KENR6924
August 2008

Disassembly and Assembly

4012-46A Industrial Engine

S12 (Engine)

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Disassembly and Assembly Section

i02887616

Fuel Priming Pump - Remove and Install (Early Type)

Removal Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE
Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

1. Turn the fuel supply to the “OFF” position.

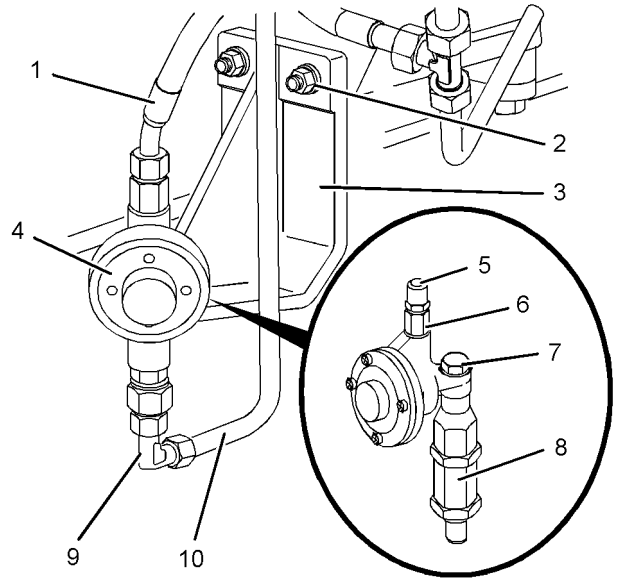


Illustration 1 g01437339

Note: Use two spanners to disconnect the connection and the hose assembly from the fuel priming pump in order to prevent the fuel priming pump from turning on the mounting bracket. Cap all open connections on the fuel priming pump.

2. Remove pipe (10) and connection (9).

3. Disconnect hose assembly (1) from fuel priming pump (4).

4. Remove nuts (2). Remove fuel priming pump (4) and bracket (3) from the engine as an assembly.

5. If necessary, follow Step 5.a through Step 5.c in order to disassemble the fuel priming pump.

a. Remove banjo bolt (7) and separate fuel priming pump (4) from bracket (3). Remove the sealing washers.

Note: Make a temporary mark in order to show the orientation of the fuel priming pump on the bracket.

b. Remove non-return valve (8) from bracket (3).

c. Remove adapter (6) and connection (5) from fuel priming pump (3).

Installation Procedure

Table 1

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	-	LOCTITE 542	1

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

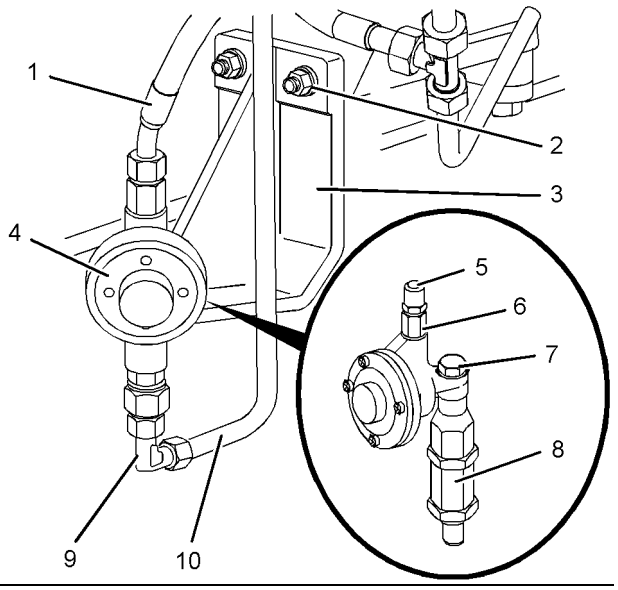


Illustration 2 g01437339

1. If necessary, follow Step 1.a through Step 1.c in order to assemble the fuel priming pump.

a. Apply Tooling (A) to the threads of adapter (6) and connection (5). Install adapter (6) and connection (5) to fuel priming pump (3).

b. Install non-return valve (8) to bracket (3). Tighten the non-return valve to a torque of 27 N·m (20 lb ft).

c. Position fuel priming pump assembly (4) and two new sealing washers on bracket (3). Install banjo bolt (7). Tighten the banjo bolt securely.

Note: Ensure the correct orientation of the fuel priming pump on the bracket.

2. Place the assembly of fuel priming pump (4) and bracket (3) in position and install nuts (2). Tighten the nuts to a torque of 50 N·m (35 lb ft).

Note: Use two spanners to connect the hose assembly and the connection to the fuel priming pump in order to prevent the fuel priming pump from turning on the mounting bracket.

3. Connect hose assembly (1) to fuel priming pump (3).

4. Install pipe (10) and connection (9).

5. Turn the fuel supply to the “ON” position.

6. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, “Fuel System - Prime”.

i02855338

Fuel Priming Pump - Remove and Install (Late Type)

Removal Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE
Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

1. Turn the fuel supply to the “OFF” position.

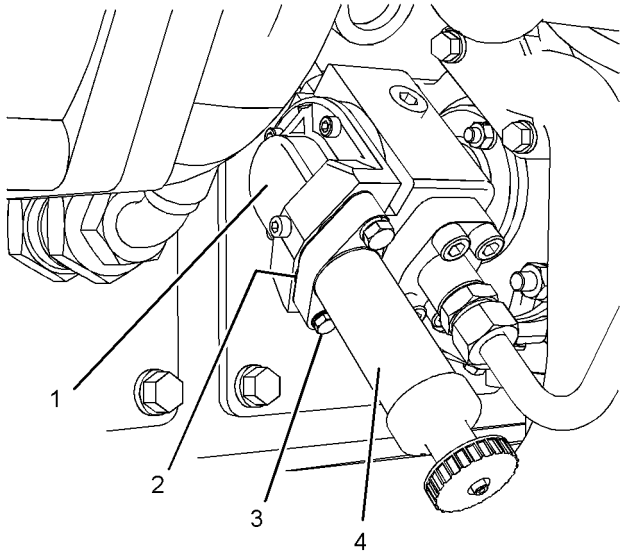


Illustration 3 g01429922

2. Remove bolts (3). Remove fuel priming pump (4) from fuel lift pump (1).

3. Remove joint (2) (not shown).

Installation Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Ensure that the joint surfaces of the fuel priming pump and the fuel lift pump are clean and free from damage.

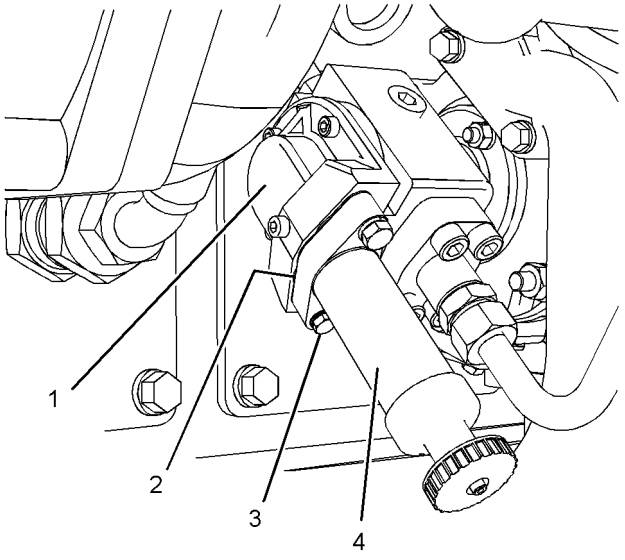


Illustration 4 g01429922

2. Position a new joint (2) (not shown) on fuel lift pump (1).

Note: Ensure correct orientation of the joint.

3. Position fuel priming pump (4) on fuel lift pump (1) and install bolts (3). Tighten the M6 bolt to a torque of 10 N·m (90 lb in). Tighten the M8 bolt to a torque of 25 N·m (220 lb in).

4. Turn the fuel supply to the “ON” position.

5. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, “Fuel System - Prime”.

i03112890

Fuel Filter Base - Remove and Install

Removal Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE
Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

1. Turn the fuel supply to the “OFF” position.

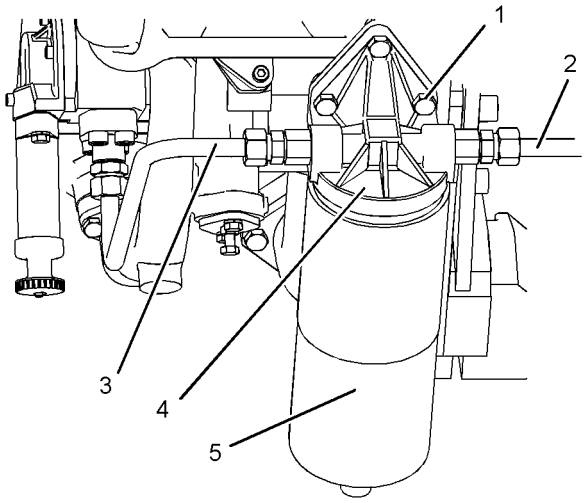


Illustration 5 g01430577

2. Drain and remove fuel filter (5). Refer to Operation and Maintenance Manual, “Fuel System Filter - Replace” for the correct procedure.

3. Disconnect pipe (2) from filter head (4).

4. Loosen pipe (3) at the lift pump. Disconnect the pipe from filter head (4).

5. Remove nuts and bolts (1) and remove filter head (4) from the mounting bracket.

Note: Cap all open pipes and connections.

Installation Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Ensure that the filter head is clean and free from damage.

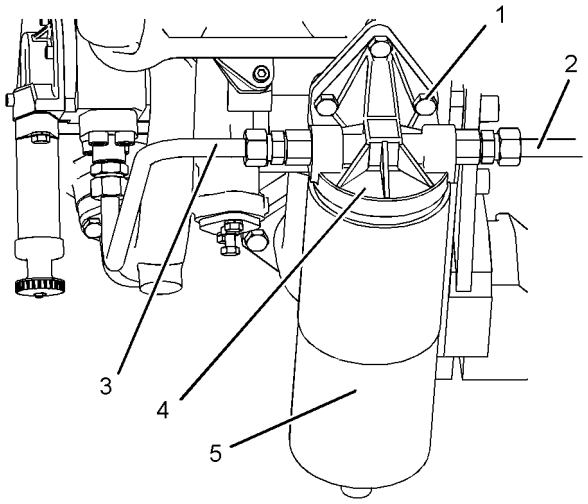


Illustration 6 g01430577

2. Position filter head (4) on the mounting bracket. Loosely connect the filter head to pipe (3).

3. Install nuts and bolts (1). Tighten the nuts and bolts to a torque of 40 N·m (30 lb ft).

4. Connect pipe (2) to filter head (4) and tighten the nuts at both ends of pipe (3) securely.

5. Install a new fuel filter (5) to filter head (4). Refer to Operation and Maintenance Manual, “Fuel System Filter - Replace” for the correct procedure.

6. Turn the fuel supply to the “ON” position.

7. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, “Fuel System - Prime”.

i03112920

Fuel Transfer Pump - Remove and Install (Lift Pump)

Removal Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE
Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

1. Turn the fuel supply to the “OFF” position.

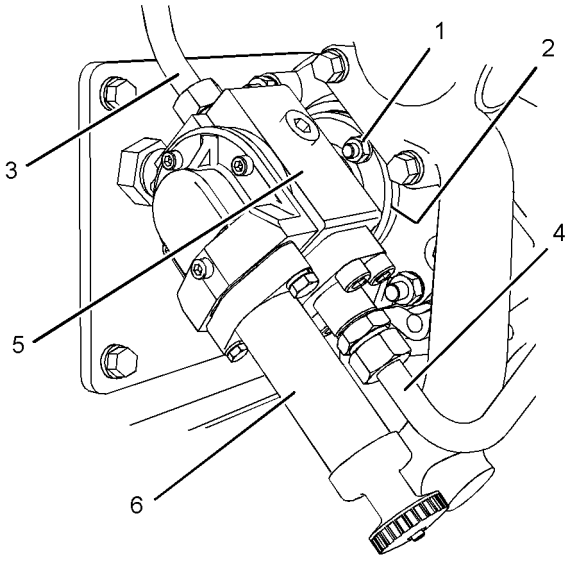


Illustration 7 g01429930

A fuel lift pump that is equipped with the later type of fuel priming pump

2. If the fuel lift pump is equipped with the later type of fuel priming pump, disconnect pipe (3) from fuel lift pump (5).

If the fuel lift pump is equipped with the early type of fuel priming pump, remove the banjo bolt and sealing washers and remove pipe (3).

Remove pipe (4).

Note: Cap all open pipes and connections.

3. Remove nuts (1) and remove fuel lift pump (5) from the engine oil pump.

4. Remove joint (2) (not shown).

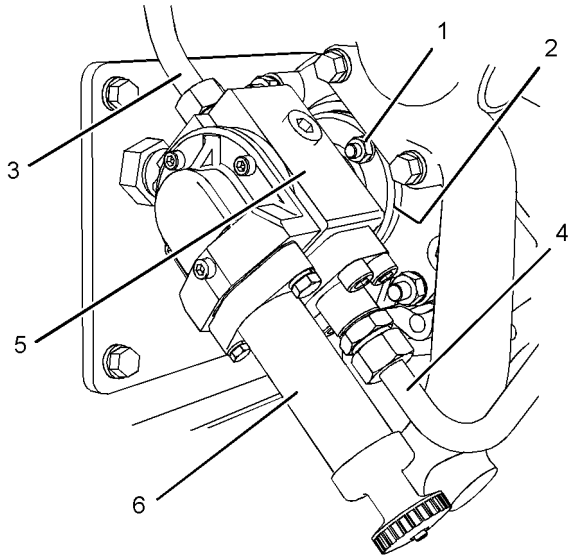
5. If the fuel lift pump is equipped with the later type of fuel priming pump, remove fuel priming pump (6) from fuel lift pump (5). Refer to Disassembly and Assembly, “Fuel Priming Pump - Remove and Install” for the correct procedure.

Installation Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Ensure that the joint surfaces of the fuel lift pump and the engine oil pump are clean and free from damage. Inspect the seal and inspect the drive for the fuel lift pump for wear or damage.



g01429930

Illustration 8

A fuel lift pump that is equipped with the late type of fuel priming pump

2. If the fuel lift pump is equipped with the late type of fuel priming pump, install fuel priming pump (6) to fuel lift pump (5). Refer to Disassembly and Assembly, “Fuel Priming Pump - Remove and Install” for the correct procedure.

3. Position a new joint (2) (not shown) on the engine oil pump. Lubricate the drive for the fuel lift pump and the seal in the engine oil pump with clean engine oil.

Note: Ensure that the shaft of the fuel lift pump is aligned with the drive in the rear of engine oil pump.

4. Position fuel lift pump (5) on the engine oil pump. Install nuts (1). Tighten the nuts to a torque of 25 N·m (18 lb ft).

5. Install pipe (4).

   If the fuel lift pump is equipped with the later type of fuel priming pump, connect pipe (3) to fuel lift pump (5).

   If the fuel lift pump is equipped with the early type of fuel priming pump, install pipe (3). Install the banjo bolt and new sealing washers. Tighten the banjo bolt to a torque of 68 N·m (50 lb ft).

6. Turn the fuel supply to the “ON” position.

7. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, “Fuel System - Prime”.

i02887615

Fuel Manifold (Rail) - Remove and Install

Removal Procedure

Start By:

a. Remove the electronic governor control unit. Refer to Disassembly and Assembly, “Governor - Remove and Install”. Removal of the electronic governor control unit is only necessary if A Bank fuel rail requires removal.

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

NOTICE
Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

1. Turn the fuel supply to the “OFF” position.

2. Cut the cable straps that secure the thermocouples for the exhaust temperature sensors to the fuel rail. Loosen the clips that secure the thermocouples for the exhaust temperature sensors to the fuel rail and detach the thermocouples from the fuel rail.

Note: Do not allow the unions to turn when the pipes are disconnected from the fuel rail. This will damage the threads in the fuel rail. Use two spanners in order to loosen the pipes from the unions.

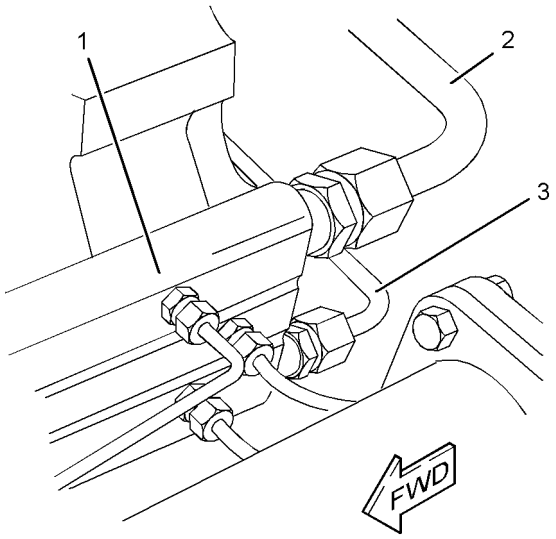


Illustration 9 g01437826
Typical example

3. Disconnect pipe (2) from fuel rail (1). Allow the fuel to drain from the fuel rail. Disconnect pipe (3) from fuel rail (1). Allow the oil to drain from the fuel rail.

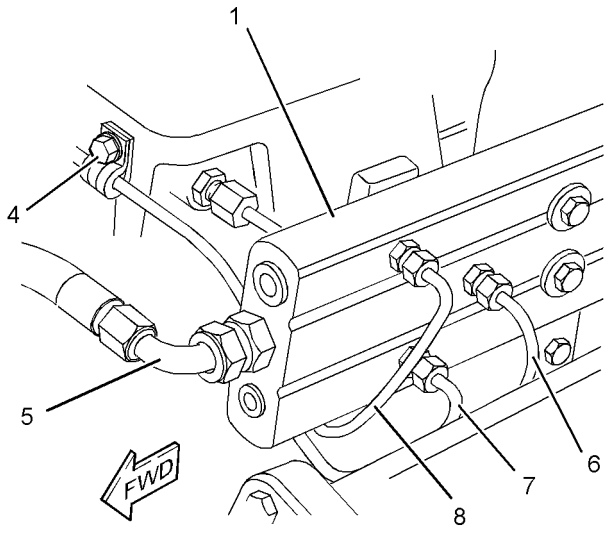


Illustration 10 g01437839
Typical example

4. Disconnect hose assembly (5) from fuel rail (1).

5. Remove pipe (6) and remove pipe (8).

6. Remove bolt (4) and remove pipe (7).

7. Repeat Step 5 and Step 6 in order to remove the remaining pipes.

Note: Cap the pipes and cap the connections on the fuel rail.

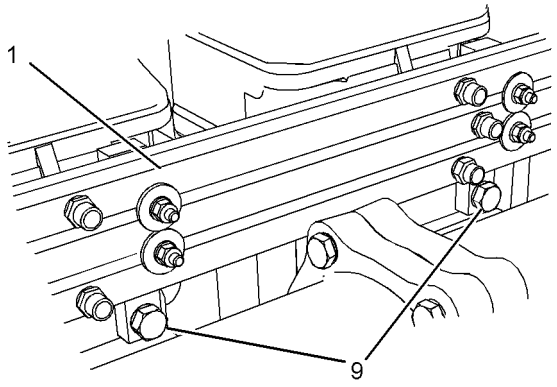


Illustration 11 g01437840
Typical example

8. Remove bolts (9). Remove fuel rail (1) from the engine.

Installation Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Ensure that the fuel rail and the pipes are clean and free from restrictions.

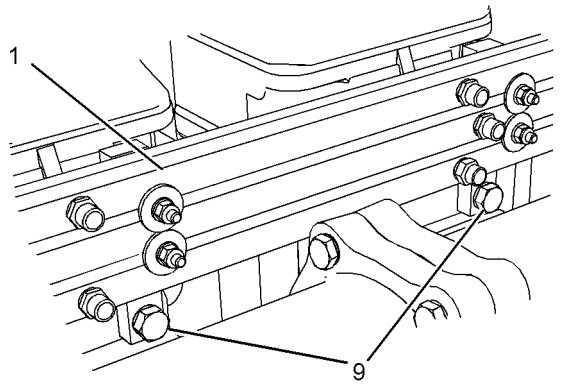


Illustration 12 g01437840
Typical example

2. Place fuel rail (1) in position and install bolts (9). Tighten the bolts to a torque of 50 N·m (35 lb ft).

Note: Do not allow the unions to turn when the pipes are connected to the fuel rail. This will damage the threads in the fuel rail. Use two spanners in order to tighten the pipes to the unions.

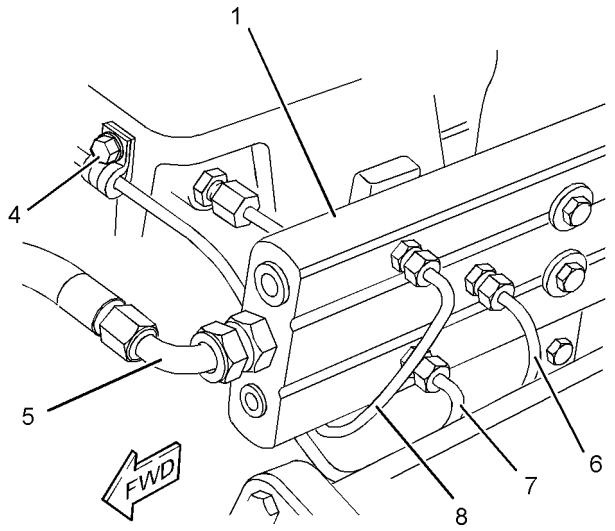


Illustration 13 g01437839
Typical example

3. Install pipe (7). Install bolt (4) to the tube clip. Tighten the bolt to a torque of 40 N·m (30 lb ft).

4. Install pipe (8) and install pipe (6).

5. Repeat Step 3 and Step 4 in order to install the remaining pipes.

6. Connect hose assembly (5) to fuel rail (1).

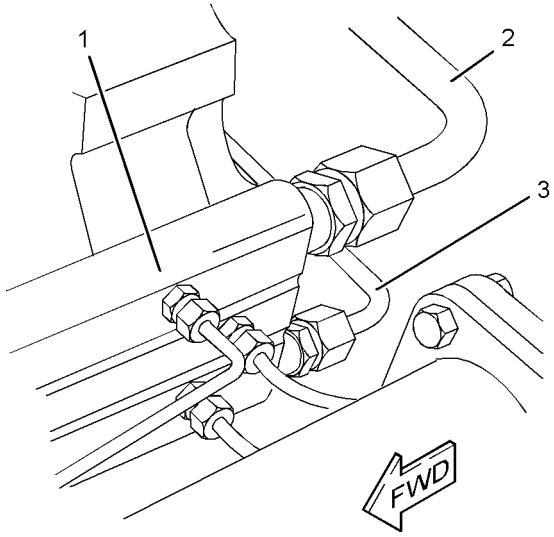


Illustration 14 g01437826
Typical example

7. Connect pipe (2) and connect pipe (3) to fuel rail (1).

8. Position the thermocouples for the exhaust temperature sensors on the fuel rail. Secure the thermocouples to the fuel rail with clips and new cable straps.

9. Turn the fuel supply to the “ON” position.

10. Remove the air from the fuel system. Refer to Operation and Maintenance Manual, “Fuel System - Prime”.

End By:

a. Install the electronic governor control unit. Refer to Disassembly and Assembly, “Governor - Remove and Install”. Installation of the electronic governor control unit is only necessary if A Bank fuel rail was removed.

i02855349

Governor - Remove (Electronic Control Unit)

Removal Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

⚠ WARNING

Accidental engine starting can cause injury or death to personnel working on the equipment.

To avoid accidental engine starting, disconnect the battery cable from the negative (−) battery terminal. Completely tape all metal surfaces of the disconnected battery cable end in order to prevent contact with other metal surfaces which could activate the engine electrical system.

Place a Do Not Operate tag at the Start/Stop switch location to inform personnel that the equipment is being worked on.

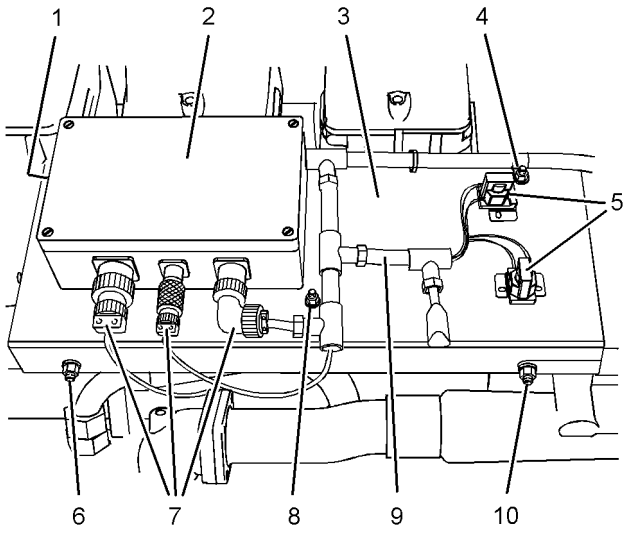


Illustration 15 g01430611
Typical example

1. Disconnect electrical connectors (7) from electronic governor control unit (2).
2. Disconnect harness assembly (9) from solenoids (5).
3. Cut the cable straps that secure harness assembly (9) to plate (3). Remove nut (1) (not shown), nut (8) and nut (4). Loosen the clip that secures the harness assembly to plate (2). Detach the harness assembly from the plate.
4. Loosen nuts (6) and (10). Remove electronic governor control unit (2) and plate (3) as an assembly.

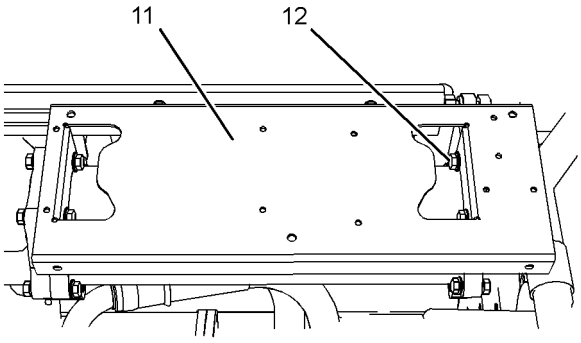


Illustration 16 g01438725

5. If necessary, remove nuts and bolts (12) and remove plate (11).

i02855350

Governor - Install (Electronic Control Unit)

Installation Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. If necessary, follow Step 1.a and Step 1.b in order to install the mounting plate for the electric governor control unit.

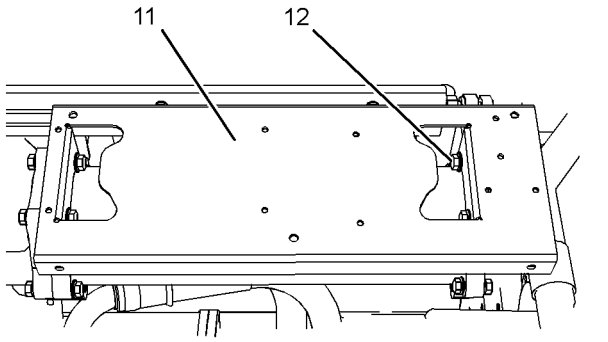


Illustration 17 g01438725

a. Ensure that the anti-vibrationmounts on plate (11) are free from damage.

b. Position plate (11) and install nuts and bolts (12). Tighten the nuts and bolts to a torque of 50 N·m (35 lb ft).

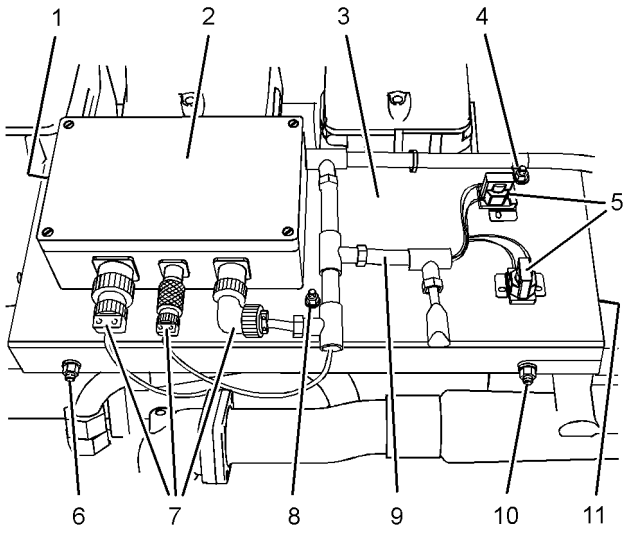


Illustration 18 g01452119

Typical example

2. Install electronic governor control unit (2) and plate (3) to plate (11) (not shown) as an assembly. Install nut (1) (not shown) and nut (8). Tighten nuts (1), (6), (8) and (10) to a torque of 25 N·m (18 lb ft).

If a replacement electronic governor control unit has been installed, the feedback for the governor must be calibrated. Refer to Special Instruction, “Pandoras Digital Govenor” for the correct procedure.

3. Connect harness assembly (9) to solenoids (5).

4. Connect electrical connectors (7) to electronic governor control unit (2).

5. Position harness assembly (9) on plate (3). Secure the harness assembly to the plate with the clip and new cable straps. Install nut (4). Tighten the nut to a torque of 25 N·m (18 lb ft).

i02855353

Governor Actuator - Remove and Install

Removal Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

⚠ WARNING

Accidental engine starting can cause injury or death to personnel working on the equipment.

To avoid accidental engine starting, disconnect the battery cable from the negative (−) battery terminal. Completely tape all metal surfaces of the disconnected battery cable end in order to prevent contact with other metal surfaces which could activate the engine electrical system.

Place a Do Not Operate tag at the Start/Stop switch location to inform personnel that the equipment is being worked on.

Governor Actuator

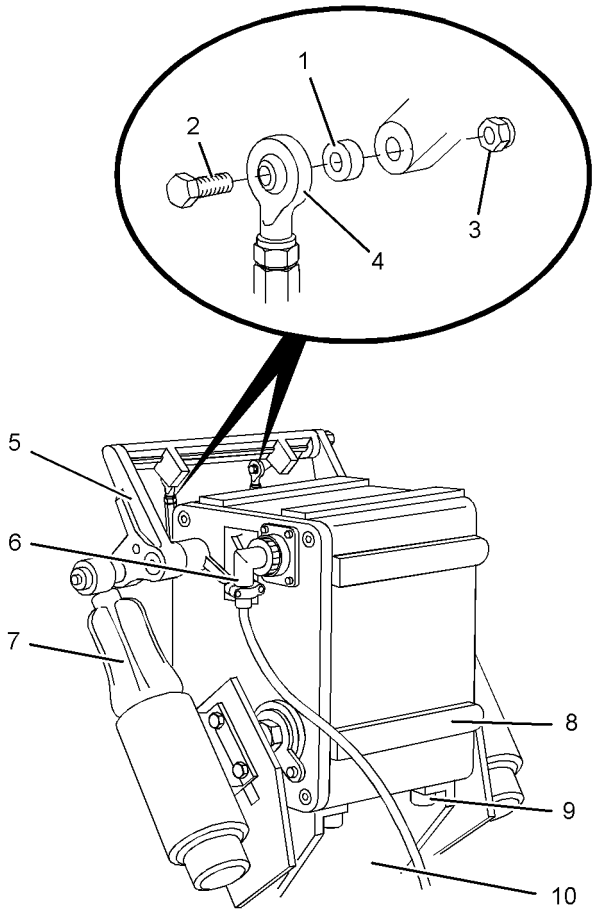


Illustration 19 g01452129

1. Disconnect electrical connector (6) from governor actuator (8).
2. Compress the plungers on stop solenoids (7). Use suitable cable straps in order to secure the plungers in the compressed position.
3. Remove the heat shield from the thermostat housings.
4. Remove nuts (3), bolts (2) and spacers (1) in order to disconnect control rods (4) from lever (5).
5. Remove allen head bolts (9) and carefully lift governor actuator (8) from mounting bracket (10).
6. If necessary, remove lever (5) from governor actuator (8).

Note: Mark the position of the lever for installation purposes.

Stop Solenoids and Governor Actuator Mounting Bracket

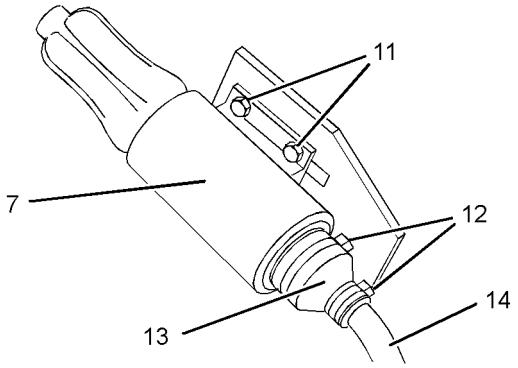


Illustration 20 g01430622

1. Cut cable straps (12) and slide rubber covers (13) down harness assemblies (14).
2. Make temporary identification marks on the connections of harness assemblies (14). Disconnect the harness assemblies from stop solenoids (7).
3. Remove nuts and bolts (11) and remove stop solenoids (7) from the mounting brackets.

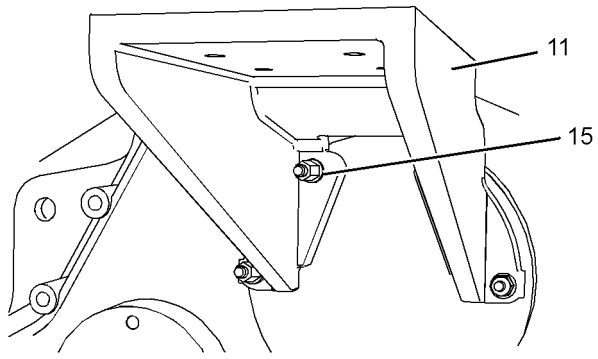


Illustration 21 g01452125

4. If necessary, remove nuts (15) and remove mounting bracket (11) from the timing case.

Installation Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Stop solenoids and Governor Actuator Mounting Bracket

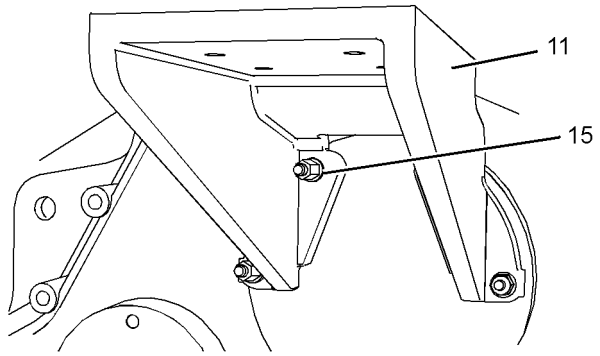


Illustration 22 g01452125

1. If necessary, position mounting bracket (11) on the studs in the timing case. Install nuts (15) hand tight.

2. Install the governor actuator. Refer to “Governor Actuator, Installation Procedure”.

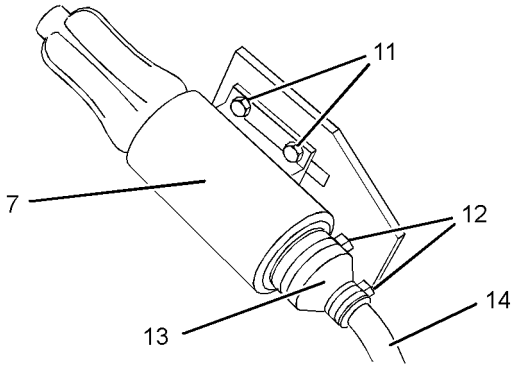


Illustration 23 g01430622

3. Position stop solenoids (7) on the mounting brackets. Install nuts and bolts (11). Tighten the nuts and bolts to a torque of 25 N·m (18 lb ft). Ensure that the lever of the actuator has full movement. Carefully remove the cable straps that secured the plungers for the stop solenoids in the compressed position.

Note: If the lever on the actuator has restricted movement, adjust the position of the mounting brackets for the stop solenoids until full movement of the lever is achieved.

4. Connect harness assemblies (14) to stop solenoids (7).

5. Slide rubber covers (13) into position. Secure the rubber covers with new cable straps (12).

Governor Actuator

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

⚠ WARNING

For safe operation and the ability to stop the engine, ensure that the governor actuator will return the fuel injectors to the “NO FUEL” position.

Failure to stop the engine may result in personal injury or death.

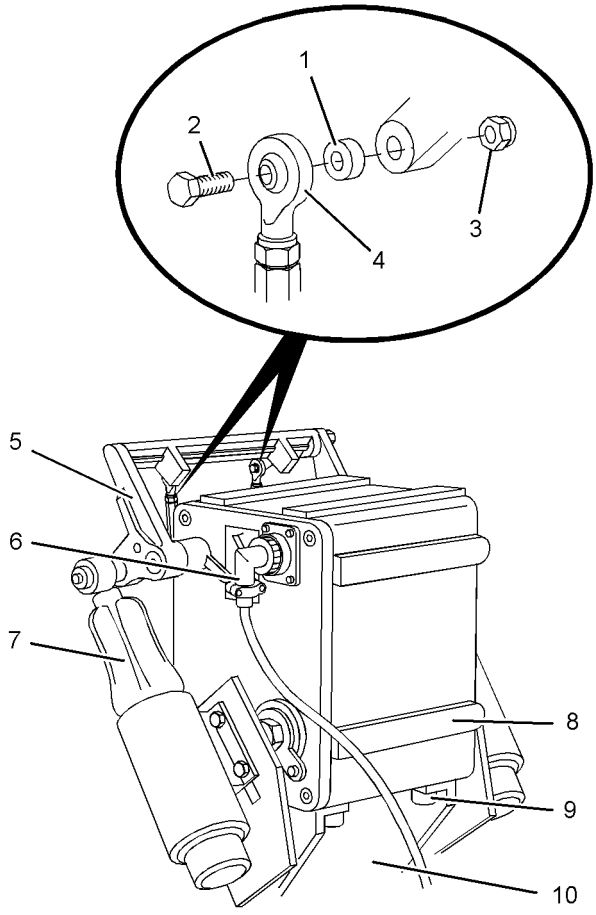


Illustration 24 g01452129

1. If necessary, install lever (5) to governor actuator (7). Tighten the clamp bolt securely.

Note: Ensure that the lever is aligned in the correct position.

2. Position governor actuator (8) onto mounting bracket (10) and install allen head bolts (9). Tighten the allen head bolts to a torque of 25 N·m (18 lb ft). If the mounting bracket was removed from the timing case, tighten the nuts to a torque of 50 N·m (35 lb ft).

3. Connect electrical connector (6) to governor actuator (8).

4. Calibrate the operation of the governor actuator and the governor electronic control unit. Refer to Operation and Maintenance Manual, “Governor Actuator - Check” for more information.

5. Connect control rods (4) to lever (5). Install bolts (2), spacers (1) and nuts (3). Tighten the nuts and bolts to a torque of 10 N·m (89 lb in).

6. Install the heat shield to the thermostat housings.

i02855355

Fuel Injection Control Linkage - Remove

Removal Procedure

Start By:

a. Remove the rocker assemblies. Refer to Disassembly and Assembly, “Rocker Arm and Shaft - Remove”.

b. Remove the cam followers. Refer to Disassembly and Assembly, “Lifter Group - Remove”.

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Removal of the Fuel Injection Control Linkage from the Cylinder Head

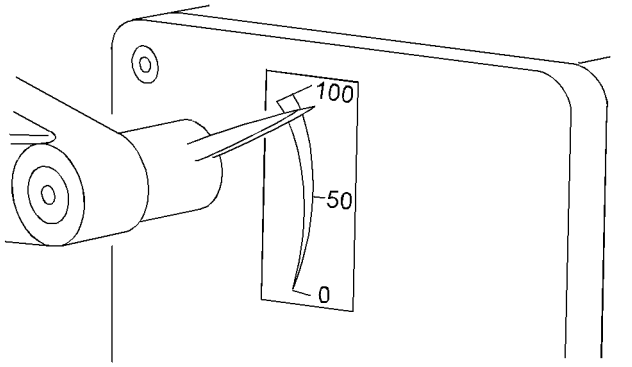


Illustration 25 g01621558

The “FULL FUEL” position on the governor actuator

1. Set the governor actuator to the “FULL FUEL” position.

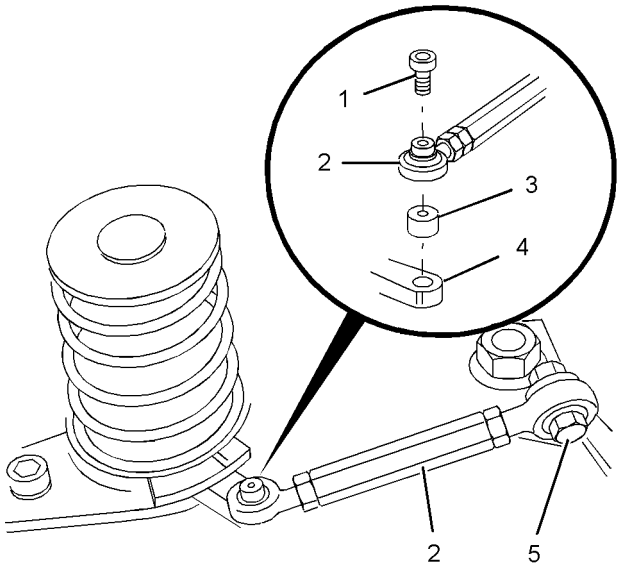


Illustration 26 g01438795

2. Remove allen head bolt (1) in order to disconnect link (2) from fuel injector (4). Remove spacer (3).

3. Remove the nut and bolt (5). Remove link (2).

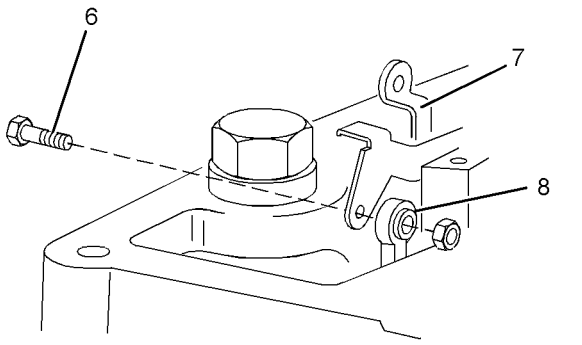


Illustration 27 g01438735

4. Remove the nut and bolt (6) in order to disconnect rod (8) from break-back lever (7).

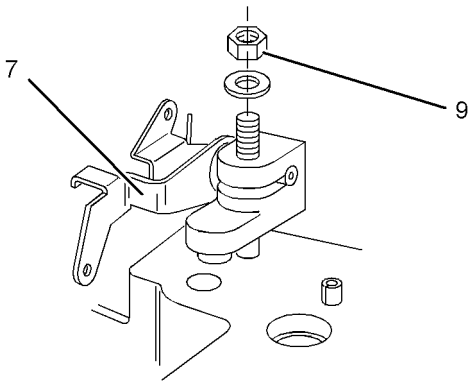


Illustration 28 g01438762

5. If necessary, remove locking nut (9) and remove break-back lever (7) from the cylinder head.

Removal of the Fuel Injection Control Linkage from the Timing Case

1. Remove the governor actuator. Refer to Disassembly and Assembly, “Governor Actuator - Remove and Install”.

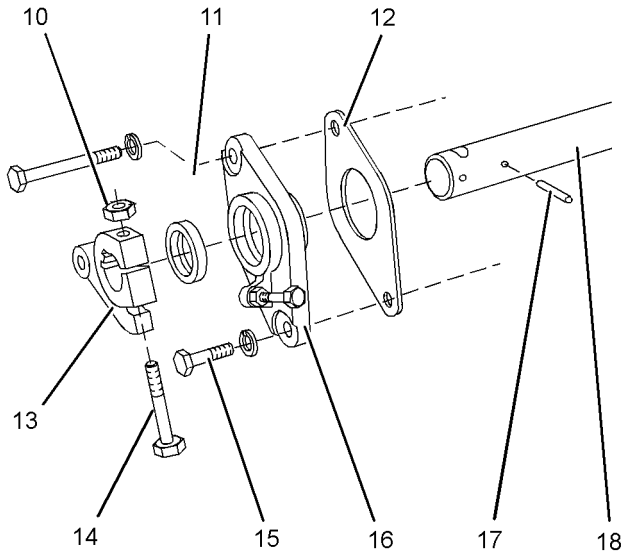


Illustration 29 g01452204

2. Remove nut (10) and bolt (14) from lever (13).

3. Remove lever (13) from shaft (18).

4. Remove pin (17) from shaft (18).

5. Remove bolts (15) and remove housing (16) from the timing case. Remove joint (12).

6. Remove seal (11) from housing (16).

Removal of the Fuel Injection Control Linkage from the Crankcase

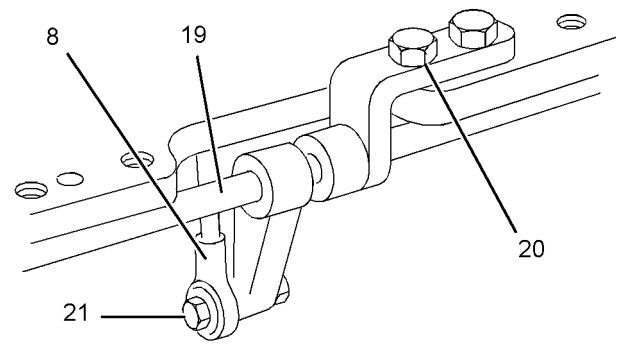


Illustration 30 g01439276

1. Remove nuts and bolts (21) and remove rods (8).

2. Remove bolts (20). Carefully remove control shafts (19) through the front of the crankcase.

i02855358

Fuel Injection Control Linkage - Install

Installation Procedure

NOTICE
Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Installation of the Fuel Injection Control Linkage to the Crankcase

1. Lubricate the bearing surfaces of the control shafts with clean engine oil.

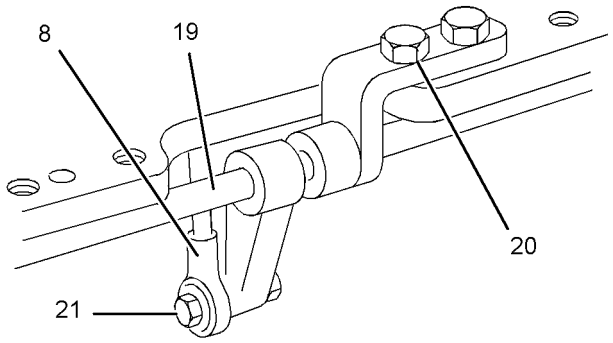


Illustration 31 g01439276

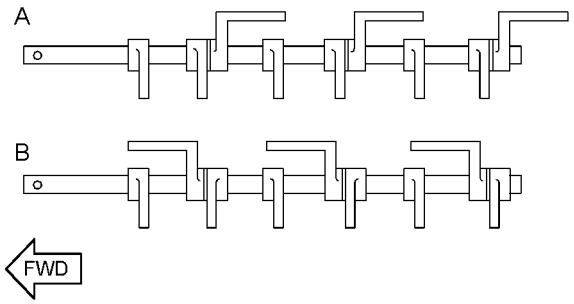


Illustration 32 g01439294

(A) A Bank control shaft
(B) B Bank control shaft

2. Carefully install control shafts (19) through the front of the timing case. Ensure the correct location and orientation of the control shafts. Refer to Illustration 32.

3. Install bolts (20). Tighten the bolts hand tight. Ensure that the control shafts are free to rotate as each bolt is tightened.

4. Tighten bolts (20) to a torque of 50 N·m (35 lb ft).

Note: Ensure that the control shafts are still free to rotate.

5. Connect rods (8) to control shafts (19) and install nuts and bolts (21). Tighten the nuts and bolts to a torque of 8 N·m (70 lb in).

Installation of the Fuel Injection Control Linkage to the Timing Case

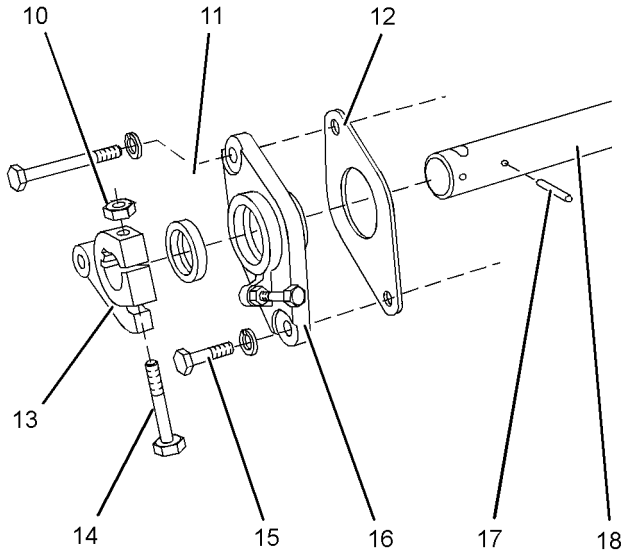


Illustration 33 g01452204

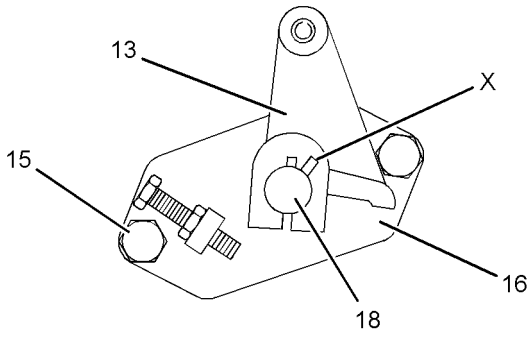


Illustration 34 g01452554

A Bank Fuel injection control linkage

1. Ensure that housing (16) is clean and free from damage. Lubricate the outer diameter of a new seal (11) with clean engine oil. Install the seal to the housing.

Note: Ensure that the inner face of the seal is seated squarely against the shoulder in the housing.

2. Install a new joint (12) to the timing case.

3. Ensure that the end of control shaft (18) is free from burrs or sharp edges. Lubricate the end of the control shaft with clean engine oil.

4. Carefully slide seal (11) over the end of control shaft (18) and position housing (16) against the gear case.

Note: Ensure that the lip of the seal is not damaged as the seal is pushed over the groove in the shaft.

5. Install bolts (15). Tighten the bolts to a torque of 50 N·m (35 lb ft).

6. Install pin (17) to shaft (18). Tap the pin into the shaft until the leading edge of the pin is flush with the edge of the shaft.

7. Align slot (X) with pin (17) and install lever (13) to shaft (18).

Note: Ensure that the front face of the lever is flush with the front of the shaft.

8. Install bolt (14) to lever (13) and tighten securely. Install nut (10) to bolt (14) and tighten securely.

9. Install the governor actuator. Refer to Disassembly and Assembly, “Governor Actuator - Remove and Install”.

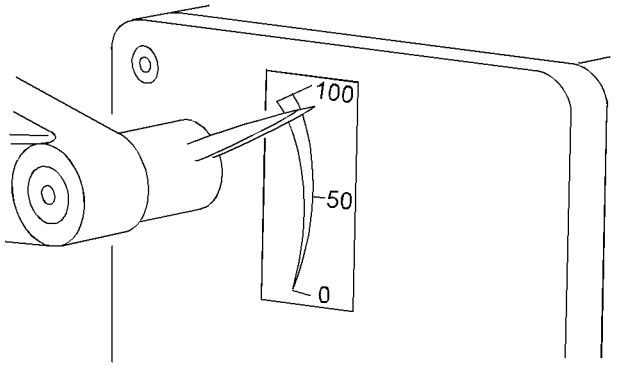


Illustration 35 g01621558

The “FULL FUEL” position on the governor actuator

10. Set the governor actuator to the “FULL FUEL” position.

Installation of the Fuel Injection Control Linkage to the Cylinder Head

1. If the break-back lever is removed from the cylinder head, check the tension of the spring. Refer to Systems Operation, Testing and Adjusting, “Fuel Injector Adjustment” for the correct procedure.

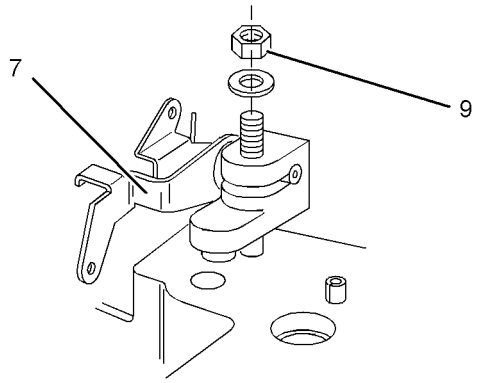


Illustration 36 g01438762

2. Install break-back lever (7) to the cylinder head. Install locking nut (9) hand tight.

3. Insert a 0.25 mm (0.010 inch) feeler gauge between the arm and the block of break-back lever (7). Rotate the break-back in an counterclockwise direction. Tighten the nut to a torque of 50 N·m (35 lb ft). Remove the feeler gauge.

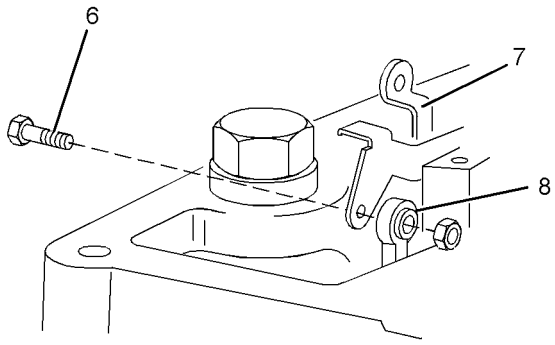


Illustration 37 g01438735

4. Connect rod (8) to break-back lever (7) and install the nut and bolt (6). Tighten the nut and bolt to a torque of 8 N·m (70 lb in).