Perkins®

KENR6225-01
April 2008

Systems Operation Testing and Adjusting

402D-403D-404D Industrial Engine

GG (Engine)
GH (Engine)
GJ (Engine)
GK (Engine)
GL (Engine)
GM (Engine)
GN (Engine)
GP (Engine)
GQ (Engine)
GS (Engine)

Fuel Injection Pump

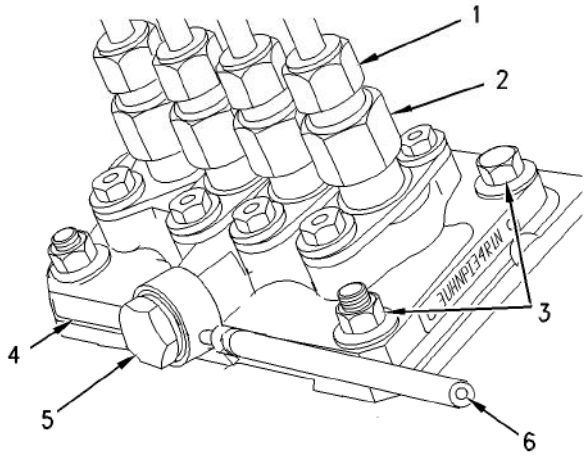

Illustration 10 g00746909

Fuel injection pump (typical example)

(1) Fuel line to the fuel injectors
(2) Fuel delivery valve
(3) Nuts and setscrews for mounting the fuel injection pump to the cylinder block
(4) Shim
(5) Vent screw for the fuel injection pump
(6) Fuel flow from the fuel transfer pump

The electric fuel shutoff solenoid must be energized in order for fuel to flow through the system.

The fuel injection pump is a cassette type pump. The cassette type pump contains the following components: fuel delivery valves, fuel rack, and pushrods. The fuel injection pump is installed directly into the cylinder block.

The part number and code letters for the fuel injection pump are stamped on the front of the pump.

The fuel injection pump is a pressurized system that is totally enclosed. The pump sends the correct amount of fuel under high pressure at the correct time through the fuel injectors to the individual cylinders. The fuel injection occurs near the end of the compression stroke. The fuel injection pump regulates the amount of fuel that is delivered to the fuel injectors. This action controls the engine rpm by the governor setting or the position of the throttle control.

The camshaft is driven by the idler gear in the timing case. Lobes on the camshaft cause the pushrod for each cylinder to reciprocate. The reciprocating motion first draws the fuel. The reciprocating motion then pressurizes the fuel. A fuel delivery valve (2) for each cylinder acts as a check valve in order to prevent a loss of pressure to the fuel injector.

The correct operation of the fuel injection pump requires the pump to be completely full of fuel and empty of air. When the vent screw (5) is loosened, air can escape from the fuel injection pump.

The fuel injection pump will lubricate the components during operation.

Fuel Injectors

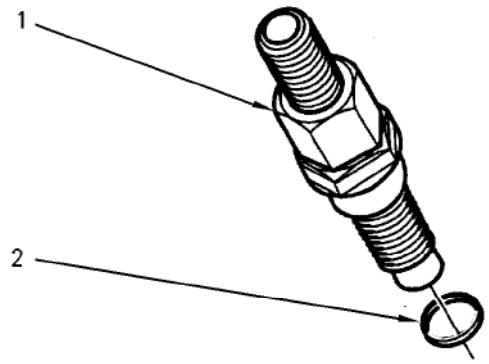

Illustration 11 g00836660

(1) Fuel injector
(2) Sealing washer

The sealing washer (2) helps to prevent blowby. The sealing washer also sets the projection of the fuel injector (1) into the precombustion chamber. This projection affects the time that is required for combustion in the cylinder. If the projection is excessive, engine knock can occur at high rpm.

Note: When a fuel injector (1) is installed in the cylinder head, a new sealing washer (2) should be installed.

The operating pressure of the fuel injector is set and tested at the factory. Refer to Specifications, “Fuel Injectors” for the pressure settings of the fuel injector.

During operation, extra fuel is used as coolant and lubricant for components of the fuel injector.

Wiring Diagram for a 65 Amp Alternator and a 85 Amp Alternator

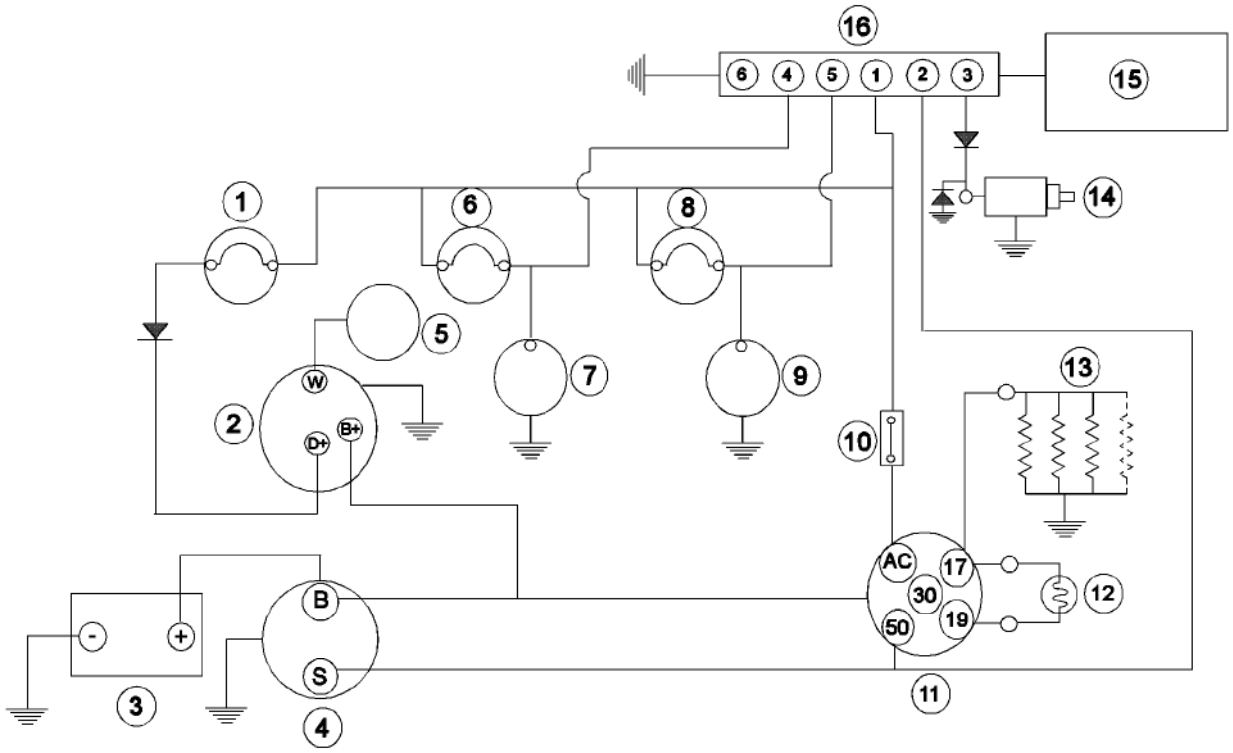

Illustration 21 g01519204

(1) Warning lamp (alternator)
(2) Alternator
(3) Battery
(4) Electric starting motor
(5) Tachometer
(6) Warning lamp (oil pressure)
(7) Engine oil pressure switch
(8) Warning lamp (coolant temperature)
(9) Coolant temperature switch
(10) Fuse
(11) Ignition switch
(12) Signal for glow plug
(13) Glow plugs
(14) Fuel shutoff solenoid
(15) Automatic shutdown device
(16) Electrical connector

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Gear Group (Front) - Time

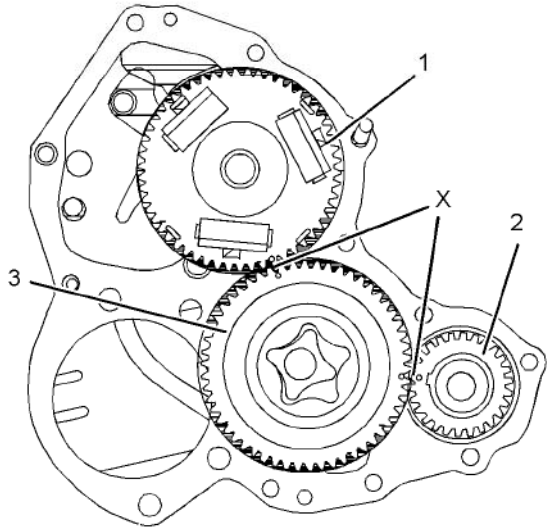

Illustration 36 g01335186

1. Align timing mark (X) on idler gear (3) with the timing mark on crankshaft gear (2) and align timing mark (X) on idler gear (3) with the timing mark on camshaft gear (1).

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Governor - Adjust

Note: The setting of the front housing is only necessary if the front housing is damaged or if the front housing must be renewed.

Table 6

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	21825617	Dial Indicator graduated in 0.01 mm (0.0004 inch)	1
	-	Extension that is 20 mm (0.787 inch)long	1
B	27610331	Dial holder	1
C	27610332	Adapter for the cylinder block	1
D	27610333	Calibration spring	1
E	-	Allen head screw (M4 x 20 mm x 0.70)	1
F	-	Optical Tachometer	1

Record the Governor Settings

NOTICE
The engine must be in running condition in order to carry out the governor adjustment procedure. If the engine cannot be returned to a running condition contact an authorized Perkins distributor

NOTICE
If the engine is fitted with a Boost Compensation Device contact an authorized Perkins distributor.

If the front housing has been removed, install the front housing. Refer to Disassembly and Assembly, “Housing (Front) - Install”

The setting of the low idle stop screw and the high idle stop screw must be recorded. The settings are recorded in order to ensure that the governor operation is restored.

Note: Engine speed must be recorded from the crankshaft.

1. Operate the engine until the normal operating temperature is reached.
2. Use Tooling (F) to record the engine rpm at low idle.
3. Accelerate the engine to high idle. Use Tooling (F) and record the engine rpm as “Speed A”.

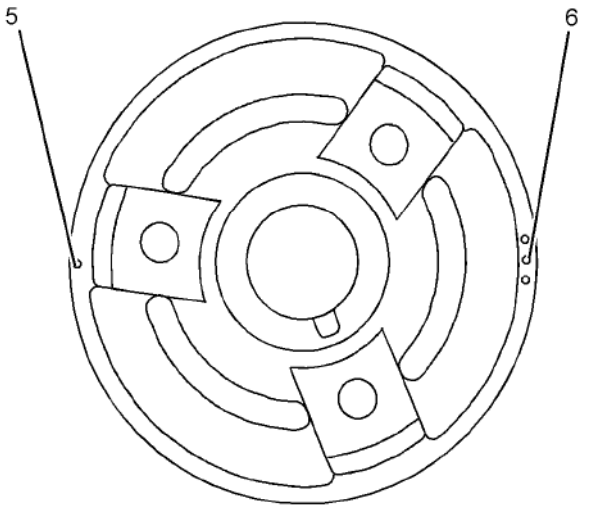

Illustration 58 g01392787

Top center markings for the Crankshaft pulley

1. Rotate the crankshaft in a clockwise direction that is viewed from the front of the engine. When the inlet valve of the No. 4 cylinder has started to open and the exhaust valve of the No. 4 cylinder has not completely closed, ensure that the “Top” mark (3) on the timing case aligns with “Single dot” (5) on the crankshaft pulley. Check the valve lash of the inlet valve and the exhaust valve of the No. 1 cylinder. If necessary, make an adjustment.

Note: The “Single dot” (5) on the crankshaft pulley is the reference point for the top center position of No. 1 and No. 4 cylinders. The “Middle dot” (6) on the crankshaft pulley is the top center reference point for No. 2 and No. 3 cylinders.

   a. Loosen the valve adjustment screw locknut that is on adjustment screw (2).

   b. Place the appropriate feeler gauge (1) between the rocker arm and the valve. Turn adjustment screw (2) while the valve adjustment screw locknut is being held from turning. Adjust the valve lash until the correct specification is achieved.

   c. After each adjustment, tighten the valve adjustment screw locknut while adjustment screw (2) is being held from turning.

2. Rotate the crankshaft in a clockwise direction 180°. When the inlet valve of the No. 2 cylinder has started to open and the exhaust valve of the No. 2 cylinder has not completely closed, ensure that the “Top” mark (3) on the timing case aligns with “Middle dot” (6) on the crankshaft pulley. Check the valve lash of the inlet valve and the exhaust valve of the No. 3 cylinder. If necessary, make an adjustment.

   If adjustment is necessary, refer to Steps 1.a, 1.b, and 1.c above.

3. Rotate the crankshaft in a clockwise direction 180°. When the inlet valve of the No. 1 cylinder has started to open and the exhaust valve of the No. 1 cylinder has not completely closed, ensure that the “Top” mark (3) on the timing case aligns with “Single dot” (5) on the crankshaft pulley. Check the valve lash of the inlet valve and the exhaust valve of the No. 4 cylinder. If necessary, make an adjustment.

   If adjustment is necessary, refer to Steps 1.a, 1.b, and 1.c above.

4. Rotate the crankshaft in a clockwise direction 180°. When the inlet valve of the No. 3 cylinder has started to open and the exhaust valve of the No. 3 cylinder has not completely closed, ensure that the “Top” mark (3) on the timing case aligns with “Middle dot” (6) on the crankshaft pulley. Check the valve lash of the inlet valve and the exhaust valve of the No. 2 cylinder. If necessary, make an adjustment.

   If adjustment is necessary, refer to Steps 1.a, 1.b, and 1.c above.

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Valve Depth - Inspect

Table 9

Required Tools		
Part Number	**Part Description**	**Qty**
21825617	Dial gauge	1
21825496	Dial gauge holder	1

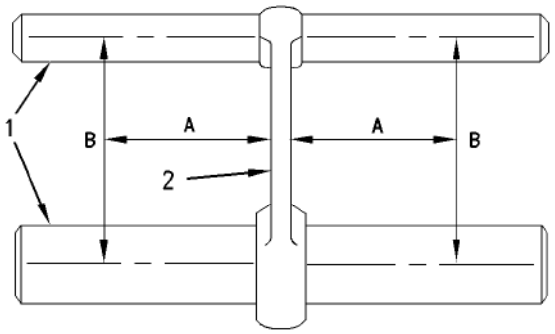

Illustration 70 g00690891

Inspection of the connecting rod parallel alignment.

(1) Measuring pins
(2) Connecting rod
(A) Measure the distance 100 mm (3.94 inch) from the connecting rod.
(B) Measure the distance between the center of the bore for the piston pin bearing and the center of the connecting rod bearing bore.

1. Use the appropriate tools in order to measure the distances for the connecting rod (2).
   - Appropriate gauges for measuring distance
   - Measuring pins (1)

Note: The connecting rod bearings should be removed before taking the measurements.

2. Measure the connecting rod for distortion and parallel alignment between the bores.

   The measurements must be taken at distance (A). Distance (A) has a value of 100 mm (3.94 inch) from both sides of the connecting rod.

   Measure length (B).

   The total difference in measurements of length (B) from each side should not vary more than ± 0.08 mm (± 0.0031 inch).

3. Inspect the piston pin bearing and the piston pin for wear and other damage.

4. Measure the clearance of the piston pin in the piston pin bearing. Refer to Specifications, “Connecting Rod” for clearance dimensions.

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Connecting Rod Bearings - Inspect

Check the connecting rod bearings and the connecting rod bearing journal for wear or other damage.

Connecting rod bearings are available with a smaller inside diameter than the original size bearings. These bearings are for crankshafts that have been ground.

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Main Bearings - Inspect

Check the main bearings for wear or other damage. Replace both halves of the bearings and check the condition of the other bearings if a main bearing is worn or damaged.

Main bearings are available with a smaller inside diameter than the original size bearings. These bearings are for main bearing journals that have been ground.

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Cylinder Block - Inspect

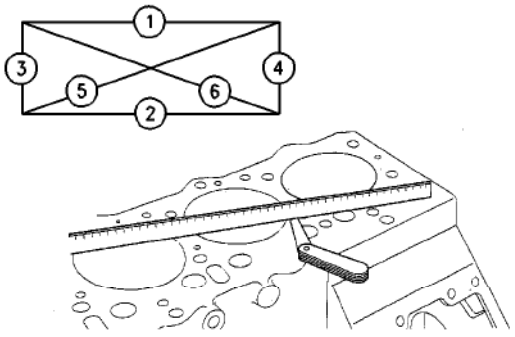

Illustration 71 g00907375

Use a straight edge and a feeler gauge to check the six positions for flatness. Refer to Illustration 71.

Inspect the top of the cylinder block for cracks, damage, and warpage.