FLYWHEEL GP - Specifications
C2.2 Engines For Caterpillar Built Machines - KENR6946

- Flywheel
- Flywheel Housing

FLYWHEEL GP - Disassembly and Assembly
C2.2 Engines For Caterpillar Built Machines - KENR6948

- Flywheel - Remove
- Flywheel - Install

GEAR GP - Specifications
C2.2 Engines For Caterpillar Built Machines - KENR6946

- Gear Group (Front)

HOUSING GP-FLYWHEEL - Specifications
C2.2 Engines For Caterpillar Built Machines - KENR6946

- Flywheel Housing

HOUSING GP-FLYWHEEL - Disassembly and Assembly
C2.2 Engines For Caterpillar Built Machines - KENR6948

- Flywheel Housing - Remove and Install - Engines with Flywheel Housing and Back Plate

HOUSING GP-FRONT - Specifications
C2.2 Engines For Caterpillar Built Machines - KENR6946

- Housing (Front)

HOUSING GP-FRONT - Disassembly and Assembly
C2.2 Engines For Caterpillar Built Machines - KENR6948

- Housing (Front) - Remove
- Housing (Front) - Disassemble
- Housing (Front) - Assemble
- Housing (Front) - Install

LIFTING GP-ENGINE - Specifications
C2.2 Engines For Caterpillar Built Machines - KENR6946

- Engine Lifting Bracket

PAN GP-OIL - Specifications
C2.2 Engines For Caterpillar Built Machines - KENR6946

- Engine Oil Pan

PAN GP-OIL - Disassembly and Assembly
C2.2 Engines For Caterpillar Built Machines - KENR6948

- Engine Oil Pan - Remove and Install

PISTON & ROD GP - Specifications
C2.2 Engines For Caterpillar Built Machines - KENR6946

- Connecting Rod Bearing Journal
- Connecting Rod
- Piston and Rings

PISTON & ROD GP - Disassembly and Assembly
C2.2 Engines For Caterpillar Built Machines - KENR6948

- Pistons and Connecting Rods - Remove
- Pistons and Connecting Rods - Disassemble

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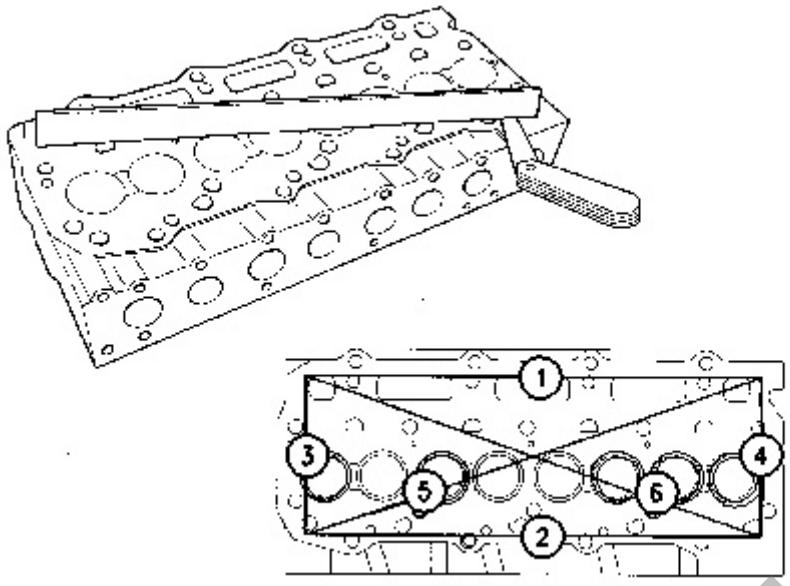


Illustration 3 g00907448

Typical example

5. Use a straight edge and a feeler gauge to check the six positions of the cylinder head for distortion. Refer to Specifications, "Cylinder Head" for the requirements of flatness.

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Illustration 1 g01304583

Typical example

1. Follow Steps 1.a through 1.d in order to position the appropriate piston at top center.

   a. Install Tooling (A) and (B) in position on the cylinder head in order to compress a valve spring for the appropriate piston.

   b. Use Tooling (A) in order to compress valve spring (3) and open the valve slightly.

      Note: Do not compress the spring so that the valve spring retainer (2) touches the valve stem seal.

   c. Carefully rotate the crankshaft until the piston touches the valve.

      Note: Do not use excessive force to turn the crankshaft. The use of force can result in bent valve stems.

   d. Continue to rotate the crankshaft and gradually release the pressure on Tooling (A) until the piston is at the top center position. The valve is now held in a position that allows the valve spring to be safely removed.

NOTICE

Ensure that the valve spring is compressed squarely or damage to the valve stem may occur.

---

2. Use tool (A) in order to compress valve spring (3). Remove valve keepers (1) .

   Note: For four cylinder engines, if all valve springs require replacement the procedure can be carried out on two cylinders at the same time. The procedure can be carried out on the following pairs of cylinders. 1 with 4 and 2 with 3. Ensure that all of the valve springs are installed before changing from one pair of cylinders to another pair of cylinders.

NOTICE

Do not turn the crankshaft while the valve springs are removed.

---

3. Apply sufficient pressure to Tooling (A) in order to allow removal of the valve keepers (1) .

   Note: Do not compress the spring so that the valve spring retainer (2) touches the valve stem seal.

   Remove valve keepers (1) .

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Illustration 4 g01311837

Typical example

6. Install the upper half of connecting rod bearing (8) to connecting rod (1) .
7. Install the lower half of connecting rod bearing (9) to connecting rod cap (10).

End By: Install the pistons and the connecting rods. Refer to Disassembly and Assembly, "Piston and Connecting Rods - Install".

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Water Temperature Regulator Housing for C2.2 (Naturally Aspirated) and C2.2 (Turbocharged) Engines

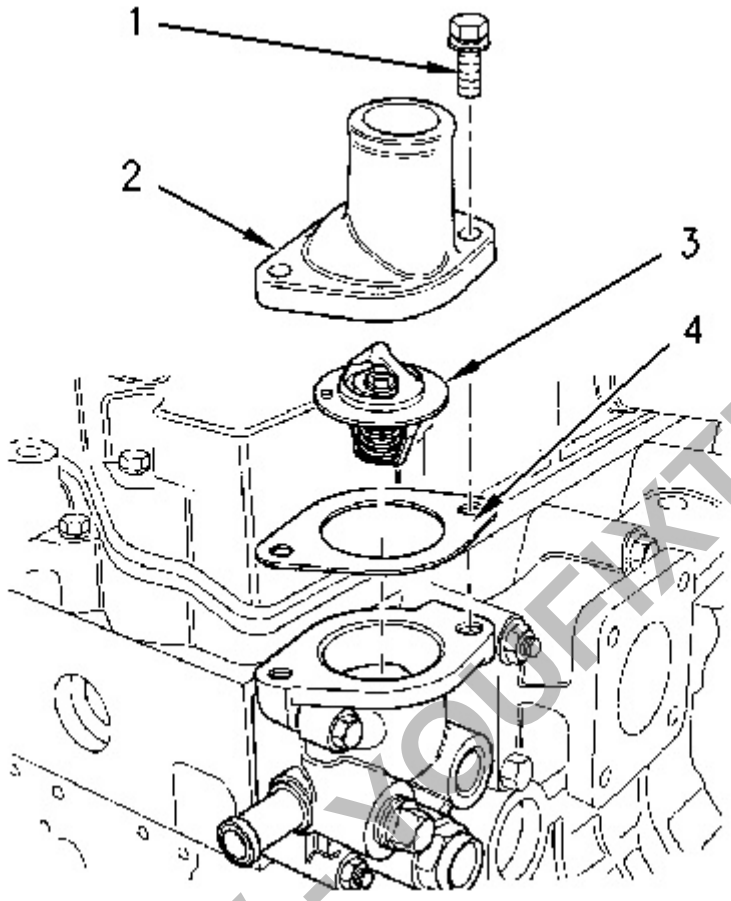
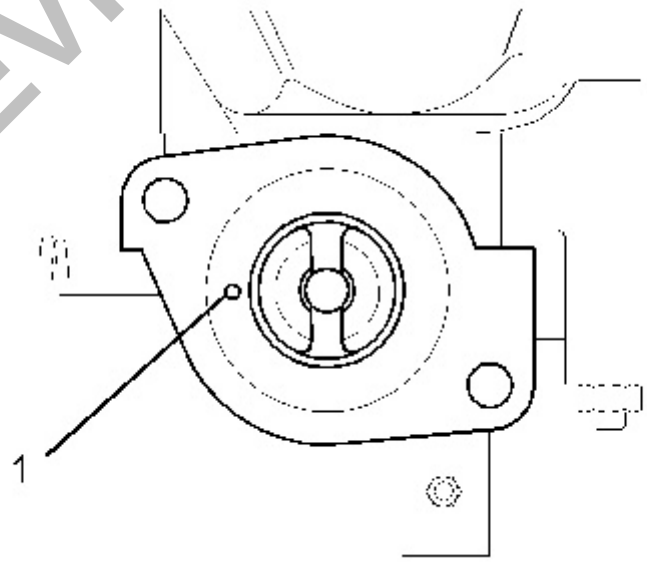


Illustration 2 g00820265



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Systems Operation
259B3 Compact Track Loader, 247B3 and 257B3 Multi Terrain Loaders and 216B3, 226B3, 236B3, 242B3 and 252B3 Skid Steer Loaders Machine Electronic Control System

Media Number -UENR0255-01 **Publication Date -01/01/2013** **Date Updated -17/01/2013**

i03939290

Electrical Output Components

SMCS - 1400; 7000-EK

Solenoids

Auxiliary One Solenoid

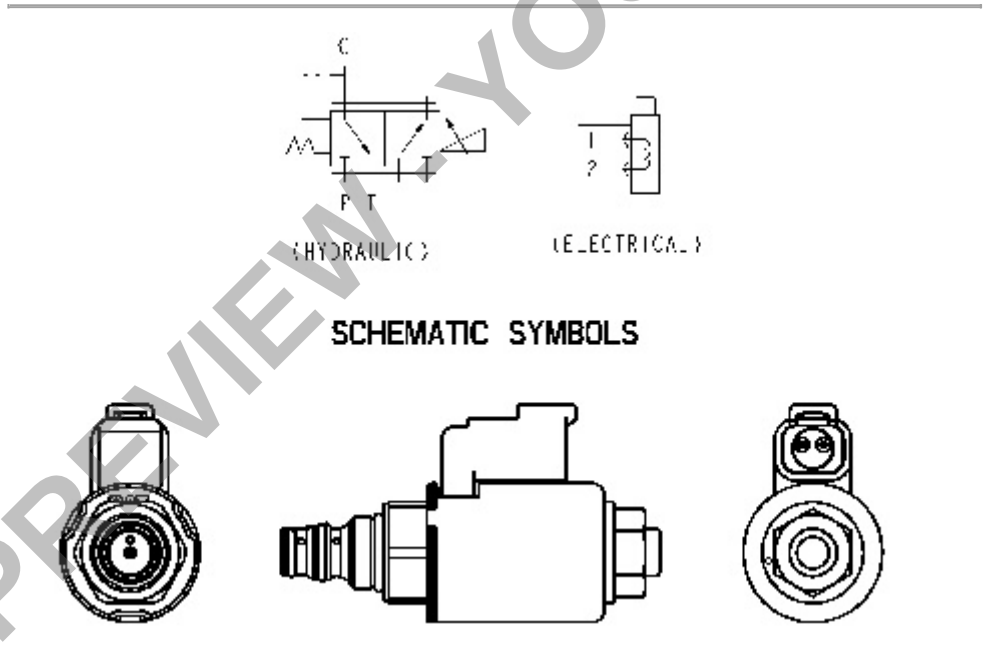


Illustration 1 g01274041

The solenoid has a connector with two contacts. The solenoid ground is connected to the ECM through contact J1-49. The signal contact is connected to the ECM through contact J1-48.

Auxiliary Two Solenoid

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- A sensor has failed.
- The power supply circuit is shorted to a ground source.
- The ECM has failed. The failure of the ECM is unlikely.

Note: The following test procedure may create other diagnostic codes. Clear the diagnostic codes when the problem has been correct. Verify that CID 0041 FMI 04 is active before performing this procedure.

Test Step 1. CHECK THE SENSOR

A. Turn the key start switch to the OFF position.

B. One at a time, disconnect each sensor from the machine harness.

C. After disconnecting each sensor, check to see if the CID 0041 FMI 04 code is still active.

D. Reconnect the sensor and disconnect the next sensor. Check to see if the CID 0041 FMI 04 code is still active.

E. Repeat the previous step until all sensors have been checked.

Expected Result:

The diagnostic code is not active when a sensor is disconnected.

Results:

- **OK -** The diagnostic code is not active when a sensor is disconnected. Inspect the harness to the sensor for any failures. Disconnecting the sensor could temporarily cause the short to be removed from the harness. Reconnect the suspect sensor and verify that the diagnostic code has become active again.

  Repair: Repair the harness or replace the sensor accordingly.

  STOP

- **NOT OK -** The diagnostic code is still active. The machine harness may be shorted to ground. Proceed to Test Step 2.

Test Step 2. CHECK FOR A SHORT TO GROUND

A. Disconnect the negative battery cable and turn the key start switch to the OFF position.

B. Disconnect the machine harness connector J1 from the ECM.

C. At the harness connector for the ECM, measure the resistance between contact J1-68 (wire P994-BU) and all other contacts that are used in the J1 and J2 connectors.

Expected Result:

The resistance is greater than 5000 ohms.

Results:

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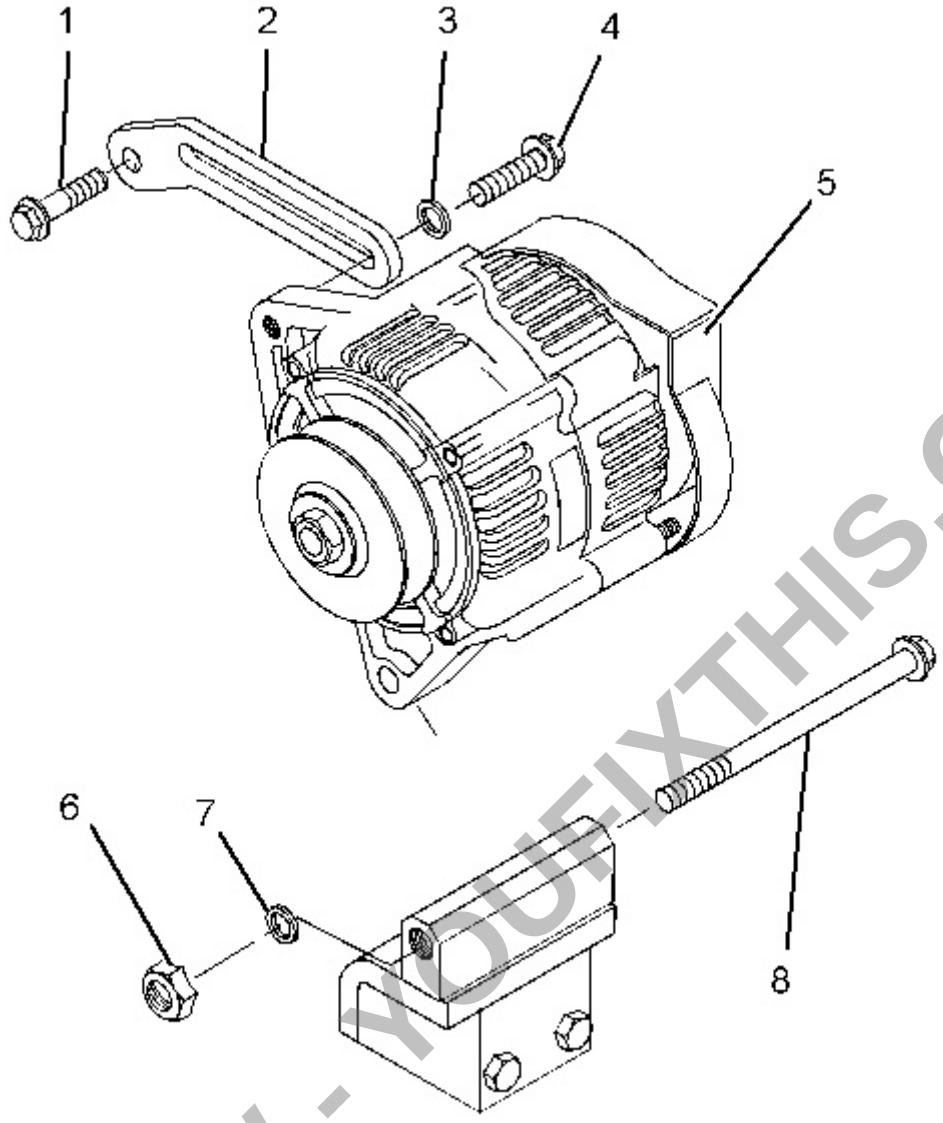


Illustration 2 g01308285

Typical example

1. If necessary, install adjusting link (2) and install bolt (1) finger tight.
2. Position alternator (5) on the mounting bracket.
3. Install bolt (8), washer (7) and nut (6) finger tight.
4. Install bolt (4) and washer (3) finger tight.
5. Install the V-Belt. Refer to Disassembly and Assembly, "V-Belts - Remove and Install".

   Note: Ensure that the alternator pulley is in alignment with the crankshaft pulley. Ensure that all fasteners are tightened.

6. Connect the harness assembly (not shown) to the alternator.

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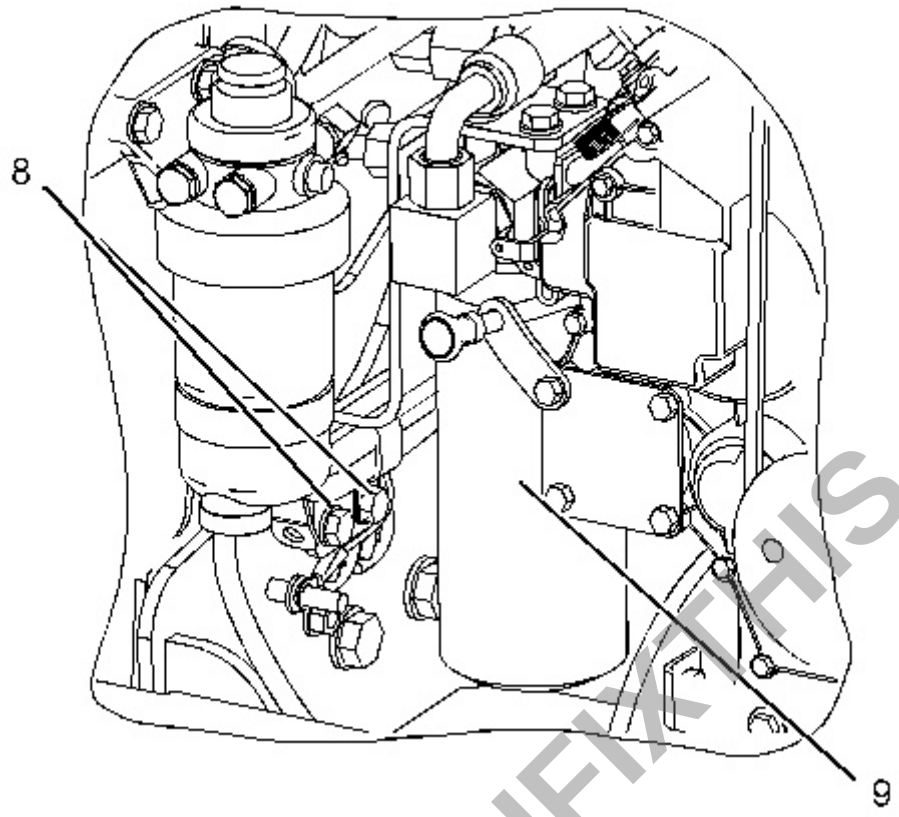


Illustration 3 g01052058

4. Remove bolts (8) . Disconnect the harness assembly from filter group (9) . Disconnect filter group (9) and reposition filter group (9) .

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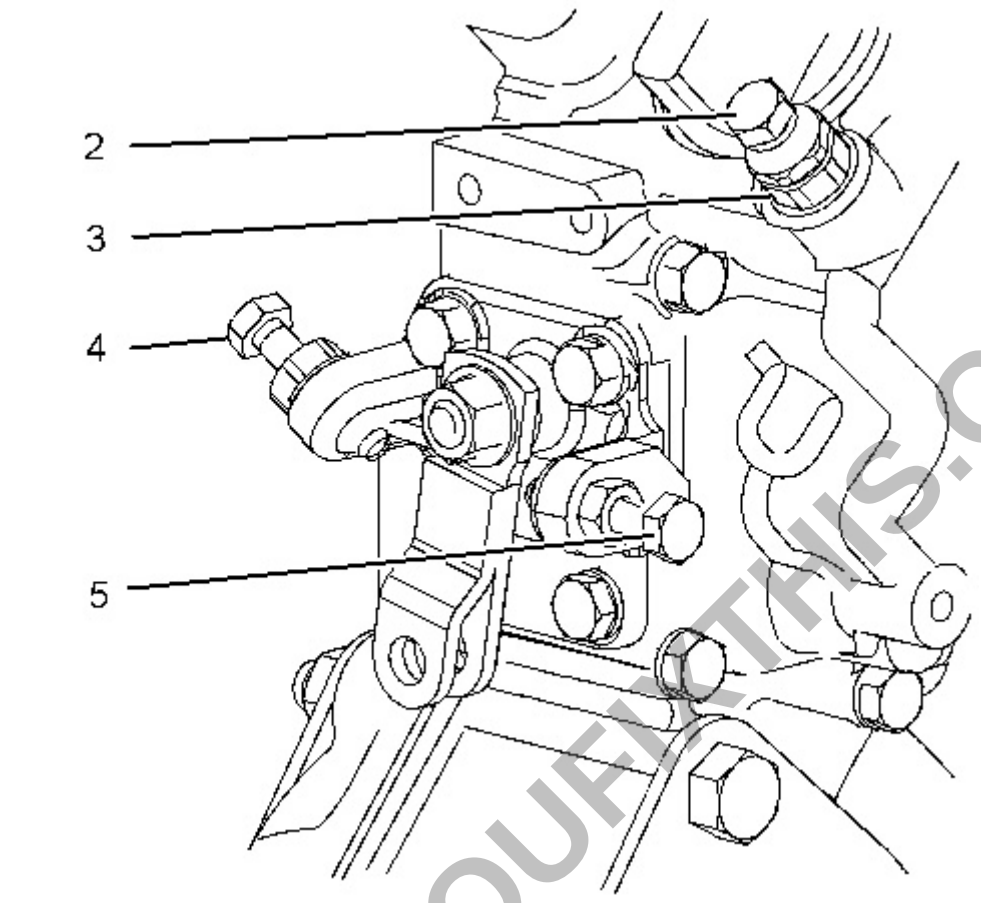


Illustration 2 g01445067

4. Remove tamper proof caps (1) .
5. Record Protrusion (X) of the high idle stop screw (4) .
6. Record Protrusion (Y) of the low idle stop screw (5) .
7. Release locknut (3) . Turn high idle trimmer screw (2) for four turns counterclockwise and tighten locknut (3) .
8. Accelerate the engine to high idle. Use Tooling (F) and record the engine rpm as "Speed B".

Note: The recorded "Speed B" will be lower than the recorded "Speed A" .

Removal of the Old Front Housing

1.

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(9) Main Relief Valve

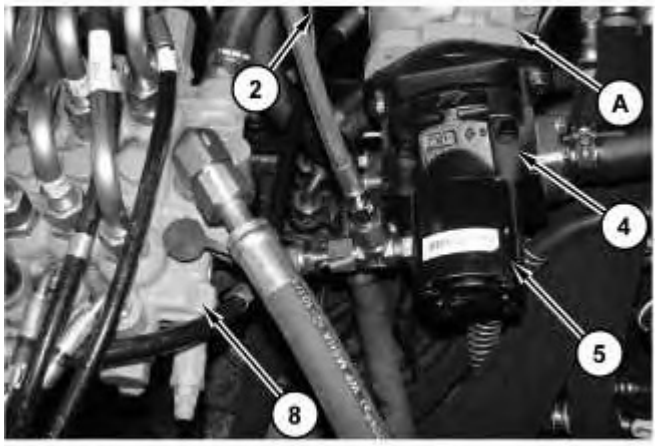


Illustration 2 g02158057

Typical example of the hydraulic system

(A) Piston Pump (hydrostatic)

(2) Hydraulic Tank Group

(4) Gear Pump (work tool)

(5) Gear Pump (charge oil)

(8) Control Valve (work tool)

Gear pump (4) supplies the work tool hydraulic system with oil. Pump (4) is mounted to the front end of the piston pump for the hydrostatic system. Pump (4) is splined to the drive shaft of the piston pump (A) for the hydrostatic system. The piston pump (A) for the hydrostatic system is mounted to the engine. When the engine speed increases, the speed of pump (4) increases. This causes pump (4) to pump more oil to the work tool hydraulic system.

The gear pump (4) for the work tool continuously pumps oil through control valve (8). Control valve (8) is an open center control valve. The oil pressure for control valve (8) is regulated by a main relief valve (9) that is installed in control valve (8) .

The pilot oil for the work tool hydraulic system is supplied by gear pump (5). If the machine is equipped with an air conditioner, the oil flows out of gear pump (5) to the motor for the air conditioner. From the air conditioner motor, the oil flows to the fan drive motor. If the machine has no air conditioner, then the oil flows out of pump (5) and flows directly to the fan drive motor. The oil flows through the fan drive motor to the oil filter. From the oil filter, the oil flows to the front section of the piston pump (A) for the hydrostatic system. At the piston pump (A), the hydraulic oil flows passed the speed sensing valve. In order for the oil to flow to pilot valve (7),

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fluid is injected into your skin, it must be treated immediately by a doctor familiar with this type of injury.

Always use a board or cardboard when checking for a leak.

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.

Refer to Special Publication, NENG2500, "Caterpillar Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Caterpillar products.

Dispose of all fluids according to local regulations and mandates.

Before any tests are performed, visually inspect the complete hydraulic system for oil leaks and damaged parts. Refer to Testing and Adjusting, "Visual Inspection". Before any tests are performed, prepare the machine for troubleshooting. Refer to Testing and Adjusting, "Machine Preparation for Troubleshooting".

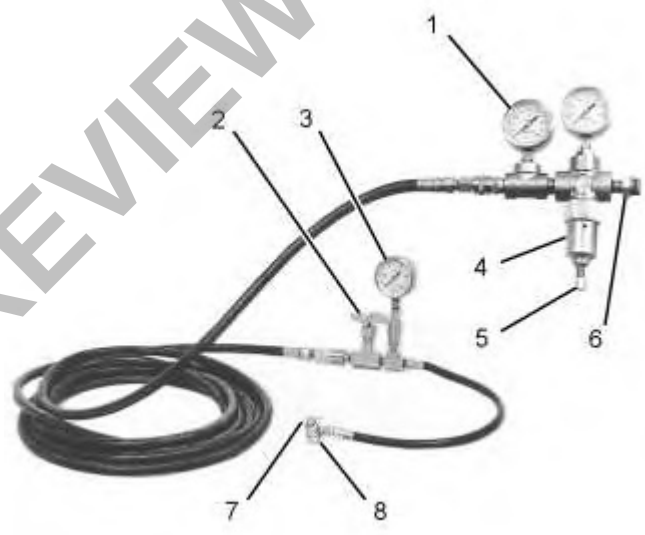


Illustration 6 g01138645

Nitrogen Charging Group

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i02797709

System Pressure - Release - Hydraulic

SMCS - 5050-553-PX

Release Procedure

WARNING

Personal injury can result from hydraulic oil pressure and hot oil.

Hydraulic oil pressure can remain in the hydraulic system after the engine has been stopped. Serious injury can be caused if this pressure is not released before any service is done on the hydraulic system.

Make sure all of the work tools have been lowered to the ground, and the oil is cool before removing any components or lines. Remove the oil filler cap only when the engine is stopped, and the filler cap is cool enough to touch with your bare hand.

1. Lower the armrest.
2. Turn the engine start switch to the ON position. Disengage the parking brake.
3. Press each side of the auxiliary hydraulic control switch (A1 and A2) for one to two seconds in order to release the auxiliary system pressure. Keep the joystick control in the NEUTRAL position while you press the auxiliary hydraulic control switch (A1 and A2).
4. Engage the parking brake.
5. Start the engine and run the engine for at least 15 seconds in order to recharge the accumulator.
6. Turn the engine start switch to the OFF position.

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Displacement ... 13.34 cc/rev (0.8140 in^3/rev)
Maximum continuous pressure ... 15000 kPa (2200.0 psi)
Maximum intermittent pressure ... 18000 kPa (2600.0 psi)
Maximum peak pressure ... 20000 kPa (2900.0 psi)
Minimum rotation at a pressure of 15000 kPa (2200.0 psi) ... 500 RPM
Maximum rotation at a pressure of 15000 kPa (2200.0 psi) ... 3500 RPM
Minimum operating temperature ... -40 °C (-40.0 °F)
Maximum temperature for continuous operation ... 93 °C (200.0 °F)
Maximum temperature for intermittent operation ... 105 °C (221.0 °F)
Setting for the relief valve at a flow rate of 13.1 L/min (3.5 US gpm) ... 5600 ± 150 kPa (812 ± 22 psi)

(2) The outlet port

(3) The adjustment screw for the relief valve and the fan speed.

(4) Torque for the nut ... 7 N·m (5.0 lb ft)

(5) Torque for the relief valve ... 30 N·m (22 lb ft)

(6) Torque for the bolt ... 30 ± 7 N·m (22 ± 5 lb ft)

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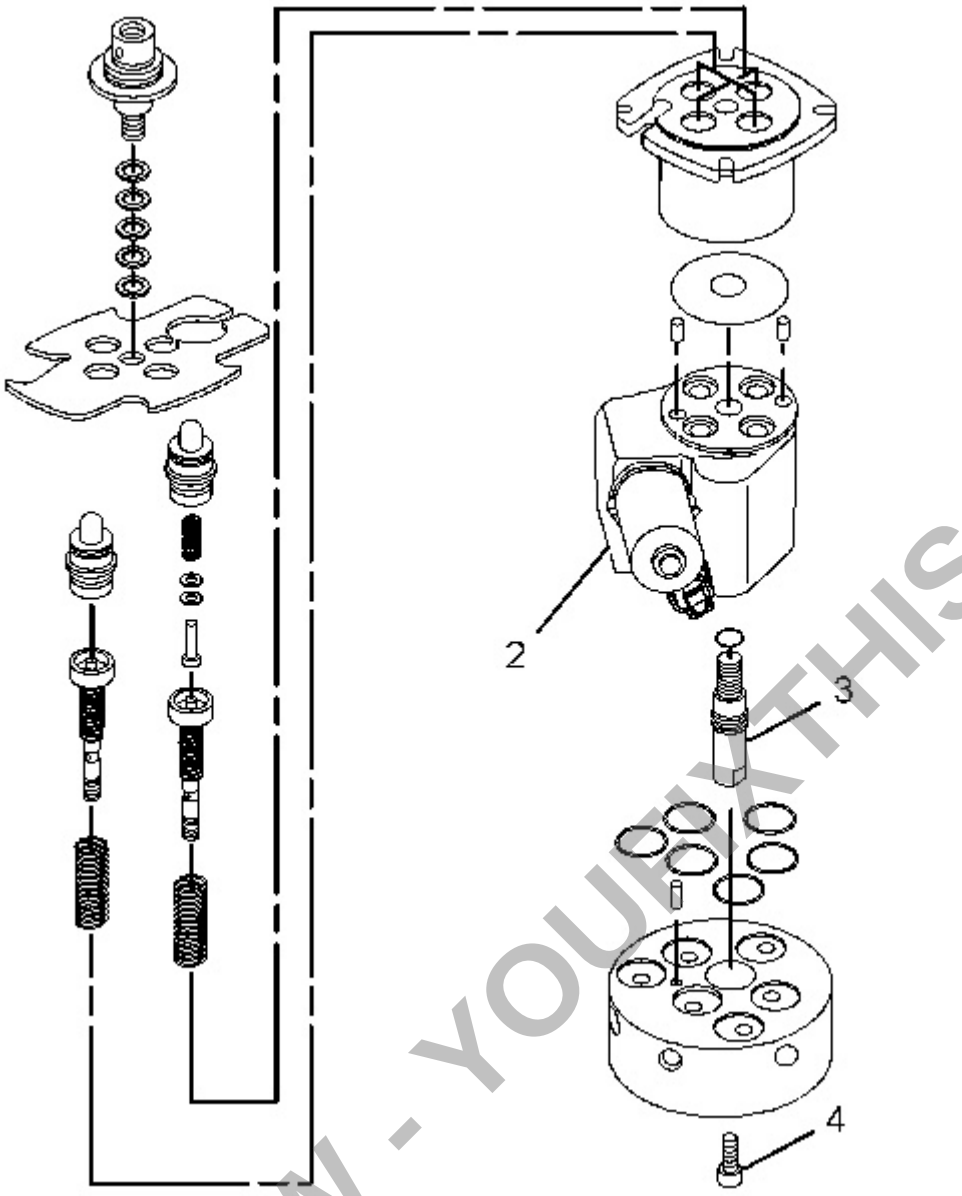


Illustration 2 g02162235

(2) **195-9700** Solenoid Valve Gp

Nominal voltage for operation ... 12 VDC
Maximum voltage for actuation with a temperature of 121 °C (250.0 °F) ... 14.5 VDC
Minimum voltage for actuation with the coil at 25 °C (77.0 °F) ... 9 VDC
Maximum wattage for continuous duty with the coil at a temperature of 121 °C (250.0 °F) ... 13.3 w
Resistance for the coil at a temperature of 20° ± 5°C (68.0° ± 9.0°F) ... 9.88 ± 0.49 Ohms

(3) Torque for the bolt ... 50 ± 5 N·m (37 ± 4 lb ft)

Note: Apply **154-9731** Thread Lock Compound to the threads of the bolt (5) .

(4) Torque for the bolt ... 18 ± 2 N·m (13 ± 1 lb ft)

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i04643912

Engine Crankcase Pressure (Blowby) - Test

SMCS - 1215; 1317

Table 1

Tools Needed		
Part Number	**Part Name**	**Quantity**
348-5430	Multi-Tool Gp	1
285-0900	Blowby Tool Group	1
NETG5049	Software License	1

Damaged pistons or rings can cause too much pressure in the crankcase. This condition will cause the engine to run rough. There will be more than a normal amount of blowby fumes rising from the crankcase breather. The breather can then become restricted in a short time, causing oil leakage at gaskets and seals that would not normally have leakage. Blowby can also be caused by worn valve guides or by a failed turbocharger seal.

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Illustration 1 g01507656

(1) External equalizer line

(2) Metered restriction

(3) Outlet

(4) Capillary tube and temperature sensing bulb

(5) Diaphragm

(6) 90° style expansion valve

(7) Inlet

(8) Ball and rod

(9) Spring

The expansion valve (6) is designed to convert the refrigerant from a high pressure and high temperature liquid into a low pressure and low temperature liquid vapor mixture. The expansion valve also controls the amount of refrigerant that is supplied to the evaporator.

The two main types of expansion valve are the 90° expansion valve and the block expansion valve. The internal operation is identical for both of the valves. The valve configuration on the air conditioning system can be found in Systems Operation, SENR5664, "Refrigerant Expansion Valve System".

The liquid refrigerant with high pressure and high temperature enters the expansion valve at the inlet (7) from the condenser. An amount of refrigerant is allowed to flow through the metered restriction (2) and the outlet (3) to the evaporator.

The size of the metered restriction is controlled by three components: ·

- Pressure in the capillary tube (4)
- Pressure in the external equalizer line (1)
- Force due to the spring (9)

The capillary tube is filled with saturated refrigerant. There is a temperature sensing bulb at the end of the capillary tube. The temperature sensing bulb is held to the evaporator outlet. As the temperature of the evaporator outlet increases, the pressure in the capillary tube increases. This pressure creates a downward force on the diaphragm (5). Some types of block valves have an internal temperature sensing bulb.

The external equalizer line connects the evaporator outlet with the underside of the diaphragm. The pressure in the line creates an upward force on the diaphragm. In a block style expansion valve, there is not a required separate external equalizer line. There is not a separate external equalizer line because the line for the evaporator outlet is routed through the block valve.

The ball and rod (8) is attached to the diaphragm and the spring. The spring creates an upward force on the ball and rod.

When the force due to the pressure in the capillary tube is greater than the combined forces due to the spring and the pressure in the external equalizer line, the valve opens wider. This allows more

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Evacuate the system before charging any Refrigerant system. Refer to Service Manual, SENR5664, "Refrigerant System - Evacuate".

In order to find the refrigerant capacity for the system that needs a refrigerant charge, refer to the Specifications, "System Capacities for Refrigerant" section. Also, refer to the Service Manual, SENR5664, "Identifying the Air Conditioning System" section.

Engine OFF

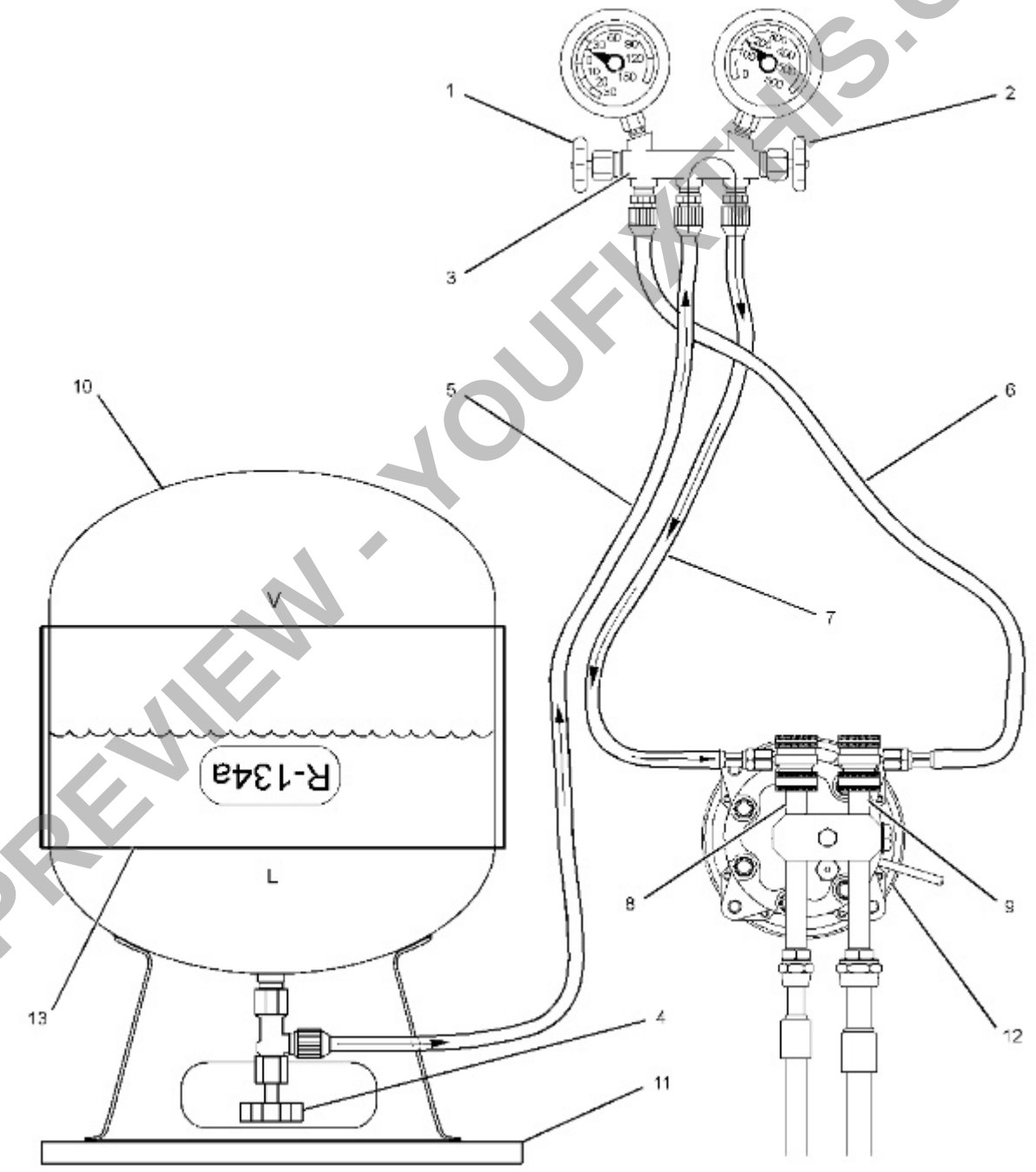


Illustration 1 g02885759

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Probable Causes

- **Diagnostic Codes**
- **Low Pressure Switch / High Pressure Switch**
- **Low Refrigerant Charge**
- **Water Valve Actuator**
- **A/C Compressor**

Recommended Actions

Diagnostic Codes

Connect Cat ET to the service tool connector. Check for active diagnostic codes. Look for active codes that are related to the HVAC system in Illustration 13. Use the appropriate circuit test to troubleshoot any active codes before continuing.

Low Pressure Switch / High Pressure Switch

Use Cat ET to monitor the "Air Conditioning Refrigerant Monitoring Circuit" status parameter. With a proper charge the status should be closed. If the status is open check the pressure switches and circuit (refer to the pressure switch tests section in this book).

Low Refrigerant Charge

Refer to Air Conditioning Performance - Test

Water Valve Actuator

Test the water value actuator control by switching to heat mode. Use Cat ET and monitor the "Cab Air Heater Engine Coolant Actuator Duty Cycle" status parameter while rotating the temperature dial. The parameter should go to 5% when the temperature dial is full CCW and 95% when the temperature dial is full CW. If the Cab Air Heater Engine Coolant Actuator Duty Cycle" doesn't move with the temperature dial, check the temperature dial (see the troubleshooting section 2661 in the machine troubleshooting guide). If the Cab Air Heater Engine Coolant Actuator Duty Cycle" moves with the temperature dial, verify the water valve actuator circuit and that the actuator is rotating.

A/C Compressor

Switch to AC mode and use Cat ET to monitor the "A/C Compressor" status parameter with the engine running. If the compressor status does not turn to ON after 20 seconds, check the evaporation temperature circuit (refer to 2357 diagnostic code in the machine TSG) and the pressure switch circuits (refer to the pressure switch tests section in this book). If the compressor status is ON and the compressor does not turn on, check for power at the compressor connection.

Note: If the compressor status is on and there is power at the compressor clutch, then replace the compressor.

Cab Temperature Low

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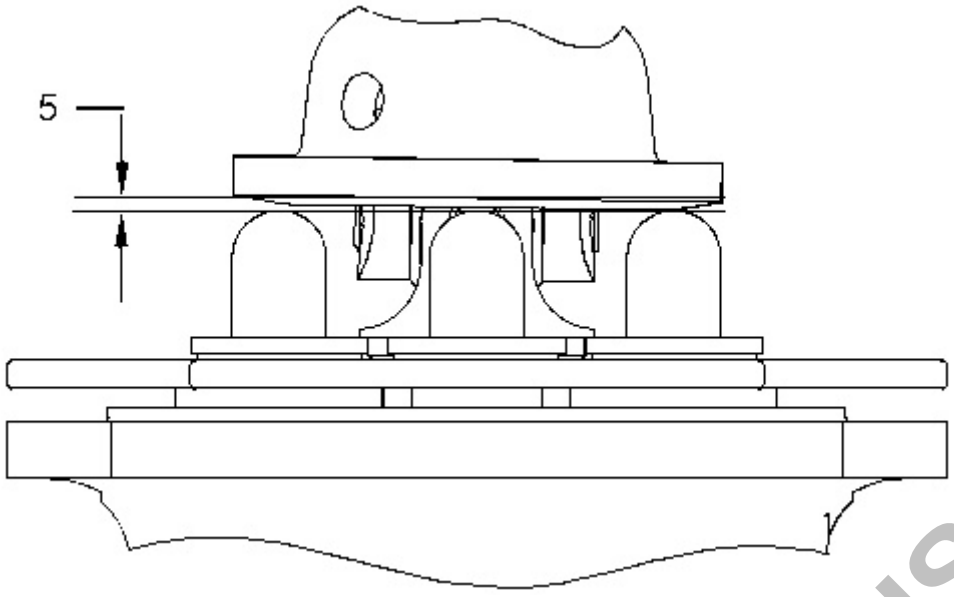


Illustration 3 g02162236

(5) When you hold the cam to a plunger, a gap develops between the cam and the plunger on the opposite side of the cam. The distance between the cam and the plunger ... 0.100 ± 0.100 mm (0.0039 ± 0.0039 inch)

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Media Number -UENR0252-01 **Publication Date -01/10/2012** **Date Updated -18/10/2012**

i02117426

Pilot Operated Hydraulic Control - Disassemble

SMCS - 5059-015; 5063-015; 5705-015

Disassembly Procedure

Start By:

A. Remove the pilot operated hydraulic control. Refer to Disassembly and Assembly, "Pilot Operated Hydraulic Control - Remove".

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(4) Neutral adjusting bolt for rotating group 2

(5) Neutral adjusting bolt for rotating group 1

(6) MA Port for rotating group 2

(7) MA Port for rotating group 1

6. Remove the plug from the MA port for rotating group 2 (6) . Install **6V-3965** Fitting with **3J-1907** O-Ring Seal into the MA port for rotating group 2 (6) . Install **8T-0860** Pressure Gauge (0 to 40000 kPa) to the MA port for rotating group 2 (6) with the following items: **6V-3989** Fitting , two **6V-4143** Quick Connect Couplers and **177-7860** Hose .

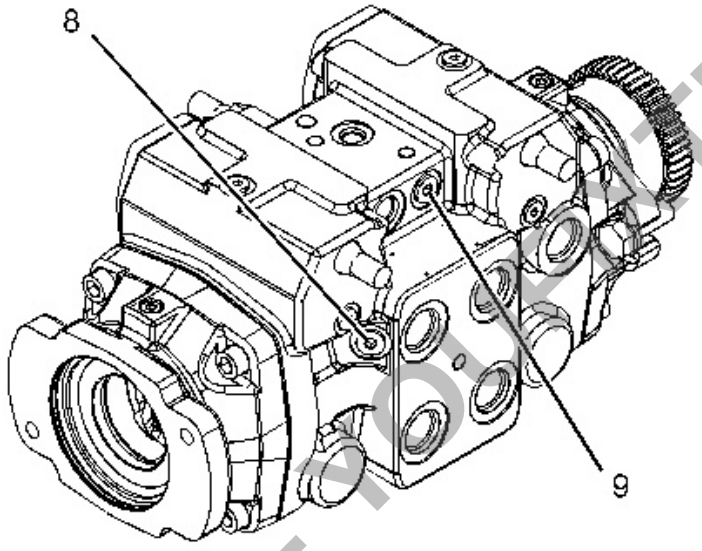


Illustration 9 g01116394

(8) MB Port for rotating group 2

(9) MB Port for rotating group 1

7. Install **8T-0860** Pressure Gauge (0 to 40000 kPa) to the MB port for rotating group 2 (8) with the following items: **6V-3989** Fitting , two **6V-4143** Quick Connect Couplers and **177-7860** Hose .
8. Place the gauges in an easily visible position.
9. Lower the cab. Route the test hoses so that the cab does not rest on any of the hoses.
10. Fasten the seat belt and lower the armrest.
11. Start the engine and run the engine at LOW IDLE.
12. Raise the cab.
13. Loosen the locknut for the neutral adjusting bolt. Do not use an impact socket.

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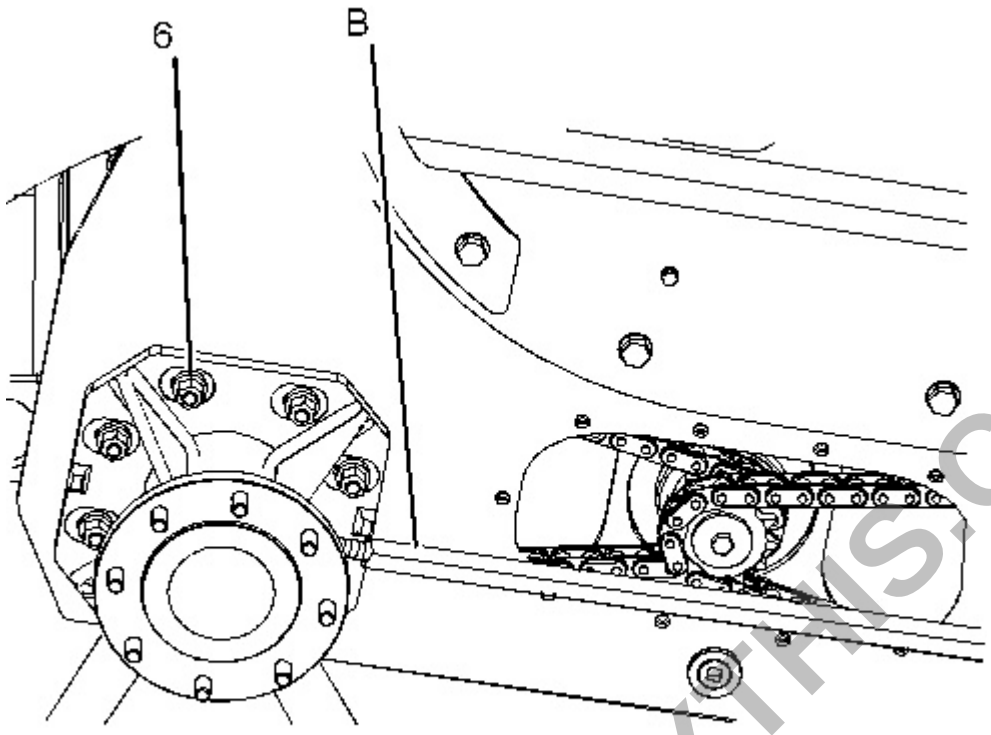


Illustration 3 g01092147

4. Loosen bolts (6) .
5. Position Tooling (B) .
6. Rotate Tooling (B) counterclockwise in order to tension the chain to the proper specification.

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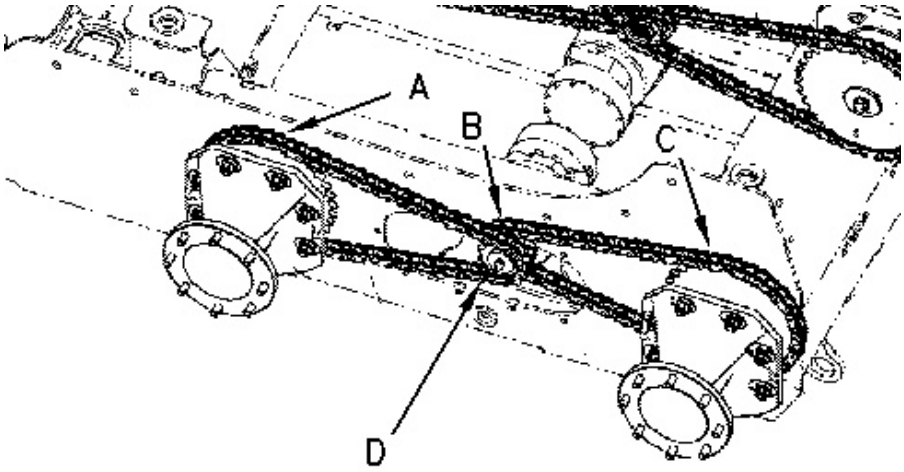


Illustration 1 g00577375

1. The front axle assemblies and the rear axle assemblies are driven by different drive chains. The drive chains are installed on Drive Sprocket (B) and Drive Sprocket (D) . The drive sprockets are mounted on the drive shaft of the hydrostatic piston motor. The two drive sprockets are the same component. The drive sprocket on the hydrostatic piston motor has sprocket drives on different planes. The drive sprockets on the front and rear axles are the same component. The sprockets on the front and rear axles are mounted at 180 degrees of opposite direction. Sprocket (A) is in line with Drive Sprocket (D) and that Sprocket (C) is in line with Drive Sprocket (B) . The drive sprockets are installed in a manner that will allow the drive chains to turn in a straight line. If any of the sprockets are installed incorrectly the drive chains cannot be installed properly. Note the orientation of all of Drive Sprocket (B) and Drive Sprocket (D) . Note the orientation of Sprocket (A) and Sprocket (C) on the axles.

2. Clean the mating surfaces of the tandem drive and the piston motor.

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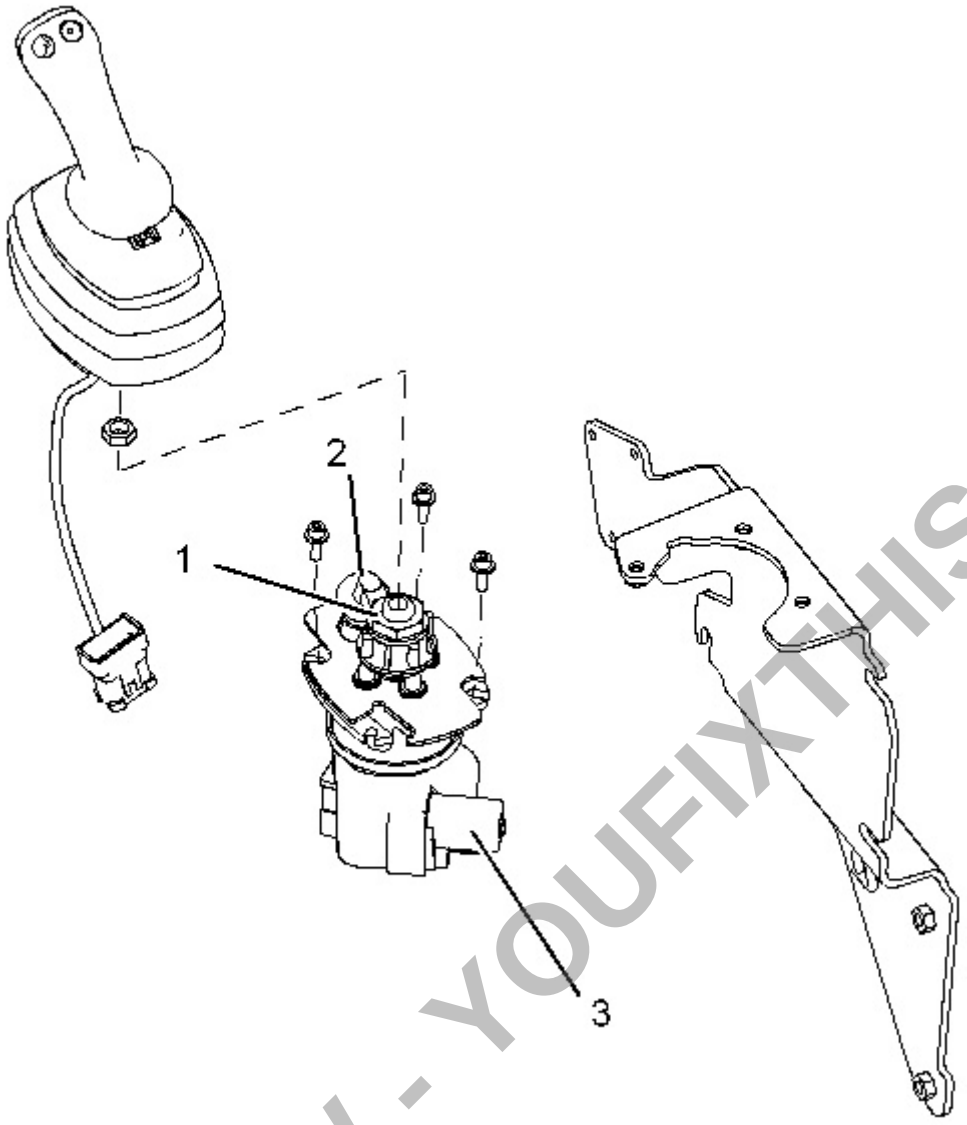


Illustration 1 g02162182

(1) Torque for the nut ... 40 ± 5 N·m (30 ± 4 lb ft)

Note: Apply **154-9731** Thread Lock Compound to the threads of the nut.

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