(10) Oil outlet port

(11) Exhaust inlet

A turbocharger is installed between the exhaust and inlet manifolds. The turbocharger is driven by exhaust gases which flow through the exhaust inlet (11). The energy of the exhaust gas turns the turbine wheel (8). Then, the exhaust gas flows out of the turbine housing (7) through the exhaust outlet (9) .

Turbine wheel (8) and compressor wheel (3) are installed on the same shaft. Therefore, turbine wheel (8) and compressor wheel (3) rotate at the same rpm. The compressor wheel is enclosed by compressor housing (2). The compressor wheel compresses the air. The air flows into the engine cylinders through the inlet valves of the cylinders.

The oil from the main gallery of the cylinder block flows through the oil inlet port (5) in order to lubricate the turbocharger bearings (4) and (6). The pressurized oil passes through the bearing housing of the turbocharger. The oil is returned through the oil outlet port (10) to the oil pan.

The turbocharger has a wastegate. The wastegate is controlled by the boost pressure. This allows some of the exhaust gas to bypass the turbine at higher engine speeds. The wastegate is a type of flapper valve that automatically opens at a preset level of boost pressure in order to allow exhaust gas to flow around the turbine. The wastegate allows the design of the turbocharger to be more effective at lower engine speeds.

The wastegate is controlled by a diaphragm which is open to the atmosphere on one side and open to the manifold pressure on the other side.

An air/fuel ratio control is installed between the turbocharger and the fuel injection pump. The air/fuel ratio control performs the following functions:

- The fuel is limited on acceleration in order to prevent an overspeed condition.
- The generation of black smoke is reduced.
- The fuel efficiency is improved and emissions are reduced at low boost when the fuel rack is limited for low power output.

Cylinder Head And Valves

The valves and the valve mechanism control the flow of the air and the exhaust gases in the cylinder during engine operation. The cylinder head assembly has two valves for each cylinder. Each valve has one valve spring. The ports for the inlet and exhaust valves are on the right side of the cylinder. Steel valve seat inserts are installed in the cylinder head for both the inlet and the exhaust valves. The valve seat inserts can be replaced.

The valves move along steel guides. The guides are treated with phosphate in order to reduce friction and wear. The valve guides can be replaced. The exhaust valve guide has a counterbore in order to prevent the seizure of the valve stem. The seizure of the valve stem is caused by a buildup of carbon under the head of the valve.

The inlet and the exhaust valves are opened and closed by the rotation and movement of the following components:

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i02485800

Crankshaft

SMCS - 1202

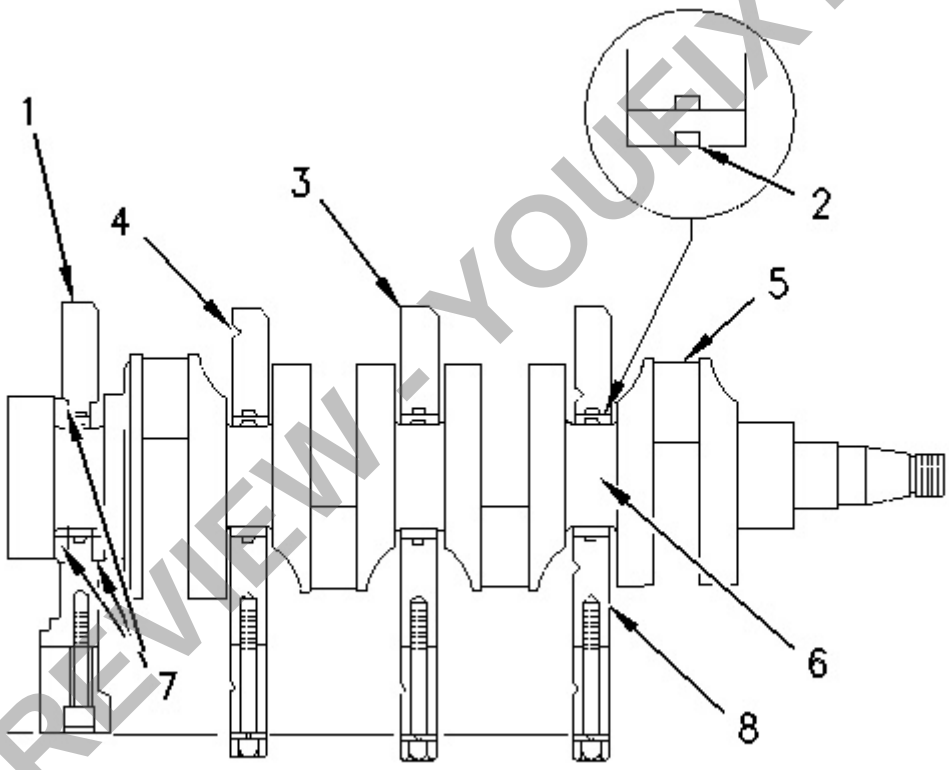

Illustration 1 g00465053

(1) Chamfer

The chamfer faces the front of the engine.

(2) Upper half of the main bearing with the oil groove

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NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

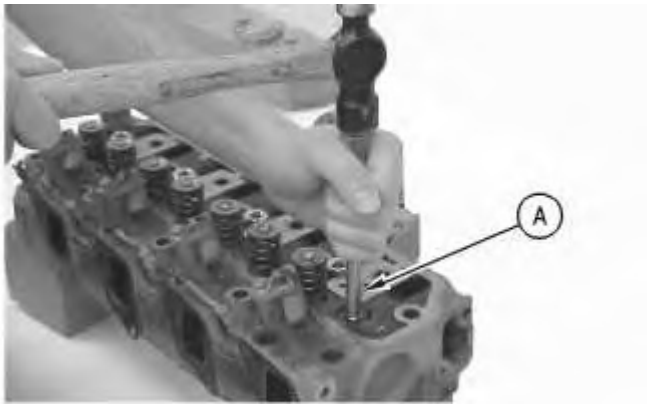

Illustration 2 g00702790

1. Use Tool (A) in order to remove the valve guides from the cylinder head.
2. Repeat the procedure for the remaining valve guides.

Installation Procedure

Table 2

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	FT-2716	Valve Guide Driver	1
B	FT-2717	Stop Collar	1

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

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Specifications
3034 Engine for Caterpillar Built Machines
Media Number -SENR5008-06 **Publication Date -01/09/2004** **Date Updated -29/09/2004**

i01309073

Crankshaft Pulley

SMCS - 1205

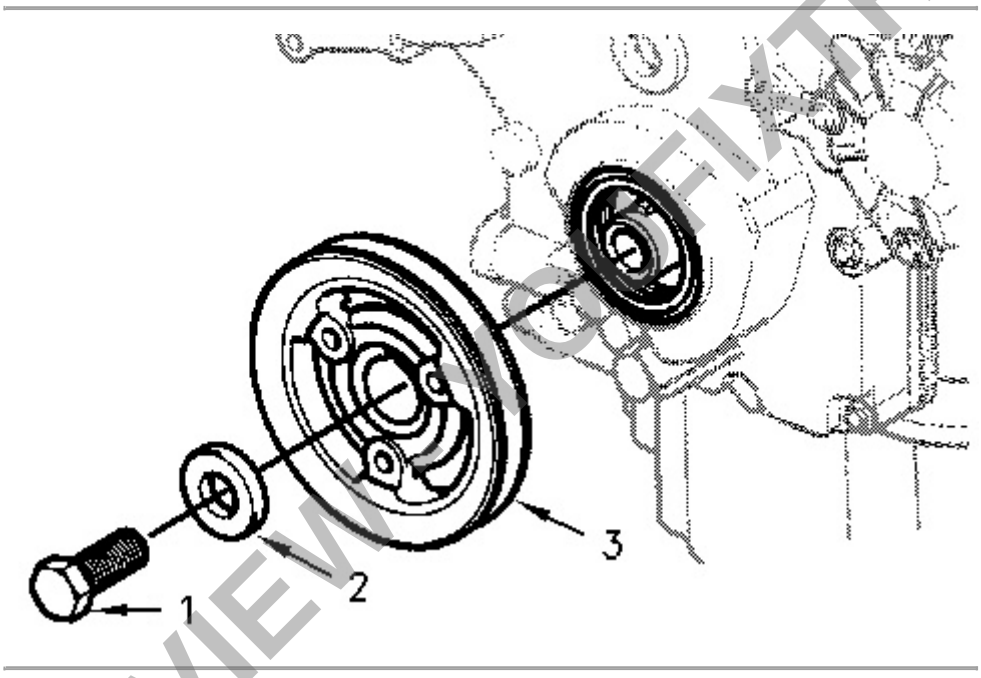

Illustration 1 g00693377

(1) Crankshaft pulley bolt

Tighten the crankshaft pulley bolt to the following torque: ... 185 N·m (136 lb ft)

(2) Washer

(3) Crankshaft pulley

Note: Apply Loctite 5900 to the keyway and the surface of the washer on all crankshaft pulleys. Inject a 3 mm (0.12 inch) bead of **8T-9022** Silicone Gasket into the crevice between the crankshaft and the crankshaft pulley.

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Illustration 1 g00825811

2. Install new gasket (7) in position on the engine.

3. Place water pump (4) in position on the engine and install bolts (8) and nut (10) . Tighten nut (10) and bolts (8) that fasten water pump (4) to the engine.

4. Install lower hose (not shown) and tighten the hose clamp. Install hose (11) on water pump (4) and tighten hose clamps (9) .

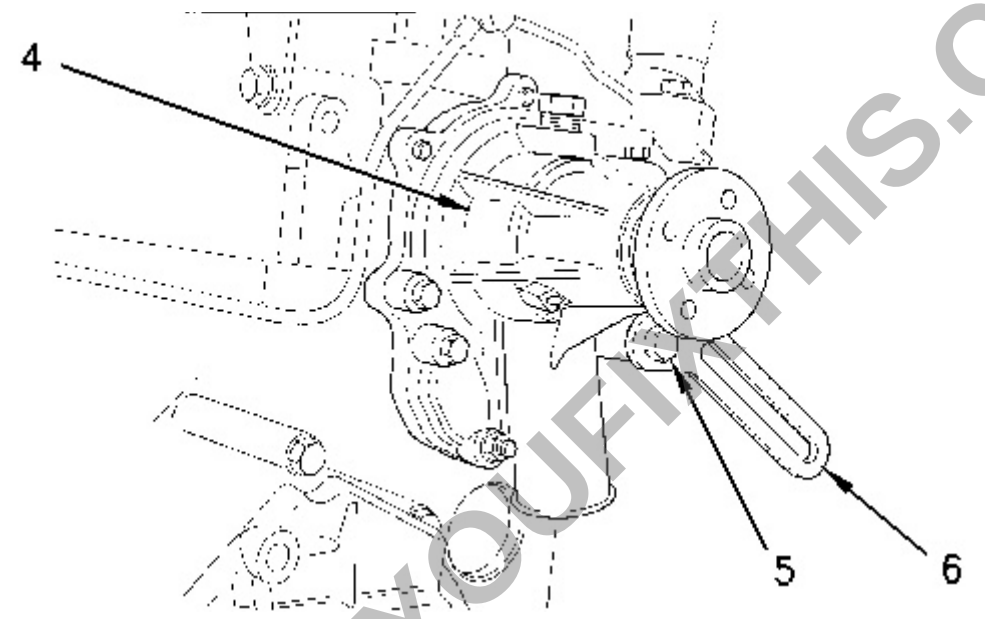

Illustration 2 g00825842

5. Place alternator bracket (6) into position on water pump (4) and install bolt (5) on water pump (4) .

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Illustration 5 g00779964

Location of the solenoid valve for the hydrostatic pilot

The solenoid valve is associated with the following machines:

216 (4NZ1-UP)

226 (5FZ1-UP)

228 (6BZ1-UP)

236 (4YZ1-3999)

246 (5SZ1-3999)

248 (6LZ1-UP)

Illustration 6 g00779967

Location of the solenoid valve for the hydrostatic pilot

The solenoid valve is associated with the following machines:

236 (4YZ4000-UP)

246 (5SZ4000-UP)

252 (FDG1-UP)

262 (CED1-UP)

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6. Click the "Save" button. A successful message will be displayed. Refer to Illustration 4.
7. Click "OK". The PM Intervals have been customized.

Illustration 5 g01250119

"Reset All PM Intervals" confirmation message

If you choose to click the "Reset to Default" button on the "Customize PM Intervals" screen, the window as shown in Illustration 5 will appear.

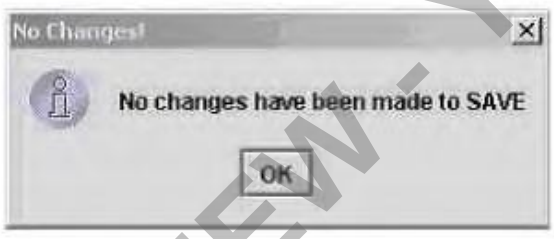

Illustration 6 g01250121

No "PM Interval" changes message

If you click the "Save" button on the "Customize PM Intervals" screen and have not changed from the defaults, the window as shown in Illustration 6 will appear.

Edit PM Check List

The PM Checklist is a description of the steps that should be taken when performing a planned maintenance. The steps can include everything from checking fluid levels to replacing parts. Through EquipmentManager you can edit these checklists to add, edit, or remove steps.

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Date/Time ▼	Power Loss	Satellite Blocked	Time and Geo. Fence Active	Time and Geo. Fence Alarm	Power Mode	Event Pending	Digital #1 Active	Digital #2 Active	Digital #3 Active	Digital #4 Active
08/01/2006 10:09:01 PM	No	Yes	Yes	Yes	Active (Power Mode 1)	No	Yes	No	No	No
07/31/2006 10:09:01 PM	No	Yes	Yes	Yes	Active (Power Mode 1)	No	Yes	No	No	No
07/30/2006 10:09:01 PM	No	Yes	Yes	Yes	Active (Power Mode 1)	No	Yes	No	No	No
07/29/2006 10:28:38 PM	No	Yes	Yes	Yes	Active (Power Mode 1)	No	Yes	No	No	No
07/29/2006 10:09:00 PM	No	Yes	Yes	Yes	Active (Power Mode 1)	No	Yes	No	No	No
07/28/2006 10:09:01 PM	No	Yes	Yes	Yes	Active (Power Mode 1)	No	Yes	No	No	No
07/27/2006 10:09:00 PM	No	Yes	Yes	Yes	Active (Power Mode 1)	No	Yes	No	No	No
07/26/2006 10:09:02 PM	No	Yes	Yes	Yes	Active (Power Mode 1)	No	Yes	No	No	No

Illustration 6 g01390795

Bottom of the "Status History" screen

When you are done, click the "Change Date Range" button. The "Status History" table will again load the date in order to reflect the updated range of the date. Click the "Back" button in order to return to the "Equipment Registration Detail" screen.

Note: The "Change Date Range" function works similarly in many views or screens throughout the application.

Table 4 describes fields that are found on the "Status History" screen. Click the "Back" button in order to return to the "General Registry" screen.

Table 4

"Status History" Screen		
Field	**Description**	**Values**
"Date/Time"	Displays the date and time of the status report. If the PLM is set to send status once per day, these values should be approximately one day apart each time.	
"Power Loss" (Low Voltage)	Indicates that the PLM experienced a loss of power or low voltage sometime between this status report and the last status report.	Yes, No
"Satellite Blocked"	Indicates that the PLM was blocked from the satellite sometime between this status report and the last status report.	Yes, No
"PW Active"	Indicates that "Time and Geographic Fencing" is active.	Yes, No, N/A
"PW Alarms"		

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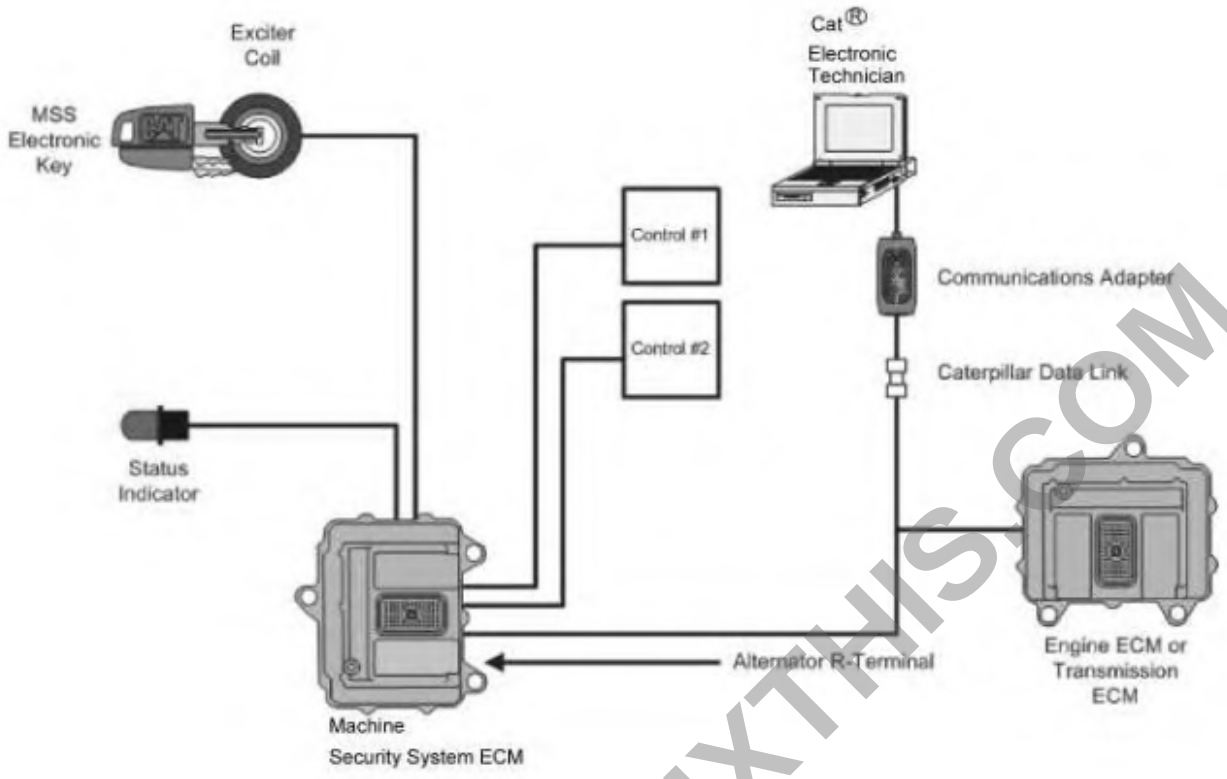

Illustration 1 g02181780

Machine security system (MSS)

The ECM for the machine security system is a hardened computer that is designed specifically for the MSS.

The Cat® electronic key for the MSS contains an electronic chip that is embedded in the head of the key. This chip in the head of the key contains a unique identification number. The Cat® electronic key uses the same key cut as the standard Cat® key. The electronic key can be used to operate any machine that uses the current Cat® keyswitch. The Cat® electronic key comes in a gray color or a yellow color. Cat® electronic keys are not configurable.

The exciter coil of the MSS is a ring shaped device. The exciter coil is mounted around the existing Cat® keyswitch. The exciter coil is used to read the ID that is contained in the Cat® electronic key.

Note: Ensure that you have only one electronic key near the exciter coil when the MSS reads the key. If more than one electronic key is near the exciter coil, the MSS ECM will not read the key and the machine will not start.

The status indicator for the MSS is mounted in the dash of the machine near the keyswitch. The status indicator will give basic information about the MSS to the operator of the machine. The status indicator has two colors: red and green.

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6. Measure the voltage across the battery. Put the red lead on the positive battery terminal, and put the black lead on the negative battery terminal. Step 6 should be completed as quickly as possible after Step 5 .

   Expected Result: On 12 volt systems, the voltage is within one volt of the voltage recorded in Step 5. On 24 volt systems, the voltage is within 2 volts.

   Results:

   - YES - If the voltage in Step 5 is not more than 1 volt for 12 volt systems (2 volts for 24 volt systems) higher than the voltage in Step 6, this step is complete and the related wiring is correct at this time. Go to Step 9 .
   - NO - If the voltage in Step 5 is more than 1 volt for 12 volt systems (2 volts for 24 volt systems) higher than the voltage in Step 6, there is high circuit resistance: corrosion, loose connections and damaged wiring. Go to Step 7.

7. Check the voltage between the machine frame and the alternator B+ terminal. Record the voltage.

8. Check the voltage between the machine frame and the positive battery post. Step 8 should be completed as quickly as possible after Step 7.

   Expected Result: The voltage difference between Step 7 and Step 8 does not exceed 1 volt on 24 volt systems or 0.5 volts on 12 volt systems.

   Results:

   - YES - The voltage difference does not exceed the tolerance. The charging circuit is good. Go to Step 9 .
   - NO - The voltage difference exceeds the tolerance. There is high resistance in the charging circuit: loose cables, corroded cables, damaged cables, faulty circuit breaker and faulty main relay. Correct the problem. Go to Testing and Adjusting, "Initial Troubleshooting Procedure" retest the system.

9. Start the engine and set the throttle to at least 75%. Turn all accessories OFF.

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B. Start the engine and set the throttle to at least 75 percent. Turn ON all electrical accessories for the remainder of this test step. Allow the engine to run for at least 3 minutes before continuing.

C. Measure the voltage between the "B+" terminal of the alternator and the case of the alternator. Make a note of the voltage that was measured. Perform the next measurement immediately.

D. Measure the voltage across the battery. Put the red lead on the positive terminal of the battery, and put the black lead on the negative terminal of the battery. Make a note of the voltage that was measured.

Expected Result:

The voltage at the battery should be less than the voltage at the alternator. On systems that are 12 V, the difference in voltages should not be more than 1 V. On systems that are 24 V, the difference should not be more than 2 V.

Results:

- **YES -** The voltage at the battery is less than the voltage at the alternator. Also, the difference in voltages is less than 1 V for 12 V systems and the difference is less than 2 V for 24 V systems. The wiring that is related to the alternator is correct at this time.

  Repair: There is an internal problem with the alternator. Repair or Replace the alternator.

  STOP

- **NO -** The voltage at the battery is less than the voltage at the alternator. However, the difference in voltages is greater than 1 V for 12 V systems and the difference is greater than 2 V for 24 V systems. Proceed to test step 20.

Test Step 20. TEST THE POSITIVE SIDE OF THE CHARGING CIRCUIT.

A. Measure the voltage between the frame of the generator set and the "B+" terminal of the alternator. Make a note of the voltage that was measured. Perform the next measurement immediately.

B. Measure the voltage between the frame of the generator set and the positive terminal of the battery. Make a note of the voltage that was measured.

Expected Result:

The voltage difference does not exceed 1 V on 24 V systems or 0.5 V on 12 V systems.

Results:

- **VOLTAGE OK - ALT. WITHOUT IG/S TERM. -** The voltage difference does not exceed the tolerance. The positive circuit is good.

  Repair: There is an internal problem with the alternator. Repair or Replace the alternator.

  STOP

- **VOLTAGE EXCESSIVE - ALL ALT. -** The voltage difference exceeds the tolerance.

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"Status Parameters" Screen

Illustration 3 g02667376

The PL522 or 523 "Status Parameters" screens show the current operational status of the PL522 or 523 module. Refer to Illustration 3.

Table 1

Device Configuration and Status Information for PL522 and 523	
PL522 and 523 Information	**Description**
Power Mode Status	Power Mode 1: The machine has operated in the last seven days. If the key is OFF, the PL522 or 523 will wake up every 2 hours for motion detection. The modules will also check to send and receive messages every 6 hours.
	Power Mode 2: The machine has not operated for at least seven days. The PL522 or 523 will wake up every 2 hours for motion detection and once daily to send and receive messages.
Alternator Running Input	Engine Running: Product has determined that the engine is running.
	Engine Off: Product has determined that the engine is not currently running.
GPS Receiver	"Not Present" state: If Master board FW cannot communicate with the GPS receiver, the Master board firmware will consider GPS receiver "not present".
	"Functional" state: Fully operational.

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i00937307

Alternator - Disassemble

SMCS - 1405-015

Procedure

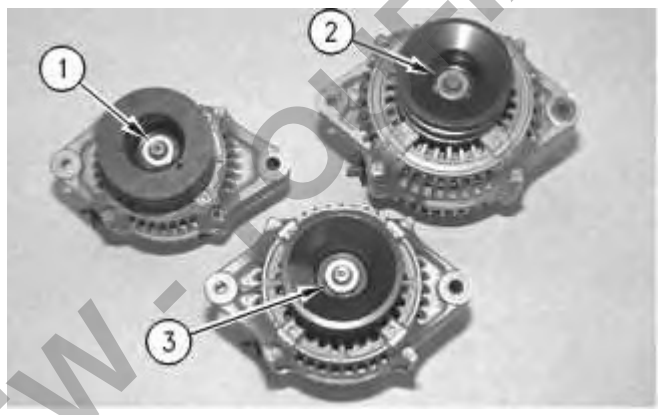

Illustration 1 g00477507

(1) G3B Alternator Pulley Nut. (2) L3A Alternator Pulley Nut. (3) K3A Alternator Pulley Nut.

1. Remove the nut that secures the pulley to the rotating shaft. An impact wrench can be used to loosen the nut. Use a deep well socket (six point). Do not use a twelve point socket.

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		increase too rapidly when the engine is started. Proceed to Test Step 14.
14. Verify the High Idle Speed A. Verify the high idle speed of the engine.	High idle	**Result:** The high idle operates for an excessive time. Check the fuel injection pump for correct operation and settings. Verify that the problem is resolved. **Result:** The high idle does not operate for an excessive time. Proceed to Test Step 15.
15. Inspect the Oil Supply Line A. Inspect the oil supply line for leaks.	Leaks	**Result:** The oil supply line has leaks. The supply line must be repaired or replaced. Verify that the problem is resolved. **Result:** The oil supply line does not have leaks. Proceed to Test Step 16.
16. Inspect the Turbocharger for a Restriction A. Inspect the turbocharger for a restriction in the bearing housing.	Restriction	**Result:** The turbocharger has a restriction in the bearing housing. The bearing housing must be repaired or the turbocharger must be replaced. Verify that the problem is resolved. **Result:** The turbocharger has a restriction in the bearing housing. Proceed to Test Step 17.
17. Inspect the Engine Oil Filter A. Inspect the engine oil filter for a	Oil Filter	**Result:** The engine oil filter has a restriction. Clean the engine oil filter base and the housing for the engine oil filter.

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procedure. A test of the second opening pressure requires the disassembly of the fuel injection nozzle and the use of special shims. Disassembly of the fuel injection nozzles may invalidate the standards for emissions of the engine.

1. Connect fuel injection nozzle (12) to the tooling that is shown in Illustration 2.

   The spray from the fuel injection nozzle must be directed into **1U-8857** Extension (14) and **8S-2270** Fuel Collector (15) .

   Refer to the table in the Specifications Module, "Fuel Injection Nozzles" topic for the correct pressure settings. If the opening pressure is not within the range of the setting which is given in the table, the fuel injection nozzle must be replaced.

   Use clean **6V-6068** Calibration Fluid when the fuel injection nozzles are tested. The calibration fluid is similar to SAE J-967 (ISO 4113) oil.

2. Close the gauge protector valve. Close the shutoff valve. Open the pump isolator valve. Flush the fuel injection nozzle by operating the nozzle tester. Operate the nozzle tester for 10 to 15 strokes at a rate of approximately sixty strokes per minute.

3. Open the gauge protector valve. Slowly increase the pressure until the valve in the fuel injection nozzle opens. Note the highest pressure indication on the dial indicator before the pointer moves to 0 kPa (0 psi). This highest pressure indication is the opening pressure of the fuel injection nozzle. The opening pressure will happen when valve needle rises from the nozzle seat.

   Refer to the table in the Specifications Module, "Fuel Injection Nozzles" topic for correct pressure settings. If the opening pressure is not within the range of the setting that is given in the table, the fuel injection nozzle must be replaced.

Back Leakage Test

1. Connect fuel injection nozzle (12) to the tooling that is shown in Illustration 2.

   Position the fuel injection nozzle so that the direction of the fuel spray is into **1U-8857** Extension (14) and **8S-2270** Fuel Collector (15) .

2. Pump the pressure to about 1030 kPa (150 psi) below the opening pressure of the fuel injection nozzle. Refer to the Specifications Module, "Fuel Injection Nozzles" topic for the correct setting of the opening pressure. Release the handle. When the pressure begins to decrease, note the time that is required for the pressure to decrease to approximately 0 kPa (0 psi). If the fuel injection nozzle is not damaged, the time will not be less than 5 seconds or more than 45 seconds.

   If the time that is required for the pressure to decrease to 0 kPa (0 psi) is less than 5 seconds, too much fuel is leaking around the valve needle. Replace the fuel injection nozzle.

3. Look for any leakage from the pressure faces of the holder and the retaining nut of the fuel injection nozzle. If leakage is visible, make sure that the components are tightened to the correct torque.

   If leakage continues to occur, unscrew the retaining nut from the body. Inspect the threaded surfaces for foreign particles and damage. If the faces are clean and undamaged, test the fuel injection nozzle. Repeat Steps 1 and 2.

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The hydraulic oil tank (13) stores the hydraulic oil for the machine. The hydraulic tank supplies oil to the hydrostatic system, the work tool hydraulic system, and the pilot hydraulic system.

A strainer is located inside the oil tank on the end of the supply line. The tank is not pressurized. A hose connects the tank to a breather.

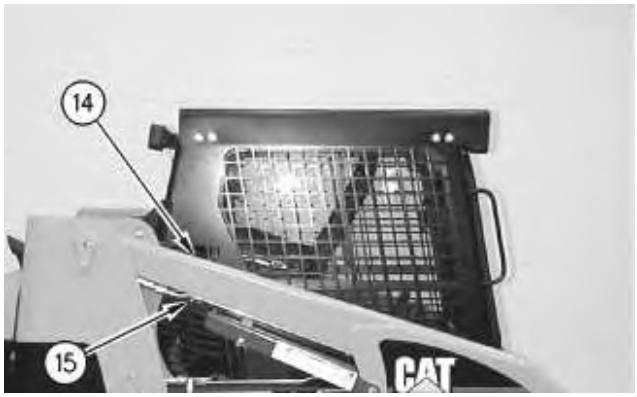

Illustration 3 g00823339

(14) Hydraulic tank filler cap

(15) Hydraulic tank sight gauge

The sight gauge (15) is located on the right side of the machine below the filler cap (14). Maintain the oil level approximately in the middle of the sight gauge. Refer to the Operation and Maintenance Manual, SEBU7468, "Hydraulic System Oil Level - Check" for more information.

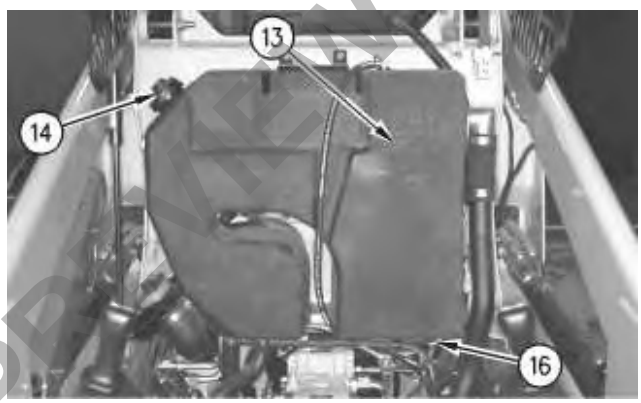

Illustration 4 g00823341

(13) Hydraulic tank

(14) Filler cap

(16) Oil temperature sender

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1. Check the hydraulic oil level in the sight glass for the hydraulic tank.
2. Look for air bubbles in the oil. Look for water in the oil.

   Note: Air bubbles may be caused by a fitting that is loose or damaged. A loose fitting or a damaged fitting allows air to enter the suction side of the system. This causes the oil to leak.
3. Add oil to the hydraulic system, if necessary. Refer to the Operation and Maintenance Manual for the recommended oil and for the correct procedure.
4. Check all lines, all hoses, and all connections for damage and for leaks. Look for fluid on the ground under the machine.

   Note: If fluid can leak out of a fitting or out of a connection, air can leak into the system.
5. Remove the hydraulic oil filter and inspect the filter for foreign material. A magnet will separate ferrous particles from nonferrous particles.

Next, perform the operational checks and last perform the instrument tests.

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i01787405

Gear Motor (Fan) - Remove

SMCS - 1386-011

Removal Procedure

Table 1

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	9L-8493	Cap (7/16 JIC)	1
	9S-5518	Plug (7/16 JIC)	1
	6V-9510	Face Seal Plug (1 - 14 THD)	2
	6V-9831	Cap As (1 - 14 THD)	2
	6V-9511	Face Seal Plug (1 13/16 - 12 THD)	2
	6V-9832	Cap As (1 13/16 - 12 THD)	2

Start By:

A. Release the pressure in the hydraulic system. Refer to Disassembly and Assembly, "Hydraulic System Pressure - Release".

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

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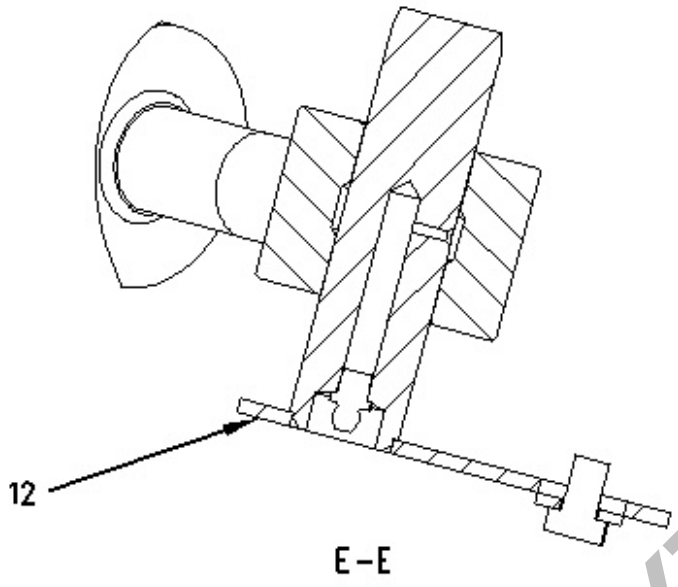

Illustration 6 g00891415

(12) **142-8791** Pins from the tilt cylinders to the bucket control linkage

Diameter ... 31.75 ± 0.03 mm (1.250 ± 0.001 inches)
Length ... 122.00 ± 1.50 mm (4.803 ± 0.059 inch)

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Systems Operation
All Products Air Conditioning and Heating R134a for All Caterpillar Machines
Media Number -SENR5664-22 **Publication Date -01/08/2012** **Date Updated -13/08/2012**

i02982781

Refrigerant Condenser

SMCS - 1805

Illustration 1 g00289099

Typical Condenser

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C. Disconnect the wire harness from the switch.

D. Place the switch in the ON position.

E. Measure the resistance from terminal 4 to terminal 5 of the work tool lockout switch.

Expected Result:

The resistance should be greater than 5000 Ohms.

Results:

- **OK -** The resistance is greater than 5000 Ohms.

  Repair: The wire harness has a short. Repair the wire harness and/or the connector or replace the wire harness and/or the connector.

  Stop.

- **NOT OK -** The resistance is not greater than 5000 Ohms.

  Repair: The work tool lockout switch has failed. Replace the switch.

  Stop.

Test Step 5. CHECK THE CIRCUIT FOR THE WORK TOOL LOCKOUT SWITCH

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

B. Raise the cab. See Operation and Maintenance Manual, "Cab Tilting".

C. Locate the Interlock ECM. The interlock ECM is located on the back side of the cab. The cab must be in the RAISED position in order to get to the ECM.

D. Disconnect the wire harness from the ECM.

E. Measure the resistance from contact 60 to contact 3 (wire E917-WH to wire 201-BK) on the wire harness connector.

Expected Result:

The resistance should be less than 5 Ohms.

Results:

- **OK -** The resistance is less than 5 Ohms.

  Repair: The ECM is very unlikely to have failed. Reconnect all connections and visually inspect the wire harness. Verify that the problem still exists. If the problem still exists, perform the Test Steps again.Replace the ECM, if the cause of the problem was not found after the second attempt. See Testing and Adjusting, "Electronic Control Module (ECM) - Replace".

  Stop.

- **NOT OK -** The resistance is greater than 5 Ohms. Proceed to Test Step 6.

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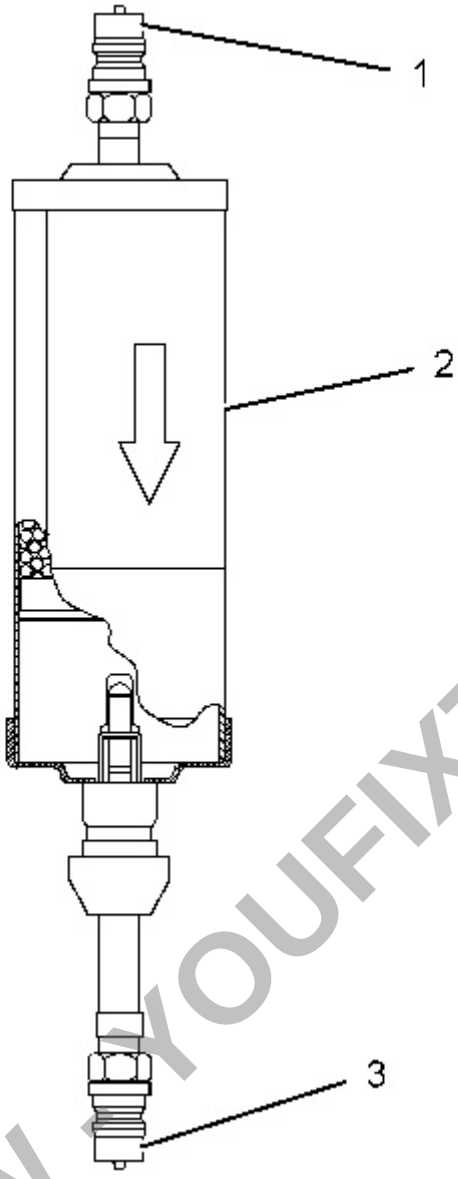

Illustration 1 g01520430

Typical In-Line Dryer with quick disconnects

(1) Inlet hose with air conditioner quick disconnect

(2) Dryer

(3) Outlet hose with air conditioner quick disconnect

Note: Replace dryer (2) annually. Dryer (2) should also be replaced whenever the system is opened.

Disassembly and Assembly

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i01715235

Window Wiper Motor - Remove and Install

SMCS - 7305-010-MQ

Removal Procedure

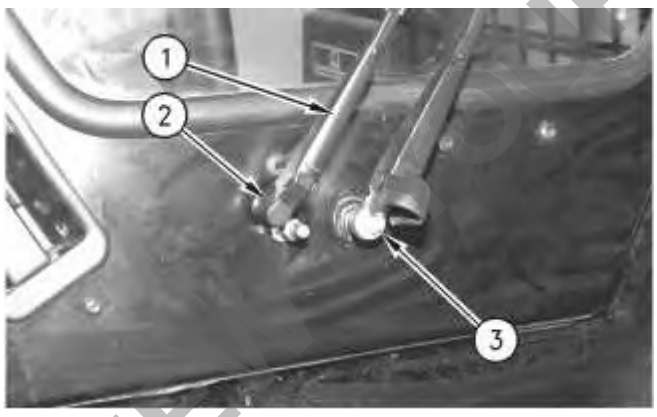

Illustration 1 g00882579

1. Open covers (2). Remove nuts (3) and wiper arm assemblies (1) .

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		Actual		Actual
Engine Speed	1000 ± 50 RPM		2820 ± 50 RPM	
Charge Pressure	2900 ± 100 kPa (421 ± 15 psi)		3300 ± 200 kPa (480 ± 30 psi)	
Speed Sensing Pressure	1100 ± 100 kPa (160 ± 15 psi)		2200 ± 100 kPa (319 ± 15 psi)	
Pressure for the Pump Case	100 ± 50 kPa (15 ± 7 psi)		200 ± 100 kPa (29 ± 15 psi)	
Fan Speed	1225 ± 25 RPM		2300 ± 50 RPM	

Table 11

HYDROSTATIC SYSTEM TESTS		
STALL TEST		
TEST	**SPECIFICATION**	**ACTUAL**
Engine Stall Speed	2200 ± 500 RPM	
MA Pressure Front Pump	38200 ± 2000 kPa (5512 ± 290 psi)	
MA Pressure Rear Pump	38200 ± 2000 kPa (5512 ± 290 psi)	
DOUBLE STALL TEST		
TEST	**SPECIFICATION**	**ACTUAL**
Engine Stall Speed	2000 ± 500 RPM	
MA Pressure Front Pump	35000 ± 3000 kPa (5075 ± 435 psi)	
MA Pressure Rear Pump	35000 ± 3000 kPa (5075 ± 435 psi)	
MAXIMUM RUNOUT		
TEST	**SPECIFICATION**	**ACTUAL**
Engine Speed	2820 ± 50 RPM	
Speed Sensing Pressure PS2	2200 ± 100 kPa (320 ± 15 psi)	
Charge Pressure PS1	3300 ± 200 kPa (480 ± 30 psi)	

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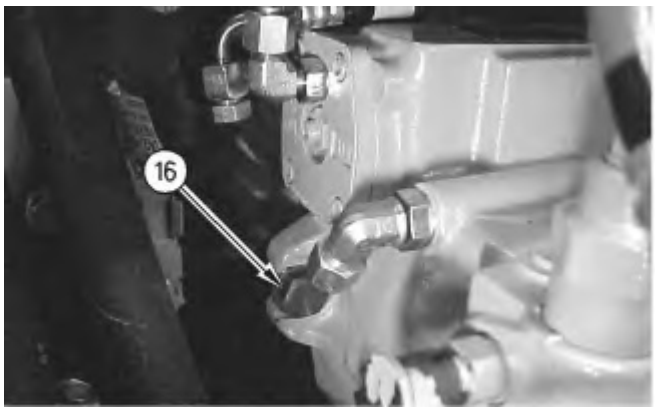

Illustration 5 g00680505

4. Use Tooling (A) to remove bolts (15) and (16) and the washers that secure the piston pump to the engine.
5. Slide the piston pump toward the front of the machine for removal.

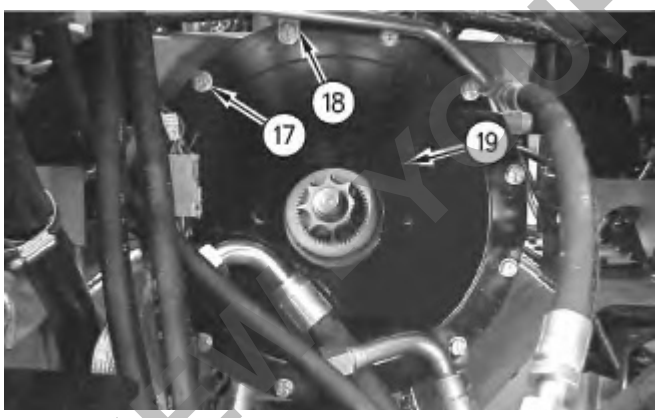

Illustration 6 g00602449

6. Remove twelve bolts (17), the washers, and clip (18) .
7. Remove adapter plate (19) .

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