- Crankshaft Rear Seal - Install
- Crankshaft Pulley - Remove and Install
- Crankshaft Front Seal - Remove
- Crankshaft Front Seal - Install
- Crankshaft Main Bearings - Remove
- Crankshaft Main Bearings - Install
- Crankshaft - Remove
- Crankshaft - Install
- Bearing Clearance - Check

CYLINDER BLOCK GP - Specifications
3003, 3013, 3014 and 3024 Engines for Caterpillar Built Machines - SENR5022

- Cylinder Block

CYLINDER BLOCK GP - Disassembly and Assembly
3003, 3013, 3014 and 3024 Engines for Caterpillar Built Machines - SENR5027

- Crankshaft Main Bearings - Remove
- Crankshaft Main Bearings - Install
- Bearing Clearance - Check

CYLINDER HEAD GP - Specifications
3003, 3013, 3014 and 3024 Engines for Caterpillar Built Machines - SENR5022

- Fuel Injection Nozzles
- Cylinder Head Valves
- Cylinder Head

CYLINDER HEAD GP - Disassembly and Assembly
3003, 3013, 3014 and 3024 Engines for Caterpillar Built Machines - SENR5027

- Inlet and Exhaust Valve Springs - Remove and Install
- Inlet and Exhaust Valves - Remove and Install
- Cylinder Head - Remove
- Cylinder Head - Install

DRIVE GP-FAN - Specifications
3003, 3013, 3014 and 3024 Engines for Caterpillar Built Machines - SENR5022

- Fan Drive

FLYWHEEL GP - Specifications
3003, 3013, 3014 and 3024 Engines for Caterpillar Built Machines - SENR5022

- Flywheel
- Flywheel Housing

FLYWHEEL GP - Disassembly and Assembly
3003, 3013, 3014 and 3024 Engines for Caterpillar Built Machines - SENR5027

- Flywheel - Remove
- Flywheel - Install

GEAR GP - Specifications
3003, 3013, 3014 and 3024 Engines for Caterpillar Built Machines - SENR5022

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And Definitions

uit that will open the circuit if too much

ts are controlled by a magnet. A magnet
ed switch; it opens the contacts of a

n a temperature or pressure gauge. The
ssure. Its resistance changes to give an
e or pressure.

n electrical component that is activated by
ectromagnet when current flows through it.
switch part of the relay.

nt in an electrical circuit that will open the
. This does not destroy the circuit breaker
circuit again.

component that is activated by electricity.
t when current flows through it. The
or move a piece of metal that can do work.

RENR81
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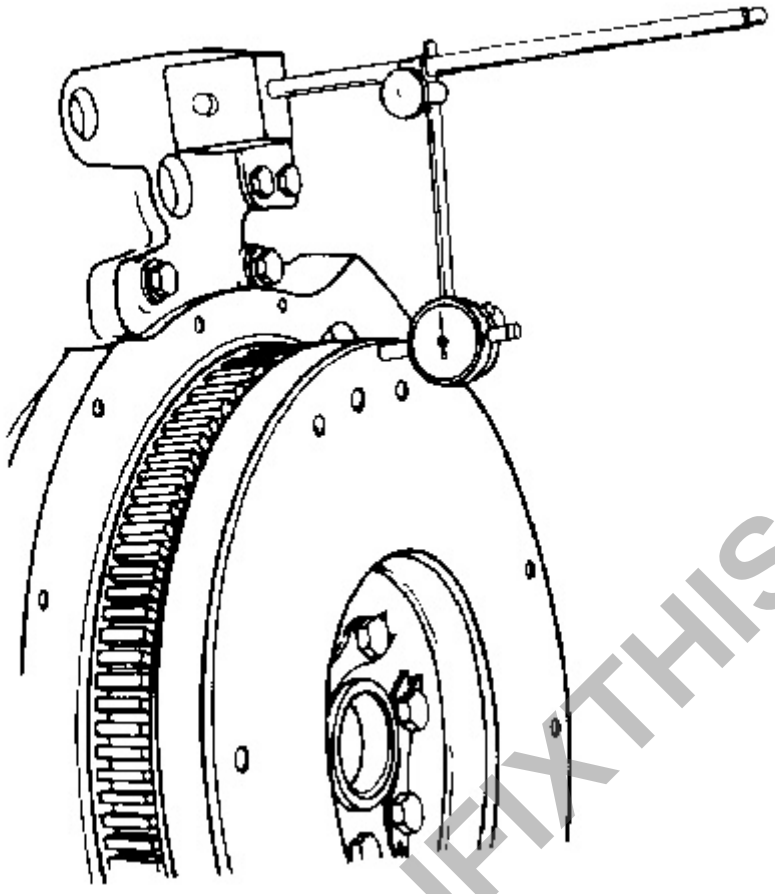


Illustration 1 g00295955

Checking face runout of the flywheel

1. Refer to Illustration 1 and install the dial indicator. Always put a force on the crankshaft in the same direction before the dial indicator is read. This will remove any crankshaft end clearance.
2. Set the dial indicator to read 0.00 mm (0.00 inch).
3. Turn the flywheel at intervals of 90 degrees and read the dial indicator.
4. The difference between the lower measurements and the higher measurements that are performed at all four points must not be more than 0.20 mm (0.008 inch), which is the maximum permissible flywheel face runout.

Flywheel Runout

Note: The flywheel housing must be removed in order to perform this runout check.

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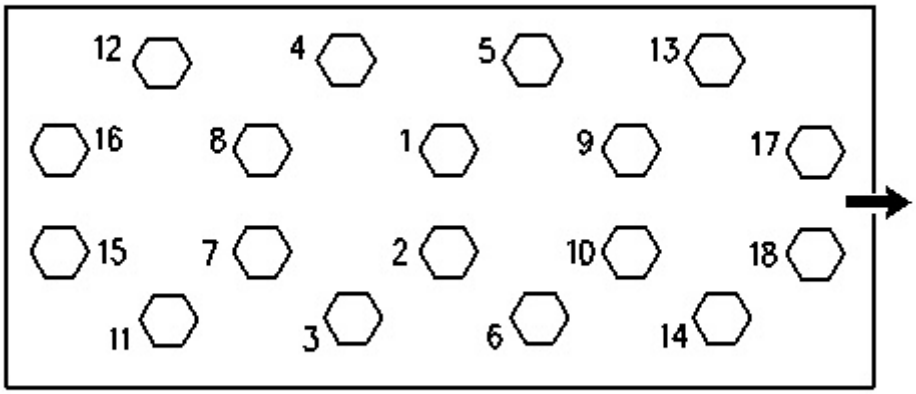


Illustration 4 g00764124

Bolt tightening sequence for the 3014 and the 3024 engines

The arrow points toward the front of the engine.

1. Lightly lubricate the threads and the thrust faces of the bolts with clean engine oil. Install the bolts and tighten the bolts finger tight. Tighten the bolts in the numerical sequence that is shown in Illustration 1 for 3 cylinder engines. Tighten the bolts in the numerical sequence that is shown in Illustration 4 for 4 cylinder engines.

   Tighten the bolts to the following torque:

   3013, 3014, and 3024 engines ... 100 N·m (74 lb ft)

2. Tighten the bolts again in the numerical sequence to a torque of 100 N·m (74 lb ft).
3. Finally, tighten the bolts in the numerical sequence to a torque of 100 N·m (74 lb ft).

Measuring the Distortion of the Cylinder Head

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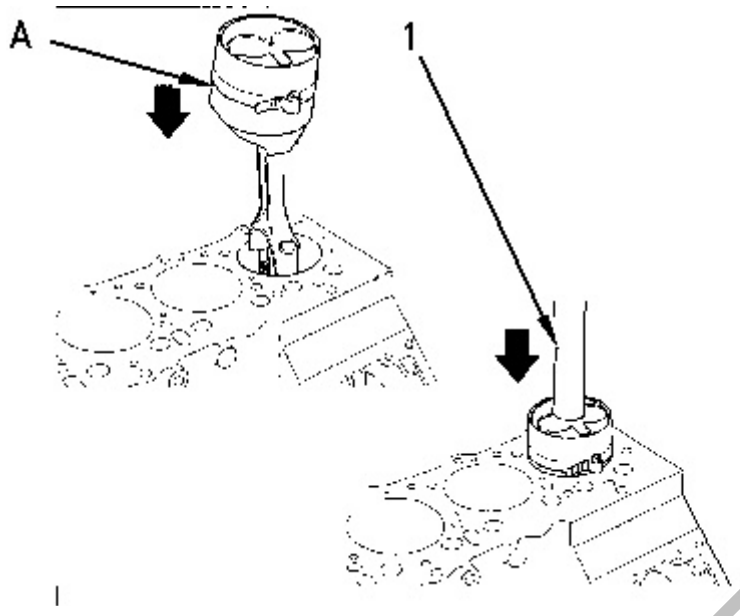


Illustration 1 g00829711

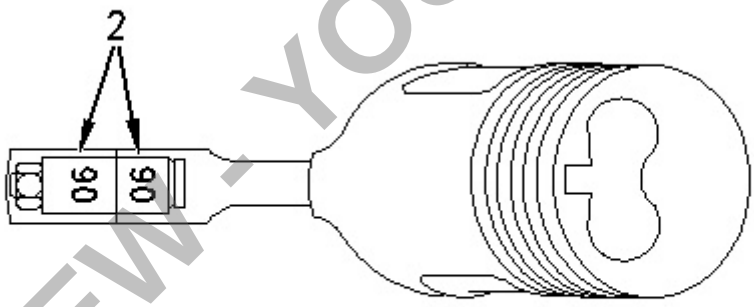


Illustration 2 g00829724

3. Put the piston and connecting rod in the cylinder bore. Align the identification marks on the top of the piston to the front of the cylinder block. Align identification marks (2) on the side of the connecting rod to the right side of the cylinder block. Put Tool (A) in position on the cylinder block and compress the piston rings.

   Note: Move the piston rings on the pistons until the ring openings are separated by approximately 90 degrees. Refer to Disassembly and Assembly, "Pistons and Connecting Rods - Assemble".

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The voltage regulator is a solid-state electronic switch. The voltage regulator senses the voltage of the system. The regulator then uses switches to control the current to the field windings. This controls the voltage output in order to meet the electrical demand of the system.

Starting System Components

Solenoid

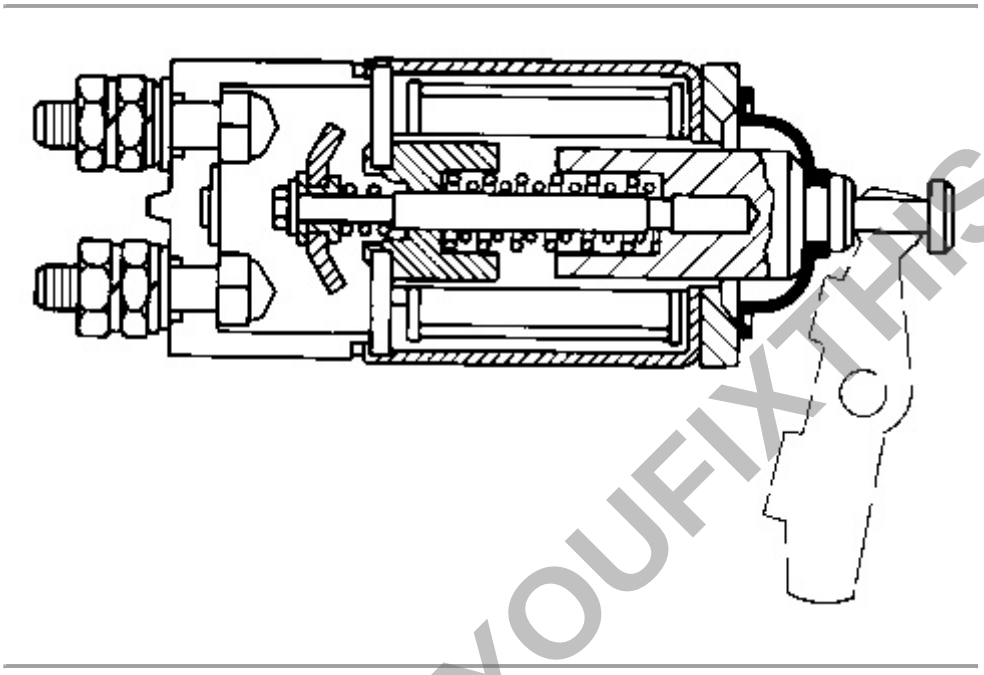


Illustration 3 g00292316

Typical solenoid schematic

A solenoid is an electromagnetic switch that performs two basic functions:

- The solenoid closes the high current starter motor circuit with a low current start switch circuit.
- The solenoid engages the starter motor pinion with the ring gear.

The solenoid has windings (one set or two sets) around a hollow cylinder. A plunger with a spring load device is inside of the cylinder. The plunger can move forward and backward. When the start switch is closed and electricity is sent through the windings, a magnetic field is created. The magnetic field pulls the plunger forward in the cylinder. This moves the shift lever in order for the pinion drive gear to engage with the ring gear. The front end of the plunger then makes contact across the battery and across the motor terminals of the solenoid. The starter motor then begins to turn the flywheel of the engine.

When the start switch is opened, current no longer flows through the windings. The spring now returns the plunger to the original position. At the same time, the spring moves the pinion gear away from the flywheel.

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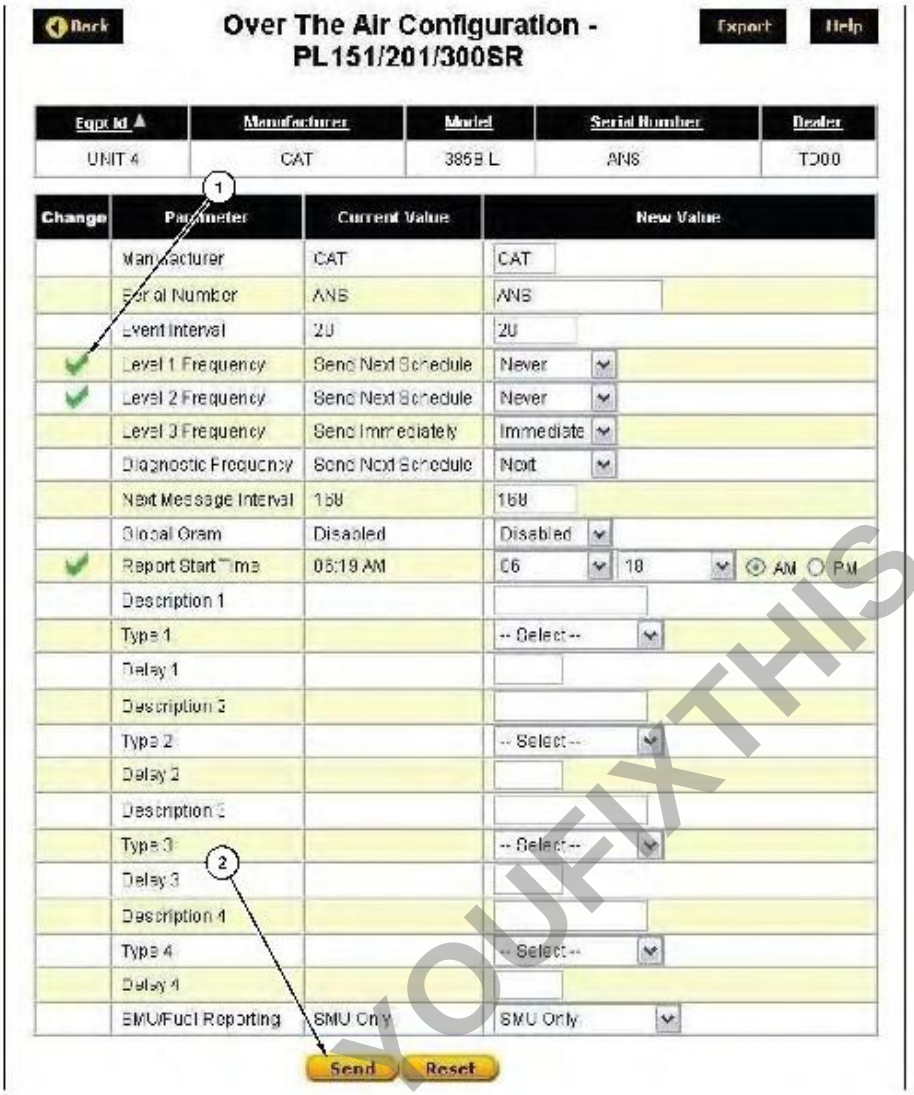


Illustration 9 g01721395

"Over the Air Configuration" screen

(1) Green check mark

(2) "Send" button

2. Change the desired parameters of the configuration by either typing new values into the text fields or selecting new values from the drop-down menus that appear in the "New Value" column of the table.

   A green check mark (1) will appear in the "Change" column next to any parameter that has been changed.

   ReferenceRefer to Systems Operation, "General Registry", Systems Operation, "Digital Registry", and Systems Operation, "Transmission Registry" for more information about the parameters and values.

   Note: Machine "Start Time" and "Stop Time" are supported by PL321 systems with the current software version. This configuration can only be set by using the "Over the Air Configuration" feature. When the "Start Time" and "Stop Time" feature is available, the "Start Time" and the "Stop Time" parameters will appear and the parameters can be set to "On" or "Off".

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The state of recently configured fences is displayed as an icon in the "Config History" field. The type of icon indicates one of the following states:

Yellow Hour Glass - Pending

Green Check Mark - Successful

Grey Stop Watch - No new activity

The Pending or the Successful icons will be viewable for seven days after the configuration parameters have been sent to the Product Link module. After seven days, the "Successful" status will revert to the grey stop watch icon. If a pending configuration is not confirmed within the seven day time period, then Caterpillar recommends that a new configuration be sent.

To view details of the configuration history, click the icon in the "Config History" column. The Time and Geographic Fencing Configuration History screen appears.

Table 2 lists the descriptions of each of the fields that are in this screen.



Illustration 12 g01397882

Table 2

Field	Description
Request Type	The type of fence that had been configured. Click the link to view configuration details.
Fence Description	The description provided for the fence configured fence.
Configuration Date	The date of the configuration: **Bold Date** – Date the fence was configured in the EquipmentManager software. **Normal Date** – Date Product Link accepted the fence configuration.
State	The state of the configuration request: **Pending** – Yellow hour glass **Successful within the last 7 days** – Green check mark **Successful but older than 7 days** – Grey stop watch

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Systems Operation
EquipmentManager User Guide
Media Number -KENR6303-08 **Publication Date -01/05/2010** **Date Updated -18/05/2010**

i03322229

Administration

SMCS - 7600; 7606

You can customize EquipmentManager in the "Administration" section of EquipmentManager in order to enable the most effective use of the tool, productive use of the tool, and efficient use of the tool. While the "Preferences" primarily affect the way information is displayed in EquipmentManager, the "Administration" functions are where you will group equipment, set up and assign event reactions, manage the registry parameters of the Product Link Modules (PLM), upload repair and refueling history, set up fences, manage planned maintenance, and so on. These functions, once configured, should not need to be changed on a daily basis.



Illustration 1 g01700556

"Administration" screen

(1) "Administration" link

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example of the "Event Summary" section of the "EquipmentManager Home" screen that will appear after the initial time.

Also, EquipmentManager allows you to manage your equipment by an exception. There are three "Status" levels of events.

Action (red) - The "Action" status indicates an event that is deemed of the highest importance. "Action" events should be given the most attention and "Action" events should be resolved first.

Monitor (yellow) - The "Monitor" status indicates an event that should have attention, but this event does not require immediate resolution.

Normal (green) - The "Normal" status indicates an event that is deemed least important of the actions that require attention or resolution.

"Date Format" and "Time Format" Preferences

The "Date Format" and the "Time Format" that are used to display all dates and times throughout EquipmentManager may be set to your preference.

In the "Time Zone" drop-down menu, the time may be set to the time zone of your dealership, the time zone of the location of your equipment, or any other time zone.

In the "Time Format" drop-down menu, the time may be viewed with the following options: "12 Hr Format", "12 Hr with AM/PM" and "24 Hour (Military Time)".

In the "Daylight Savings" drop-down menu, the daylight savings time may be chosen.

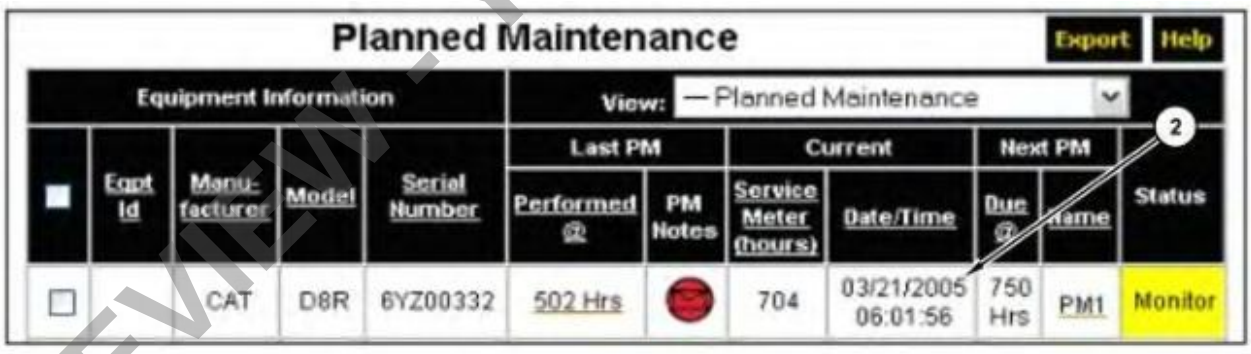


Illustration 2 g01708096

Example of the "Date Format" and the "Time Format"

(2) "Date/Time"

The "Planned Maintenance" screen is an example that displays "Date/Time" (2) within EquipmentManager. Refer to Illustration 2.

"Location Display"

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i04008433

General Information

SMCS - 7631

The Cat® machine security system (MSS) discourages unwanted operation of a machine. The MSS uses the new Cat® electronic key. The Cat® electronic key contains an electronic chip. The electronic chip has a unique identification number (ID). An exciter coil is mounted around the key start switch. The exciter coil reads the ID of the key.

The electronic control module (ECM) of the MSS is set up with the ID of the keys of the intended users. When the MSS is armed, the ECM validates the ID of the key in the keyswitch. If that ID is in the list of authorized keys in the ECM and the key is valid, the machine will operate normally. If that ID is not in the list of authorized keys or the key is not valid, the MSS will keep the machine functions disabled.

Components

The MSS consists of the following components:

- ECM
- Cat® electronic key
- Exciter coil
- Status indicator

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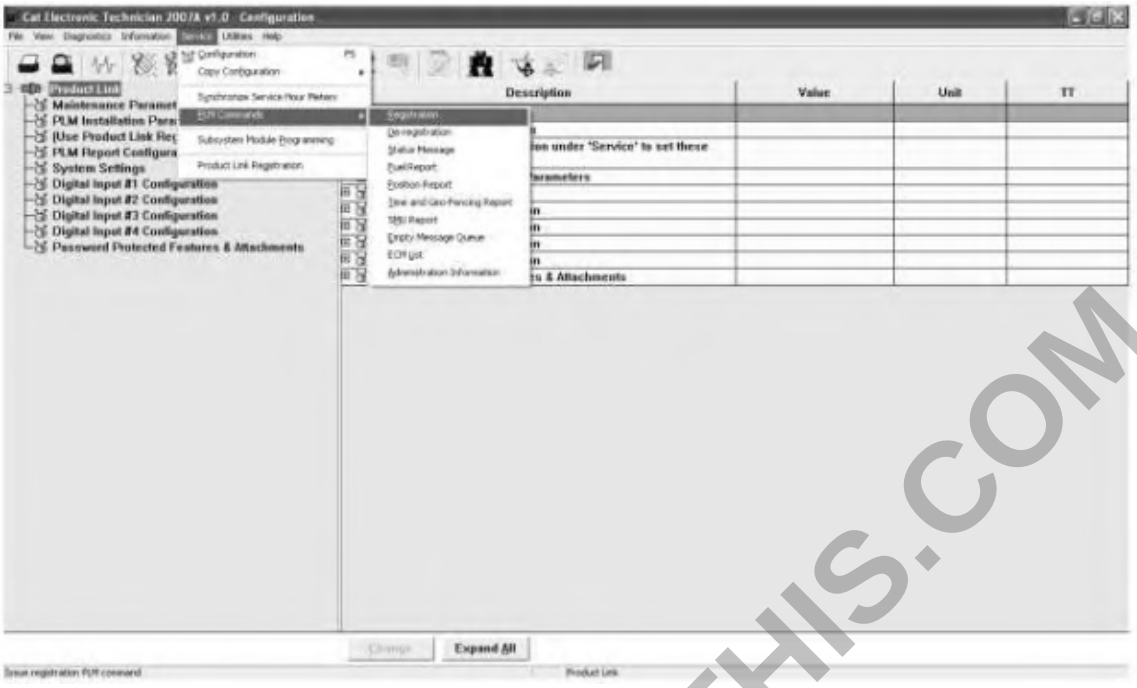


Illustration 3 g01362222

"Registration" Screen

1. Click "Service" on the toolbar. Select "Product Link Registration". Refer to Illustration 3.
2. Enter information in the following fields: "Machine Make Code", "Machine Serial Number", "Dealer Code", "Confirmation Email Address" (optional) and "Service Meter Hours". Refer to Illustration 5.

   Note: In a PL321 system, the machine serial number will be auto filled via information from the other ECMs on the CDL. The user will have the option to "Synchronize Service Meter Hours" if the PL321 is considered a "slave". The user will have the option to "Set Master Hours" if the PL321 is considered the "master". Refer to Illustration 4.

   Note: This will not change the SMH on other ECMs. Only the SMH on Product Link will be modified.
3. Click "Register". Refer to Illustration 5.
4. After "Registration" is selected, a dialog box will appear. The message will ask "Are you sure?". Click "Yes" or click "No". Clicking "Yes" will queue the registration messages and administration messages.
5. A confirmation message will be displayed. Click "OK"

   Note: After receiving a confirmation, you will be returned to the "Registration" screen.

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- Exposed insulation
- Points of rubbing wire

b. Check all of the hold down clamps for the harness in order to verify that the harness is properly clamped. Also check all of the hold down clamps for the harness in order to verify that the harness is not compressed by the clamp. Pull back the harness sleeves in order to check for a flattened portion of wire. The flattened portion of wire is caused by the clamp that holds the harness.

Expected Result: The wires are free of abrasion, nicks, or cuts and the harness is properly clamped.

Results:

OK - The wires are free of abrasion, nicks, or cuts and the harness is properly clamped. Proceed to test step 5.

NOT OK - A problem exists with the wiring.

Repair: Repair the wires or replace the wires, as required.

STOP.

5. **CHECK THE CONNECTORS FOR MOISTURE OR CORROSION.**

a. Ensure that the connector seals and the white sealing plugs are in place. If any of the seals or plugs are missing, replace the seal or plug. If necessary, replace the connector.

b. Check all of the wiring harnesses in order to verify that the harness does not make a sharp bend out of a connector. Sharp bends will deform the connector seal and will create a path for the entrance of moisture. See Illustration 1.

Note: Minor seal abrasion is normal on the ECM connector seals. Minor seal abrasion will not allow the entry of moisture.

c. Thoroughly inspect ECM connectors for evidence of moisture entry. If moisture or corrosion is evident in the connector, the source of the moisture entry must be found. Also, the source of the moisture entry must be repaired. If the source of the moisture entry is not repaired, the problem will reoccur. Simply drying the connector will not fix the problem. Likely paths for the entrance of moisture are from missing seals, improperly installed seals, nicks in exposed insulation, and improperly mated connectors.

Note: Moisture can also travel from one connector through the inside of a wire to the ECM Connector. If moisture is found in the ECM connector, thoroughly check all connectors and wires on the harness that connect to the ECM. The ECM is not the source of the moisture. Do not replace an ECM if moisture is found in either ECM connector.

Note: If corrosion is evident on the contacts or the connector, use only denatured alcohol to remove the corrosion. Use a cotton swab or a soft brush to remove the corrosion. Do not use cleaners that contain trichloroethylene because trichloroethylene may damage the connector.

Expected Result: All of the connectors must be coupled and all of the seals must be inserted. The harness and the wiring should be free of corrosion, moisture, abrasion, and pinch points.

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Test Step 2. CHECK THE SYSTEM VOLTAGE AT THE ECM.

A. The engine must still be running at high idle.

B. DO NOT DISCONNECT the machine harness from the ECM. At the connector of the ECM, prepare to make a voltage measurement by using the **7X-1710** Multimeter Probe .

C. At the machine harness for the ECM, insert the probe into the back of connector. Measure the voltage (VDC) between pin 1 and pin 3.

Expected Result:

The battery voltage should be greater than 9 VDC for a 12 volt system, and the battery voltage should be greater than 21.3 VDC for a 24 volt system.

Results:

- **OK -** The battery voltage is correct. Proceed to Test Step 3.
- **NOT OK -** The battery voltage is too low.

  Repair: The machine harness is not correct. Repair the machine harness or replace the machine harness.

  Stop.

Test Step 3. CHECK IF THE DIAGNOSTIC CODE IS STILL ACTIVE.

A. Remove the connector from the ECM. Inspect the contacts and clean the contacts of the harness connectors.

B. Reconnect all harness connectors.

C. Turn the key start switch to the ON position.

D. Clear all inactive diagnostic codes.

E. Operate the machine.

F. Determine if CID 0168 FMI 01 is present.

Expected Result:

CID 0168 FMI 01 is present.

Results:

- **YES -** CID 0168 FMI 01 is present.

  Repair: The problem has not been corrected. It is unlikely that the ECM has failed. Perform the previous Test Steps again. If the cause of the diagnostic code is not found, replace the ECM. See Testing and Adjusting, "Electronic Control Module (ECM) - Replace".

  Stop.

- **NO -** CID 0168 FMI 01 is not present.

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This warning does not supersede the published requirements and regulations that are found in "Title 30 of the Code of Federal Regulations (CFR)". This warning does not allow a deviation from the published requirements and regulations that are found in "Title 30 of the Code of Federal Regulations (CFR)". Every mine operation should conduct hazard assessments. Also, every mine operation should meet all of the requirements of "Title 30 of the Code of Federal Regulations (CFR)" in order to ensure safe operation in the storage, transportation, loading, and blasting of explosives.

The following Product Link specifications are provided to aid in conducting hazard assessments and ensuring compliance with all local regulations.

Product Link Transmitter Power - 5 to 10 W

Transmit Frequency Range - 148 to 150 MHz

General Troubleshooting Information

Many Caterpillar machines have a published Electrical System Schematic that reflects a Product Link installation. Refer to these schematics if a troubleshooting procedure instructs you to "Repair the harness". Perform continuity checks and resistance checks at the connectors in order to locate a failure in the harness. At a component connector, always check the ground circuit. Less than 5 ohms of resistance is required from the ground contacts to frame ground. A problem may be incorrectly diagnosed, if an excessive resistance that is greater than 5 ohms is present in the ground circuit. During a troubleshooting procedure, the user should inspect all component and harness connections before a component is replaced. If these connections are not clean and tight, the connection may cause an electrical problem.

The problem can be permanent or the problem may be intermittent. Ensure that the wires are pushed into the connectors completely. Make sure that the connections are tight before other tests are performed. A failure of an electrical component may cause a failure of another component or a failure may be caused by the failure of other components. Always attempt to find a failure. The following test procedures are written for a technician with a working knowledge of electricity and electronics. The user should correct the cause of a failure in the electrical system before you replace a component.

The test procedures that are found in Systems Operation, Troubleshooting, Testing and Adjusting Manual are written for a technician that has a working knowledge of electricity and electronics. Caterpillar recommends that the electrician has a knowledge regarding the danger that is inherent in electrical troubleshooting. Caterpillar recommends that the technician can measure voltage and resistance with a multimeter. In some cases, a technician may perform checks of the electrical circuits. Consider the following guidelines before performing electronic troubleshooting procedures:

- Remove power.
- Before you read the resistance or continuity, lock out the test circuit with a tag.
- Isolate circuit branches for resistance or continuity checks in order to prevent reading through components.
- When reading a wire end to end and within a connector, read the test input pin to all adjacent pins for shorts within the connector locking mechanism.

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i01410464

Engine Oil Pressure

SMCS - 1924

Minimum oil pressure at low idle with a temperature of 18 to 20°C (64 to 68°F) ... 62 kPa (9 psi)

Maximum oil pressure at high idle and at normal operating temperature

3003 engine ... 262 to 359 kPa (38 to 52 psi)

3013 engine ... 262 to 359 kPa (38 to 52 psi)

3014 engine ... 262 to 359 kPa (38 to 52 psi)

3024 engine ... 352 to 448 kPa (51 to 64 psi)

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i00950883

Pump Mounting Housing, Flange and Hub -Install

SMCS - 1017-012; 1024-012; 3108-012; 5073-012; 5084-012

Installation 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 attachments have been lowered, 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. Install the flange and the hub. Install three bolts. Tighten the bolts to a torque of 49 N·m (36 lb ft) .

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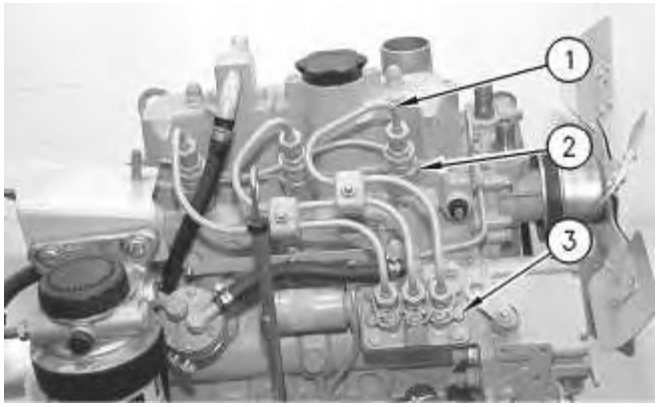


Illustration 2 g00587462

1. Install fuel injection lines (1) on the engine as a unit.

NOTICE

Do not let the tops of fuel nozzles turn when the fuel line nuts are loosened or tightened.

The nozzles will be damaged if the top of the nozzle turns in the body.

The engine will be damaged if a defective fuel injection nozzle is used because the shape of fuel (spray pattern) that comes out of the nozzles will not be correct.

2. Connect fuel injection lines (1) to fuel injection pump (3). Tighten the fuel injection line nuts to the following torque:

   3003 Engine ... 22 N·m (16 lb ft)

   3013, 3014, and 3024 Engines ... 20 N·m (15 lb ft)

3. Connect fuel injection lines (1) to fuel injection nozzles (2). Tighten the fuel injection line nuts to the following torque:

   3003 Engine ... 22 N·m (16 lb ft)

   3013, 3014, and 3024 Engines ... 20 N·m (15 lb ft)

4. Prime the fuel system. Refer to Testing and Adjusting, "Fuel System - Prime" for more information.

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When the pilot valves (joysticks) are in the HOLD position, the supply line for the pilot valves (E) is blocked. The pilot valves will return to the HOLD position when the pilot valves are released. Refer to the Operation and Maintenance Manual, SEBU7203, "Joystick Controls" for more information on the operation of the pilot valves (joysticks).

BOOM LOWER Position

When the right hand pilot valve is moved to the BOOM LOWER position, the supply line is open to line (B). Line (B) routes oil to the boom control valve in the bank valve. The pilot oil shifts the spool. Oil can then flow to the head end of the boom cylinder. Refer to the Operation and Maintenance Manual, SEBU7203, "Joystick Controls" for more information on the operation of the pilot valves (joysticks).

BOOM RAISE Position

When the right hand pilot valve is moved to the BOOM RAISE position, the supply line is open to line (A). Line (A) routes oil to the boom control valve in the bank valve. The pilot oil shifts the spool. Oil can then flow to the rod end of the boom cylinder. Refer to the Operation and Maintenance Manual, SEBU7203, "Joystick Controls" for more information on the operation of the pilot valves (joysticks).

BUCKET CLOSE Position

When the right hand pilot valve is moved to the BUCKET CLOSE position, the supply line is open to line (F). Line (F) routes oil to the bucket control valve in the bank valve. The pilot oil shifts the spool. Oil can then flow to the head end of the bucket cylinder. Refer to the Operation and Maintenance Manual, SEBU7203, "Joystick Controls" for more information on the operation of the pilot valves (joysticks).

BUCKET DUMP Position

When the right hand pilot valve is moved to the BUCKET DUMP position, the supply line is open to line (C). Line (C) routes oil to the bucket control valve in the bank valve. The pilot oil shifts the spool. Oil can then flow to the rod end of the bucket cylinder. Refer to the Operation and Maintenance Manual, SEBU7203, "Joystick Controls" for more information on the operation of the pilot valves (joysticks).

STICK OUT Position

When the left hand pilot valve is moved to the STICK OUT position, the supply line is open to line (H). Line (H) routes oil to the stick control valve in the bank valve. The pilot oil shifts the spool. Oil can then flow to the head end of the stick cylinder. Refer to the Operation and Maintenance Manual, SEBU7203, "Joystick Controls" for more information on the operation of the pilot valves (joysticks).

STICK IN Position

When the left hand pilot valve is moved to the STICK IN position, the supply line is open to line (G). Line (G) routes oil to the stick control valve in the bank valve. The pilot oil shifts the spool. Oil can then flow to the rod end of the stick cylinder. Refer to the Operation and Maintenance Manual, SEBU7203, "Joystick Controls" for more information on the operation of the pilot valves (joysticks).

SWING LEFT Position

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i02310936

Blade Lift Cylinder

SMCS - 5102-B8; 5102

S/N - -

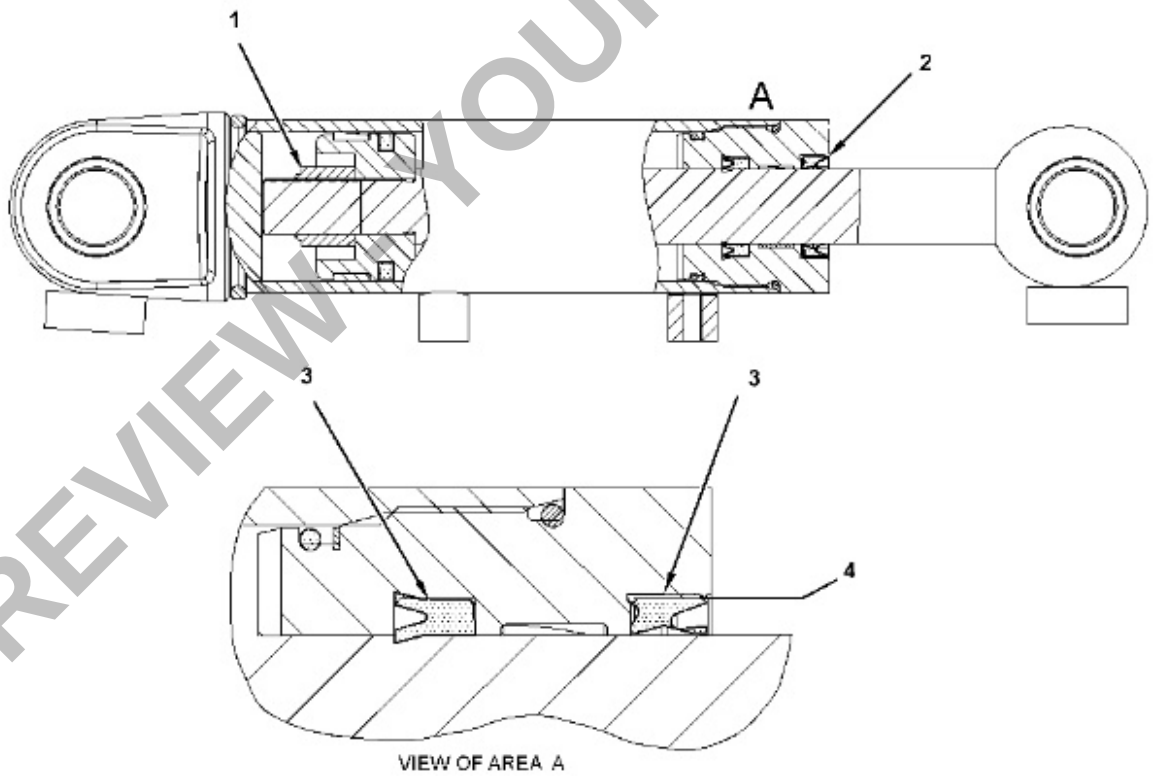


Illustration 1 g01157441

(1) Lubricate the threads with clean grease. Tighten the **4P-2337** Locknut to the following torque. ... 235 ± 24 N·m (173 ± 18 lb ft)

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i01340909

Undercarriage Cylinder (Adjustable Gauge) - Install

SMCS - 7562-012

Installation Procedure

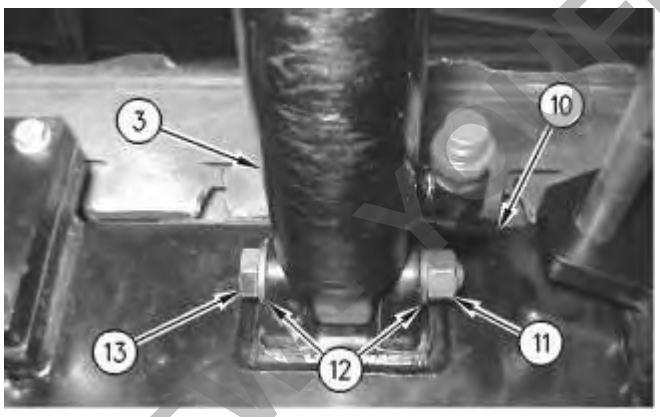


Illustration 1 g00709201

1. Install the cylinder (3) to one of the track roller frames (10) with a bolt (13), two washers (12), and a nut (11) .

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Make sure all of the attachments have been lowered, 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.

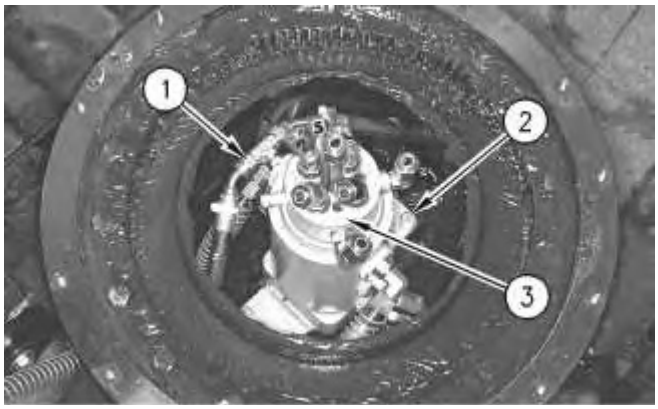


Illustration 1 g00477052

1. Install swivel (3).
2. Install the four bolts and washers (2). Tighten the bolts to a torque of 28 ± 7 N·m (21 ± 5 lb ft).
3. Install eight hoses (1) .

,

End By: Install the undercarriage. Refer to Disassembly and AssemblyRENR2808, "Undercarriage Frame - Install".

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Specifications
301.5, 301.6 and 301.8 Mini Hydraulic Excavators Machine System Specifications
Media Number -RENR2804-05 **Publication Date -01/07/2012** **Date Updated -19/07/2012**

i03465207

Pilot and Travel Speed Manifold

SMCS - 3206; 4805; 5077

S/N - -

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Plugs

SMCS - 7553

Straight Thread O-Ring Plugs

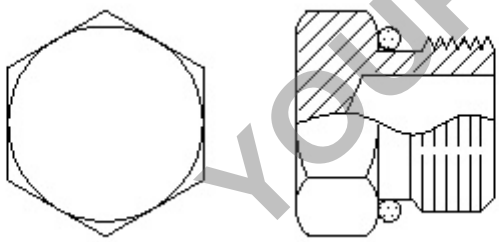


Illustration 1 g00911999

Table 1

Ferrous Straight Thread O-Ring Plug Torques for Mating with Ferrous Materials		
Thread Size Inch	**Internal Hex Plug Torque**	**External Hex Plug Torque**
5/16	7 ± 1 N·m (62 ± 9 lb in)	13 ± 2 N·m (115 ± 18 lb in)
3/8	13 ± 2 N·m (115 ± 18 lb in)	20 ± 3 N·m (177 ± 27 lb in)
7/16	20 ± 3 N·m (177 ± 27 lb in)	40 ± 6 N·m (30 ± 4 lb ft)
1/2	25 ± 4 N·m (221 ± 35 lb in)	45 ± 7 N·m (33 ± 5 lb ft)

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