Product: COMPACT TRACK LOADER
Model: 299D XHP COMPACT TRACK LOADER NLC
Configuration: 299D XHP Compact Track Loader NLC00001-UP (MACHINE)

Systems Operation
C3.8 Engines for Caterpillar Built Machines
Media Number -KENR9884-02 **Publication Date -01/09/2013** **Date Updated -24/09/2013**

i04779500

Air Inlet and Exhaust System

SMCS - 1050

The intake system supplies the engine with the proper quantity of clean air, while the exhaust system collects exhaust gases from the engine and carries the gasses away.

The intake system consists of an air cleaner, turbocharger, intake manifold, intake air heater, and intake valves.

The exhaust system consists of exhaust valves, exhaust manifold, turbocharger, and muffler.

Turbocharger

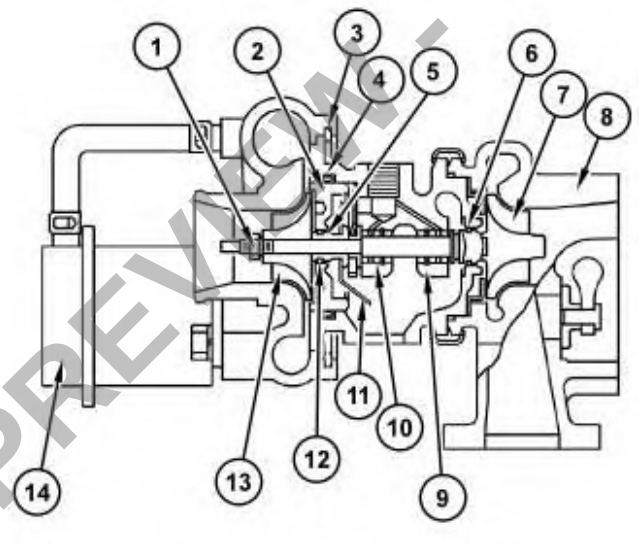


Illustration 1 g02887559

(1) Lock nut

(2) Thrust bearing

(3) Snap ring

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Illustration 7 g02918916

(13) Camshaft gear

(14) Camshaft stopper

(15) Camshaft

The camshaft is normally driven by gearing from the crankshaft.

This is made of special cast iron, and the journal and cam sections are chilled to resist wear. One intake and one exhaust cam is provided for each cylinder.

The journal diameters are large to permit removal of the shaft from its bore. The journal sections are force-lubricated.

Timing Gears

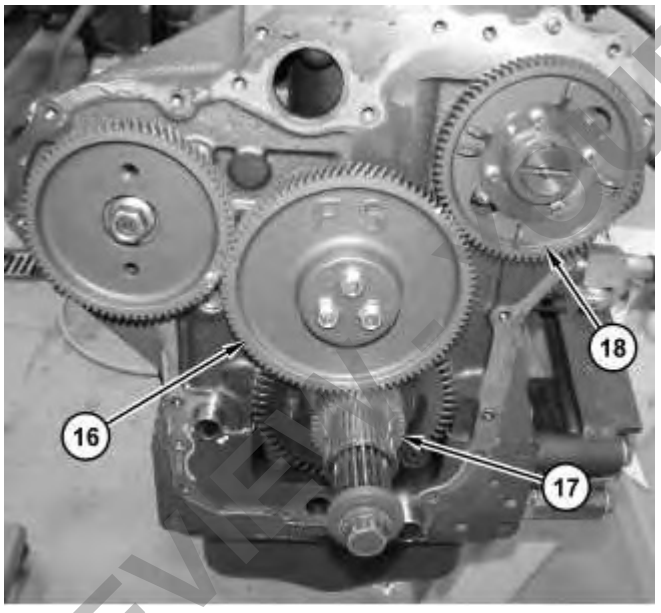


Illustration 8 g02918936

(16) Idler gear

(17) Camshaft gear

(18) Crankshaft gear

The crankshaft is the hub around which other parts of the engine can be timed and driven. This is done by the meshing of gears as shown in the Illustration.

The timing gears transmit torque from the crankshaft to the oil pump and injection pump and, at the same time, correctly control fuel injection to the cylinders and valve timing.

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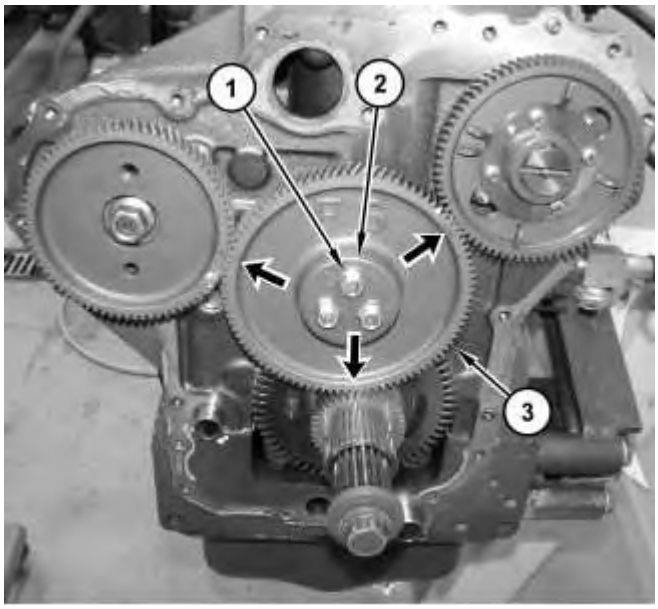


Illustration 1 g02871716

2. Ensure that timing marks on the gears are aligned.

   Alternatively, make temporary timing marks on the gears in order to show alignment.

3. Install Tooling (A) onto the flywheel. Remove bolts (1) and plate (2) .

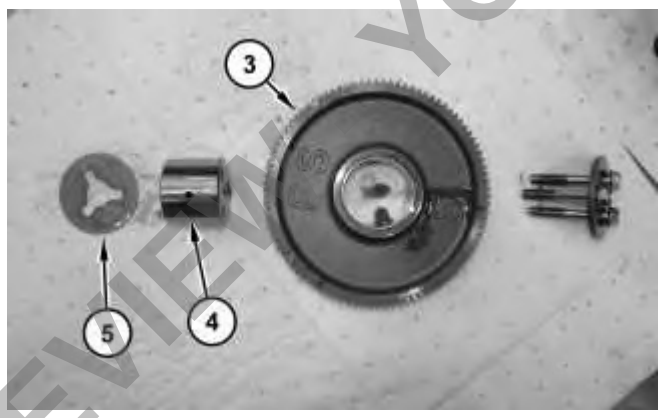


Illustration 2 g02872045

4. Remove idler gear (3), shaft (4), and plate (5) .

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Product: COMPACT TRACK LOADER
Model: 299D XHP COMPACT TRACK LOADER NLC
Configuration: 299D XHP Compact Track Loader NLC00001-UP (MACHINE)

Specifications

299D and 299D XHP Compact Track Loaders and 272D and 272D XHP Skid Steer Loaders Machine Systems

Media Number -UENR2329-00 **Publication Date -01/02/2012** **Date Updated -21/02/2012**

i04762509

Radiator and Hydraulic Oil Cooler (Fan)

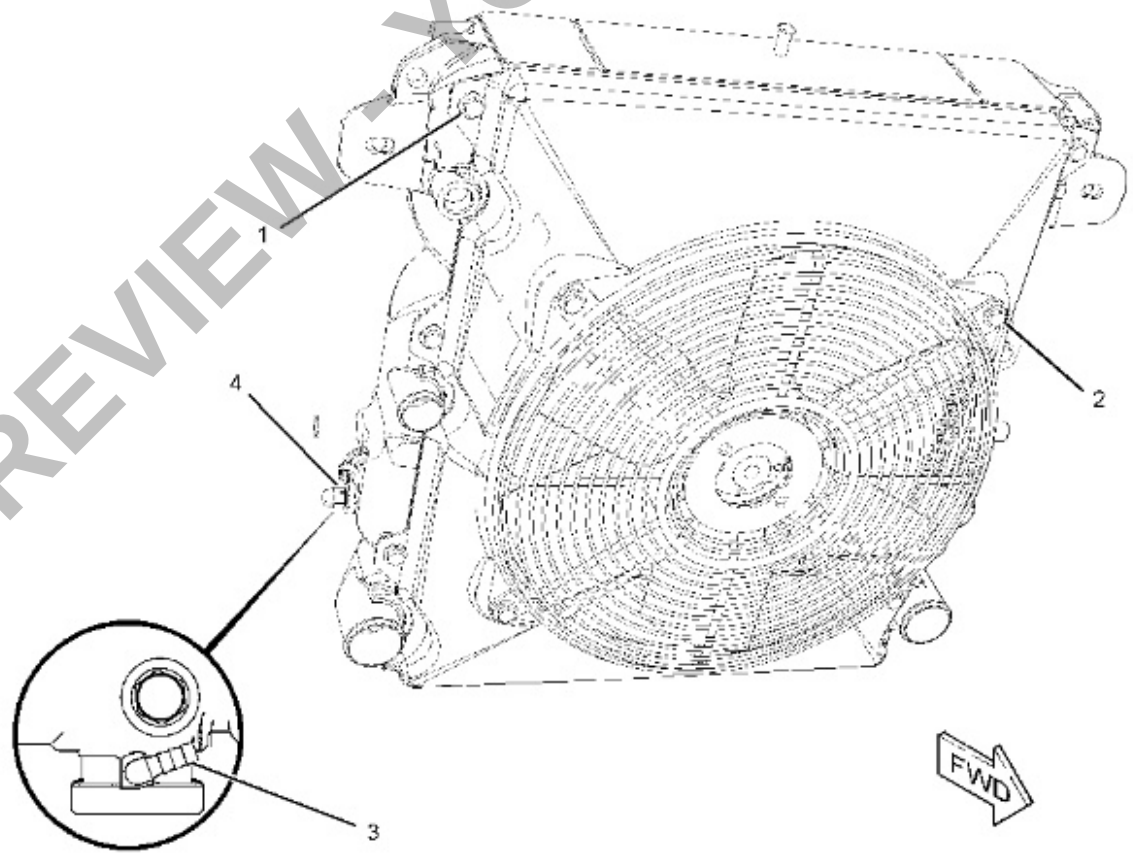
SMCS - 1351; 1356; 1386

S/N - GSL1-UP

S/N - HCL1-UP

S/N - NLC1-UP

S/N - SHY1-UP



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Product: COMPACT TRACK LOADER
Model: 299D XHP COMPACT TRACK LOADER NLC
Configuration: 299D XHP Compact Track Loader NLC00001-UP (MACHINE)

Systems Operation

AccuGrade® Grade Control System For Skid-Steer Loader, Multi-Terrain Loader and Compact Track Loader

Media Number -KENR6250-01 **Publication Date -01/03/2012** **Date Updated -05/03/2012**

i03567882

Display

SMCS - 7220



Illustration 1 g01830473

(1) Up Arrow Button

(2) Down Arrow Button

(3) Mode Button

LCD Information

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ground from the service input stops the scrolling. The diagnostic code that is shown is now on hold.

Note: The diagnostic codes from other ECMs can be shown on the display. Use the same procedure in order to place the diagnostic codes on hold.

Diagnostics are provided in order to assist service personnel during troubleshooting of intermittent diagnostic codes. The service code indicator ("SERV CODE") is shown when the diagnostic code is present. This can aid in the troubleshooting of intermittent diagnostic codes. The service code indicator changes from "SERV CODE" that is OFF to "SERV CODE" that is ON. This occurs when the diagnostic code changes status. When the diagnostic code is on hold for a problem the action alarm SOUNDS briefly during the change of status. These diagnostics signal the service personnel while inspections are performed. These diagnostics assist in troubleshooting intermittent diagnostic codes by one service person.

A diagnostic code is removed from the memory of the main display module when the diagnostic code has been cleared. When a problem is corrected, it is necessary to remove the corresponding diagnostic code from the memory of the main display module. See "Clearing Logged Diagnostic Codes" for details on clearing logged diagnostic codes.

The memory of the main display module saves a diagnostic code until the code is cleared. The main display module does not allow clearing of a diagnostic code that corresponds to a diagnostic code which is present.

Service Mode 4

Service Mode 4 displays the software part number of the machine ECM .

Service Mode 5

Service Mode 5 displays the machine parameters.

Service Mode 5 has four screens. See table 2. The default screen is Screen 1 which displays the engine coolant temperature.

Table 2

Service Mode 5 Screens		
Service Mode	**Screen**	**Description**
5	1	Engine Coolant Temperature
	2	Hydraulic Oil Temperature
	3	Left Drive Motor Speed and Direction
	4	Right Drive Motor Speed and Direction

Service Mode 6

Service Mode 6 displays the parameters of the components.

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- The signal circuit is open.
- The +battery circuit from the electrical system to the switch is open.
- The signal circuit is shorted to the +battery circuit.
- The signal circuit is shorted to ground.

System Response:

The implements will stop working until the right-hand joystick is returned to the center position. After the joystick has been centered, the implements will behave normally, but the Self Level, Return-to-Dig, Lift Snubbing, and Work Tool Positioner features will be disabled. The green Self Level icon on the machine left-hand display will no longer light up when the Self Level Cab switch is turned on. In the case of an intermittent fault, these features will be disabled until the next key cycle.

Note: Ensure that CID 2197 FMI 04 is active.

Test Step 1. CHECK THE ECM AND THE HARNESS.

A. Turn the disconnect switch and the key start switch to the ON position.

B. Disconnect the harness from the sensor.

C. At the harness connector for the sensor, measure the voltage between contact 1 (wire P769-YL) and contact 4 (wire P770-WH).

Expected Result:

The voltage measures approximately 12 DCV.

Results:

- **YES -** The voltage measures approximately 12 DCV. Proceed to test step 2.
- **NO -** The voltage does NOT measure battery voltage. The ECM has failed or the harness has failed. Proceed to test step 5.

Test Step 2. CHECK THE ECM AND THE HARNESS.

A. The harness remains disconnected from the sensor.

B. At the harness connector for the switch, measure the voltage between contacts 2 (wire T867 -BU) and ground contact 4 (wire P770-WH).

Expected Result:

The voltage measures approximately 12 ± 0.5 DCV.

Results:

- **YES -** The voltage measures approximately 12 ± 0.5 DCV. The harness is correct.

  Repair: Replace the switch.

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Product: COMPACT TRACK LOADER
Model: 299D XHP COMPACT TRACK LOADER NLC
Configuration: 299D XHP Compact Track Loader NLC00001-UP (MACHINE)

Troubleshooting

299D and 299D XHP Compact Track Loaders and 272D and 272D XHP Skid Steer Loaders Machine Electronic Control System

Media Number -UENR2479-02 **Publication Date -01/12/2012** **Date Updated -12/12/2012**

i05092569

MID 039 - CID 2687 - FMI 08

SMCS - 1439-038-VF; 4351-038-NS

Conditions Which Generate This Code:

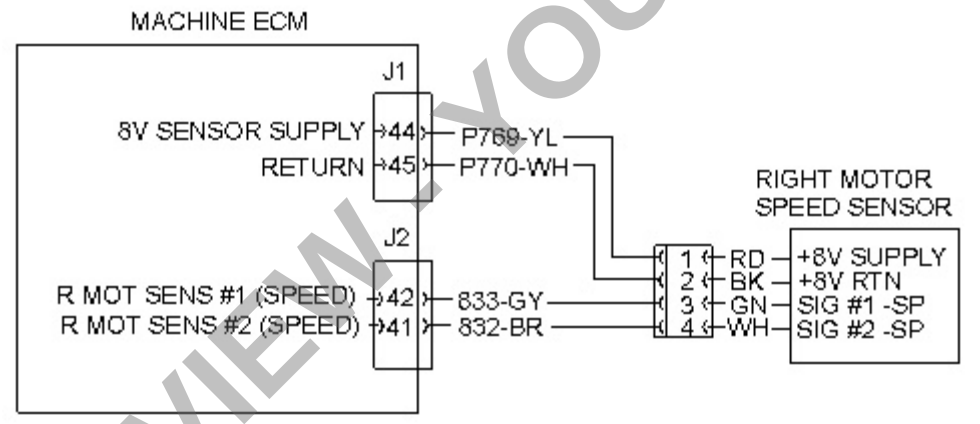


Illustration 1 g01365487

Schematic for the Right Drive Motor Speed Sensors

This diagnostic code is associated with the Right Drive Motor Speed Sensor #1. Each motor has two speed sensors, two signal wires, a power signal wire, and a ground. The ECM is able to diagnose each signal wire independently. Each signal wire provides a frequency input to the ECM that is proportional to motor speed. If this diagnostic code is active, the ECM will keep the code active until a good sensor signal is observed by the ECM. **This means that the drive motors must be moved in order for the ECM to determine if the active code can be cleared.**

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additional information. D. Check fuel quality. Refer to Systems Operation/Testing and Adjusting, "Fuel Quality - Test" for the proper procedure. Check the fuel tank for debris or foreign objects which may block the fuel supply. E. Check for the proper operation of the fuel transfer pump. Refer to Systems Operation/Testing and Adjusting, "Fuel System" for test information. F. Check the fuel rail pressure in Cat ET. Refer to Troubleshooting, "Fuel Rail Pressure is High" for the rail pressure when accelerating.		
5. Engine Load A. Check accessories and parasitic loads on the engine.	Engine loads	**Result:** There is not a parasitic load. Proceed to Test Step 6. **Result:** There is a parasitic load. Remove the parasitic load.
6. Valve Lash A. Check the valve lash. The valve lash can affect the performance of the engine.	Valve lash	**Result:** The valve lash is not set correctly. Set the valve lash. Refer to Testing and Adjusting, "Engine Valve Lash - Inspect/Adjust" for the correct procedure.

Complete the procedure in the order in which the steps are listed.

If the procedure did not correct the issue, contact your Cat dealer Technical Communicator (TC). For further assistance, your TC can confer with the Dealer Solutions Network (DSN).

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(C) Engine ECM

(1) Key Switch ON Signal

(2) Starter Switch Signal

(3) Emergency Stop Switch

(4) Oil Pressure Switch

(5) CAN Communication

(6) Engine Warning Light Signal

(7) Glow (Air Heater) Lamp Signal

(8) Starter Relay

(9) Fuel Temperature Sensor

(10) Glow (Air Heater) Relay

(11) Supply Pump

(12) SCV (Suction Control Valve)

(13) Rail Pressure Sensor

(14) Rail

(15) Supply Pump

(16) Mass Air Flow Sensor

(17) Injector

(18) NRS DC Motor

(19) NRS Lift Sensor

(20) Intake Air Heater

(21) Intake Air Pressure Sensor

(22) Intake Air Temperature Sensor

(23) Coolant Temperature Sensor

(24) Crankshaft Position Sensor

(25) Camshaft Position Sensor

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Overview

These engines are equipped with a common rail fuel system. The fuel injection pump and the fuel lines deliver fuel to an electronic unit injector in each cylinder. A solenoid on each injector meters the amount of fuel that is delivered by the injector. An Electronic Control Module (ECM) sends signals to two pressurizing assemblies on the pump and to the injector solenoids in order to control the injection of fuel.

Electronic Control System

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Product: COMPACT TRACK LOADER
Model: 299D XHP COMPACT TRACK LOADER NLC
Configuration: 299D XHP Compact Track Loader NLC00001-UP (MACHINE)

Troubleshooting
C3.8 Engines for Caterpillar Built Machines
Media Number -KENR9325-03 **Publication Date -01/07/2013** **Date Updated -25/07/2013**

i05123658

Fuel Consumption Is Excessive

SMCS - 1250-035

Probable Causes

- Look for excessive idle or high load
- Logged diagnostic codes or active diagnostic codes
- Fuel quality
- Unstable fuel supply
- Calibration procedure of the engine speed/timing
- Unstable injection system
- Restriction in the air inlet and exhaust
- Check for damaged accessory equipment

Recommended Actions

Note: The procedures have been listed in order of probability. Complete the procedures in order.

Table 1

Troubleshooting Test Steps	Values	Results
1. Excessive Idle or High Load A. Use Caterpillar Electronic Technician (ET) to check the Current Totals for excessive idle time and/or for a high load factor. These factors would be indicative of poor operating habits.	Idle time or load	**Result:** The idle times or load was excessive. Reduce idle times or load. **Result:** The idle times or load was not excessive.

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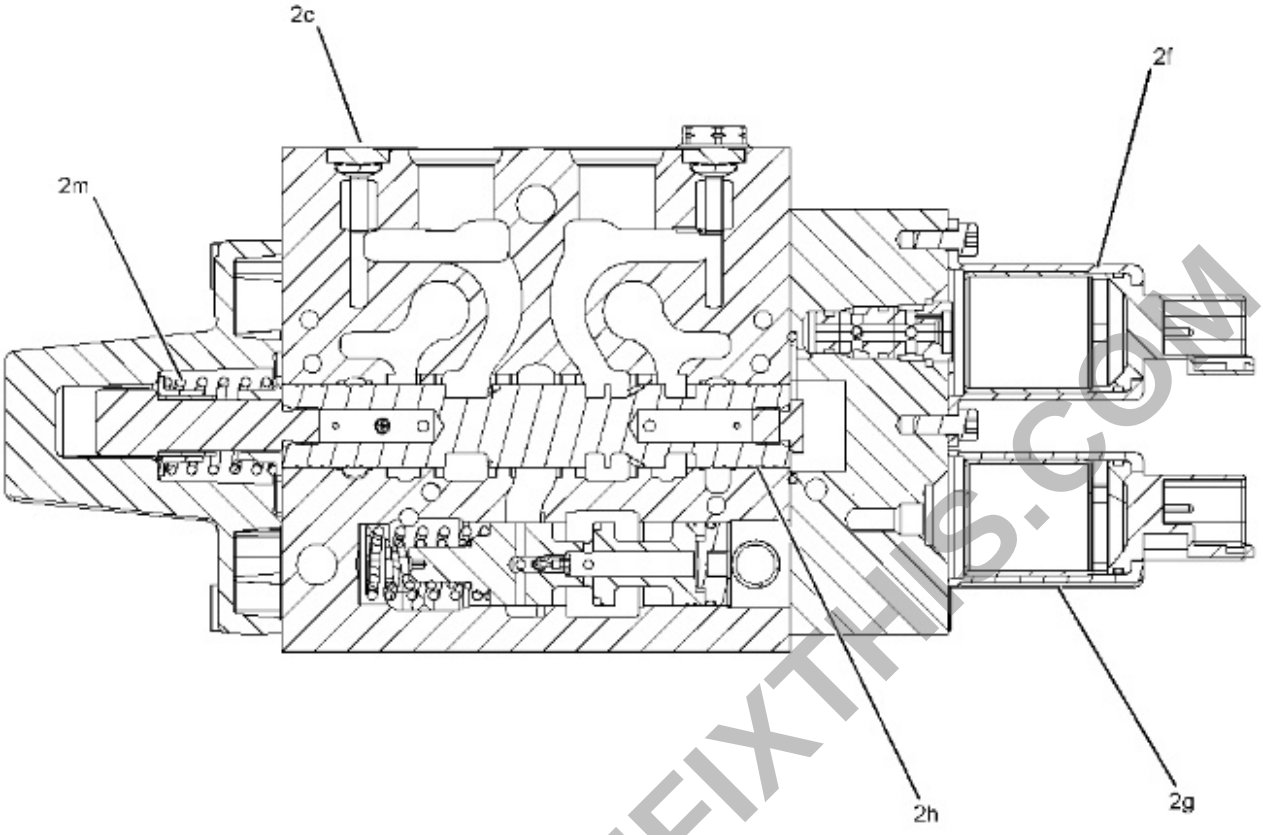


Illustration 10 g02935315

(2c) Relief and check valves (lift)

(2f) Solenoid (lower) "C1"

(2g) Solenoid (lift)"C2"

(2h) Spool (lift circuit)

(2m) Spring (spool)

Spring (2m) keep raise valve spool (2h) in the HOLD position when solenoid valves (2g) and (2f) have not been actuated. Raise valve spool (2h) in the HOLD position blocks the oil in both ends of the raise cylinders. The spool (2h) keeps the raise cylinders from moving.

Check valve (2g) further limits raise cylinder drift toward the lower position if leakage occurs between raise valve spool (2h) and the valve body.

Spool movement is controlled by actuation of solenoids (2g) and (2f) , which allow oil to flow to either end of raise valve spool (2h) .

Lift Control Valve - Lift Position

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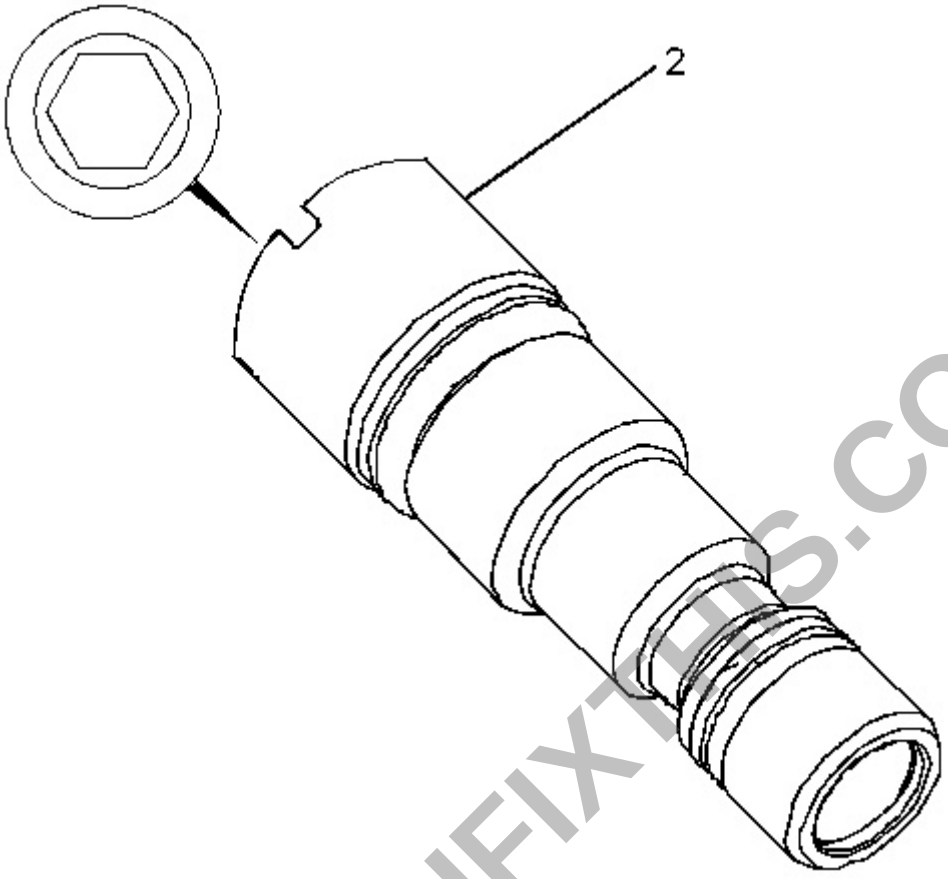


Illustration 5 g02930056

(2) Load sense relief valve

a. Raise the cab. Refer to Operation and Maintenance Manual, "Cab Tilting" for the correct procedure.

b. Remove the plastic cap over the load sensing adjustment screw.

c. Use an "M4" allen wrench in order to adjust the adjustment screw. Turn the load sensing adjustment screw clockwise in order to increase the setting and counterclockwise in order to decrease the setting. Make small adjustments at a time.

d. Replace the plastic cap over the load sensing adjustment screw.

e. Lower the cab and repeat Step 6.

7. Move the electrohydraulic control (work tool) to the NEUTRAL position.

Pump Discharge Pressure Test

Table 4

Required Tools			
Tool	**Part Number**	**Description**	**Qty**

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the cause of the failure is not found, contact the Technical Communicator at your dealership for possible consultation with Caterpillar. This consultation may effect repair time. If the ECM must be replaced, refer to Testing and Adjusting, "Electronic Control Module (ECM) - Replace".

STOP

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Disassembly and Assembly
299D and 299D XHP Compact Track Loaders and 272D and 272D XHP Skid Steer Loaders Machine Systems

Media Number -UENR2333-00 **Publication Date -01/03/2012** **Date Updated -06/03/2012**

i04789761

Hydraulic Oil Filter Base - Remove and Install

SMCS - 5068-010-BA

Removal Procedure

Start By:

A. Release the hydraulic system pressure.



Illustration 1 g02800097

1. Disconnect hose assembly (1) .

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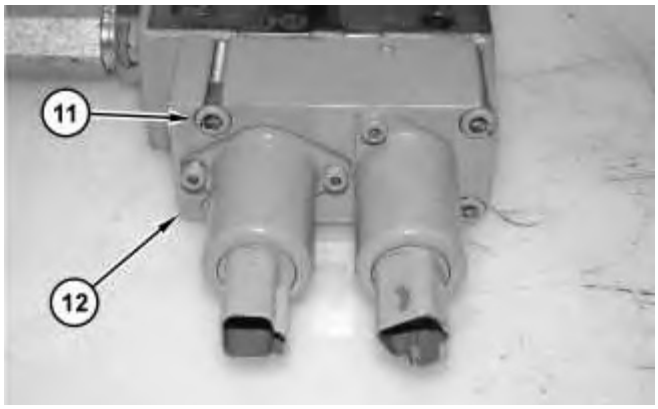


Illustration 24 g02839579

26. Install pilot valve assembly (12) . Install bolts (11) . Tighten bolts (11) to a torque of 8.5 ± 1.5 N·m (75.2 ± 13.3 lb in)

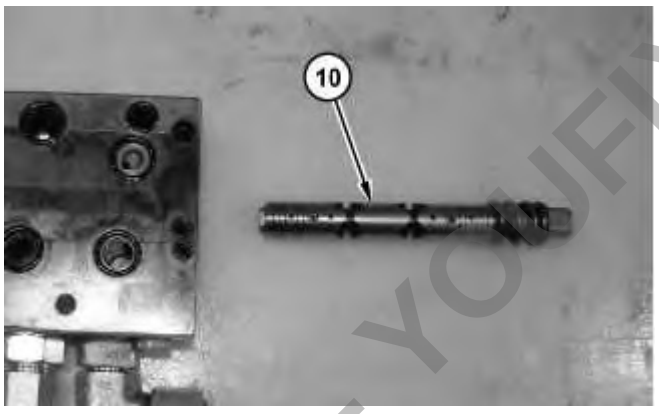


Illustration 25 g02839559

27. Install spool assembly (10) .

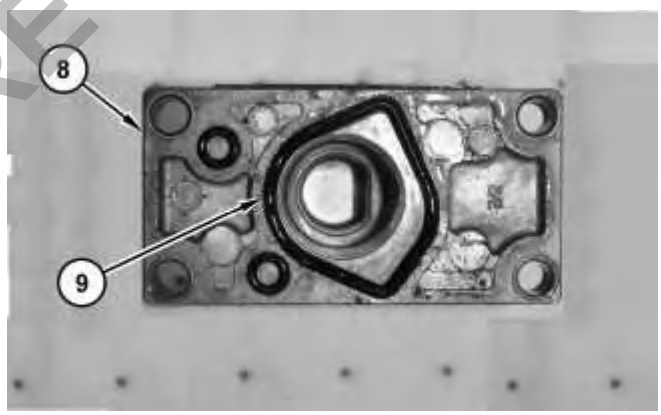


Illustration 26 g02839683

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REHS1799	Multi Terrain Loader	"Installing the 233-5873 Installation Arrangement (Air Conditioner, Heater)(Kit)"
REHS1801	Skid Steer Loader	"Installing the 218-6747 Installation Arrangement (Air Conditioner, Heater)(Kit)"
REHS1802	Skid Steer Loader	"Installing the 218-6749 Installation Arrangement (Air Conditioner Conversion)(Kit)"
REHS2488	All Products	"Refrigerant Compressor Functional Test for All Caterpillar Machines"
REHS3093	Large Track-Type Tractor	"Improving the Cab Environment for the Operator of Track-Type Tractors"
REHS3678	All Products	"Refrigerant Dryer Functional Test"
REHS4025	Wheel Loader Integrated Toolcarriers	"Replacement of the Blower Assembly on Certain Wheel Loaders"
REHS4100	D10T, D9T, D8T	"Improvement to the Case of the Air Cleaner"
REHS4138	Integrated Toolcarriers Wheel Loader Excavator Industrial Tractor Track Feller Buncher Wheel Feller Buncher	"Assembly Instructions for Installing The Air Mix Door"
REHS4499	All Products	"Testing the Refrigerant Compressor Protection Module"
SEHS9088	Earthmoving Compactor Excavator Motor Grader Track-Type Loader Track-Type Tractor Wheel Loader Wheel Tractor-Scraper	"Installation Instructions for the 174-1508 Electric Motor"
SEHS9098	Track-Type Loader Articulated Truck Excavator Track-Type Tractor Wheel Loader	"Instructions for the Installation of the 174-1508 Electric Motor"

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Illustration 1 g01518726

6. Tag the machine with a warning tag that is similar to the one that is shown in illustration 1 in order to ensure that no one else attempts to start the machine during service.

7. As it is necessary, continue to service the component.

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- The "NORMALLY OPEN" signal circuit (wire G943-BU) is shorted to ground.
- The "NORMALLY CLOSED" signal circuit (wire G944-YL) is shorted to ground.
- The Door Switch has failed.
- The ECM has failed. This is unlikely.

Test Step 1. CHECK THE SWITCH

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

B. The diagnostic code is active.

C. Remove the wire from contact A (wire 200-BK) at the switch.

D. Toggle the switch and note the status of the diagnostic code.

Expected Result:

The diagnostic code is no longer active in either position.

Results:

- **OK -** The diagnostic code is no longer active in either position.

  Repair: The Door Switch (Implement Lockout) has failed. Replace the switch. Verify that the new switch corrects the diagnostic code.

  STOP

- **NOT OK -** The diagnostic code is active in at least one of the positions. Proceed to Test Step 2.

Test Step 2. CHECK THE SIGNAL CIRCUITS 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 connectors from the ECM.

C. At the harness connector for the ECM, measure the resistance between contact J2-37 (wire G943-BU) and frame ground.

D. Measure the resistance between contact J2-29 (wire G944-YL) and frame ground.

Expected Result:

The resistances should be greater than 5000 ohms.

Results:

- **OK -** The resistances are greater than 5000 ohms.

  Repair: It is unlikely that the ECM has failed. Exit this procedure and perform this procedure again. If the cause of the diagnostic code is not found, contact your dealership's Technical Communicator for possible consultation with Caterpillar. This consultation may

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1. Refer to Service Manual, SENR5664, "Air Conditioning and Heating Systems with R-134a Refrigerant" for the procedure. Refer to Dealer Service Tool Catalog, NENG2500, "Air Conditioning Tools" for the correct tools.

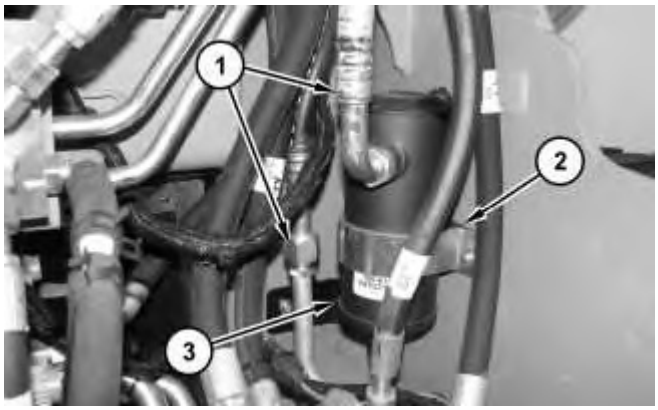


Illustration 1 g02805816

2. Disconnect hose assemblies (1). Remove clamp (2). Remove refrigerant accumulator (3).

Installation procedure

1. Install refrigerant accumulator (3) in the reverse order of removal.

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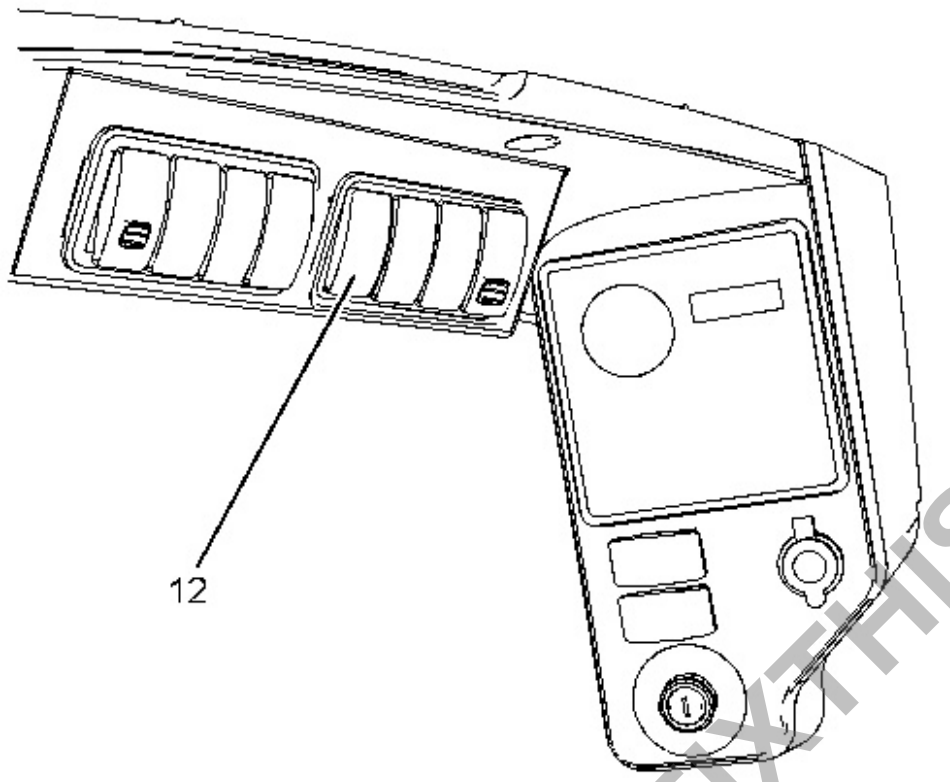


Illustration 8 g02906796

Left-hand console

(12) Multifunction switch for the left-hand joystick

The two-speed control switch (11) is a momentary switch. With the multifunction switch (12) in the two-speed position, press the button once in order to activate the rabbit mode. Press the switch again in order to deactivate the rabbit mode and return to the normal mode. When the machine is in normal mode, the hydrostatic system functions in the same manner as the machines that are equipped with the one speed piston motors.

When the operator presses the two-speed control switch (11) in order to activate the rabbit mode, the switch sends an electrical signal to the valve (speed and shut off) (3). Since the solenoid in the control manifold (two-speed control) is now energized the spool that is part of the control manifold (two-speed control) shifts to the left. When the spool is shifted to the left, the spool will allow charge oil to flow to the speed selector valve (8) that is a part of piston motor (hydrostatic left side) (1) and the speed selector valve (8) that is a part of Piston Motor (hydrostatic right side) (6) .

The normal angle of the swashplate is at the maximum angle. When the swashplate is at the maximum angle, the piston motor is at maximum displacement. When the piston motor is at maximum displacement, the piston motors are at high torque and the piston motor is at low speed.

When the charge oil pressure is greater than the force of the spring that is positioning the speed selector valves (8), the charge oil pressure forces the spools in the speed selector valves (8) to shift upward. When the speed selector valves are shifted upward, the speed selector valves (8) will direct oil to the bottom of pistons (7). Pistons (7) control the angle of swashplate in the piston motors. Pistons (7) cause the piston motors to destroke. The swashplate angle is now at minimum

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13. Remove bearing race (18) and piston assembly (19) .

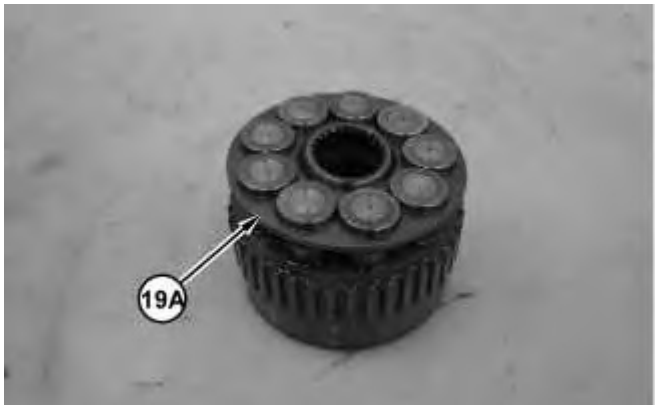


Illustration 9 g01513257

14. Remove piston assembly (19A) .

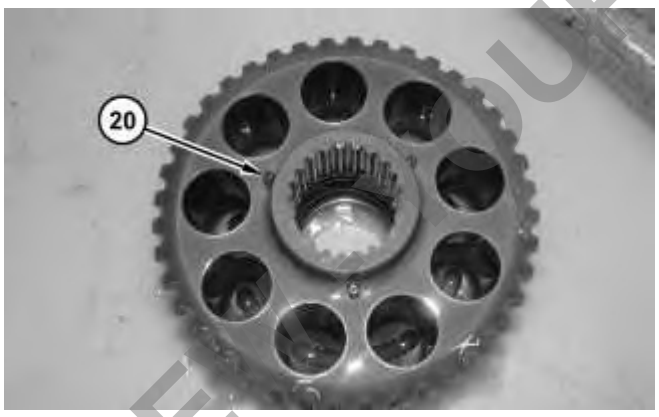


Illustration 10 g01512054

15. Remove pins (20) .

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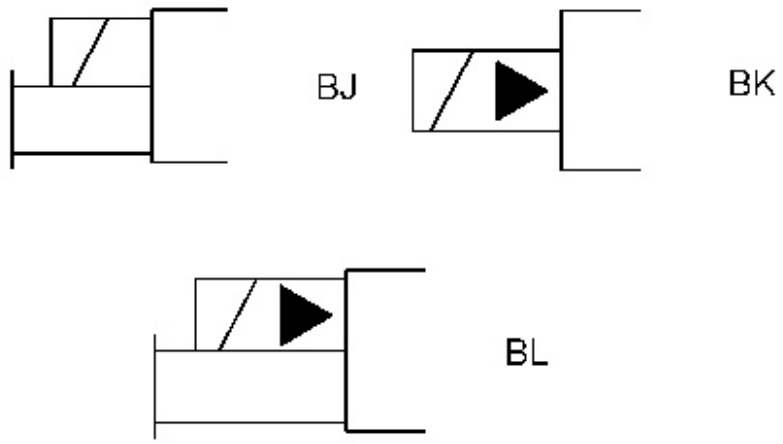


Illustration 17 g01820273

(BJ) Solenoid or manual

(BK) Solenoid and pilot

(BL) Solenoid, pilot, or manual

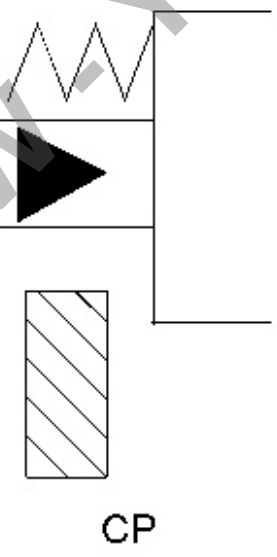


Illustration 18 g01629934

(CP) Connector (Mechanical Stop)

Electrical Controls

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Product: COMPACT TRACK LOADER
Model: 299D XHP COMPACT TRACK LOADER NLC
Configuration: 299D XHP Compact Track Loader NLC00001-UP (MACHINE)

Specifications

299D and 299D XHP Compact Track Loaders and 272D and 272D XHP Skid Steer Loaders Machine Systems

Media Number -UENR2329-00 **Publication Date -01/02/2012** **Date Updated -21/02/2012**

i05335097

Track Adjuster and Recoil

SMCS - 4157; 4158

S/N - HCL1-UP

S/N - NLC1-UP

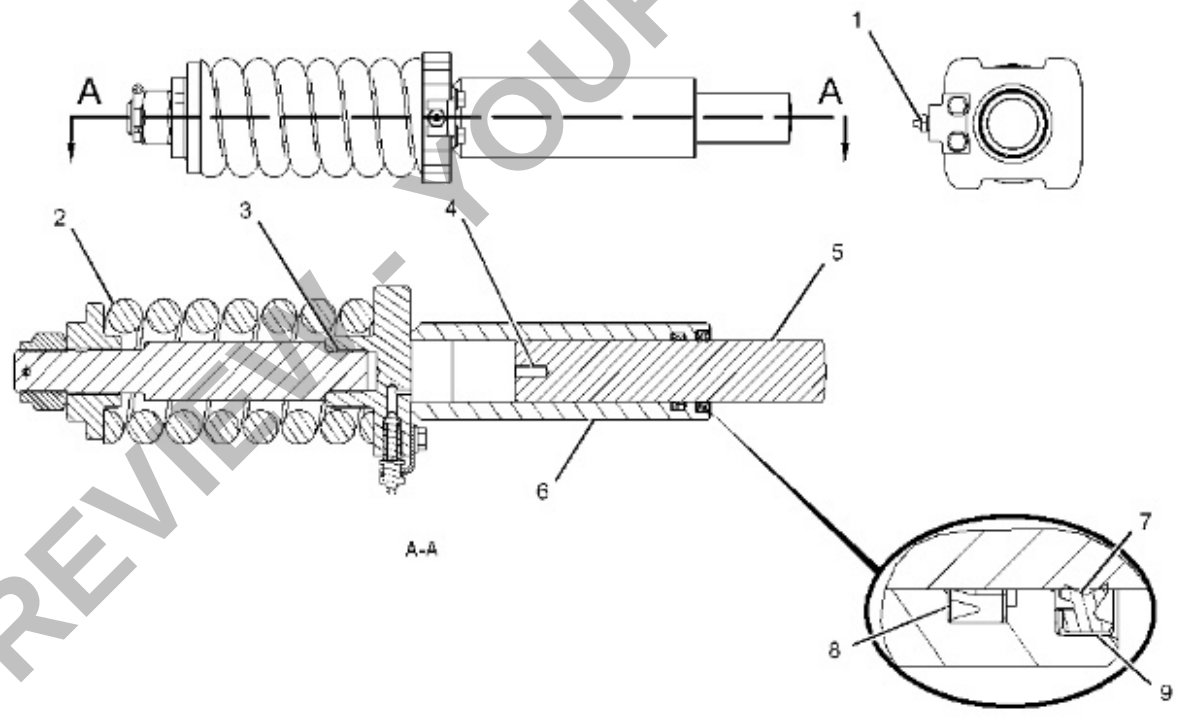


Illustration 1 g03379923

Table 1

Specifications for 304-1898 Track Adjuster and Recoil Gp			
Item	**Qty**	**Part**	**Specification Description**

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