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Radiator - Remove

C227 TIER 4B (FINAL) [NDM471837 -]	WE
C232	WE
L221	WE
L228	WE

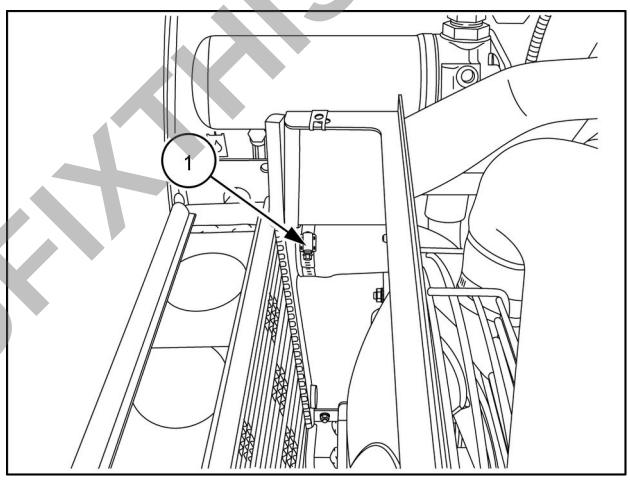
⚠ WARNING

Burn hazard!
Be very careful to avoid contact with hot fluids. If fluid is extremely hot, allow it to cool to a moderately warm temperature before proceeding.
Failure to comply could result in death or serious injury.

W0362A

Prior operation:
Drain the coolant system. See **Radiator - Drain fluid (10.400)**
Prior operation:
Remove the air cooler.

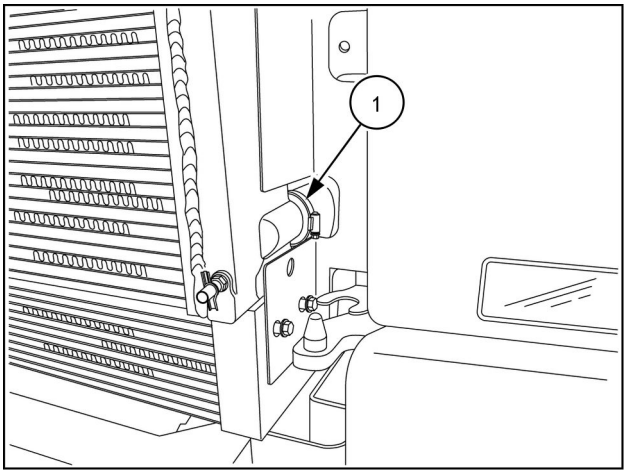
1. Disconnect the upper radiator hose **(1)**.



RAPH12SSL0065AA 1

2. Disconnect the lower radiator hose **(1)**.

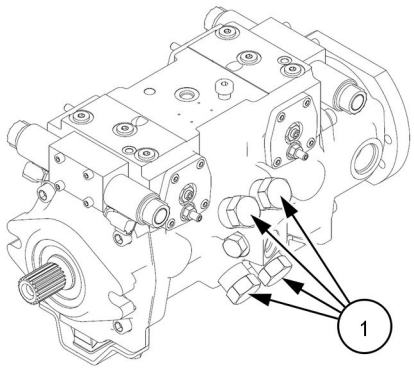
NOTE: *Rear access door removed for picture clarity.*



RAPH12SSL0083AA 2

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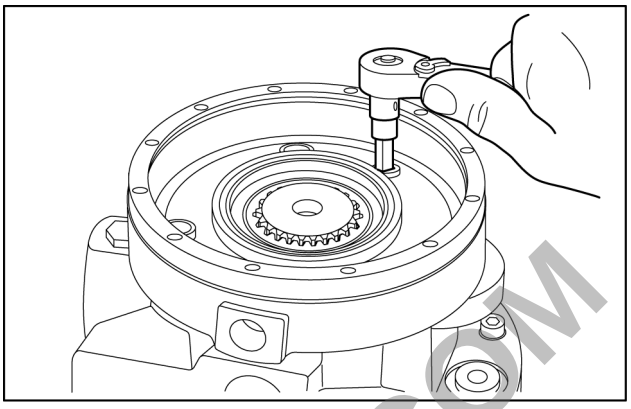
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Component	Identification	Torque	Consumable
Pressure limiter valve **(1)**	 RAPH13SSL0964FA 1	**249 N·m** (**184 lb ft**)	None

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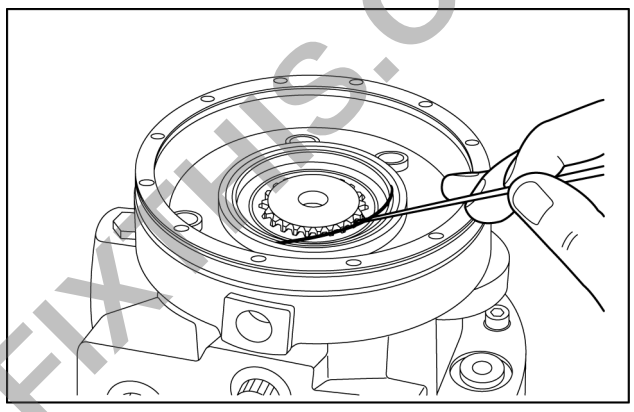
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27. Apply **LOCTITE® 243™** to the threads and install the socket head cap screws into the brake housing. Tighten the socket head cap screws alternately from side to side to a torque of **70 - 77 N·m** (**51.6 - 56.8 lb ft**).



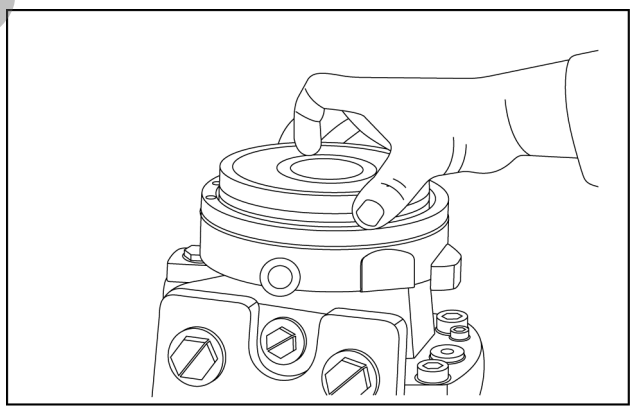
83115553 20

28. Lubricate the seal with clean hydraulic oil. Install the seal in the brake housing.



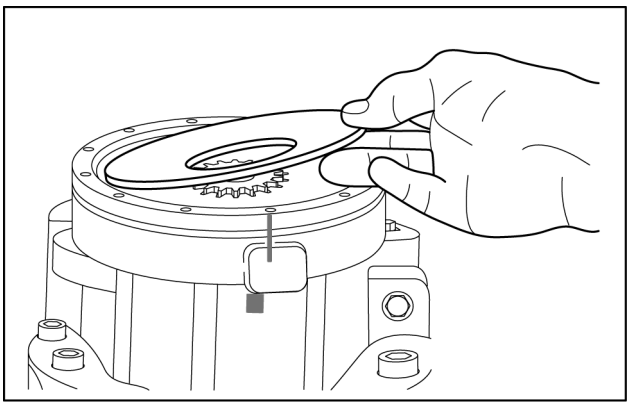
83115552 21

29. Lubricate the seals on the piston with clean hydraulic oil and install the piston into the brake housing.



83115551 22

30. Install the disc spring on top of the piston.



83115549 23

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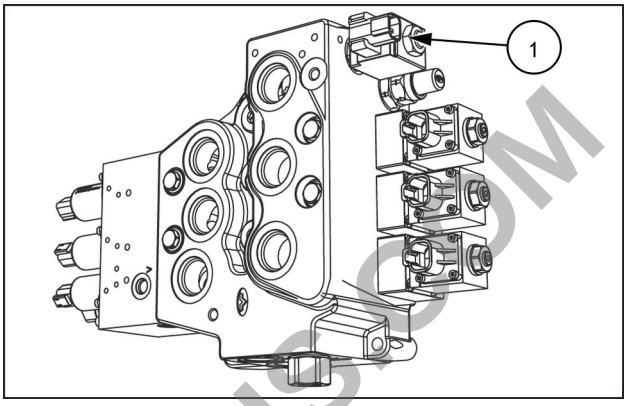
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Main control valve - Remove - Loader port lock solenoid

200 Series Compact Track Loaders	WE Electro hydraulic controls
200 Series Skid Steer Loaders	WE Electro hydraulic controls
L228	WE Electro hydraulic controls

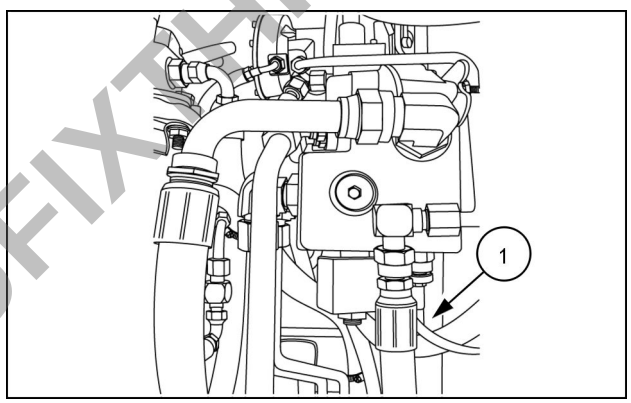
1. Locate the loader control valve **(1)** on the right hand side of the machine.

NOTE: *Image **1** is an example of the main control valve for Electro-Hydraulic (EH) controlled machines. The loader control valve on mechanically controlled machines is in the same location.*



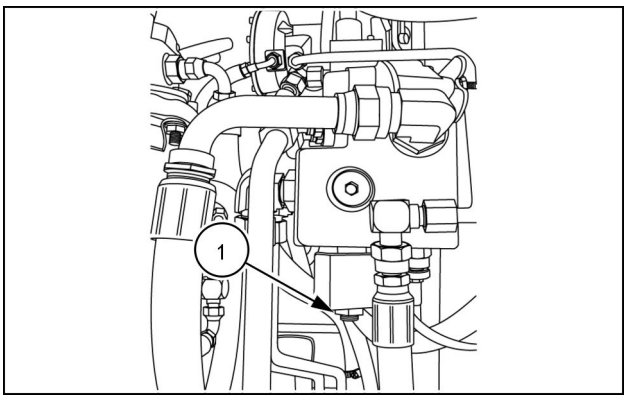
RAPH12SSL0446AA 1

2. Disconnect the electrical connector **(1)** from the solenoid.



931002090 2

3. Remove the nut from the solenoid **(1)**.



931002090 3

4. Remove the solenoid.

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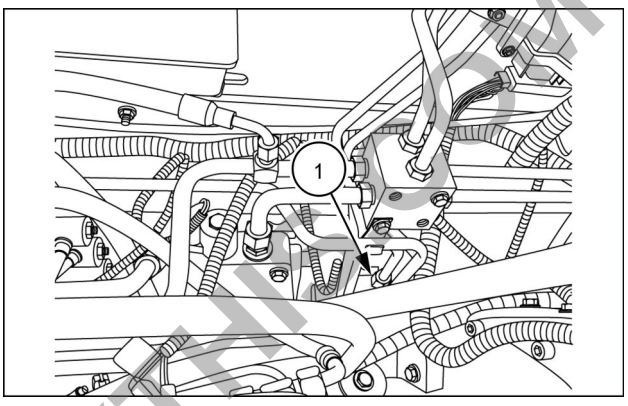
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Ride control solenoid valve block - Install

C227	WE
C232	WE
L221	WE
L228	WE

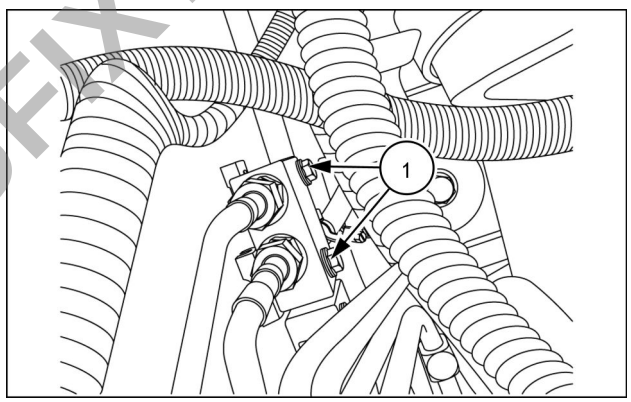
Prior operation:
Ride control solenoid valve block - Remove (35.701)

1. Locate valve **(1)** position on body.



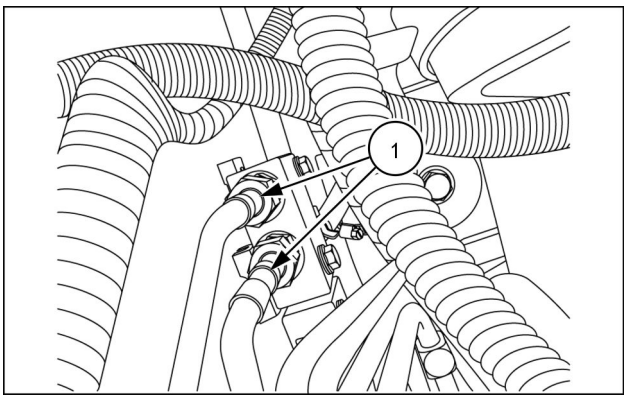
931001804 1

2. Install mounting hardware **(1)**.



931001698 2

3. Connect upper tubes **(1)**.



931001698 3

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(*) See content for specific models

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Wiring harnesses - Electrical schematic sheet 06 Engine F5C T4 (Vehicle)

C227 TIER 4B (FINAL) [NDM471837 -]	WE Mechanical hydraulic controls
C232 TIER 4B (FINAL) [NFM402195 -]	WE Mechanical hydraulic controls
L221 TIER 4B (FINAL) [NEM479941 -]	WE Mechanical hydraulic controls
L228	WE Mechanical hydraulic controls

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Wiring harnesses - Electrical schematic sheet 20 Unit Control Module

C227 TIER 4B (FINAL) [NDM471837 -]	WE Electro hydraulic controls
C232 TIER 4B (FINAL) [NFM402195 -]	WE Electro hydraulic controls
L221 TIER 4B (FINAL) [NEM479941 -]	WE Electro hydraulic controls
L228	WE Electro hydraulic controls

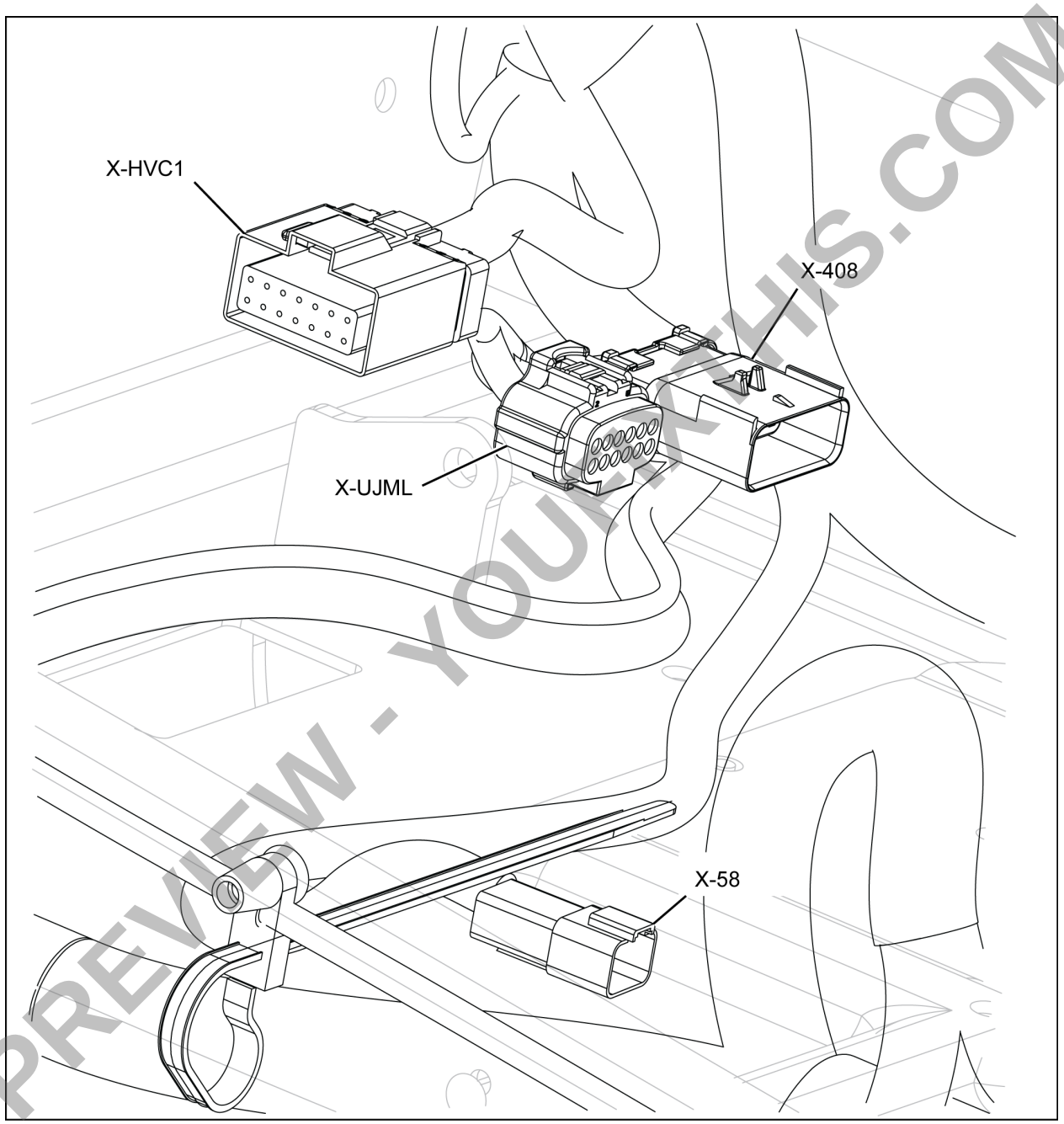
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OPT_GND_FRT	Ground	**Wire connectors - Component diagram - Grounds (55.100)**
X-BRKPRS	Brake pressure switch	Not available
X-PLTLK	Pilot interlock	Not available
X-BRK	Brake valve solenoid	Not available
X-CHGPRS	Hydraulic charge pressure switch	Not available
X-2SPD	2 speed valve solenoid	Not available



RAPH12SSL0471GA 6

Detail 5

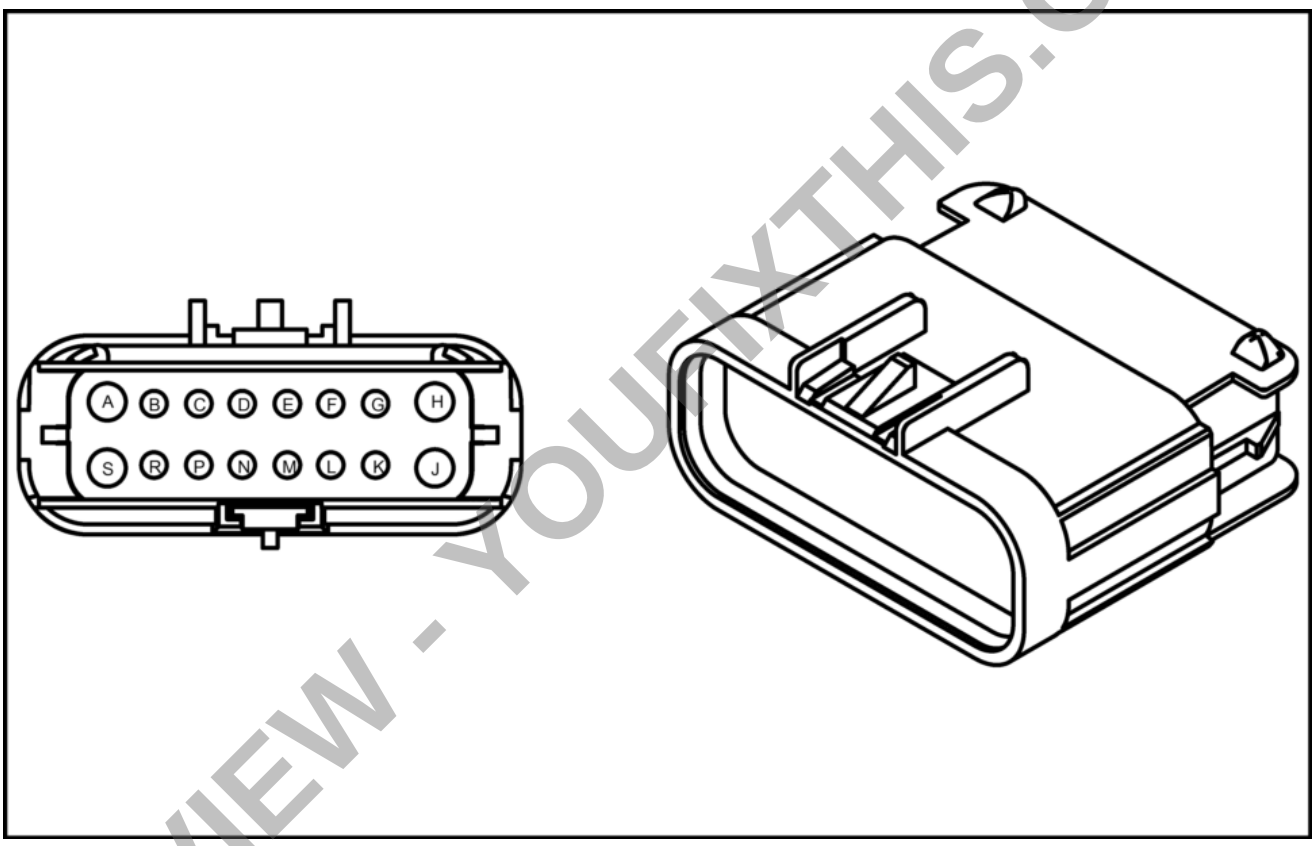
Connector title	Component	Pin information
X-HVC1	Cab/HVAC interconnect	**Wire connectors - Component diagram - Connectors A - Z (55.100)**
X-UJML	UJM left hand	**Wire connectors - Component diagram - Connectors A - Z (55.100)**
X-408	left hand handle interconnect	**Wire connectors - Component diagram 40 (55.100)**

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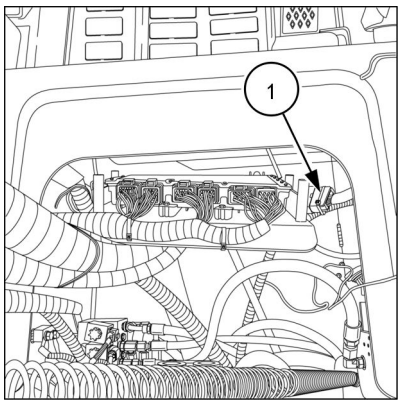
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CONNECTOR TELE - TELEMATICS

CONNECTOR TELE - TELEMATICS		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
A	336	TELEMATICS UNSWITCHED BATTERY
C	802	TELEMATICS IGNITION POWER
D	244	ALTERNATOR LAMP TELEMATICS ENGINE ON
E	308	VEHICLE WORKING CONDITION
H	925	TELEMATICS GROUND
L	503D	TELEMATICS CAN HI
M	504D	TELEMATICS CAN LO
S	205A	TELEMATICS CRANK DISABLE



87696550 45



RAPH12SSL0240AA 46

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Electrical systems - 55

Wiper and washer system - 518

C227 TIER 4B (FINAL) [NDM471837 -]
C232 TIER 4B (FINAL) [NFM402195 -]
L221 TIER 4B (FINAL) [NEM479941 -]
L228 TIER 4B (FINAL) [NFM401134 -]

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1222-VCM Sustained Over Temperature Limit

C232	WE Electro hydraulic controls
L221 TIER 4B (FINAL) [NEM479941 -]	WE
L228	WE Electro hydraulic controls

Context:
Diagnostic Trouble Code **1222 - Health Monitor Functions - UCM - UCM Sustained Over Temperature Limit** has an error priority of Red.
The hydraulics are disabled while this fault code is active.

Cause:
The UCM has sensed a high temperature within the UCM.

Possible failure modes:

1. A failure of the UCM.

Solution:

1. Turn off the machine.

   Restart the machine and recreate conditions for error. Use the EST to verify that fault code **1222 - VCM Sustained Over Temperature Limit** is active.

   A. If the fault is active, the UCM has failed. Replace the UCM.

   B. If the fault is not active, the fault may be intermittent and not currently active, continue with step **2**.
2. Visually inspect the relevant harnesses and connectors for damage, bent or dislocated pins, corroded terminals or broken wires. Verify that the connectors are fully installed. Flex the harnesses involved to reveal intermittent breaks or shorts in the wiring concerned. Operate the machine while monitoring the EST and the display. Investigate the nearby wiring.
   This Diagnostic Trouble Code resolution procedure does not completely rule out the UCM as a failure point. Therefore, all other possibilities should be investigated before the UCM is considered for replacement.

   A. If damage is found or other than normal display readings are indicated, repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.

   B. If no damage or other than normal display readings are indicated, erase the Diagnostic Trouble Code and continue operation.

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B. If there is voltage, there is a short to battery or switched battery in the fuel injector number 2 Y-9002 wiring in the injector harness (INJ). Use the appropriate service manual, if necessary, to locate and repair the shorted conductor.

4. Check the fuel injector number 2 Y-9002 injector harness (INJ) wiring for a short to ground condition.

   Disconnect the vehicle harness (VE) from the engine interface at connector **X-9139**.

   With the key in the OFF position, use a multimeter to perform the following continuity checks on the injector harness (INJ) side :

From	To	Value
X-9033 pin 1	**X-9033 pin 2**	There should be no continuity.
X-9033 pin 1	Chassis ground	There should be no continuity.
X-9033 pin 2	Chassis ground	There should be no continuity.
X-9139 pin H	All pins in connector **X-9139**	There should be no continuity.
X-9139 pin G	All pins in connector **X-9139**	There should be no continuity.

   A. If there is no continuity, leave connectors **X-9033** and **X-9139** disconnected and continue to Step **5**.

   B. If there is continuity, there is a short circuit in the fuel injector number 2 Y-9002 wiring in the injector harness (INJ). Locate and repair the shorted conductor.

5. Check the fuel injector number 2 Y-9002 vehicle harness (VE) wiring for a short circuit condition.

   Disconnect the vehicle harness (VE) from the ECU A-9000 at connector **X-9121**.

   With the key in the OFF position, use a multimeter to perform the following continuity checks on vehicle harness (VE) side :

From	To	Value
X-9139 pin H	**X-9139 pin G**	There should be no continuity
X-9139 pin H	Chassis ground	There should be no continuity
X-9139 pin G	Chassis ground	There should be no continuity
X-9139 pin H	All pins in connector **X-9139**	There should be no continuity
X-9139 pin G	All pins in connector **X-9139**	There should be no continuity

   A. If there is continuity, there is a short circuit in the fuel injector number 2 Y-9002 wiring in the vehicle harness (VE). Use the appropriate service manual, if necessary, to locate and repair the shorted conductor.

   B. If there is no continuity, continue with Step **6**.

6. Check the ECU A-9000 voltage supply wiring.

   Disconnect the vehicle harness (VE) from the ECU A-9000 at connector **X-9122**.

   Place a jumper wire between **X-9122 pin K28** and chassis ground. This will energize the main relay K-9102.

   With the key in the ON position, use a multimeter to perform the following voltage checks from the vehicle harness (VE) side :

From	To	Value
X-9122 pin K03	chassis ground	There should be approximately **12.0 V**
X-9122 pin K05	chassis ground	There should be approximately **12.0 V**
X-9122 pin K01	chassis ground	There should be approximately **12.0 V**

   A. If there is approximately **12.0 V**, leave connector **X-9122** disconnected and continue to Step **7**.

   B. If there is not approximately **12.0 V**, there is a faulty ECU A-9000 voltage supply. Use the appropriate service manual, if necessary, to locate and repair the failed conductor.

7. Check the ECU A-9000 ground supply.

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3259-Starter relay high side driver circuit shorted to ground

C232 TIER 4B (FINAL) [NFM402195 -]	WE
L221 TIER 4B (FINAL) [NEM479941 -]	WE
L228	WE

Context:
The Engine Control Unit (ECU) A-9000 controls the starter control relay K-9104 using a low side and high side driver. If the ECU A-9000 detects a short circuit to ground in the high side driver circuit, this fault will occur.

Cause:
The ECU A-9000 has detected a short circuit to ground in the starter control relay K-9104 high side driver circuit.

Possible failure modes:

1. Faulty starter control relay K-9104 wiring, short to ground.
2. Faulty starter control relay K-9104, internal failure.
3. Faulty ECU A-9000, software.

Solution:

1. Verify fault is present and active.

   Use the Electronic Service Tool (EST) to check the status of this fault.

   A. If the fault is present and active, continue with Step **2**.

   B. If the fault is no longer present or in an inactive state, the fault may be intermittent and not currently active. Continue with Step **5**.

2. Check the starter control relay K-9104 coil for an internal failure.

   Remove the starter control relay K-9104.

   Use a multimeter to measure the relay coil resistance on the starter control relay K-9104 pins :

From	To	Value
X-9120 pin 85	**X-9120 pin 86**	There should be approximately **70 - 130 Ω**.

   A. If there is approximately **70 - 130 Ω**, leave the starter control relay K-9104 disconnected and continue to Step **3**.

   B. If there is not approximately **70 - 130 Ω**, the relay has failed. Replace the starter control relay K-9104.

3. Check the starter control relay K-9104 high side driver vehicle harness (VE) wiring for a short to ground.

   With the key in the OFF position, use a multimeter to perform the following continuity check for a short to ground on the vehicle harness (VE) side :

From	To	Value
X-9120 pin 85	Chassis ground	There should be no continuity.
X-9120 pin 85	**X-9120 pin 86**	There should be no continuity.

   A. If there is continuity, there is a short to ground in the starter control relay K-9104 wiring in the vehicle harness (VE). Use the appropriate service manual, if necessary, to locate and repair the shorted conductor.

   B. If there is no continuity, continue to Step **4**.

4. Check the starter control relay K-9104 high side driver vehicle harness (VE) wiring for a short circuit.

   Disconnect the vehicle harness (VE) from the ECU A-9000 at connector **X-9122**.

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From	To	Result
X-9010 pin 1	**X-9138 pin 29**	There should be continuity.
X-9010 pin 5	**X-9138 pin 30**	There should be continuity.

A. If there is continuity on both tests, leave connector **X-9138** disconnected and continue with Step **4**.

B. If there is no continuity on either or both of the checks, there is an open circuit condition in the engine harness (EN) between connector **X-9010 pin 1** and/or **X-9010 pin 5** and connector **X-9138 pin 29** and/or **X-9138 pin 30**, wire EN-9095 and/or EN-9096. Locate and repair the broken conductor.

4. Check the vehicle harness (VE) for an open circuit condition.

   Carefully disconnect the vehicle harness (VE) from the ECU A-9000 at connector **X-9121**.

   Use a multimeter to check for continuity in the vehicle harness (VE) :

From	To	Result
X-9121 pin A50	**X-9138 pin 29**	There should be continuity.
X-9121 pin A35	**X-9138 pin 30**	There should be continuity.

A. If there is no continuity on either or both of the checks, there is an open circuit condition in the vehicle harness (VE) between connector **X-9121 pin A50** and/or **X-9121 pin A35** and connector **X-9138 pin 29** and/or **X-9138 pin 30**, wire VE-9095 and/or VE-9096. Use the appropriate service manual, if necessary, to locate and repair the broken conductor.

B. If there is continuity, check the ECU A-9000 for the appropriate software and re-flash, if necessary.

5. Visually inspect the relevant harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Verify that the connectors are fully installed. Flex the harnesses involved to reveal intermittent breaks or shorts in the wiring concerned. Operate the machine while you monitor the display.

A. If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.

B. If you do not find damage and the display indicates only normal readings, then erase the fault code and continue operation.

Wiring harnesses - Electrical schematic sheet 05 - Engine Control Unit (ECU) engine connector (55.100.DP-C.20.E.05)
Wiring harnesses - Electrical schematic sheet 06 - Engine control and fuel injection (55.100.DP-C.20.E.06)

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3758-ECU internal failure - Post injection efficiency failure

C232 TIER 4B (FINAL) [NFM402195 -]	WE
L221 TIER 4B (FINAL) [NEM479941 -]	WE
L228	WE

Context:
The Engine Control Unit (ECU) A-9000 performs a diagnostic fault check for post injection 3. If the ECU A-9000 determines that there is a post injection 3 plausibility error, this fault will occur.

Solution:

1. Check the ECU A-9000 for the appropriate software and re-flash, if necessary.
   A. If the fault has been resolved, return the machine to service.
   B. If the fault has not been resolved, escalate an ASIST concern.

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B. If there is no continuity, there is an open circuit condition in the fuel metering unit Y-9000 engine harness (EN) wiring. Locate and repair the broken conductor.

4. Check the fuel metering unit Y-9000 vehicle harness (VE) wiring for an open circuit.

   Disconnect the vehicle harness (VE) from the ECU A-9000 at connector **X-9121**.

   With the key in the OFF position, use a multimeter to perform the following continuity check on the vehicle harness (VE) side :

From	To	Value ***NOTE: Wiggle the harness during the check to promote an intermittent electrical connection.***
X-9138 pin 1	**X-9121 pin A15**	There should be continuity.
X-9138 pin 2	**X-9121 pin A60**	There should be continuity.

   A. If there is no continuity, there is an open circuit condition in the fuel metering unit Y-9000 vehicle harness (VE) wiring. Use the appropriate service manual, if necessary, to locate and repair the broken conductor.

   B. If there is continuity, check the ECU A-9000 for the appropriate software and re-flash, if necessary.

5. Visually inspect the relevant harnesses and connectors for damage, bent or dislocated pins, corroded terminals, or broken wires. Verify that the connectors are fully installed. Flex the harnesses involved to reveal intermittent breaks or shorts in the wiring concerned. Operate the machine while you monitor the display.

   A. If you find damage or the display indicates other than normal display readings, then repair the damage discovered during the inspection or locate and repair the other than normal display condition and verify that the error has been resolved.

   B. If you do not find damage and the display indicates only normal readings, then erase the fault code and continue operation.

Wiring harnesses - Electrical schematic sheet 05 - Engine Control Unit (ECU) engine connector (55.100.DP-C.20.E.05)
Wiring harnesses - Electrical schematic sheet 06 - Engine control and fuel injection (55.100.DP-C.20.E.06)

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4. Verify that the swash plate sensors are connected properly.

   Verify that connector **X-93** is connected to the right hand pump swash plate sensor.

   Verify that connector **X-94** is connected to the left hand pump swash plate sensor.

   A. The connectors are secure and installed in the proper location. Check the adjustment for mechanical neutral in the right-hand pump drive circuit. Return to step **1**.

   B. The connectors are not secure or are not installed in the proper locations. Repair the harness or connectors as required. Return to step **1** to confirm elimination of fault.

Wiring harnesses - Electrical schematic sheet 19 Unit Control Module (55.100.DP-C.20.E.19)
Wiring harnesses - Electrical schematic sheet 09 EH Pump/ Hydraulics (55.100.DP-C.20.E.09)

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A. The voltage is approximately **2.5 V** in the neutral position and the voltage changes between **0.5 V** and **4.5 V**. Temporarily replace the UCM and retest. Return to step **1** to confirm elimination of the fault.

B. The voltage is not **2.5 V** in the neutral position or the voltage change is erratic. Temporarily replace the joystick and retest. Return to step **1** to confirm elimination of fault.

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module (55.100.DP-C.20.E.20)
Wiring harnesses - Electrical schematic sheet 14 Cab to Chassis Interface (55.100.DP-C.20.E.14)
Wiring harnesses - Electrical schematic sheet 16 Left-Hand Control Handle (55.100.DP-C.20.E.16)

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5512-Implausible Bucket Sensor State Vs Loader Bucket Command - Stuck Spool Or PRV

C232	WE Electro hydraulic controls
L221 TIER 4B (FINAL) [NEM479941 -]	WE
L228	WE Electro hydraulic controls

Context:
The UCM has sensed that the bucket spool position sensor does not agree with the direction of bucket travel. Diagnostic Trouble Code **5512 - Implausible Bucket Sensor State Vs Loader Bucket Command - Stuck Spool Or PRV** has an error priority of Red.
The loader hydraulics are disabled while Diagnostic Trouble Code **5512 - Implausible Bucket Sensor State Vs Loader Bucket Command - Stuck Spool Or PRV**.

Cause:
The UCM has sensed that the bucket spool position sensor does not agree with the direction of bucket travel. The fault is active while the engine is ON and the bucket spool position sensor senses the bucket movement but the solenoids are not energized or bucket movement is opposite of the energized solenoid.

Possible failure modes:

1. Improper wiring in circuit. Connector X-25 swapped with connector X-26.
2. The spool is sticking inside the valve body.
3. A failure of bucket spool position sensor.
4. A faulty UCM.

Solution:

1. Verify that the spool is not stuck in the valve.

   Turn the ignition switch OFF.

   Remove the bucket spool position sensor from the valve body.

   Turn the ignition switch ON.

   Access EST and monitor the spool position.

   Move the pintle arm while monitoring the valve position sensor signal. The value should change linearly and not become erratic.

   A. The sensor value changes in a linear fashion. The problem is in the valve body. Repair or replace the valve or spool as required. Return to step **2** to confirm elimination of the fault.

   B. The sensor values did not change in a linear fashion. The problem is in the sensor circuit. Go to step **2**.
2. Verify that the fault code is active.

   Connect the Electronic Service Tool to the service tool connector.

   To check for fault codes: Start and operate the machine.

   A. The fault code is not recorded again. OK to return the machine to service.

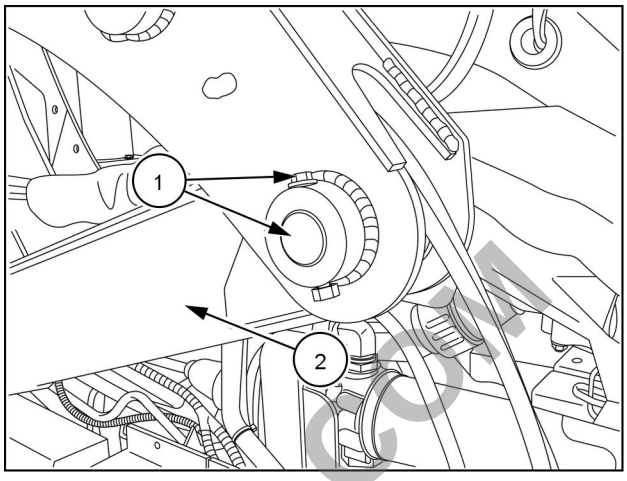
   B. Fault code **5512 - Implausible Bucket Sensor State Vs Loader Bucket Command - Stuck Spool Or PRV** is recorded again. Go to step **3**.
3. Verify that the wiring and connectors are free of damage.

   Inspect the UCM, the bucket valve solenoids, and the bucket spool position sensor connections. All connections should be secure, tight, free of corrosion, abrasion, and damage.

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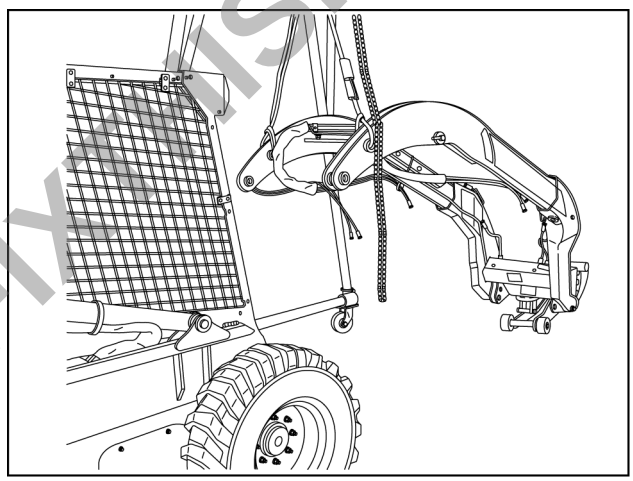
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18. Remove the loader arm hardware **(1)**, and lower the loader arm links **(2)**.



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19. Carefully remove the loader arm.



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