

SERVICE MANUAL

L218 / L220

Tier 4B (final)

200 Series Skid Steer Loader

L218 PIN NDM449275 and above; L220 PIN NDM456673 and above

Part number 47851949

English

May 2015

Replaces part number 47712047



CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

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- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

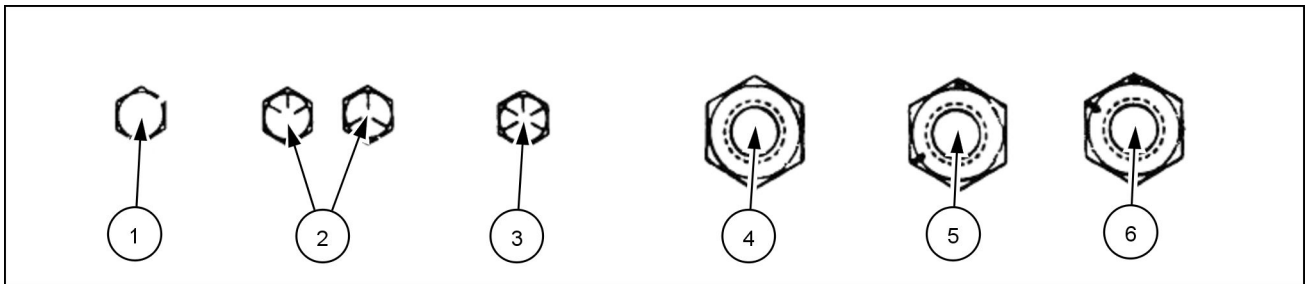
CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

INCH FLANGED HARDWARE

NOM- INAL SIZE	SAE GRADE 5 BOLT and NUT		SAE GRADE 8 BOLT and NUT		LOCKNUT GrF W/ Gr5 BOLT	LOCKNUT GrG W/ Gr8 BOLT
	UNPLATED or PLATED SILVER	PLATED W/ZnCr GOLD	UNPLATED or PLATED SILVER	PLATED W/ZnCr GOLD		
1/4	9 N·m (80 lb in)	12 N·m (106 lb in)	13 N·m (115 lb in)	17 N·m (150 lb in)	8 N·m (71 lb in)	12 N·m (106 lb in)
5/16	19 N·m (168 lb in)	25 N·m (221 lb in)	26 N·m (230 lb in)	35 N·m (310 lb in)	17 N·m (150 lb in)	24 N·m (212 lb in)
3/8	33 N·m (25 lb ft)	44 N·m (33 lb ft)	47 N·m (35 lb ft)	63 N·m (46 lb ft)	30 N·m (22 lb ft)	43 N·m (32 lb ft)
7/16	53 N·m (39 lb ft)	71 N·m (52 lb ft)	75 N·m (55 lb ft)	100 N·m (74 lb ft)	48 N·m (35 lb ft)	68 N·m (50 lb ft)
1/2	81 N·m (60 lb ft)	108 N·m (80 lb ft)	115 N·m (85 lb ft)	153 N·m (113 lb ft)	74 N·m (55 lb ft)	104 N·m (77 lb ft)
9/16	117 N·m (86 lb ft)	156 N·m (115 lb ft)	165 N·m (122 lb ft)	221 N·m (163 lb ft)	106 N·m (78 lb ft)	157 N·m (116 lb ft)
5/8	162 N·m (119 lb ft)	216 N·m (159 lb ft)	228 N·m (168 lb ft)	304 N·m (225 lb ft)	147 N·m (108 lb ft)	207 N·m (153 lb ft)
3/4	287 N·m (212 lb ft)	383 N·m (282 lb ft)	405 N·m (299 lb ft)	541 N·m (399 lb ft)	261 N·m (193 lb ft)	369 N·m (272 lb ft)
7/8	462 N·m (341 lb ft)	617 N·m (455 lb ft)	653 N·m (482 lb ft)	871 N·m (642 lb ft)	421 N·m (311 lb ft)	594 N·m (438 lb ft)
1	693 N·m (512 lb ft)	925 N·m (682 lb ft)	979 N·m (722 lb ft)	1305 N·m (963 lb ft)	631 N·m (465 lb ft)	890 N·m (656 lb ft)

IDENTIFICATION




Inch Bolts and free-spinning nuts

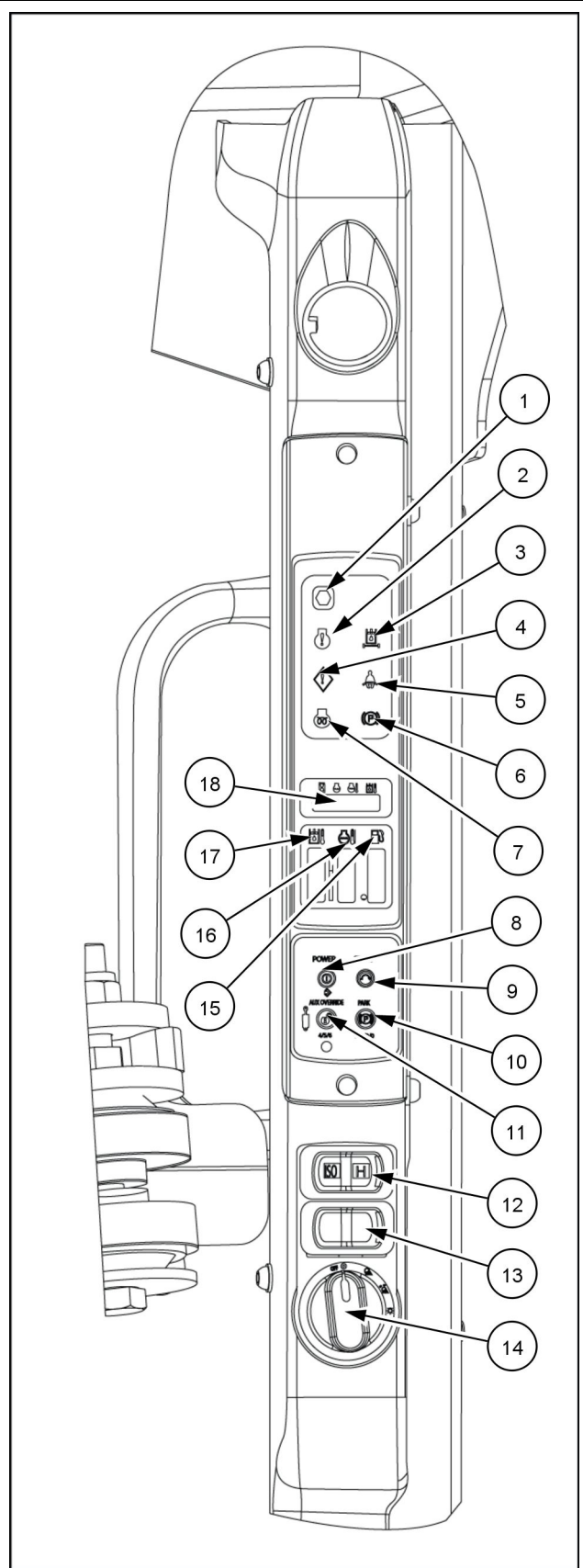


20083682 3

Grade Marking Examples

SAE Grade Identification			
1	Grade 2 - No Marks	4	Grade 2 Nut - No Marks
2	Grade 5 - Three Marks	5	Grade 5 Nut - Marks 120 ° Apart
3	Grade 8 - Five Marks	6	Grade 8 Nut - Marks 60 ° Apart

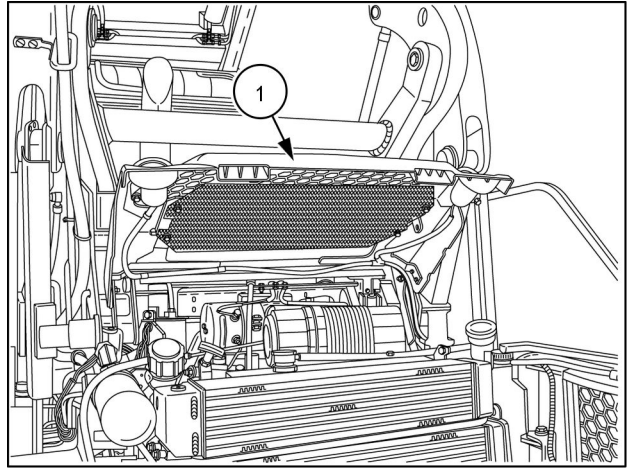
<p>(6)</p> 	<p>PARK BRAKE LAMP:</p> <p>This Red lamp illuminates to indicate the park brake is engaged.</p> <p>Under normal conditions the Park Brake will be set when:</p> <ul style="list-style-type: none"> • The PARK BRAKE switch is activated • The OPERATE button is activated • The engine is shut off • The engine is running and the seat belt is not latched • The operator leaves the seat
<p>(7)</p> 	<p>ENGINE PREHEATING LAMP:</p> <p>In cold climate starting conditions, after turning the KEY switch to RUN, this yellow Engine Pre-Heating Lamp will illuminate, instructing the operator that incoming air is being preconditioned for smoother starting. The operator must wait until the lamp goes out before attempting to start the engine.</p>
<p>(8)</p>	<p>SYSTEM POWER:</p> <p>Push for Start-up power and Engine shut down power. Use this, when in the SETUP menu, as the "enter" Data Key.</p> <p>NOTE: This button is used for user code lock and unlock.</p>
<p>(9)</p> 	<p>START:</p> <p>Push to actuate the starter motor and start the engine. Use this when in the SETUP menu, Also used to scroll within the setup menu.</p> <p>NOTE: This button is used for user code lock and unlock.</p>



93109330 2

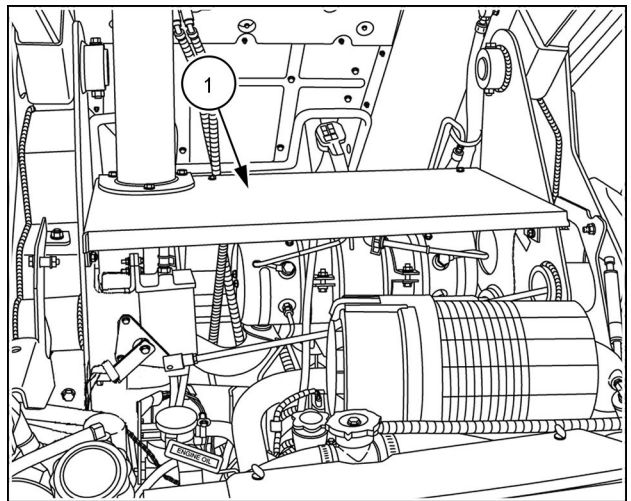
Engine - Engine and crankcase

2. Remove the engine hood strut from the side by gently prying the retaining clip just enough to release the strut.
3. Disconnect the A/C lines (if applicable).
4. Disconnect the lights and disconnect the harness from the hood.
5. Remove the engine hood mounting hardware from left-hand and right-hand side of the engine hood.
6. Remove the engine hood (1).



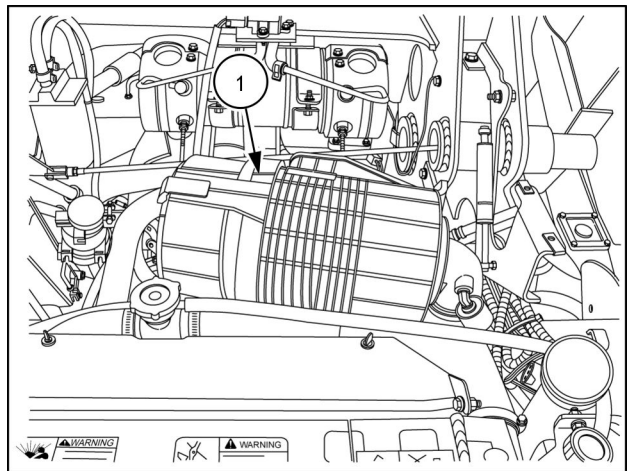
RAIL13SSL0149AA 2

7. Remove the engine cover (1).



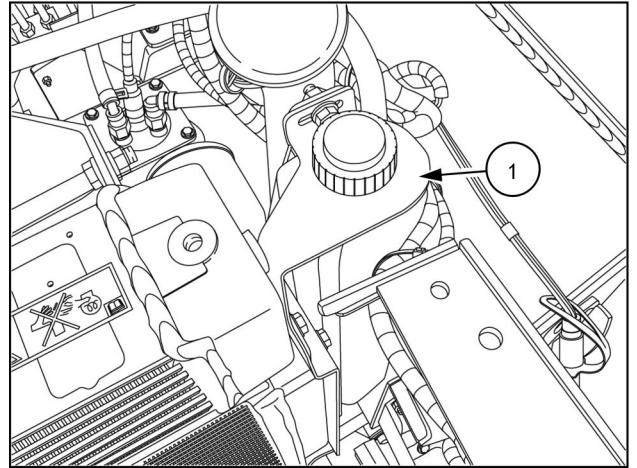
RAIL13SSL0128AA 3

8. Remove the air filter assembly (1) and hoses.



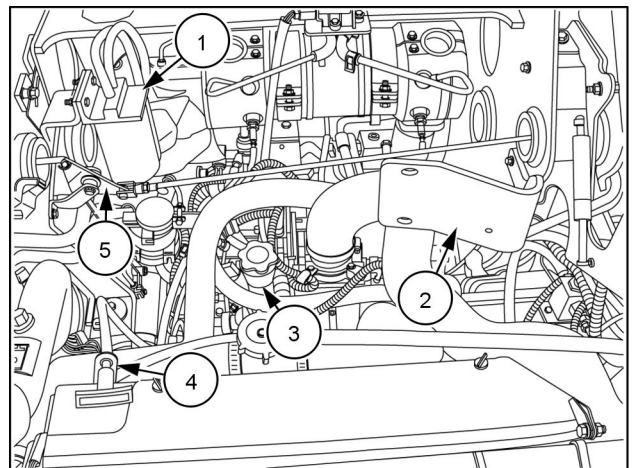
RAIL13SSL0145AA 4

32. Install the bracket (1) for the coolant overflow bottle. Torque the bolts to **27 - 37 N·m (20 - 27 lb ft)**.



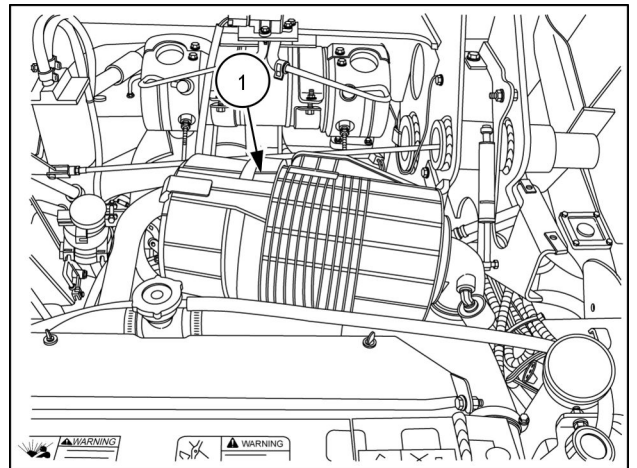
RAIL13SSL0143AA 22

33. Install the fuel filter assembly (1).
 34. Install the bracket (2) for the air filter assembly.
 35. Install the oil fill tube (3).
 36. Connect the mount (4) for the oil dip stick to the cooling package bracket.
 37. For vertical lift machines, install the boom lock bell-crank (5). Install the cotter pin on the lock pin link for the left, boom lock pin.



RAIL13SSL0144AA 23

38. Install the air filter assembly (1) and hoses. Torque the bolts to **27 - 37 N·m (20 - 27 lb ft)**. Torque the hose clamps to **3 - 4 N·m (27 - 35 lb in)**

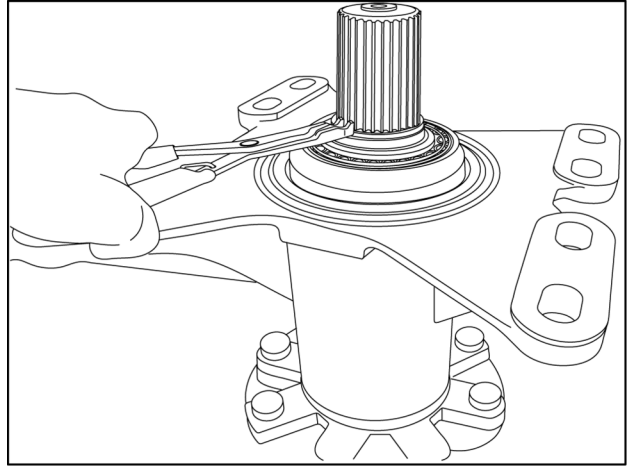


RAIL13SSL0145AA 24

Axle - Disassemble

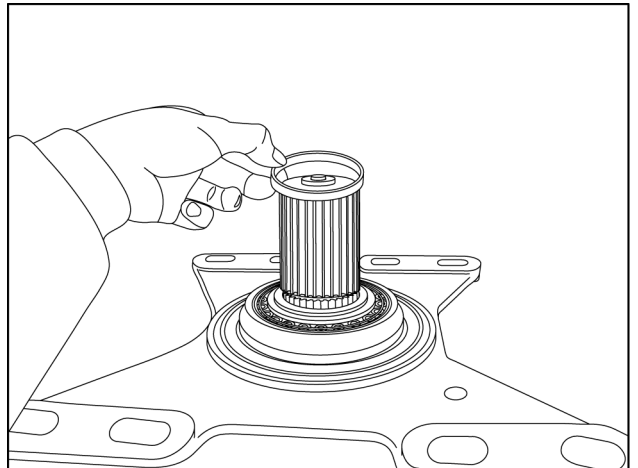
L218	
L220	

1. Remove the snap ring.



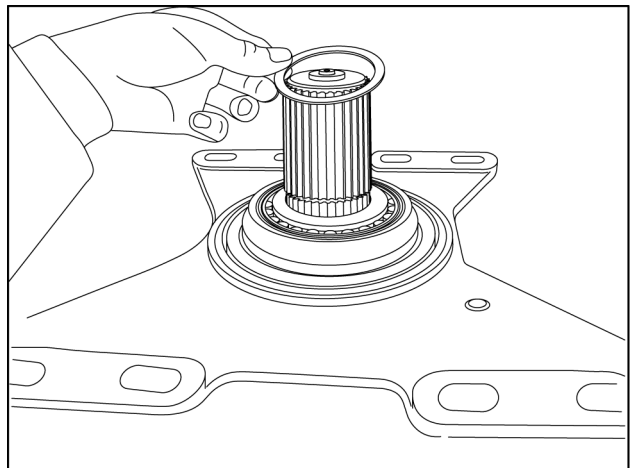
RAIL13SSL0388BA 1

2. Remove the shim.



RAIL13SSL0387BA 2

3. Remove the spacer.



RAIL13SSL0386BA 3

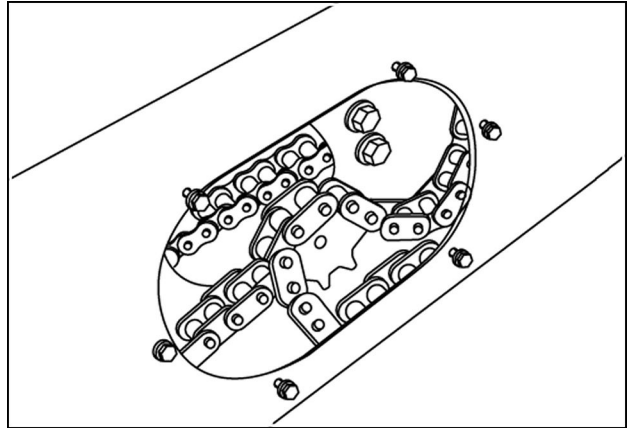


SERVICE MANUAL

Rear axle system

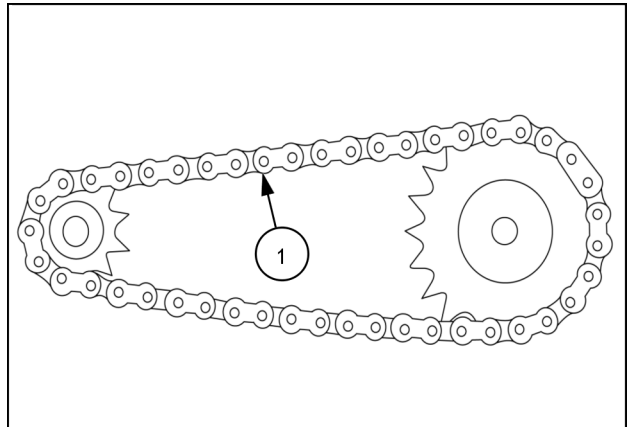
L218 TIER 4B Final [NDM449275 -]
L220 TIER 4B Final [NDM456673 -]

- The drive chain will need adjustment. Either remove the chain tank cover and proceed to step 5 or see **Chain drive - Check (25.450)** for alternative adjustment procedures.



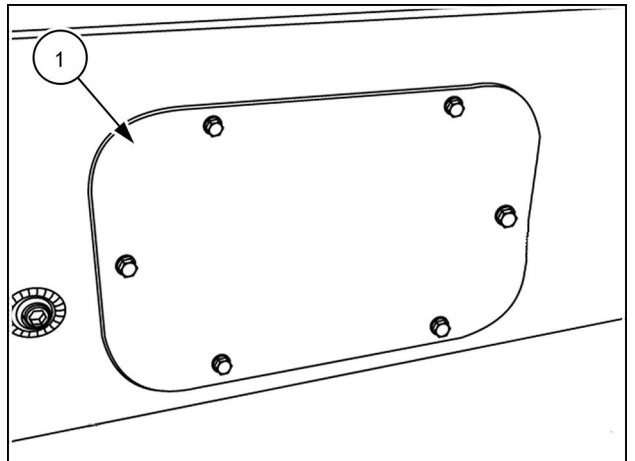
RAIL13SSL0561BA 3

- Adjust the axle so the chain has **10 - 15.0 mm (13/32 - 19/32 in)** of slack at the center **(1)** of the chain.



96091469 4

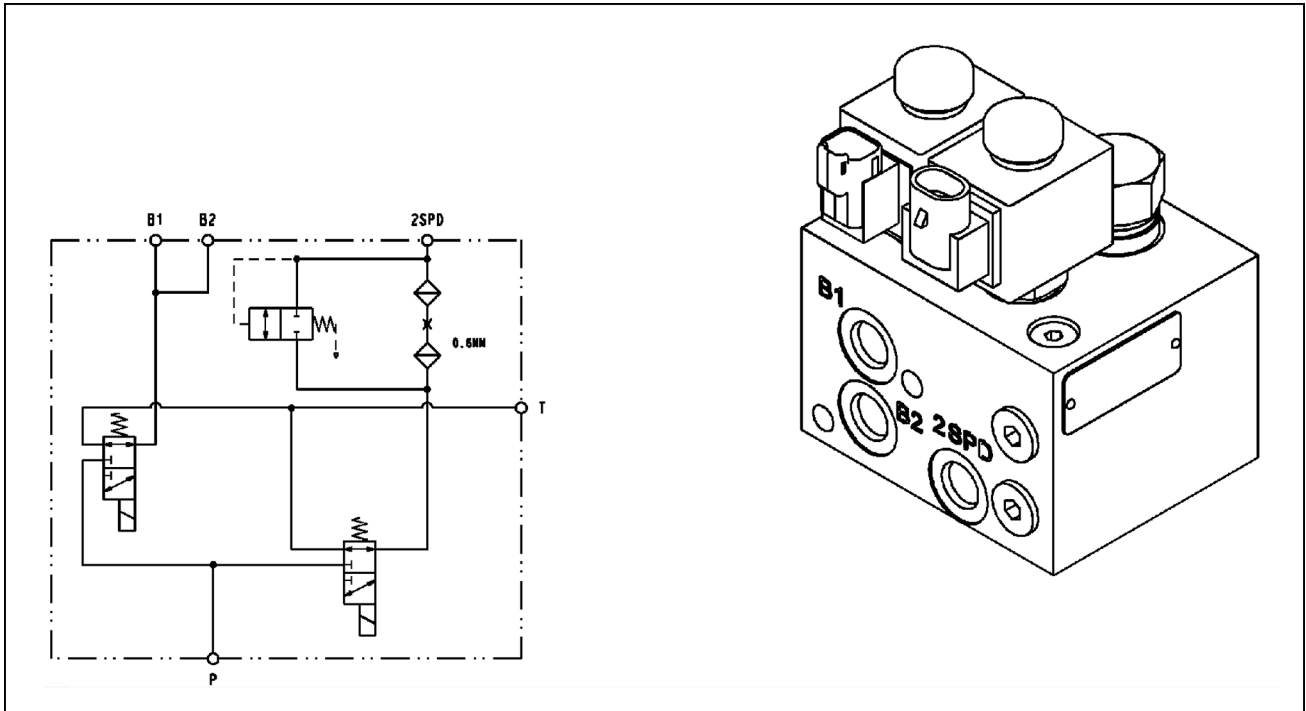
- Apply a bead of **LOCTITE® RTV SILICONE CLEAR** to the bolt holes and to the chain tank opening.
- Install the chain tank cover **(1)**.



RAPH13SSL0563BA 5

Control valve - General specification

L218	
L220	



RAPH13SSL0967EA 1

Brake, two speed valve

Hydraulic requirements:	Charge pressure = 24 - 25.5 bar (350 - 370 psi)
	Brake release pressure = 15 bar (218 psi)
Sequence valve setting	12 bar (174 psi)
Filter rating	40 – 50 microns
Port identification	P - Supply inlet
	T - Tank return
	2SPD - Two speed shift
	B1 - Brake motor 1
	B2 - Brake motor 2
	PS2 - Brake pressure switch

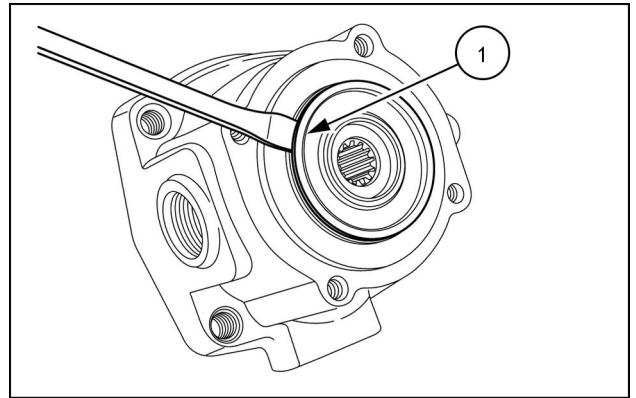
Control valve - General specification

L218	
L220	

Remove (*)	53
Install (*)	57
Servo control	
Adjust (*)	61
Motor	
Remove (*)	64
Disassemble – Single speed drive motor (*)	68
Assemble – Single speed drive motor (*)	77
Disassemble – Two speed drive motor (*)	85
Assemble – Two speed drive motor (*)	92
Install (*)	99

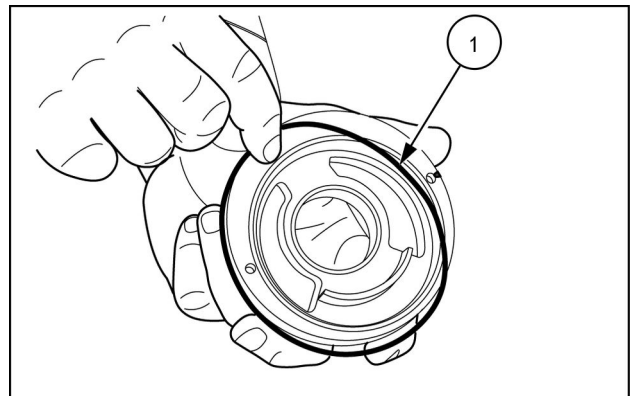
(*) See content for specific models

4. Remove the charge pump housing (1).



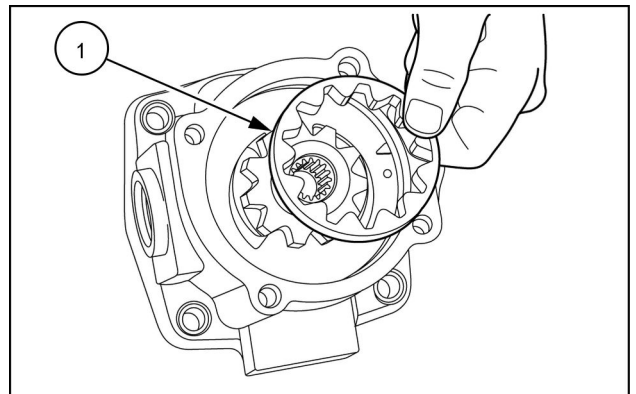
83115511 4

5. Remove o-ring (1) from charge pump housing.



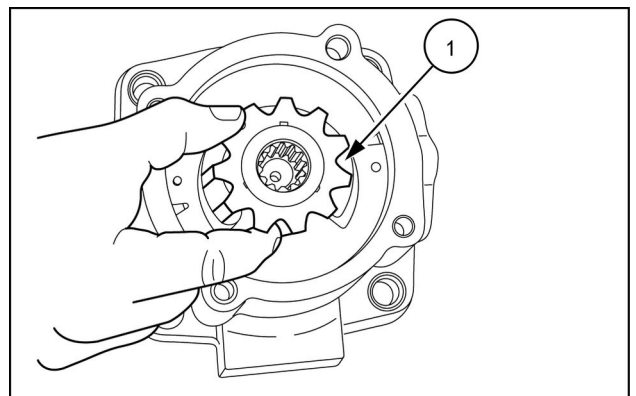
83115512 5

6. Remove the outer gear (1).



83115513 6

7. Remove the inner gear (1).



83115514 7

8. **⚠ DANGER**

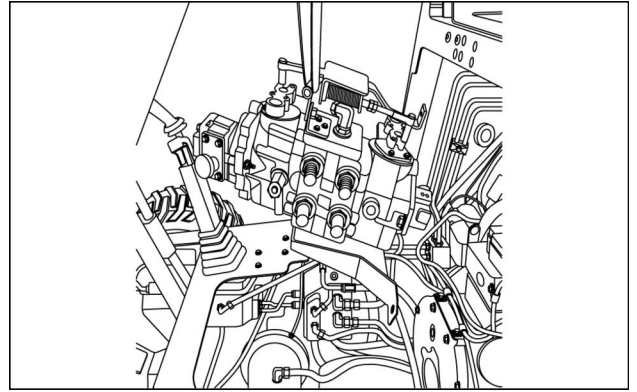
Heavy objects!

Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders.

Failure to comply will result in death or serious injury.

D0076A

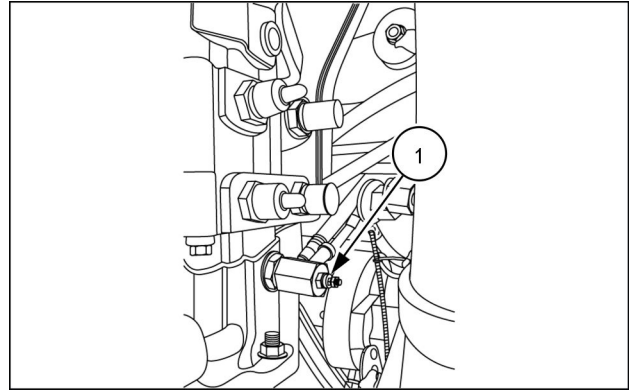
Using the hoist carefully remove pumps.



931002079 8

**Next operation:
Pump - Install (29.218)**

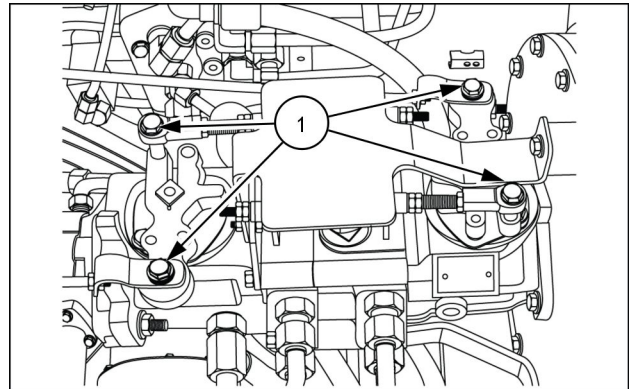
4. Connect electrical connection (1).



931002076 3

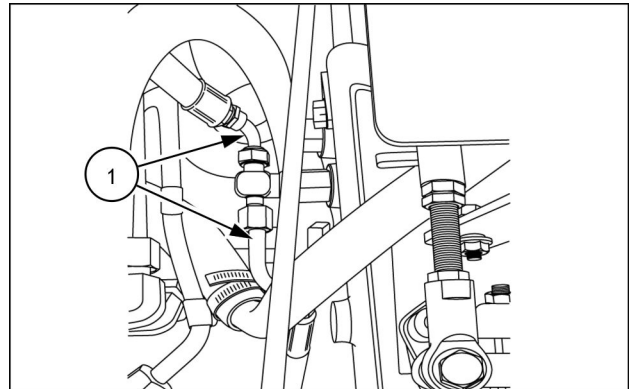
5. Connect control linkage (1).

NOTE: Image 4 is an example of mechanical linkage. Your machine may not have this style of linkage.



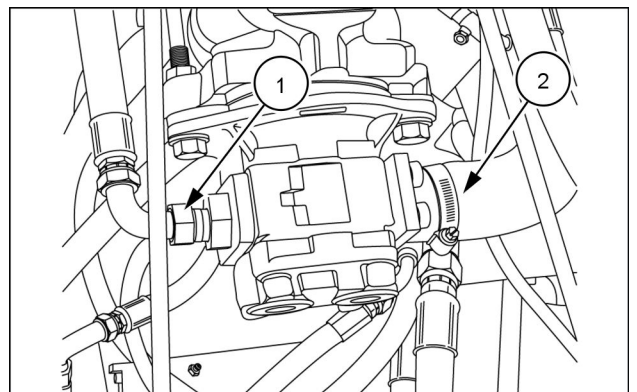
931002075 4

6. Connect the right hand side hydraulic hoses (1).



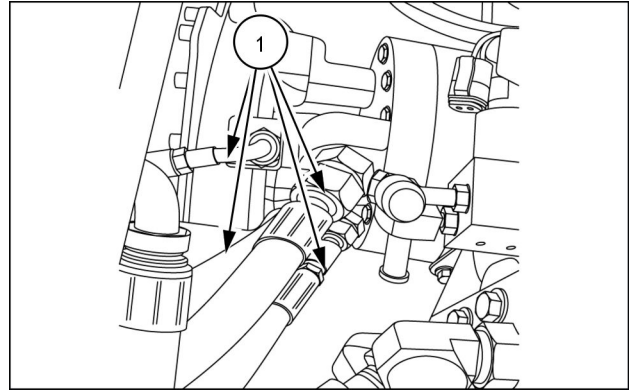
931002074 5

7. Connect the rear hydraulic tube (1) and supply hose (2).



931002073 6

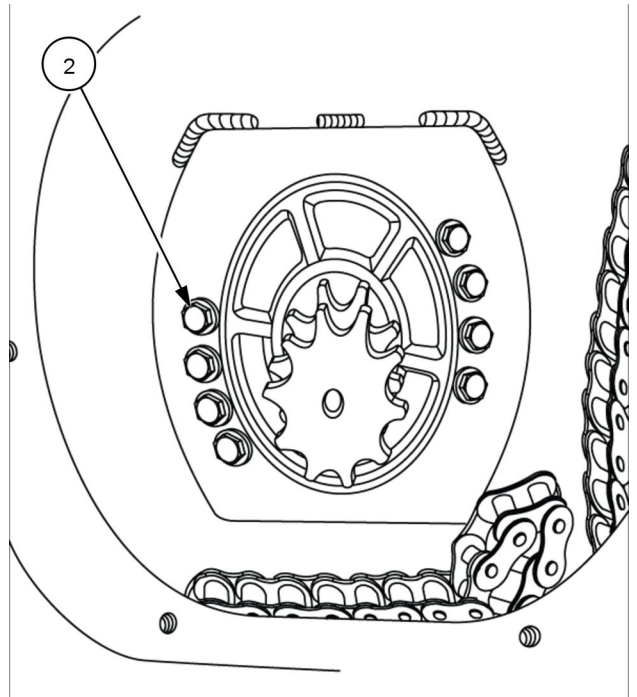
8. Label and disconnect hydraulic hoses (1) from hydrostatic drive motor and cap the open hoses and ports.



931002086 9

9. Disconnect shift tube (on 2 speed equipped models).
 10. Remove and discard hydraulic motor mounting hardware (2).

NOTE: DO NOT reuse motor mounting hardware after tightening to spec. Hardware is permanently stretched during tightening and must be discarded if loosened.



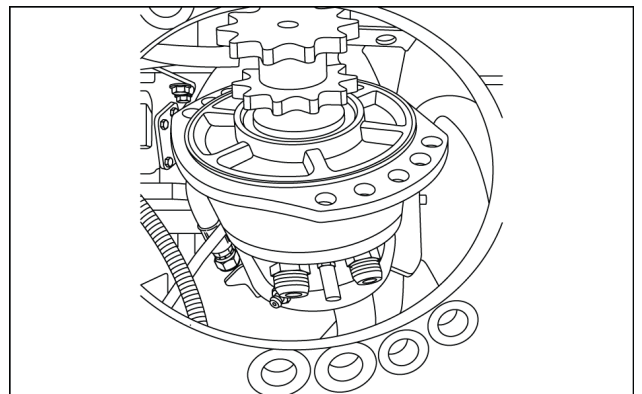
931002085B 10

11. **⚠ DANGER**

Heavy objects!
 Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders. Failure to comply will result in death or serious injury.

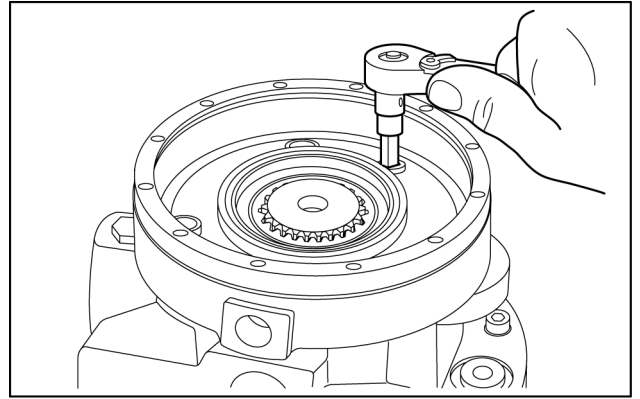
D0076A

Use acceptable lifting equipment and remove the drive motor/brake assembly.



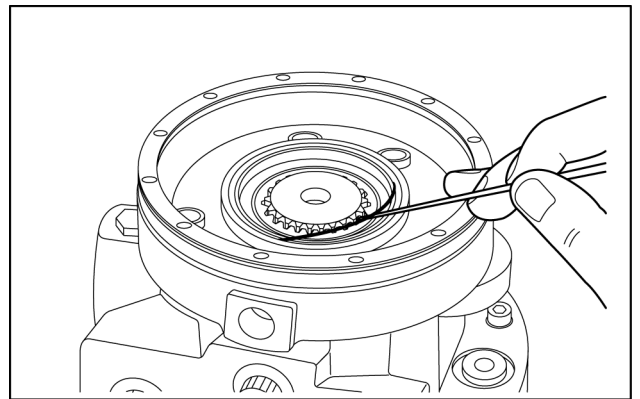
931002087 11

31. 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)**.



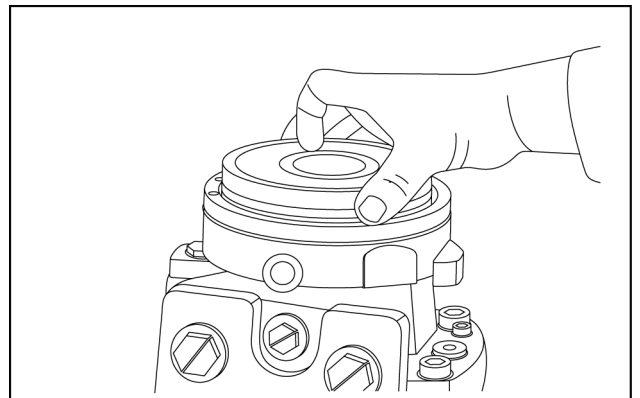
83115553 24

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



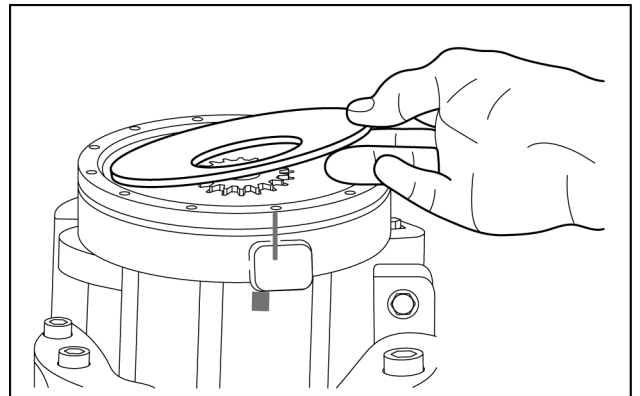
83115552 25

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



83115551 26

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



83115549 27

Motor - Install

L218	
L220	

▲ DANGER

Crushing hazard!

Failure to engage the loader arm support pin could cause the loader arm to fall unexpectedly. Verify that the loader arm support pin is engaged.

Failure to comply will result in death or serious injury.

D0020A

▲ WARNING

Crushing hazard!

Unit could fall if not properly supported. Follow jacking instructions provided for the unit. Use suitable jack stands. Be sure to position them properly.

Failure to comply could result in death or serious injury.

W0919A

▲ DANGER

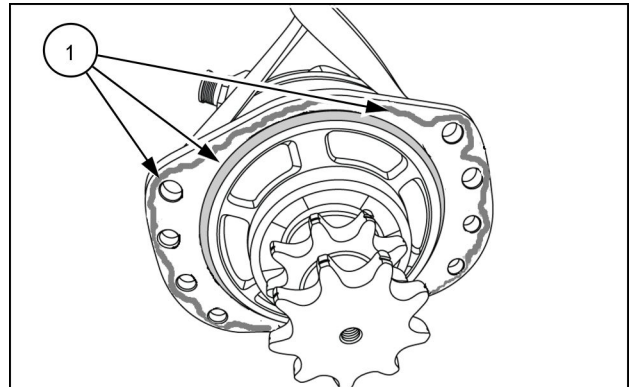
Heavy objects!

Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders.

Failure to comply will result in death or serious injury.

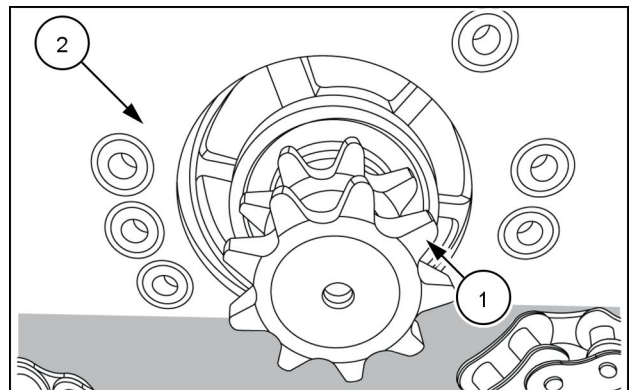
D0076A

1. Apply a bead of **LOCTITE® 598™ BLACK** adhesive, (1), in corner between pilot and flange of motor, around diameter of pilot, similar to o-ring, (approximately **12.5 ml (0.4 US fl oz)** per motor).



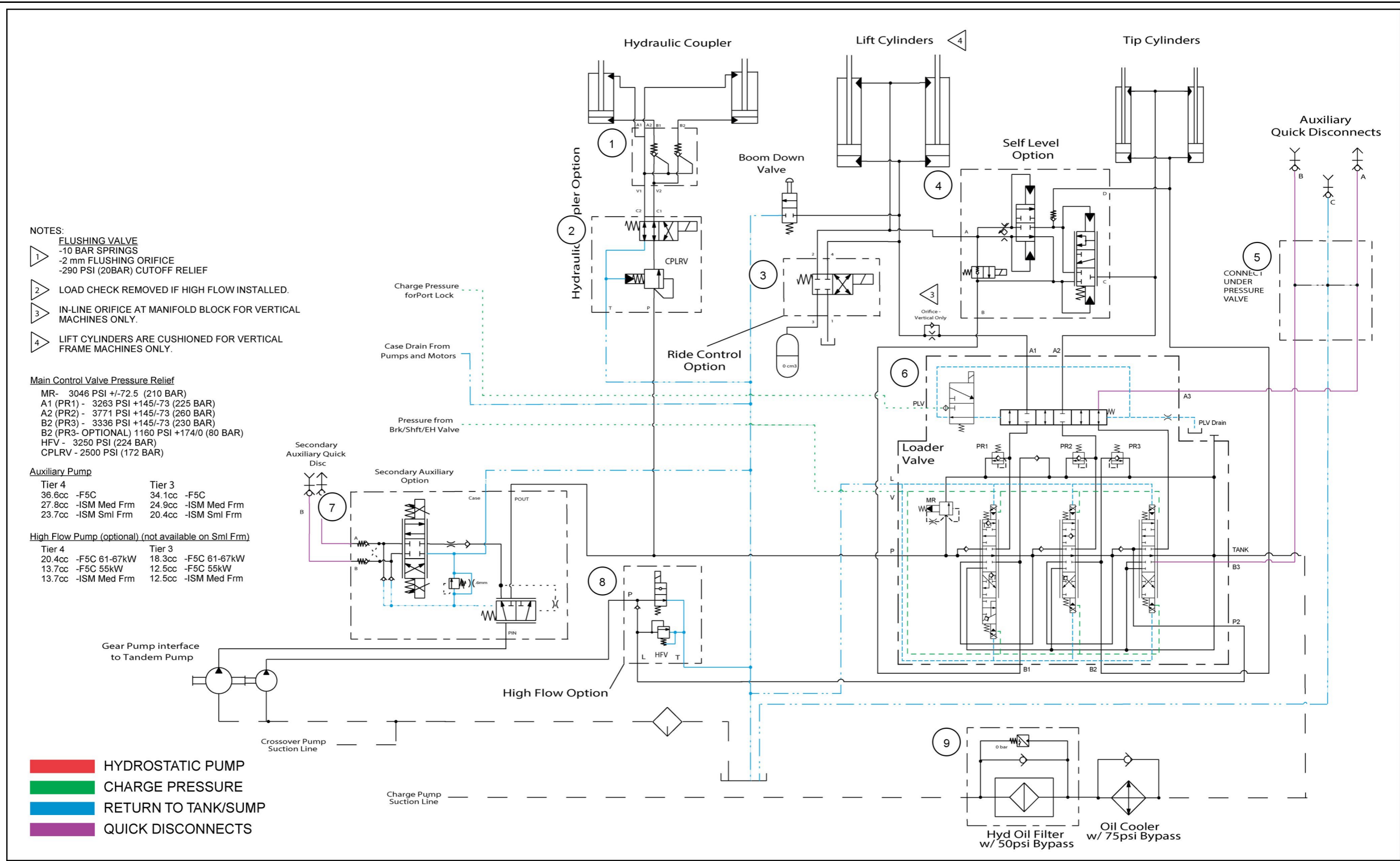
931001687A 1

2. Apply a **3 mm (0.1 in)** bead of **LOCTITE® 598™ BLACK** around the outside of the bolt holes of the motor flange and two dabs per nut between the nut and motors.



931002004 2

3. Use acceptable lifting equipment and move the drive motor/brake assembly (1) into the chassis mounting location (2).



Pump efficiency

7. Pump efficiency is determined by dividing the pump flow with restriction value by the pump flow without restriction value, then multiplying that new value by 100. Record the pump efficiency on the data collection sheet located on the following page.

NOTE: *Pump efficiency should be no less than 70 %.*



Hydraulic systems - 35

Main control valve - 359

L218 TIER 4B Final [NDM449275 -]
L220 TIER 4B Final [NDM456673 -]

Main control valve - Remove

L218	Electro hydraulic controls
L220	Electro hydraulic controls

⚠ WARNING

Burn hazard!

Before performing any service on the hydraulic system, you must allow it to cool. Hydraulic fluid temperature should not exceed 40 °C (104 °F).

Failure to comply could result in death or serious injury.

W0241A

⚠ WARNING

Pressurized hydraulic fluid can penetrate the skin and cause severe injuries.

Hydraulic fluid can also infect a minor cut or opening in the skin. Serious infection or reaction can result without immediate medical treatment. If injured by leaking fluid, see your doctor immediately.

Failure to comply could result in death or serious injury.

W0358A

⚠ WARNING

Pressurized system!

Never attempt to drain fluids or remove filters when the engine is running. Turn off the engine and relieve all pressure from pressurized systems before servicing the machine.

Failure to comply could result in death or serious injury.

W0905A

⚠ WARNING

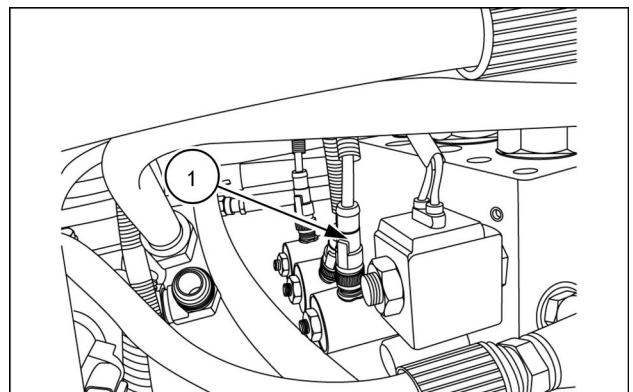
Avoid injury! Always do the following before lubricating, maintaining, or servicing the machine.

1. Disengage all drives.
2. Engage parking brake.
3. Lower all attachments to the ground, or raise and engage all safety locks.
4. Shut off engine.
5. Remove key from key switch.
6. Switch off battery key, if installed.
7. Wait for all machine movement to stop.

Failure to comply could result in death or serious injury.

W0047A

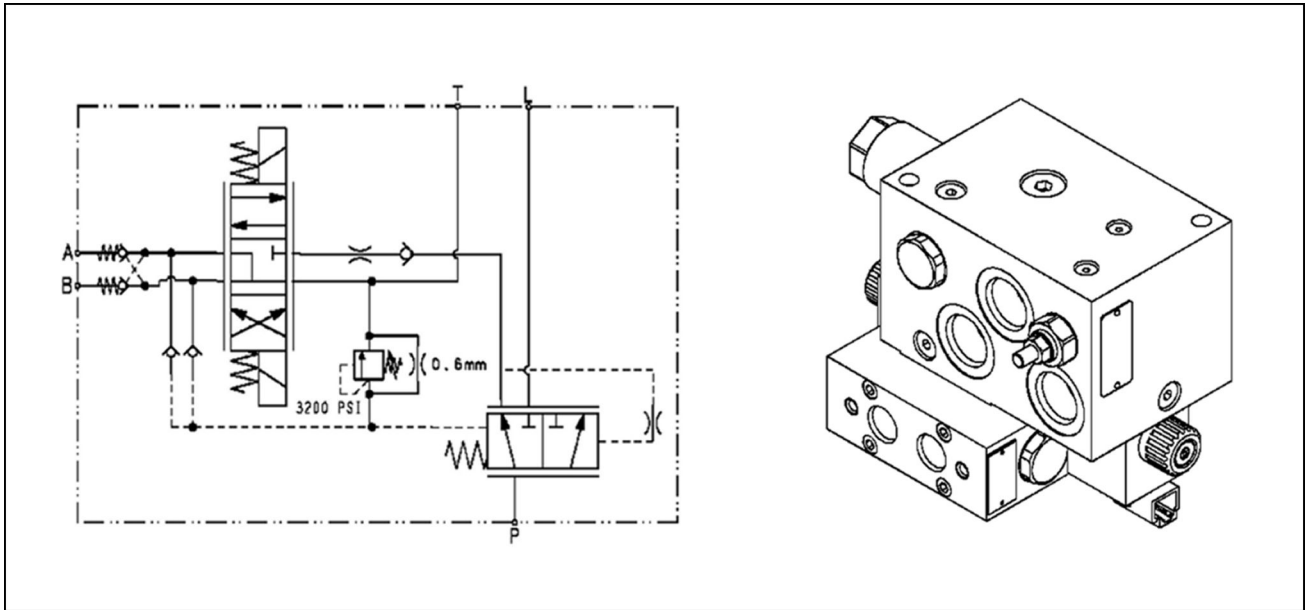
1. Apply vacuum to the hydraulic reservoir.
2. Label and disconnect the four rear solenoid connections (1).



931001708 1

Optional control valve - General specification

L218	
L220	



RAPH14SSL0020FA 1

Secondary auxiliary valve

Operating pressure	207 - 217 bar (3000 - 3145 psi)
Maximum flow	at supply inlet: 87 l/min (23.0 US gpm) at ports A and B: 30 - 38 l/min (8 - 10 US gpm) at 138 bar (2000 psi).
Relief valve setting	221 bar (3200 psi) at 18.9 l/min (5.0 US gpm)
Port identification	P – Pressure inlet L – To main control valve T – Tank return A – Male auxiliary B – Female auxiliary

10. Repeat steps **2** through **9** until the relief valve is within specification.

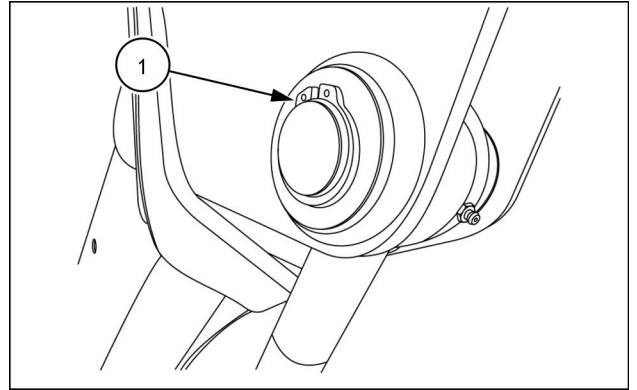
DIAGNOSTIC

Front loader arm hydraulic system

Troubleshooting (*)	39
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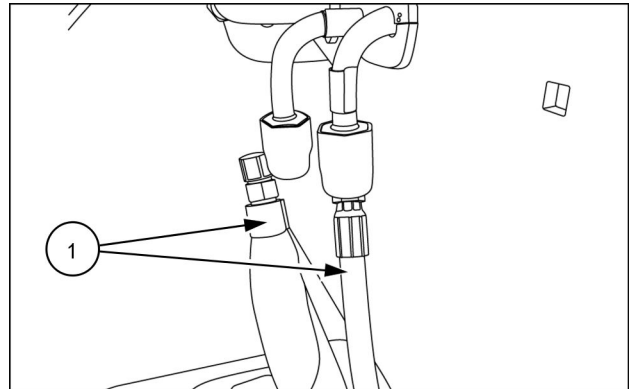
(*) See content for specific models

6. Install rod end snap rings (1).



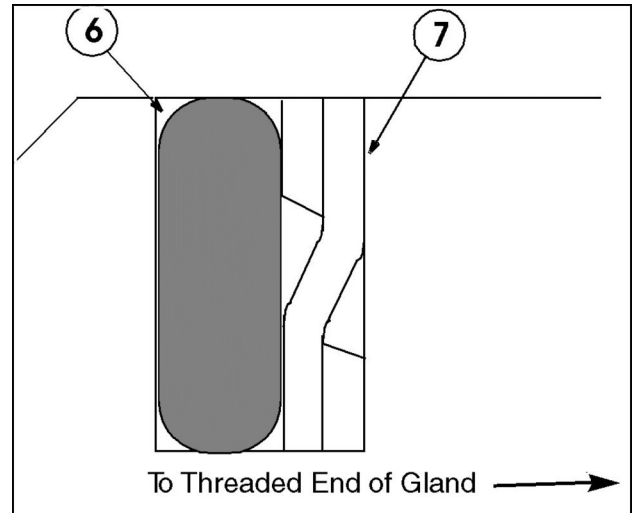
931001618 4

7. Install the hydraulic cylinder hoses (1), and position to prevent contact with other components, fenders, etc. Tighten hose fittings to standard torque.
8. Lower the lift arm
9. Start the skid steer and cycle the boom several times to remove trapped air from the system and check the cylinder for leaks.



931001628 5

5. Start the piston **(3)** into the gas valve end of the tube **(1)**. A soft hammer and wood block may be used to drive the piston farther into the tube. Carefully drive the piston at least **2 in (51 mm)** into the tube. Keep pressure against the piston when driving the piston into the tube, to prevent damage to the quad ring **(5)**. Follow the same procedure for the non-gas valve end of the tube.
6. If used, install a new back ring **(7)** on the gland **(2)**. Make sure the backup ring is installed. Follow the same procedure for the non-gas valve end of the tube.
7. Install the O-ring **(6)** next to the backup ring **(7)**. If a backup ring is not used, install an O-ring in the groove on the gland. Follow the same procedure for the non-gas valve end of the tube.



BS04D006 2

8. Lubricate the O-ring **(6)** and the backup ring **(7)** with clean hydraulic oil. Start the gland **(2)** into the tube **(1)**. Follow the same procedure for the non-gas valve **(14)** end of the tube.
9. Fasten the tube **(1)** in the vise. Tighten the gland **(2)**. Follow the same procedure for the non-gas valve end of the tube
10. Install a new O-ring **(6)** on the body **(13)** of the gas valve assembly **(10)**.
11. Install the valve core **(12)** in the body **(13)**.
12. Lubricate the O-ring **(6)** with clean hydraulic oil. Install and tighten the gas valve assembly **(10)** in the gland **(2)**.
13. Install the cap **(11)**.
14. Charge the accumulator with dry nitrogen. Please refer to **Accumulator - Charging (35.701)**
15. Install the guard **(9)** and cap screws **(8)**.

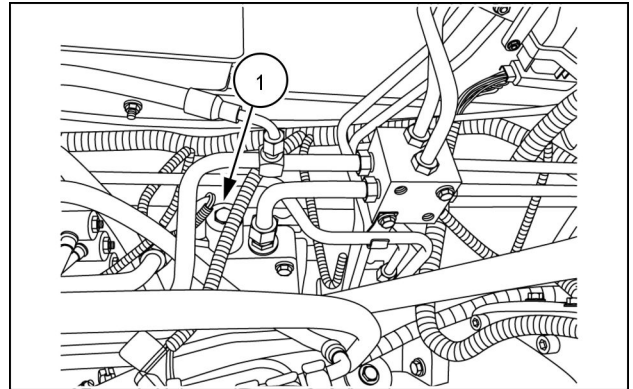
Loader bucket self-leveling controls - Remove - Valve

L218	
L220	

Prior operation:

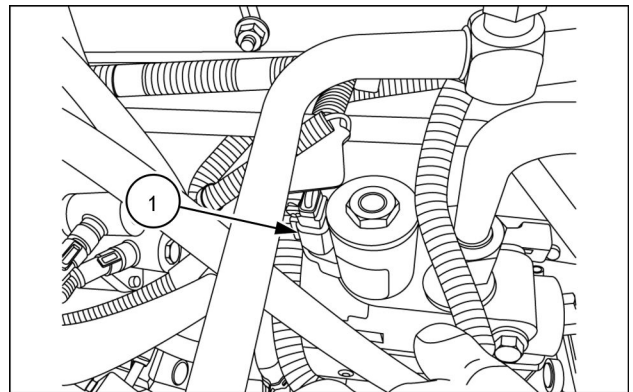
Tilt the ROPS.

1. Locate the control valve **(1)**.



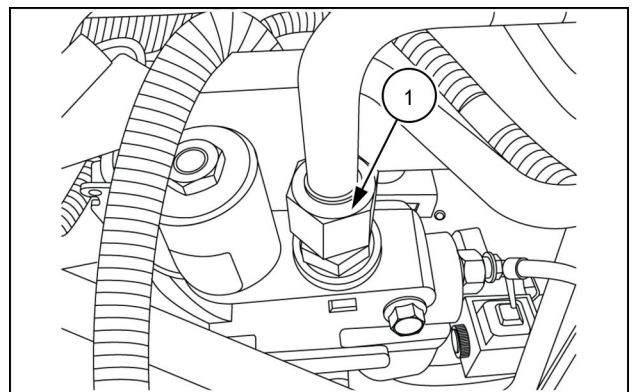
931001804 1

2. Disconnect the electrical connection **(1)**.



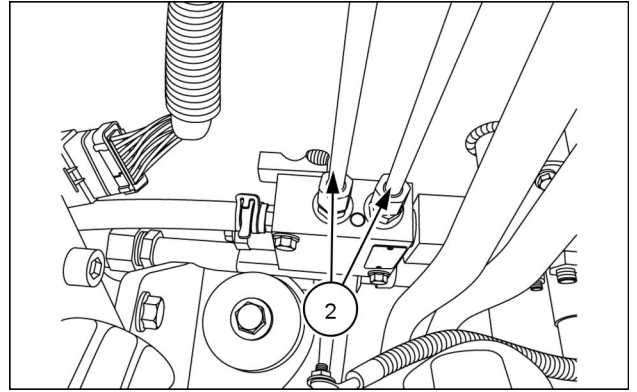
931001701 2

3. Disconnect the hydraulic tube **(1)** and cap the opened ports.



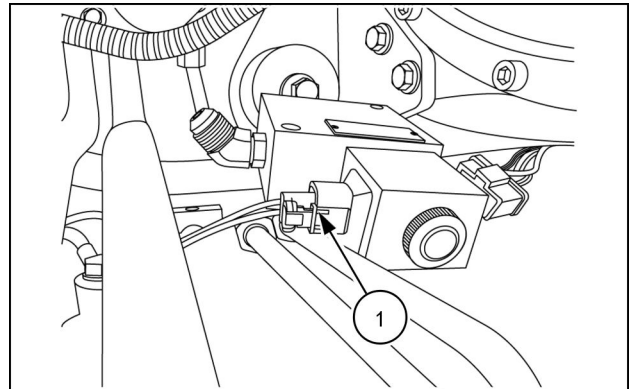
931001702 3

5. Connect the bucket hydraulic tubes **(2)**.



931001720 5

6. Connect the electrical connection **(1)**.



931001722 6

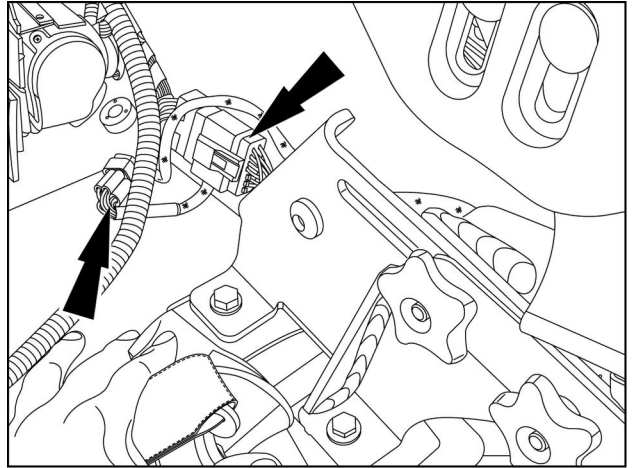


Cab climate control - 50

Heating - 100

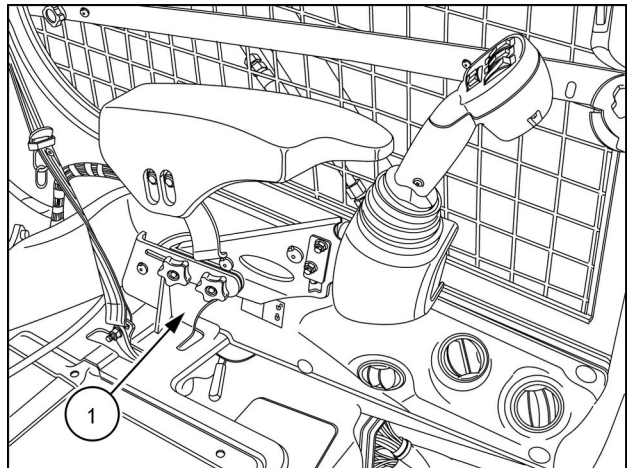
L218 TIER 4B Final [NDM449275 -]
L220 TIER 4B Final [NDM456673 -]

12. Disconnect the joystick from the wiring harness.



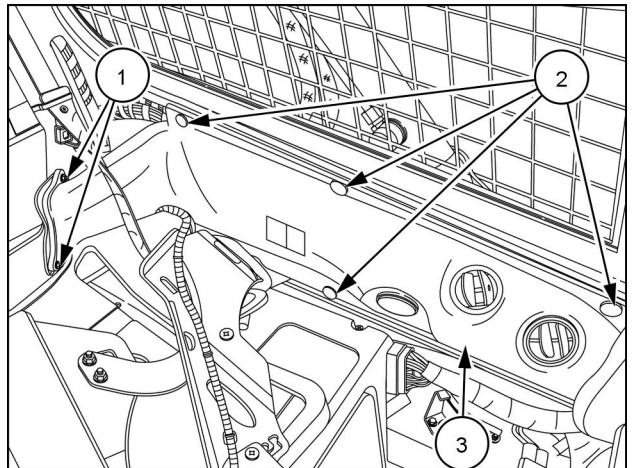
RAIL15SSL0072BA 9

13. Detach and remove the joystick assembly (1) from the cab.
14. Repeat steps 12 and 13 on the opposite side.



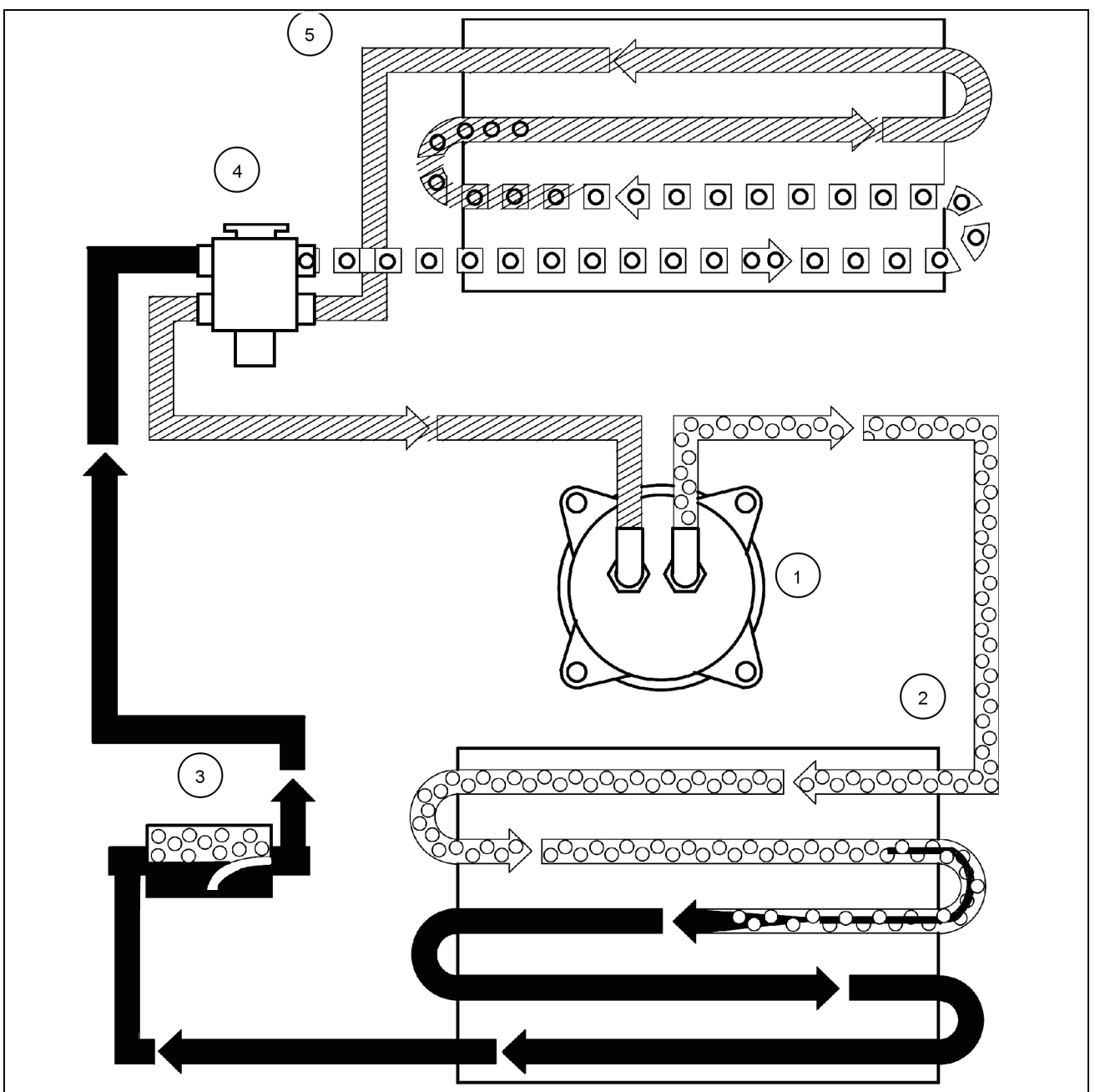
RAIL15SSL0039BA 10

15. Remove the fasteners (2) from the air duct (3).
16. Remove the screws (1) from the HVAC assembly.
17. Remove the air duct (3) from the cab.
18. Repeat steps 15 – 17 on the opposite side.



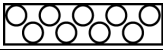



RAIL15SSL0038BA 11

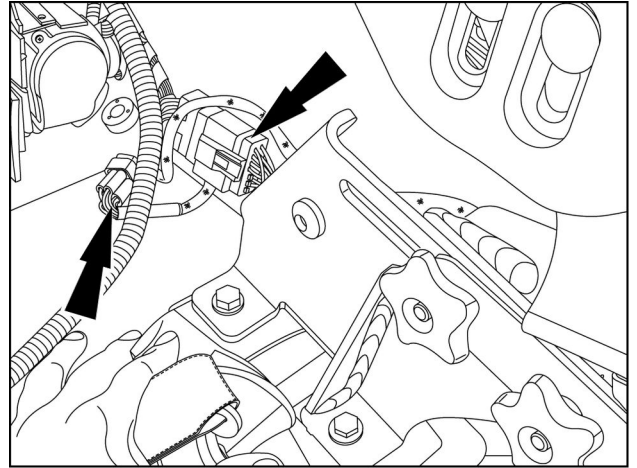
Cab climate control - Air conditioning



RCPH07CCH490ABC 1

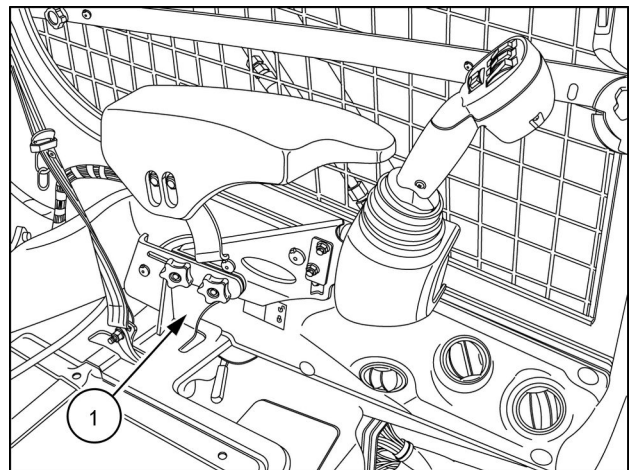
	Low pressure gas	1. Compressor	4. Thermal expansion valve
	Low pressure liquid	2. Condenser	5. Evaporator
	High pressure gas	3. Receiver-drier	
	High pressure liquid		

12. Disconnect the joystick from the wiring harness.



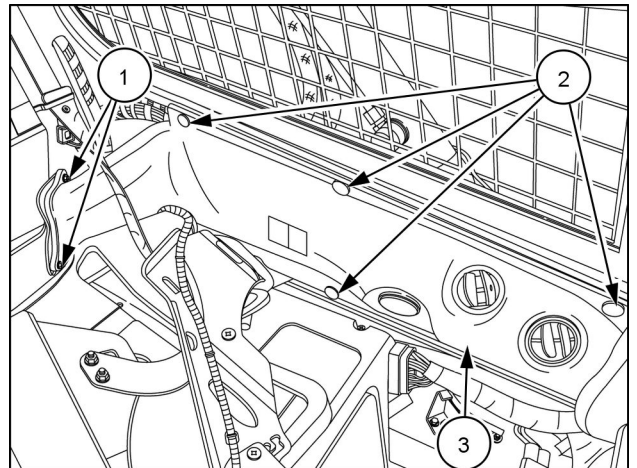
RAIL15SSL0072BA 9

13. Detach and remove the joystick assembly **(1)** from the cab.
14. Repeat steps **12** and **13** on the opposite side.



RAIL15SSL0039BA 10

15. Remove the fasteners **(2)** from the air duct **(3)**.
16. Remove the screws **(1)** from the HVAC assembly .
17. Remove the air duct **(3)** from the cab.
18. Repeat steps **15** – **17** on the opposite side.



RAIL15SSL0038BA 11



Electrical systems - 55

Electrical system - 000

L218 TIER 4B Final [NDM449275 -]
L220 TIER 4B Final [NDM456673 -]

Index

Electrical systems - 55

Engine cooling system - 012

Electrical system - Overview (*)	4
Engine coolant temperature sensor - General specification (*)	3

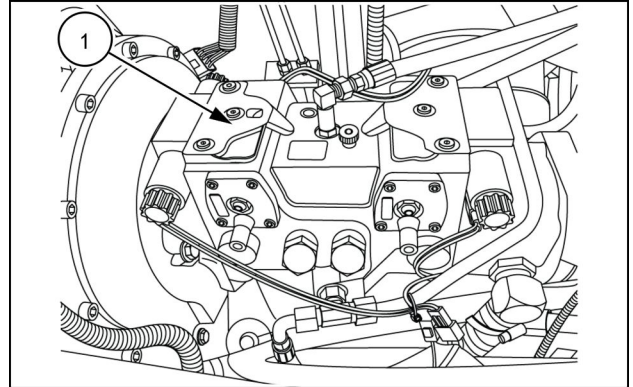
(*) See content for specific models

Hydrostatic control solenoids - Remove – Right-hand side

L218	Electro hydraulic controls
L220	Electro hydraulic controls

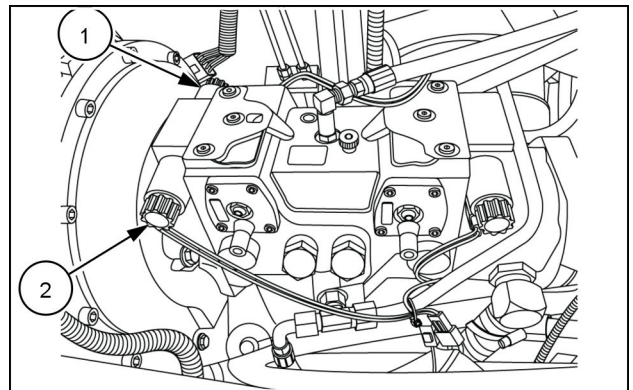
NOTE: This procedure covers how to remove the right hand forward and right hand reverse drive solenoids located on the electro-hydraulic hydrostatic pump.

1. Locate the electro-hydraulic hydrostatic pump (1).



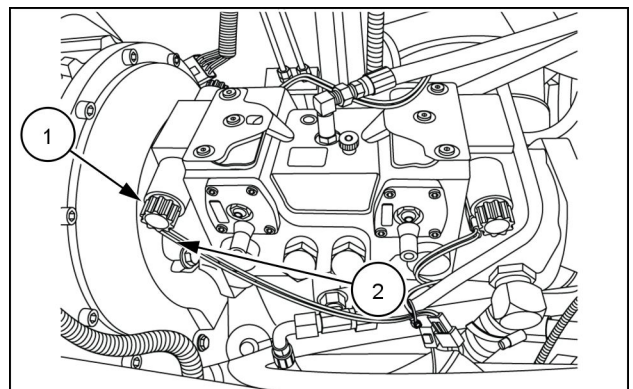
931001814 1

2. Locate the drive solenoid that needs to be removed. The right hand reverse (1) and right hand forward (2) solenoids are located on the input shaft side of the hydrostatic pump.



931001814 2

3. Disconnect the connector (2) from the solenoid. Unscrew the cap (1).



931001814 3

4. Slide the solenoid off.

Index

Electrical systems - 55

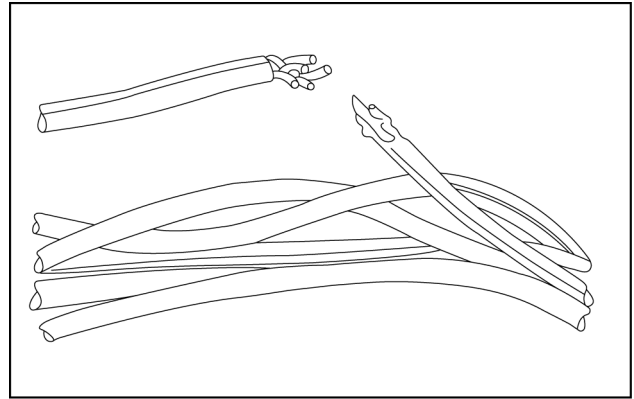
Hydraulic system control - 036

Electrical system - Overview (*)	4
Hydraulic fluid temperature control sensor - General specification (*)	3

(*) See content for specific models

Open circuit

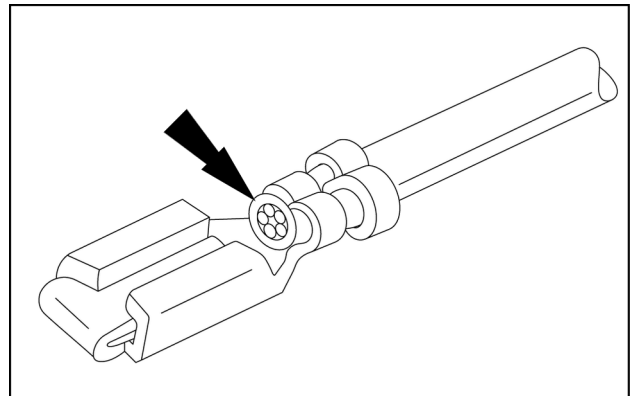
- A cut or broken wire.



RAIL14SSL0589AA 2

Open circuit

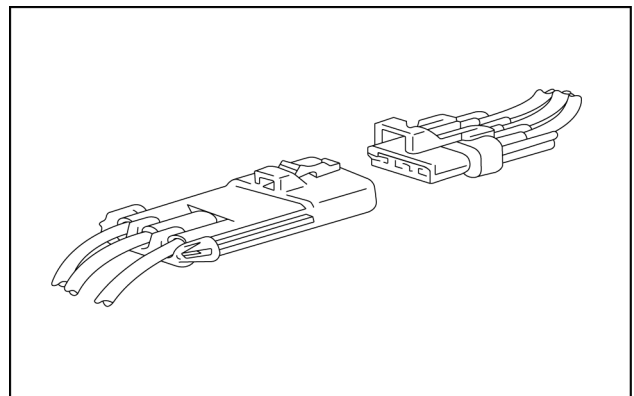
- There is no contact between the wire(s) and the terminal due to the insulation not being properly removed or positioned when the terminal was fastened to the wire(s) .



RAIL14SSL0595AA 3

Open circuit

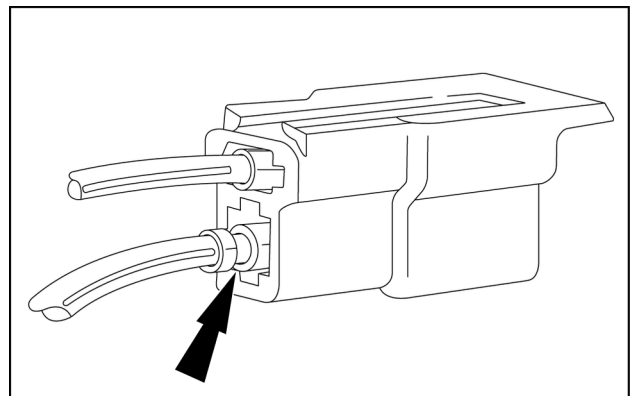
- Completely disconnected connectors do not make contact with the terminals.



RAIL14SSL0600AA 4

Open circuit

- The terminal is not positioned properly or did not stay inside the connector.

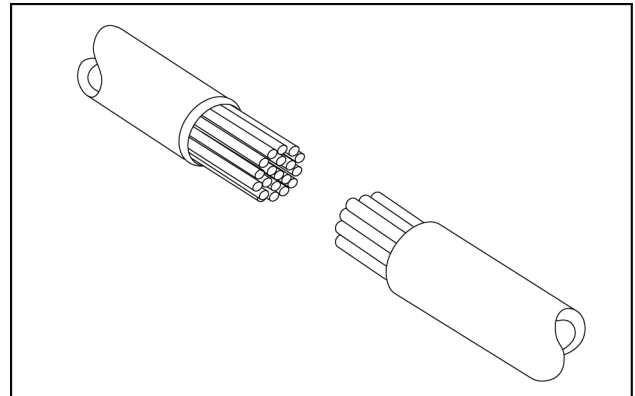


RAIL14SSL0601AA 5

Recommended splicing procedure

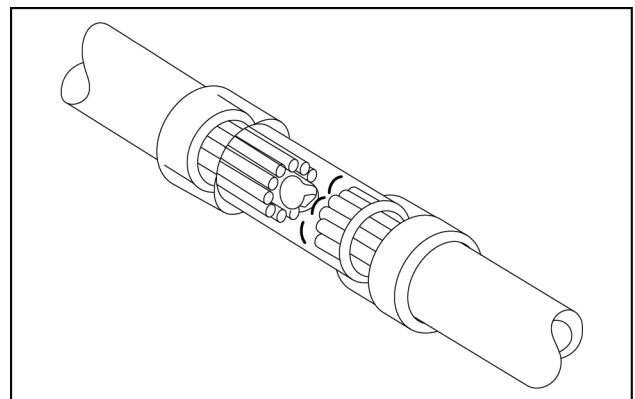
Splicing single wires

1. Strip off approximately **10 mm (3/8 in)** insulation from the wire ends.



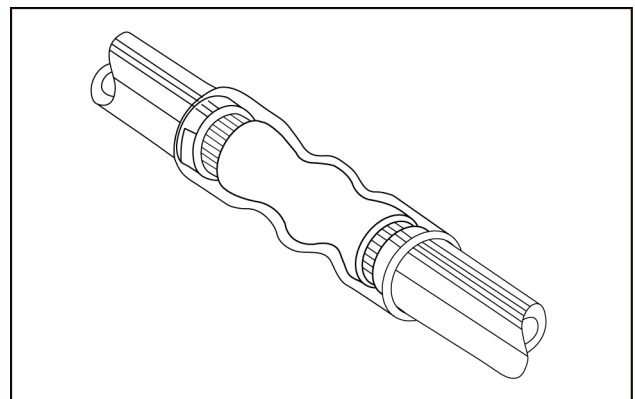
RAIL14SSL0639AA 52

2. Push the wire cores into the sleeve till they reach the stop at the center of the sleeve.



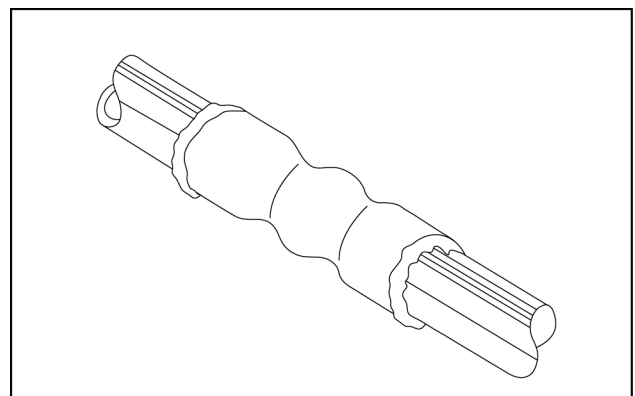
RAIL14SSL0640AA 53

3. Individually crimp both the ends of the splice sleeve.



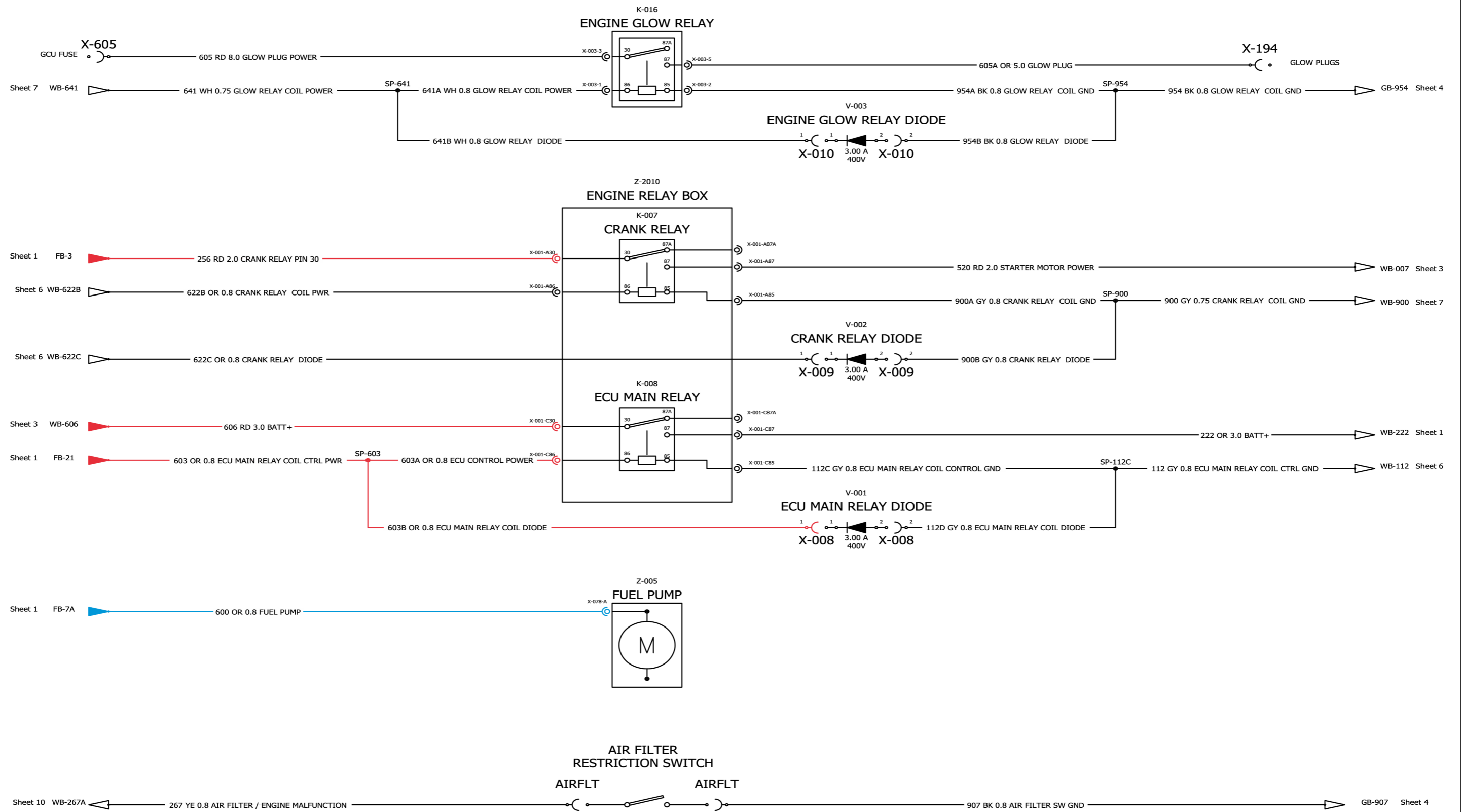
RAIL14SSL0641AA 54

4. With a hot air gun, apply heat to the splice sleeve.
5. Heat will melt the glue and adds a firm seal. When the sleeve stops shrinking and glue appears at the ends of the sleeve, remove the heat source.
6. Allow the splice to cool.



RAIL14SSL0642AA 55

ENGINE iSM



SHEET 5

RAIL13SSL0407JA 1

RIGHT HAND CONTROL HANDLE

RIGHT HAND CONTROL HANDLE

X-117

S-031

MF #1

UP

DN

S-016

S-018

RIDE CONTROL

S-014

PARK BRAKE SWITCH

U-004

PROPORTIONAL AUXILIARY HYDRAULIC SWITCH

Y-010

RIDE CONTROL SOLENOID

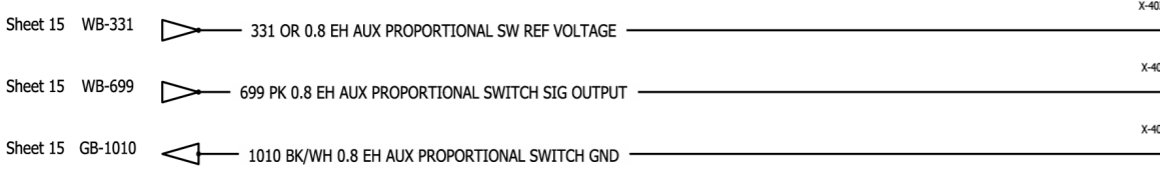
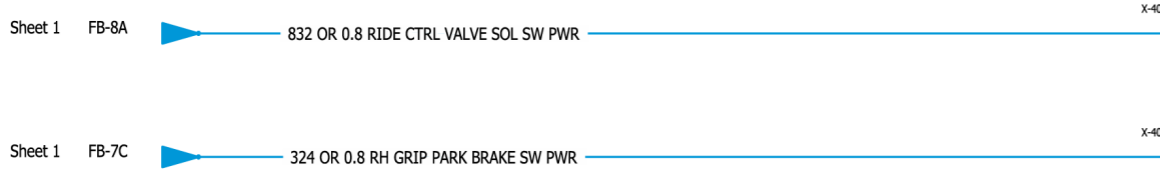
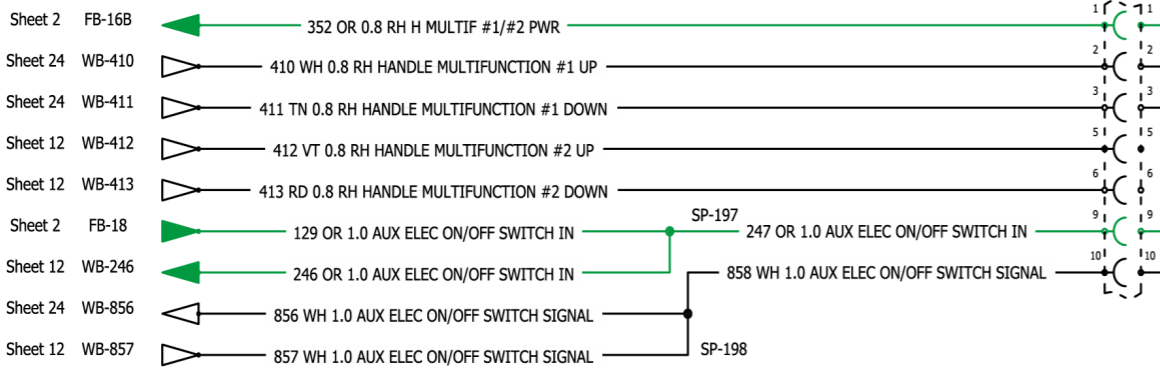
X-RDCTRL 1

X-RDCTRL 2

951 BK 0.8 RIDE CONTROL VALVE GND

GB-951 Sheet 4

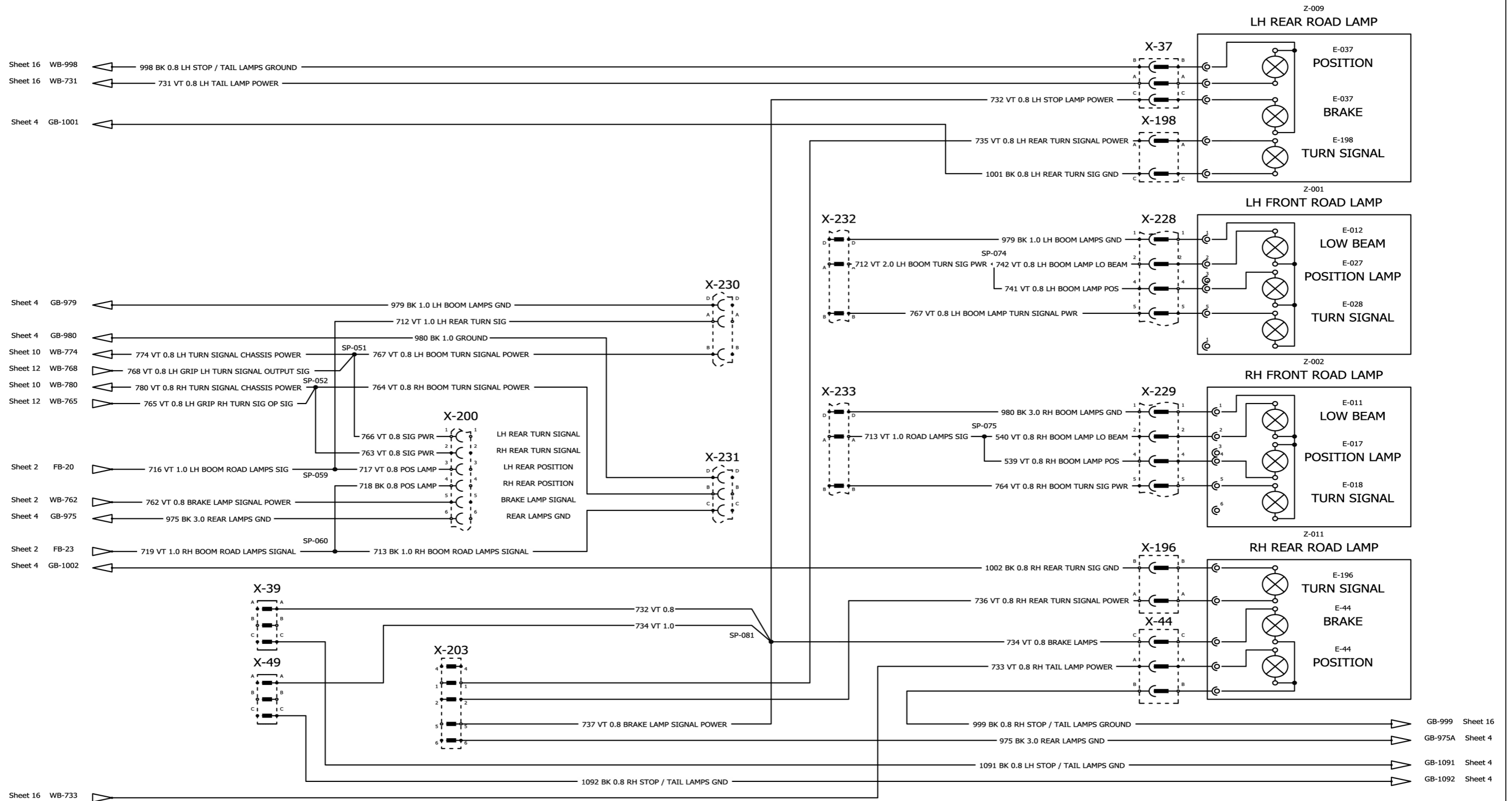
WB-307 Sheet 10



SHEET 13

RAIL13SSL0416JA 1

BOOM AND ROAD LIGHTS

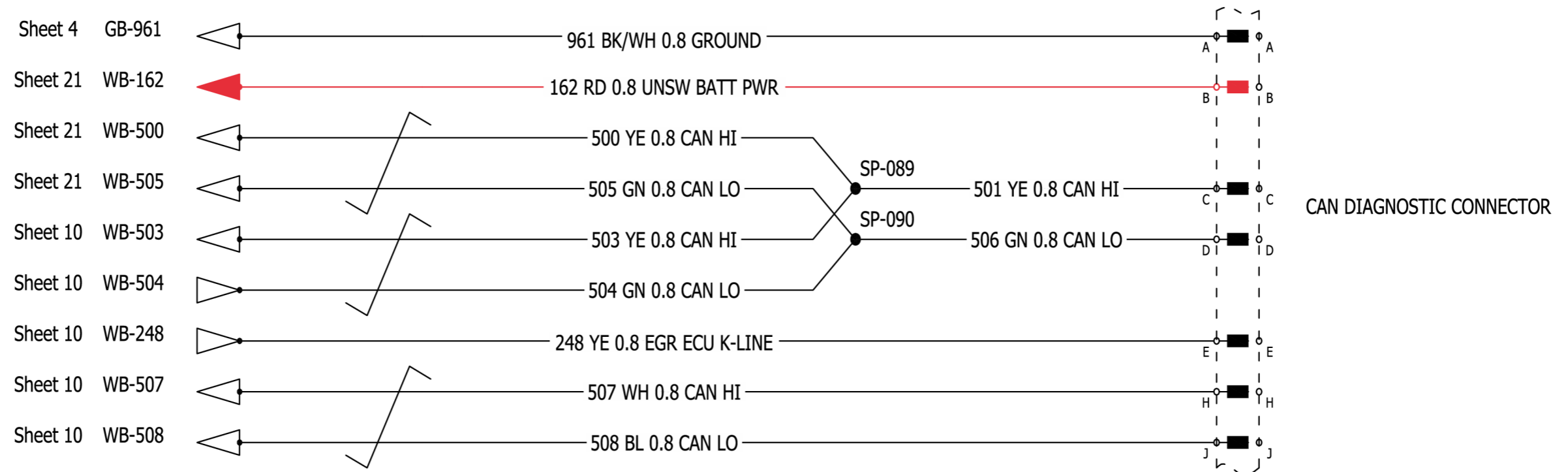


SHEET 19

RAIL13SSL0423JA 1

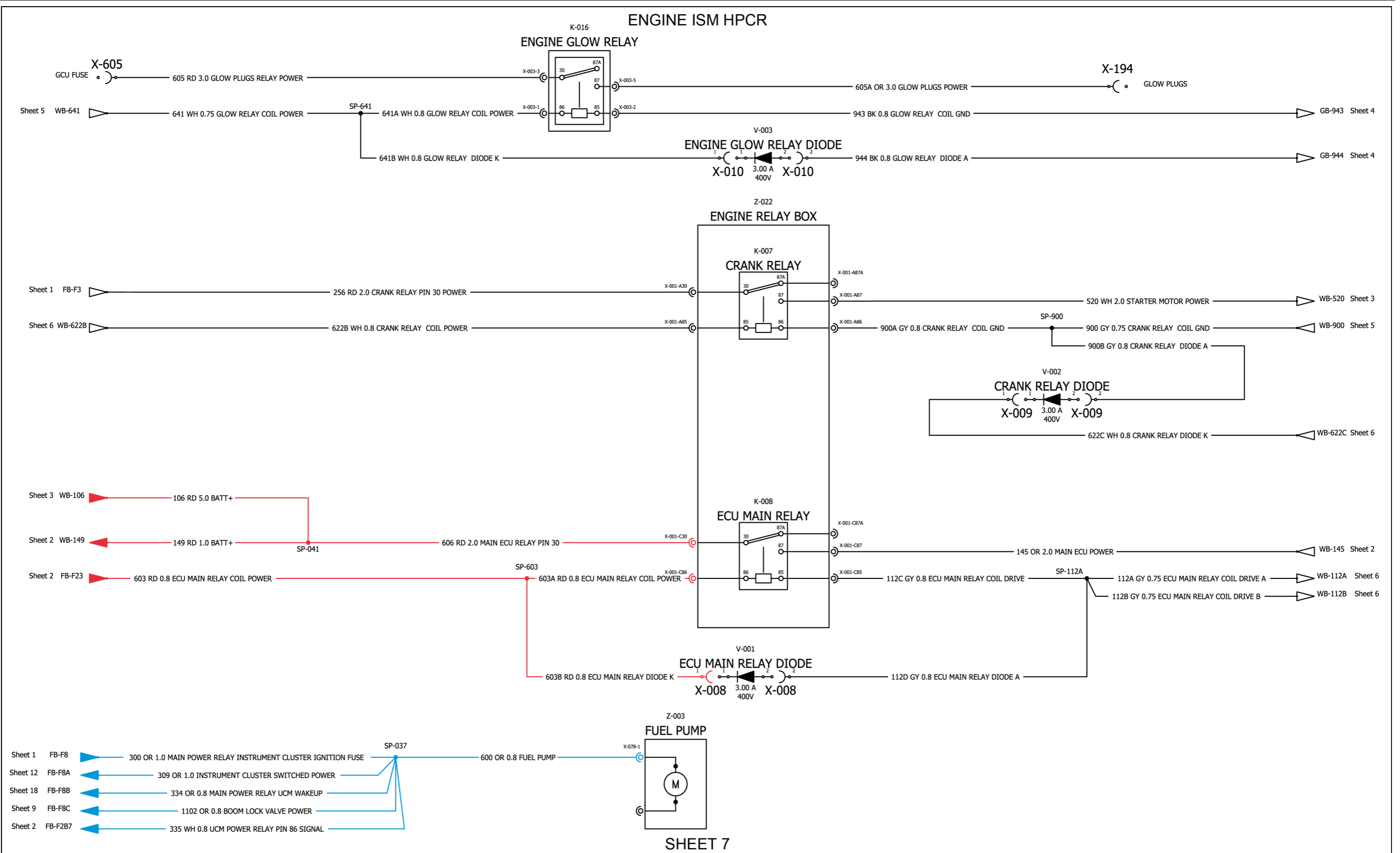
CAN DIAGNOSTIC/ TOOL

X-DIAG



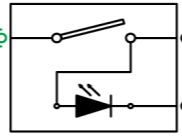
SHEET 27

RAIL13SSL0431JA 1

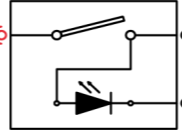


LEFT HAND CAB CONSOLE

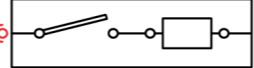
S-009 HYDRAULIC COUPLER SWITCH



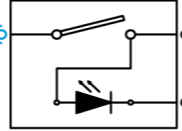
S-001 ROTATING BEACON SWITCH



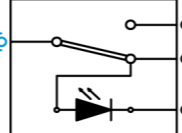
Z-008 ACCESSORY POWER OUTLET



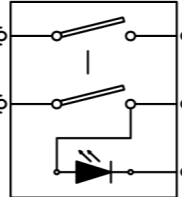
S-013 SELF LEVEL SWITCH



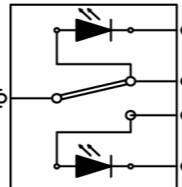
S-005 LOADER LOCKOUT SWITCH



S-041 HAZARD LAMP SWITCH

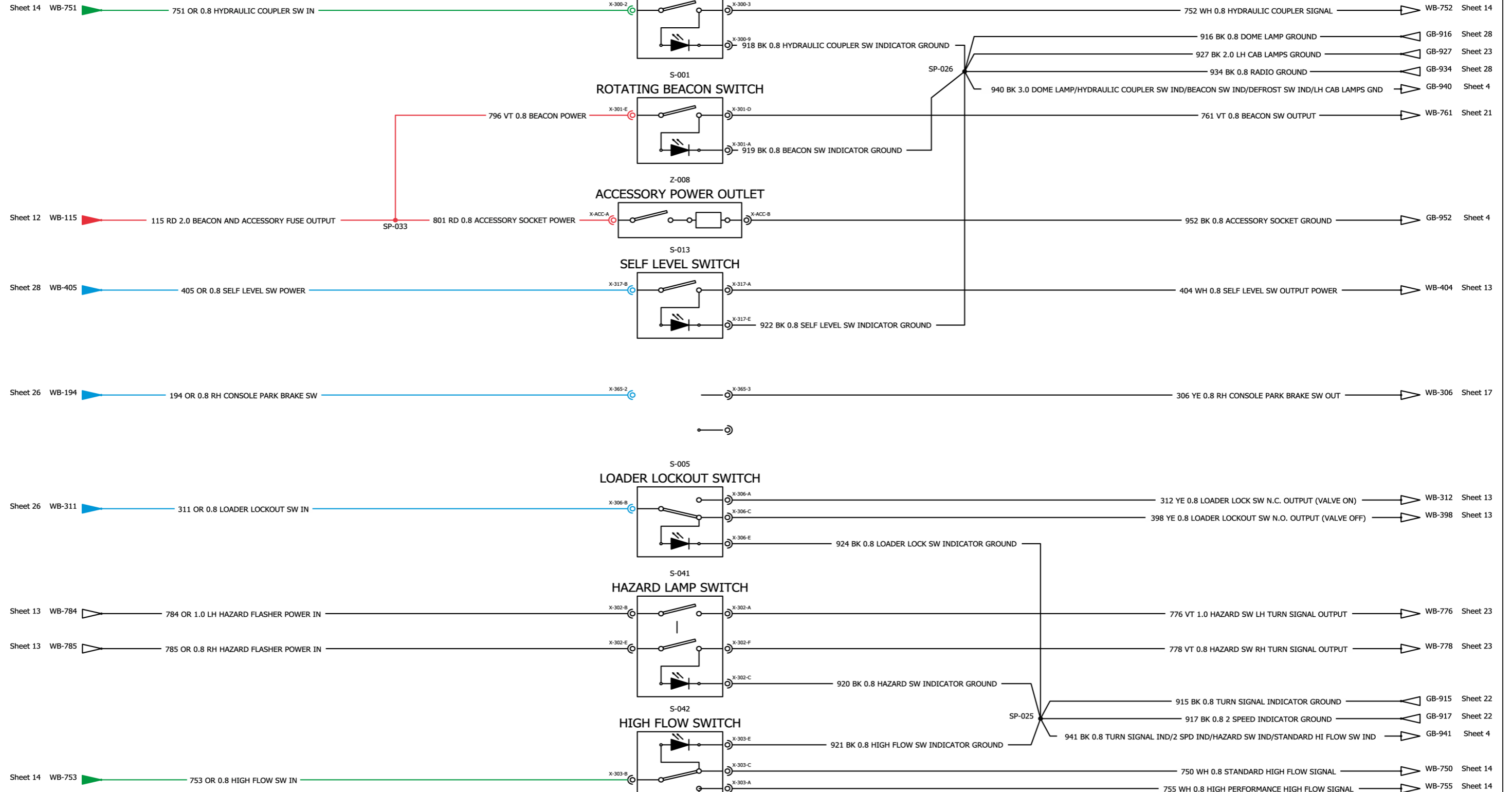


S-042 HIGH FLOW SWITCH

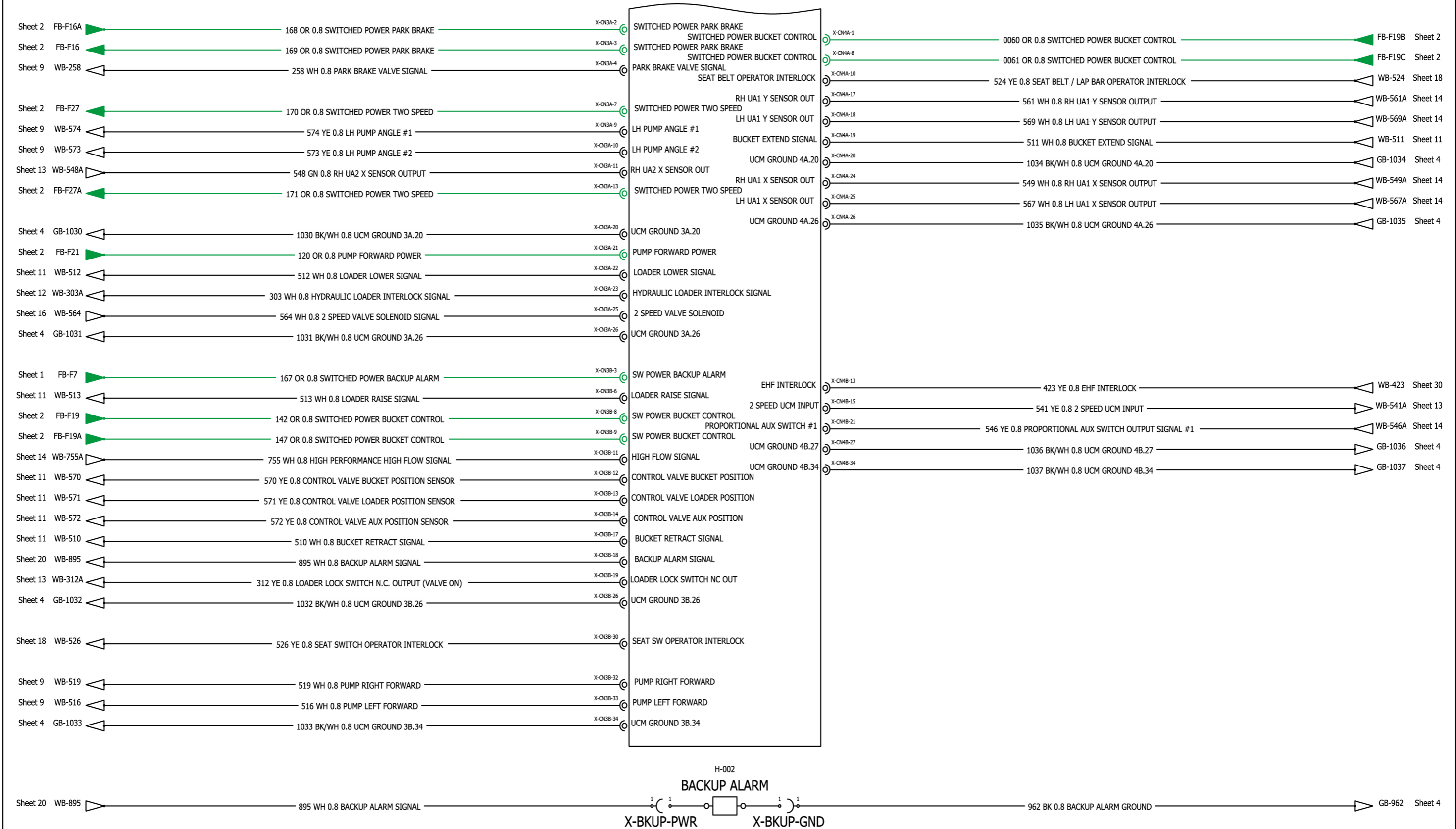


SHEET 15

RAIL13SSL0447JA 1



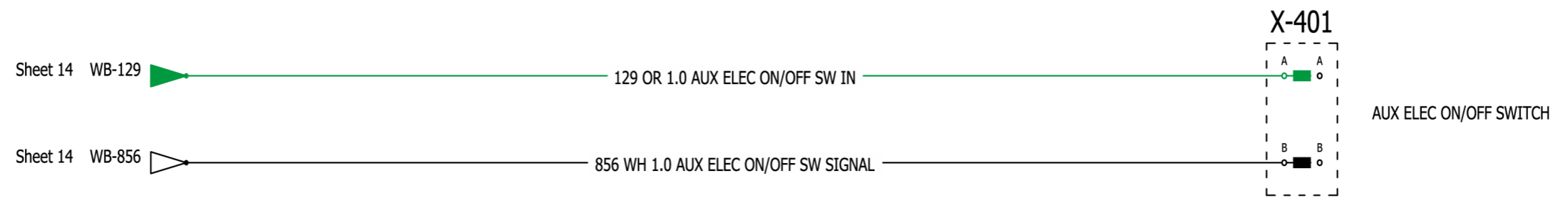
UNIT CONTROL MODULE



SHEET 20

RAIL13SSL0455JA 1

MULTIFUNCTION ON/ OFF



CONNECTS TO LEFT CONTROL HANDLE SHEET 16

SHEET 29

RAIL13SSL0464JA 1

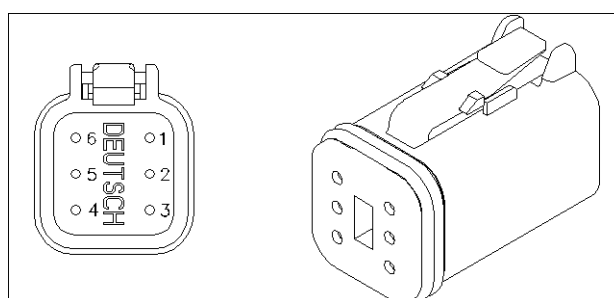
CONNECTOR X-002A - ECU-A		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
32		
33	381 (YE)	EGR POSITION SENSOR OUT X-100 PIN 18
34	360 (YE)	DOC INLET TEMPERATURE SENSOR SIGNAL X-100 PIN 19
35	362 (YE)	DOC OUTLET TEMPERATURE SENSOR SIGNAL X-100 PIN 20
36		
37	327 (YE)	DELTA P SENSOR SIGNAL X-100 PIN 21
38		
39	365 (YE)	WATER TEMPERATURE SENSOR SIGNAL X-100 PIN 22
40	367A (YE)	RAIL PRESSURE SENSOR SIGNAL X-100 PIN 23
41	367B (YE)	RAIL PRESSURE SENSOR SIGNAL X-100 PIN 24
42	813 (YE)	G SENSOR SIGNAL OUT (CAM SENSOR) X-100 PIN 25
43	814 (YE)	NE SENSOR SIGNAL (CRANK SENSOR) X-100 PIN 26
44		
45	368 (PK)	RAIL PRESSURE SENSOR POWER X-100 PIN 27
46		
47		
48		
49	803 (OR)	INJECTOR POWER 1 X-100 PIN 28
50		
51	810 (GY)	INJECTOR 3 X-100 PIN 29
52		
53		
54		
55		
56		
57		
58		
59		
60		
61	370 (YE)	BOOST PRESSURE SENSOR SIGNAL X-100 PIN 30
62		
63	383 (YE)	ETC POSITION SENSOR OUT X-100 PIN 31
64		
65		
66		
67		

Wire connectors - Component diagram 09

L218 TIER 4B Final [NDM449275 -]	NA Electro hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Electro hydraulic controls

CONNECTOR X-93 - RH PUMP SWASH PLATE SENSOR

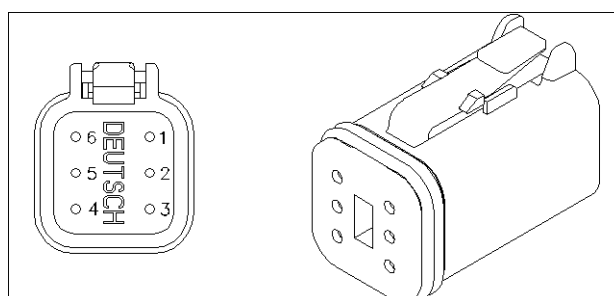
CONNECTOR X-93 - RH PUMP SWASH PLATE SENSOR		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
1	1055 (BK/WH)	RH PUMP SWASH PLATE SENSOR GROUND
2	223 (PK)	RH PUMP ANGLE SENSOR REFERENCE #1
3	575 (YE)	RH PUMP ANGLE #2
4	576 (YE)	RH PUMP ANGLE #1
5	221 (PK)	RH PUMP ANGLE SENSOR REFERENCE #2
6	1074 (BK/WH)	RH PUMP ANGLE SENSOR GROUND #2



87694112 1

CONNECTOR X-94 - LH PUMP SWASH PLATE SENSOR

CONNECTOR X-94 - LH PUMP SWASH PLATE SENSOR		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
1	1054 (BK/WH)	LH PUMP SWASH PLATE SENSOR GROUND
2	222 (PK)	LH PUMP ANGLE SENSOR REFERENCE #1
3	574 (YE)	LH PUMP ANGLE #1
4	573 (YE)	LH PUMP ANGLE #2
5	209 (PK)	LH PUMP ANGLE SENSOR REFERENCE #2
6	1073 (BK/WH)	LH PUMP ANGLE SENSOR GROUND #2



87694112 2

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Wire connectors - Component diagram 27

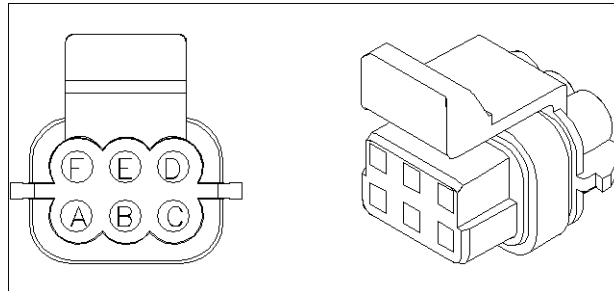
L218 TIER 4B Final [NDM449275 -]	NA Electro hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Electro hydraulic controls

CONNECTOR X-270 - BLOWER SWITCH

CONNECTOR X-270 - BLOWER SWITCH		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
1	825 OR	HVAC CLUTCH
2	821 OR	BLOWER SWITCH POWER
3	828 WH	HVAC FAN LOW
4	827 WH	HVAC FAN MEDIUM
5	850 WH	HVAC FAN HIGH

CONNECTOR X-271 - WATER VALVE

CONNECTOR X-271 - WATER VALVE		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
A	822 OR	HVAC WATER VALVE POWER
B	-	-
C	1013 (BK)	SP-179 X-271WATER VALVE
D	824 YE	HVAC TEMPERATURE CONTROL SIGNAL
E	-	-
F	-	-



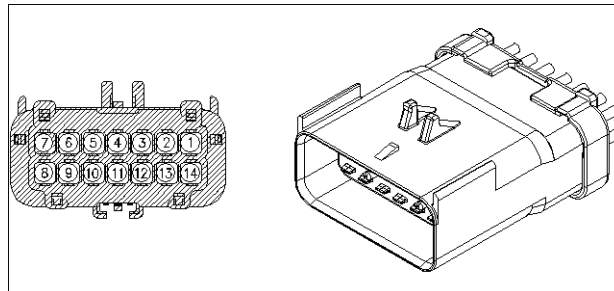
87694714 1

CONNECTOR X-275 - A/C SWITCH

CONNECTOR X-275 - A/C SWITCH		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
A	825 (OR)	HVAC CLUTCH
B	913 (BK)	HVAC COMPRESSOR CLUTCH SWITCH GROUND
C	829 (WH)	AC SWITCH OUT

CONNECTOR X-408 - LH HANDLE INTERCONNECT

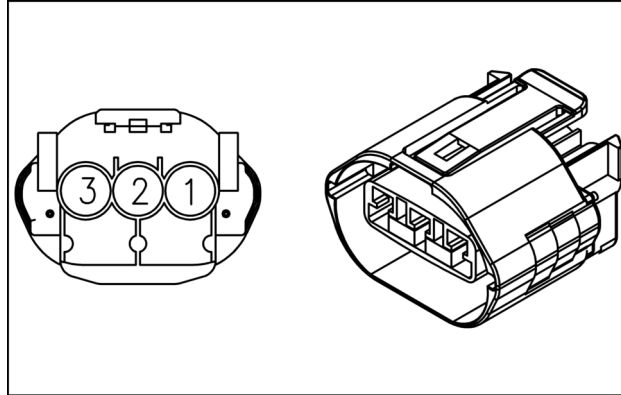
CONNECTOR X-408 - LH HANDLE INTERCONNECT		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
1	558 (OR)	2ND AUX SWITCH POWER
2	554 (WH)	2ND AUX EXTEND SW OUTPUT
3	552 (WH)	2ND AUX RETRACT SIGNAL POWER
4	891 (OR)	LH GRIP HORN/ 2 SPEED POWER
5	770 (OR)	LH GRIP FLASHER POWER
6	768 (VT)	LH GRIP LH TURN SIGNAL OUTPUT SIGNAL
7	765 (VT)	LH GRIP RH TURN SIGNAL OUTPUT SIGNAL
8	892 (WH)	HORN SIGNAL POWER
9	563 (WH)	2 SPEED SW OUTPUT SIGNAL
10	353 (OR)	LH HANDLE MULTIFUNCTION #2, #3 POWER
11	414 (VT)	LH HANDLE MULTIFUNCTION #2 UP
12	415 (RD)	LH HANDLE MULTIFUNCTION #2 DOWN
13	418 (GY)	LH HANDLE MULTIFUNCTION #3 UP
14	419 (LG)	LH HANDLE MULTIFUNCTION #3 DOWN



87382929 4

CONNECTOR X-5A - ALTERNATOR

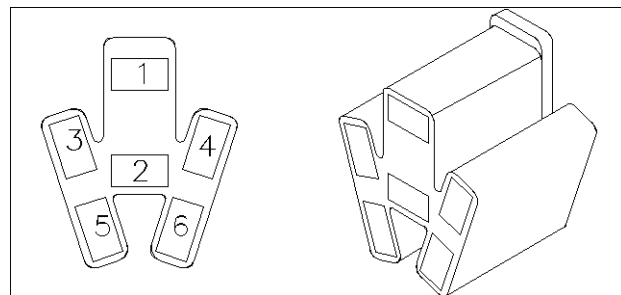
CONNECTOR X-5A - ALTERNATOR		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
1	244 YE	ALTERNATOR LAMP TELEMATICS ENGINE ON
2	127 (OR)	ALTERNATOR EXCITE
3		



84165069 10

CONNECTOR X-9 - IGNITION SWITCH

CONNECTOR X-9 - IGNITION SWITCH		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
1		
2	138 (OR)	ACCESSORY RELAY SIGNAL X-FUSE D10
3	140 (RD)	UNSWITCHED BATTERY
4	624 (WH)	INSTRUMENT CLUSTER X-C23 PIN 3
5	132 (OR)	INSTRUMENT CLUSTER X-C23 PIN 10



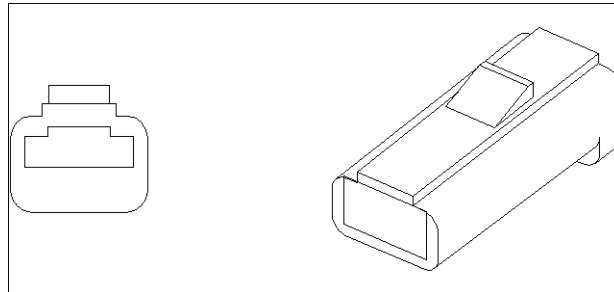
87693713 11

Wire connectors - Component diagram 07

L218 TIER 4B Final [NDM449275 -]	NA Mechanical hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Mechanical hydraulic controls

CONNECTOR X-078 - FUEL PUMP

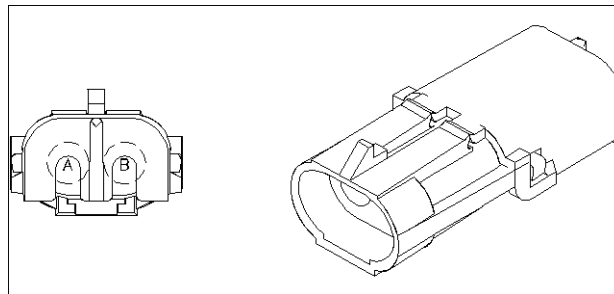
CONNECTOR X-078 - FUEL PUMP		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
A	600 (OR)	SP-037 X-078FUEL PUMP



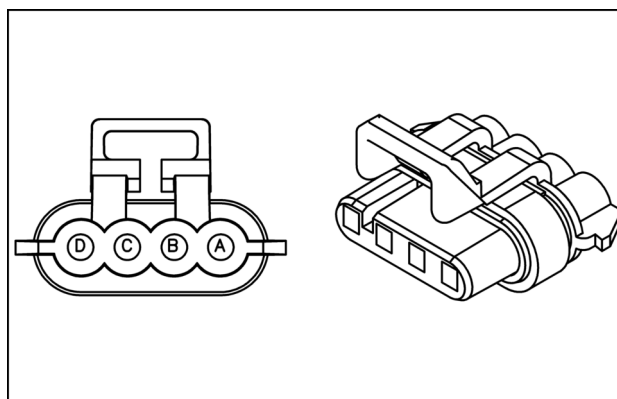
87688695 1

CONNECTOR X-74 - HVAC CONDENSER FAN

CONNECTOR X-74 - HVAC CONDENSER FAN		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
A	1084 (BK)	HVAC CONDENSER FAN GROUND
B	237 (WH)	HVAC CONDENSER FAN POWER



87692877 2



87697724 2

CONNECTOR X-232 - LH FRONT ROAD LAMP

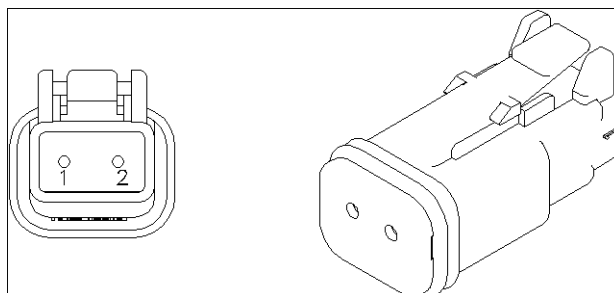
CONNECTOR X-232 - LH FRONT ROAD LAMP		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
A	712 VT	LH BOOM TURN SIGNAL POWER
B	767 (VT)	LH BOOM LAMP TURN SIGNAL POWER
C		
D	979 (BK)	LH BOOM LAMPS GROUND

CONNECTOR X-233 - RH FRONT ROAD LAMP

CONNECTOR X-233 - RH FRONT ROAD LAMP		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
A	713 VT	RH BOOM ROAD LAMPS SIGNAL
B	764 (VT)	RH BOOM TURN SIGNAL POWER
C		
D	980 (BK)	RH BOOM LAMPS GROUND

CONNECTOR X-432 - PROPORTIONAL AUX VALVE RETRACT

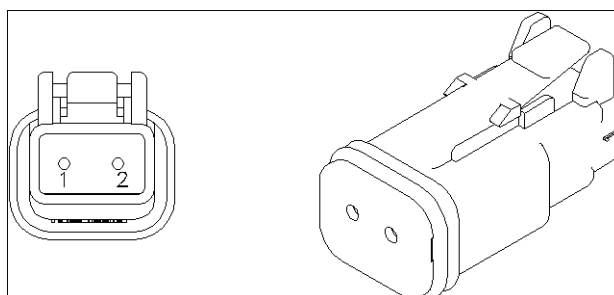
CONNECTOR X-432 - PROPORTIONAL AUX VALVE RETRACT		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
1	890 (WH)	EH AUX RETRACT VALVE
2	914 (BL)	EH AUX RETRACT GROUND



87695582 2

CONNECTOR X-433 - PROPORTIONAL AUX VALVE EXTEND

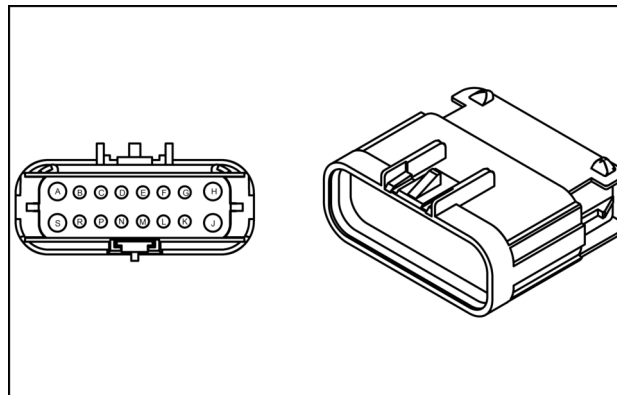
CONNECTOR X-433 - PROPORTIONAL AUX VALVE EXTEND		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
1	889 (WH)	EH AUX EXTEND SIGNAL
2	911 (BL)	EH AUX EXTEND GROUND



87695582 3

CONNECTOR X-TELE TELEMATICS 16 PIN CONNECTOR

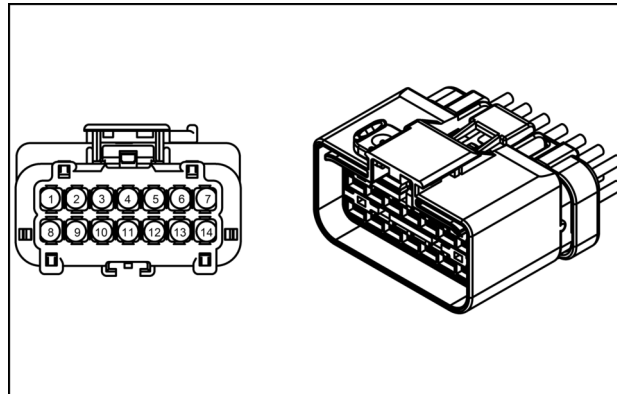
CONNECTOR X-TELE TELEMATICS		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
A	336 RD	TELEMATICS UNSWITCHED BATTERY
B		
C	802 OR	TELEMATICS IGNITION POWER
D	244 YE	ALTERNATOR LAMP TELEMATICS ENGINE ON
E	308 YE	VEHICLE WORKING CONDITION
F		
G		
H	925 BK/WH	TELEMATICS GROUND
J		
K		
L	503D YE	CAN HI
M	504D GN	CAN LO
N		
P		
R		
S	205A	



87696550 12

CONNECTOR X-ECC4B CHASSIS/CAB INTERFACE HARNESS

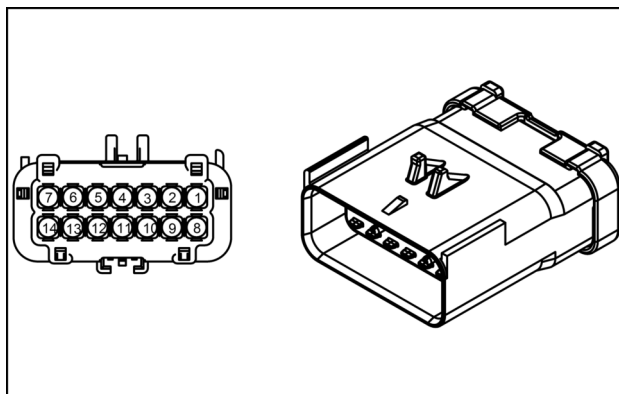
CONNECTOR X-ECC4B CHASSIS/CAB INTERFACE HARNESS		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
1	769 OR	FLASHER MODULE OUTPUT POWER
2	774 VT	LH TURN SIGNAL CHASSIS POWER
3	398 YE	LOADER LOCKOUT SW N/O OUTPUT (VALVE OFF)
4	521 YE	CONTROL PATTERN NEUTRAL
5	237 WH	HVAC CONDENSER FAN POWER
6	780 VT	RH TURN SIGNAL CHASSIS POWER
7	841 OR	A/C COMPRESSOR RELAY PIN 87 POWER
8	836 RD	COMPRESSOR/CONDENSER FAN FUSE
9	522 YE	CONTROL PATTERN H
10	233 OR	WIPER/WASHER SW POWER
11	523 YE	CONTROL PATTERN ISO
12	312 YE	LOADER LOCK SW N/C OUTPUT (VALVE ON)
13	548 GN	RH UA2 X SENSOR OUTPUT
14	560 GN	RH UA2 Y SENSOR OUTPUT



84394888 4

CONNECTOR X-CC1B CHASSIS/CAB INTERFACE HARNESS

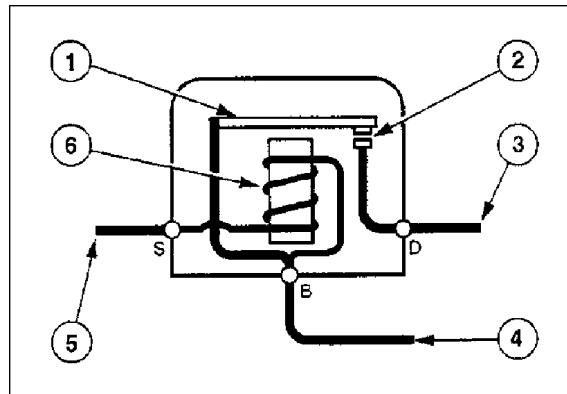
CONNECTOR X-CC1B CHASSIS/CAB INTERFACE HARNESS		
PIN NUMBER	WIRE NUMBER	CIRCUIT REFERENCE
1	797 VT	WORK LAMP POWER
2	795 VT	SIDE LAMP POWER SIGNAL
3	248 YE	DIAG SW TO ECU
4	503A YE	CAN HI
5	791 VT	ROAD LAMP SIGNAL
6		
7	910 BK/WH	INSTRUMENT CLUSTER GROUND
8	234 RD	FUEL LEVEL SENDER
9	319 OR	EH AUX POWER
10	115 RD	BEAC AND ACC FUSE OP
11	264 YE	UNSWITCHED BATTERY TO HYDRAULIC OIL TEMP SENDER
12	310 RD	UNSWITCHED BATTERY POWER
13	545 YE	FOOT THROTTLE SIGNAL
14	790 VT	LAMP SWITCH WORK LAMP SIGNAL



84398821 1

Fuse and relay box Relay - Overview

L218	
L220	



1Z0O2004112131 1

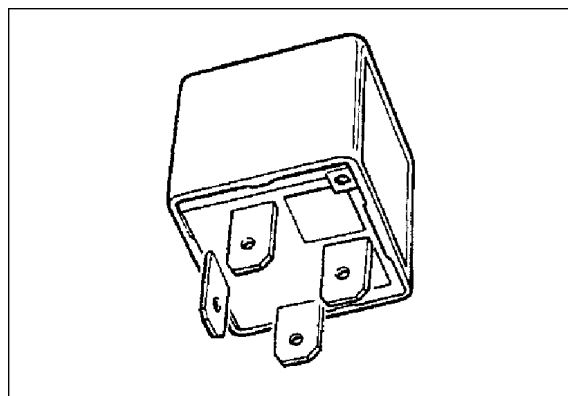
The relay is an electromagnetic switch that uses a small amount of current to switch a larger amount on and off. Relays are electrically operated switches. They are used to switch a circuit on/off in similar way to a manual switch.

When the operator closes a switch, current flows through the relay's control circuit. In this circuit there are windings surrounding an iron core which is fixed in place. Current turns the iron core into an electromagnet. The core then attracts an arm which has a contact point on it. When the point on the arm contacts the stationary point, current flows through the power circuit.

Two circuits are connected to the relay:

- A work circuit, which is switched on/off by the relay, and provides the supply for the equipment to be operated, i.e., bulbs, solenoids, etc.;
- A control circuit, switched on/off by switches, used to operate the relay.

The part of the relay which is connected to the control circuit consists of the winding of an electro-magnet. When the control circuit is switched off, the contacts are kept apart by a return spring. When the control circuit is switched on, a current flows through the coil and a magnetic force is produced. This force, which is stronger than the spring pressure, pulls the contacts of the relay together, causing the work circuit to operate.



1Z0O2004112132 2

A switch-relay system has two main advantages over a simple switch:

- The current that flows through the switch is not the same as all the current requested by the equipment to be operated, but usually by a smaller current: this allows the usage of smaller and less expensive switches;
- The distance from the supply, to the equipment, can be made as short as possible to minimize voltage drop.

Battery - Install

L218	
L220	

⚠ WARNING

Heavy objects!

Lift and handle all heavy components using lifting equipment with adequate capacity. Always support units or parts with suitable slings or hooks. Make sure the work area is clear of all bystanders. Failure to comply could result in death or serious injury.

W0398A

⚠ WARNING

Hazardous chemicals!

Battery electrolyte contains sulfuric acid. Contact with skin and eyes could result in severe irritation and burns. Always wear splash-proof goggles and protective clothing (gloves and aprons). Wash hands after handling. Failure to comply could result in death or serious injury.

W0006A

⚠ WARNING

Chemical hazard!

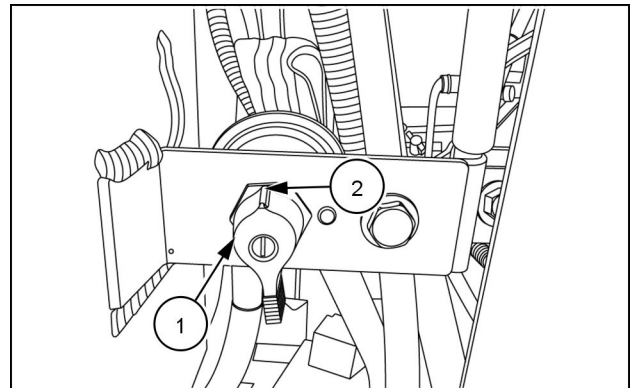
When lifting a plastic-cased battery, excessive pressure on the end walls could cause acid to spill through the vent caps. Lift a plastic-cased battery with a battery carrier or with your hands positioned on opposite corners of the battery. Always wash your hands after handling. Failure to comply could result in death or serious injury.

W0385A

Battery installation

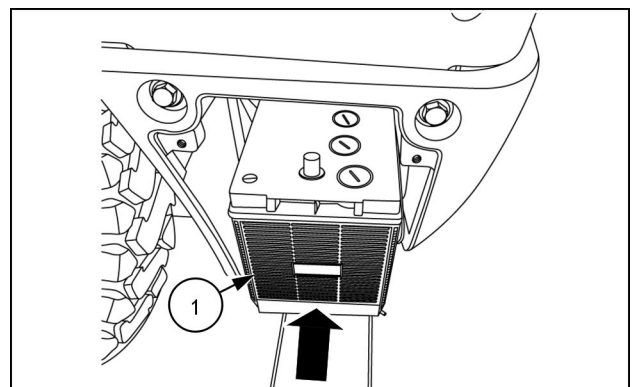
1. Confirm that the battery quick disconnecter (1) is in the off position (2), as shown.

NOTE: The battery disconnecter is optional.



931001638 1

2. Place the battery (1) in the compartment, in the direction of the arrow.



931001642 2

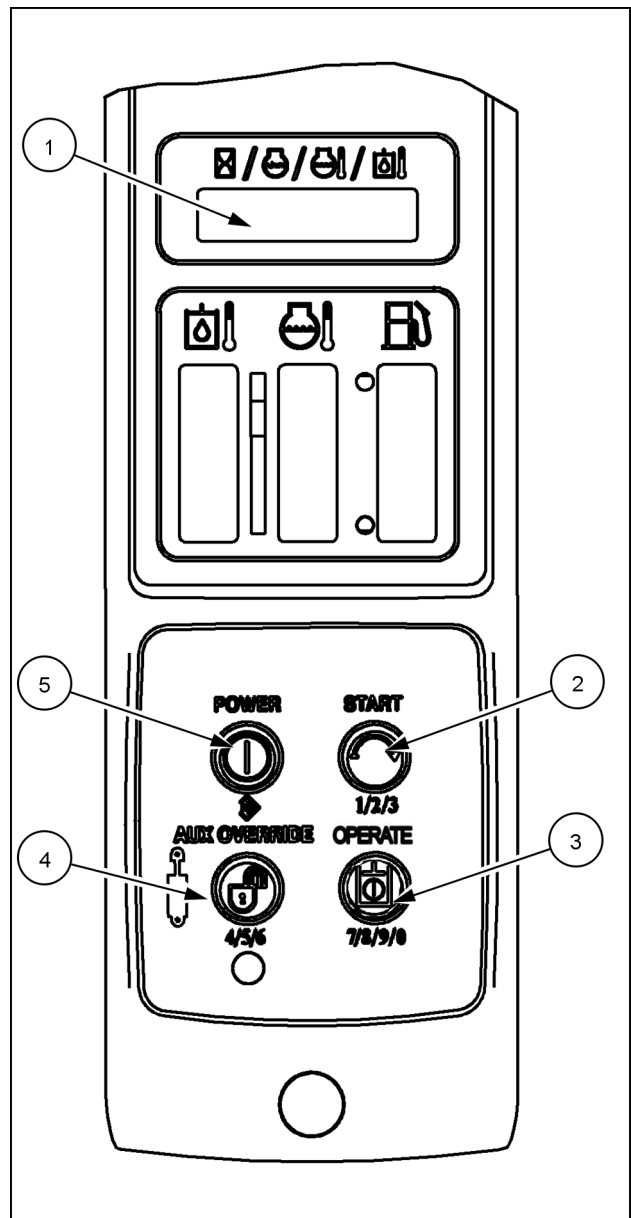
Cluster (EIC) are function buttons and function the same as the POWER (5) and START (2) switch buttons on the AIC instrument panel for the setup menu functions.

Entering the SETUP mode

1. Place the machine on firm, level ground with the lift arm and bucket down.

NOTE: For machines with the Electronic Instrument Cluster (EIC); you will need the key for these procedures.

2. Before sitting in the seat, push and hold the OPERATE button (3) and the AUX OVERRRIDE button (4) for five seconds until the display (1) shows the word SETUP.
3. You may now sit down and navigate through the SETUP menu. Familiarize yourself with the use of the switch buttons in order to help prevent erroneous settings.



931002267 2

Text display

The operator may choose a continuous display of one of the four following parameters or select cycle from the dSPly top level menu and momentarily display all four of the parameters in a cycle for a few seconds each.

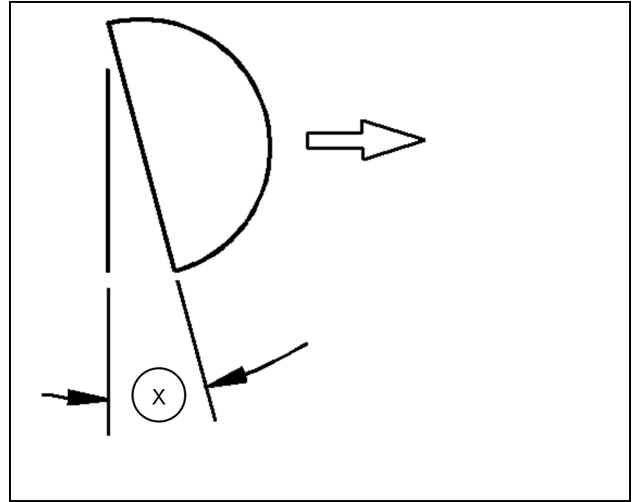
- ENHRS - Engine hours.
- ENRPM - Engine RPM.
- COOLT - Engine coolant temperature.
- HOILT - Hydraulic fluid temperature.
- CYCLE - Cycle though all four parameters.

Change or select from the dSPly level menu

NOTE: The instrument cluster is programmed to display the last setting selected when you sit in the seat.

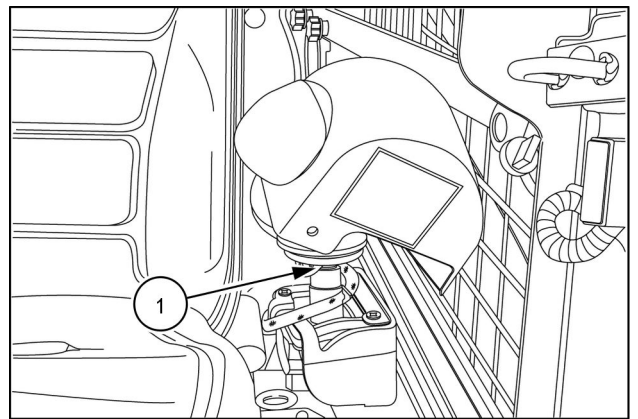
6. Orientate the joystick handle as show in image 4.

NOTE: X equals $15^\circ \pm 2^\circ$.



RAIL12SSL0567AA 4

7. Tighten the jam nut (1) to 41 N·m (30 lb ft).



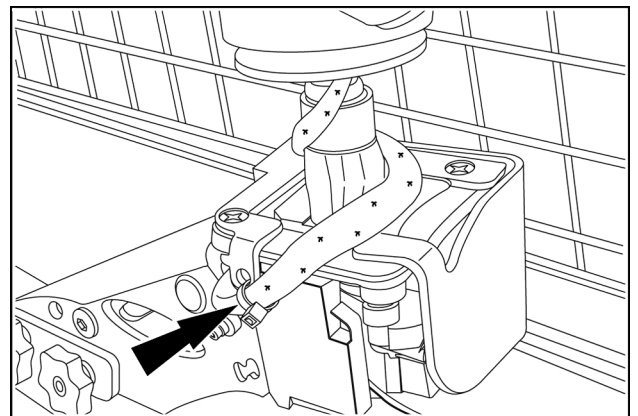
RAIL12SSL0544AA 5

8. Wrap the harness around the shaft of the left-hand joystick in a clockwise motion.

NOTE: The harness for right-hand joystick wraps around the shaft in a counterclockwise motion.

9. Locate the mark you made in step 3.

10. Attach the marked portion of the harness to the joystick base, using a wire tie.



RAPH15SSL0045BA 6

1222-Health Monitor Functions - UCM - UCM Sustained Over Temperature Limit (*)	72
1223-Health Monitor Functions - UCM - UCM Sustained Over Current Limit (*)	73
1224-Health Monitor Functions - UCM - Internal Memory or Core Monitoring Fault (*)	74
1225-Health Monitor Functions - UCM - EEPROM Memory Checksum Fault (*)	75
1350-Hyd Enable Switch - Implausible State (Hardwire vs CAN) (*)	76
1532-Backup Alarm - Short to Ground (*)	78
1533-Backup Alarm - Short to Power (*)	79
1816-Capacitor charge-up circuit malfunction (Insufficient charge) [ECU]	80
1817-Capacitor charge-up circuit malfunction (Excessive charge) [ECU]	82
1818-Engine Control Unit (ECU) watchdog fault [ECU]	84
1900-UCM - UCM Ground Fault (*)	85
1901-UCM - UCM Supply Voltage High (*)	87
1902-UCM - UCM Supply Voltage Low (*)	89
1903-UCM - UCM Supply Voltage Below Operational Limit (*)	91
1904-UCM - Rail 12VB: 5V Regulators Supply Input Power Off (*)	93
1905-UCM - 5VREF1 Sensor Supply Voltage Out of Range (*)	95
1906-UCM - 5VREF3 Sensor Supply Voltage Out of Range (*)	98
1907-UCM - Rail 12VF1: Aux Retract Input Power Off (*)	101
1908-UCM - Rail 12VF2: Bucket Extend Input Power Off (*)	103
1909-UCM - Rail 12VF3: Boom Raise/Lower Input Power Off (*)	105
1910-UCM - Rail 12VH: Ldr Plt Interlk & Port Lock Input Power Off (*)	107
1911-UCM - Rail 12VH1: Left & Right Pump Reverse Input Power Off (*)	109
1912-UCM - Rail 12VM: Left & Right Brake Lights & Aux Extend Input Power Off (*)	111
1913-UCM - Rail 12VS1: Bucket Curl Input Power Off (*)	113
1914-UCM - Rail 12VS2: Backup Alarm Input Power Off (*)	115
1915-UCM - Rail 12VT1: Two Speed Input Power Off (*)	117
1916-UCM - Rail 12VU1: Right & Left Pumps Forward Input Power Off (*)	119
1917-UCM - Rail 12VU2: Park Brake Solenoid Input Power Off (*)	121
3007-Coolant temperature sensor - Signal above range maximum [ECU]	123
3008-Coolant temperature sensor - Signal below range minimum [ECU]	126
3010-Intake manifold boost temperature sensor circuit - Signal above range maximum [ECU]	128
3011-Intake manifold boost temperature sensor circuit - Signal below range minimum [ECU]	130
3015-Fuel temperature sensor - Signal above range maximum [ECU]	132
3016-Fuel temperature sensor - Signal below range minimum [ECU]	134
3019-Intake manifold boost pressure sensor circuit - Signal above range maximum [ECU]	137
3024-Atmospheric pressure sensor inside Engine Control Unit (ECU) - Signal above range maximum [ECU]	139
3025-Atmospheric pressure sensor inside Electronic Control Unit (ECU) - Signal below range minimum [ECU]	140
3037-Intake manifold boost pressure sensor circuit - Signal below range minimum [ECU]	141
3088-Crank speed sensor - High voltage [ECU]	143
3089-Crankshaft speed sensor - Invalid signal [ECU]	145

(*) See content for specific models

Place the key switch ON.

Disconnect the wiring harness from the EGR position sensor.

Monitor for voltage fluctuation in the circuit.

A. If the voltage is less than **4.37 V**, continue with Step 5.

B. If the voltage reading changes to **4.5 - 5.5 V**, the sensor has failed. Replace the sensor.

5. Use the Service Tool D to monitor the voltage range.

Place the key switch ON.

Disconnect the wiring harness from the boost pressure sensor.

Monitor for voltage fluctuation in the circuit.

A. If the voltage is less than **4.37 V**, continue with Step 6.

B. If the voltage reading changes to **4.5 - 5.5 V**, the sensor has failed. Replace the sensor.

6. Use the Service Tool D to monitor the voltage range.

Place the key switch ON.

Disconnect the wiring harness from the camshaft speed sensor.

Monitor for voltage fluctuation in the circuit.

A. If the voltage is less than **4.37 V**, continue with Step 7.

B. If the voltage reading changes to **4.5 - 5.5 V**, the sensor has failed. Replace the sensor.

7. Check the wiring harness.

Place the key switch OFF.

Disconnect the wiring harness from the ECU.

Use a multimeter to perform the following checks.

From	To	Value
Connector X-002A pin 22	Chassis ground	There should be no continuity.
Connector X-002A pin 23	Chassis ground	There should be no continuity.
Connector X-002A pin 24	Chassis ground	There should be no continuity.
Connector X-002B pin 9	Chassis ground	There should be no continuity.

A. If the wiring harness test is good, see **Electronic module - Electrical test Engine Control Unit (ECU) verification (55.640)** to verify the ECU for proper operation.

B. If the wiring harness test fails, locate and repair the broken conductor.

8. 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.

Mechanical Units

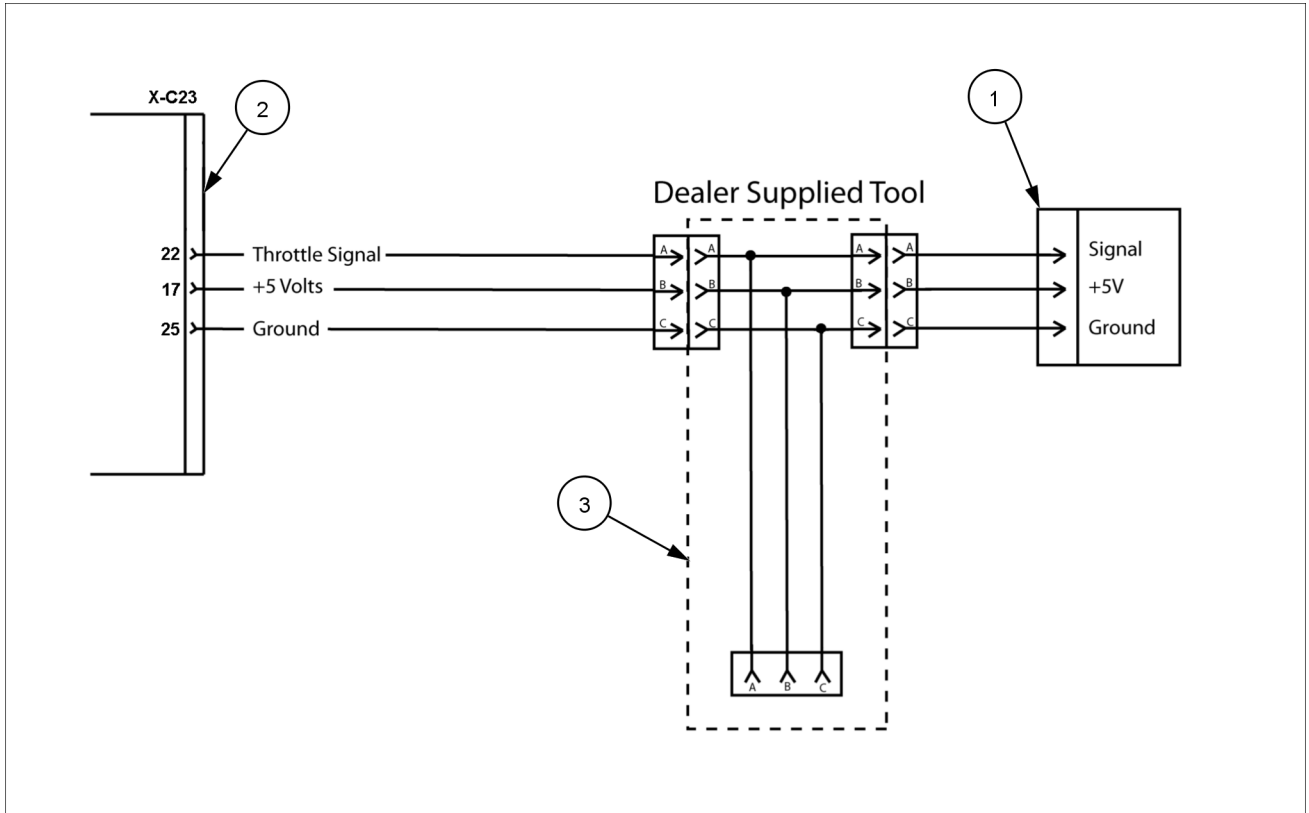
Wiring harnesses - Electrical schematic sheet 07 Engine ISM - Mechanical Units (55.100.DP-C.20.E.07)

Mechanical Units

Wiring harnesses - Electrical schematic sheet 06 Engine ISM - Mechanical Units (55.100.DP-C.20.E.06)

Throttle Signal Legend	
(1)	Throttle Signal Voltage
(2)	Throttle movement in degrees of travel. 0 degrees equals low idle. 20 degrees equals WOT (Wide Open Throttle).

This step is used to monitor the throttle signal. The sensor must be connected and active in order to continue. The dealer must build a breakout harness as shown below.



RAPH12SSL0301FA 3

Schematic legend			
(1)	Throttle position sensor	(3)	Breakout Tee
(2)	Instrument cluster		

Connect the breakout Tee and measure the voltage from pin C to pin B (or slide Back Probes into pin C and B).

Turn the ignition switch ON, engine OFF.

Measure the voltage from pin C to pin B. Move the throttle from low idle to WOT (wide open throttle). The voltage should change from approximately **0.55 V** at low idle to **4.2 V** at WOT.

A. The voltage changed between **0.55 V** at low idle to **4.2 V** at WOT. Go to step **6**.

B. The voltage did not change between **0.55 V** and **4.2 V** as the throttle moved between low idle and WOT or the voltage was less than **0.5 V** at low idle. Temporarily replace the sensor and retest. Return to step **1** to confirm elimination of fault.

6. Measure the throttle signal from the sensor to the instrument cluster.

Turn the ignition switch OFF.

Remove the breakout harness and reconnect the sensor to the instrument cluster harness.

Remove pin 22 from connector X-C23.

Turn the ignition switch ON, engine OFF.

1045-Fuel Level Sensor Open Circuit

Context:

The instrument cluster has detected an open circuit in the fuel sender signal.

Cause:

The instrument cluster has determined that the fuel level sensor resistance has failed high.

Possible failure modes:

1. Open wire in circuit.
2. Faulty fuel level sensor.
3. Instrument cluster has internal failure.

Solution:

1. 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 1045 is recorded again. Go to step 2.

2. Verify that the wiring and connectors are free of damage.

Inspect the instrument cluster and the fuel level sender connections. All connections should be secure, tight, free of corrosion, abrasion and damage.

Inspect the harness from the instrument cluster to the fuel level sender. Verify that the harness is free of damage, corrosion, abrasion or incorrect attachment.

A. The connectors are secure and the harness is free of damage. Go to step 3.

B. The connectors or the harness has damage. Repair or replace the harness or connectors as required. Return to step 1 to confirm elimination of fault.

3. Measure the resistance at the fuel level sensor.

Disconnect the harness from the sender.

Tilt the cab and remove the fuel level sender from the tank.

Move the fuel level float from the low position to the high position while measuring the resistance across the sender. The resistance should change linearly from approximately **4.5 Ω** at the full tank position to approximately **340 Ω** at the empty tank position. The resistance should change linearly without any fluctuations to a higher or lower resistance.

A. The resistance measurements from the sensor were within specifications. Go to step 4.

B. The resistance readings from the sensor were not steady or the values were not accurate. Temporarily replace the sensor and retest. Return to step 1 to confirm elimination of fault.

4. Check fuel level wiring.

Measure the resistance between X-14 pin A and chassis ground. The resistance should be less than **10 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

Measure the resistance from X-14 pin B to instrument cluster connector X-C23, pin 24. The resistance should be less than **10 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

1213-Calibration Functions - Loader Valve Calibration Not Complete

L218 TIER 4B Final [NDM449275 -]	NA Electro hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Electro hydraulic controls

Context:

Diagnostic Trouble Code 1213 has an error priority of Amber.
There are no restrictions with Diagnostic Trouble Code 1213.

Cause:

UCM has sensed that the Loader Valve Calibration is not complete.

Possible failure modes:

1. Calibration not complete
2. Failure of UCM

Solution:

1. Use the machine to recreate conditions for error. Use the EST to verify fault code 1213 Calibration Functions - Loader Valve Calibration Not Complete is active.
 - A. If the fault is active, continue with step 2.
 - B. If the fault is not active, the fault may be intermittent and not currently active, continue with step 3.
2. Use the EST to perform calibration on the Loader Valve.

Electrical system - H1 - Calibration procedures – Loader valve (55.000)

 - A. If the fault code clears, continue normal operation.
 - B. If the fault code does not clear, replace the Loader Valve and reperform calibration. If the code persists, replace UCM.
3. 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 Display. Investigate 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.

- 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.

Use a digital voltmeter to measure the resistance between X-CN1A pin 9 and chassis ground. The resistance should be greater than **20,000 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The resistance is greater than **20,000 Ω**. Go to step **5**.

B. The resistance is less than **20,000 Ω**. There is a short circuit to chassis ground. Repair or replace the harness as required. Return to step **1** to confirm elimination of the fault.

5. Reconnect the components to the harness one at a time while monitoring the resistance.

Use a digital voltmeter to measure the resistance between X-CN1A pin 9 and chassis ground.

Reconnect the components one at a time (right hand control handle and Universal Joystick Module), while monitoring the resistance reading. The resistance should be greater than **20,000 Ω** while the components are reconnected into the circuit.

A. The resistance is greater than **20,000 Ω** but dropped below **20,000 Ω** when a component was reconnected into the circuit. Temporarily replace the component that dropped the resistance. Return to step **1** to confirm elimination of the fault.

B. The resistance is greater than **20,000 Ω** while each component was reconnected into the circuit. Temporarily replace the UCM and retest. Return to step **1** to confirm the elimination of the fault.

6. Check for a short to battery.

Turn the ignition switch OFF.

Disconnect the UCM connector, X-CN1A.

Disconnect the right hand control handle and Universal Joystick Module.

Turn the ignition switch ON and measure the voltage between X-CN1A pin 9 and chassis ground. The voltage should be less than **0.5 V**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The voltage is less than **0.5 V**. Go to step **7**.

B. The voltage is greater than **0.5 V**. There is a short circuit to another voltage source. Repair or replace the harness as required. Return to step **1** to confirm the elimination of the fault.

7. Reconnect the components to the harness while monitoring the voltage.

Use a digital voltmeter to measure the voltage between X-CN1A pin 9 and chassis ground.

Reconnect the components one at a time (right hand control handle and Universal Joystick Module), while monitoring the voltage reading. The voltage should be less than **0.5 V** while the components are reconnected into the circuit.

A. The voltage is less than **0.5 V** but changed to a voltage greater than **1 V** when a component was reconnected into the circuit. Temporarily replace the component that changed the voltage. Return to step **1** to confirm elimination of the fault.

B. The voltage is less than **0.5 V** while each component was reconnected into the circuit. Temporarily replace the UCM and retest. Return to step **1** to confirm the elimination of the fault.

Small EH machines F5H engine

Wiring harnesses - Electrical schematic sheet 01 Main Power Distribution, EH Units (55.100.DP-C.20.E.01)

Wiring harnesses - Electrical schematic sheet 02 Accessory Power Distribution, EH Units (55.100.DP-C.20.E.02)

Wiring harnesses - Electrical schematic sheet 03 Ignition Charging System, EH Units (55.100.DP-C.20.E.03)

Wiring harnesses - Electrical schematic sheet 19 Unit Control Module, EH Units (55.100.DP-C.20.E.19)

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module, EH Units (55.100.DP-C.20.E.20)

Small EH machines ISM engine

Wiring harnesses - Electrical schematic sheet 19 Unit Control Handle - EH Units (55.100.DP-C.20.E.19)

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module - EH Units (55.100.DP-C.20.E.20)

Wiring harnesses - Electrical schematic sheet 01 Main Power Distribution - EH Units (55.100.DP-C.20.E.01)

Wiring harnesses - Electrical schematic sheet 02 Accessory Power Distribution - EH Units (55.100.DP-C.20.E.02)

1914-UCM - Rail 12VS2: Backup Alarm Input Power Off

L218 TIER 4B Final [NDM449275 -]	NA Electro hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Electro hydraulic controls

Context:

UCM has sensed that a 12 V UCM input has failed low. Diagnostic Trouble Code 1914 has an error priority of Amber. There are no restrictions while Diagnostic Trouble Code 1914 is active.

Cause:

UCM has sensed that a 12 V UCM input has failed low. The fault is active while the ignition is ON, crank pin is low, Diagnostic Code 1903 is not active, and UCM input voltage is less than **9 V**.

Possible failure modes:

1. Blown fuse.
2. Open wire in circuit.
3. Shorted wire in circuit.
4. Failure of UCM.

Solution:

1. Verify that the fault code is active.

Connect the Electronic Service Tool to the service tool connector.

To check for fault code: Start and operate machine.

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

B. Fault code 1914 is recorded again. Go to step **2**.

C. Fault code 1914 is recorded along with other diagnostic codes such as 1904, 1907 to 1913, 1915 to 1917 and/or Right or Left Swatch Plate Sensor fault codes. Test the fuses and relays. Repair as required. Return to step **1** to confirm elimination of the fault.

2. Verify the harness is not damaged.

Turn the ignition switch OFF.

Verify the connections to the UCM connector X-CN3B pin 3 are tight and secure.

Verify the harness is free of damage, abrasion, corrosion and incorrect attachment.

A. The wiring harness is not damaged and all connections are secure. Go to step **3**.

B. The harness is damaged or the connectors are loose or damaged. Repair or replace the harness as required. Return to step **1** to confirm elimination of fault.

3. Measure the voltage at the fuse

Turn the ignition switch ON.

Measure voltage from the UCM Backup Alarm Fuse F-007 terminal B2 to chassis ground. The voltage should be approximately **12 V**.

A. The voltage is approximately **12 V**. Go to step **4**.

B. The voltage is less than **9 V**. Go to step **5**.

4. Test the UCM connection.

Turn the ignition switch OFF.

Place the key switch ON.

Use a multimeter to perform the following check on the wiring harness.

From	To	Value
Connector X-020 pin 1	Connector X-020 pin 2	There should be approximately 4.5 - 5.5 V.

- A. If the voltage reading is out of the range, continue with Step 5.
 - B. If the voltage reading is in range, see **Electronic module - Electrical test Engine Control Unit (ECU) verification (55.640)** to verify the ECU for proper operation.
5. Check the wiring harness for a short to low condition.

Place the key switch OFF.

Carefully disconnect the wiring harness from the ECU.

Use a multimeter to perform the following checks on the wiring harness.

From	To	Value
Connector X-020 pin 1	Chassis ground	There should be no continuity.
Connector X-020 pin 2	Chassis ground	There should be no continuity.
Connector X-020 pin 2	Connector X-020 pin 1	There should be no continuity.

- A. If there is no continuity, continue with Step 6.
 - B. If there is continuity, there is a short to low condition in the wiring harness. Locate and repair the broken conductor.
6. Check the wiring harness for an open circuit condition.

Place the key switch OFF.

Use a multimeter to perform the following checks on the wiring harness.

From	To	Value
Connector X-020 pin 1	Connector X-002B pin 28	There should be continuity.
Connector X-020 pin 2	Connector X-002A pin 16	There should be continuity.

- A. If there is continuity, see **Electronic module - Electrical test Engine Control Unit (ECU) verification (55.640)** to verify the ECU for proper operation.
 - B. If there is no continuity, there is an open circuit in the wiring harness. Locate and repair the broken conductor.
7. 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.

Mechanical Units

Wiring harnesses - Electrical schematic sheet 06 Engine ISM - Mechanical Units (55.100.DP-C.20.E.06)

Mechanical Units

Wiring harnesses - Electrical schematic sheet 07 Engine ISM - Mechanical Units (55.100.DP-C.20.E.07)

EH Units

Wiring harnesses - Electrical schematic sheet 06 Engine ISM HPCR - EH Units (55.100.DP-C.20.E.06)

EH Units

Wiring harnesses - Electrical schematic sheet 05 Engine ISM HPCR - EH Units (55.100.DP-C.20.E.05)

3090-Camshaft speed sensor - No signal

Control Module : ECU

Context:

When retrieving this fault code using Service Tool D, display code is P0342. The Engine Control Unit (ECU) receives a signal at the ECU connector X-002A pin 42, indicating the position of the camshaft sensor also known as G sensor. This signal is produced when a toothed wheel attached to the high pressure pump passes the camshaft sensor. The ECU provides a **5.0 V** reference signal from the ECU connector X-002B at pin 9, and a ground reference signal from the ECU connector X-002A pin 18.

Cause:

The camshaft signal to the ECU is erratic.

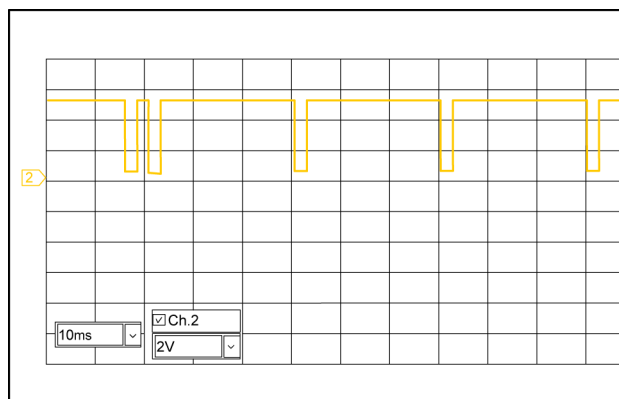
Possible failure modes:

1. The camshaft sensor has failed internally.
2. The camshaft sensor circuit wiring is faulty.
3. The ECU has failed internally.

Solution:

1. Verify that the fault is present and active.

Use the Service Tool D to check the "Cam Speed Active Flag" value. See **Electrical system Computer support tools - Overview Data Monitoring Screen (55.000)**.



- A. If the waveform does not compare to the graph, continue with Step 2.
 - B. If the waveform is in range, the fault may be intermittent and not currently active. Continue with Step 6.
2. Verify that the wiring harness and connectors are free of damage.

Inspect the wiring harness from the ECU to the camshaft sensor connector.

Verify that the wiring harness is free of damage, corrosion, abrasion and incorrect attachment.

 - A. The connectors are secure and the wiring harness is free of damage. Continue with Step 3.
 - B. The connectors or the wiring harness has damage. Repair or replace the wiring harness or connectors as required.
 3. Check the **5.0 V** and ground reference circuit.

Disconnect the wiring harness from the camshaft sensor.

Place the key switch ON.

3268-Engine Control Unit (ECU) fuel pump output - Shorted to low source

Control Module : ECU

NOTE: The high pressure pump is also known as the Suction Control Valve (SCV).

Context:

When retrieving this fault code using Service Tool D, display code is P0627. The Engine Control Unit (ECU) provides a **5.0 V** reference from the ECU connector X-002B pin 20 and a ground reference from ECU connector X-002B pin 7 to the high pressure pump sensor.

Cause:

The ECU is sensing the high pressure pump control current is less than **400 mA**.

Possible failure modes:

1. The high pressure pump has failed.
2. The wiring harness has failed.
3. The ECU has failed internally.

Solution:

1. Use the Service Tool D to verify the fault is active.

Use the Service Tool D to check the "SCV Current" at idle. See **Electrical system Computer support tools - Overview (55.000)**.

There should be **1,500 - 1,900 mA**.

- A. If the amperage is less than **4.0 mA**, continue with Step 2.
 - B. If the amperage is in range, the fault may be intermittent and not currently active. Continue with Step 5.
2. Verify that the wiring harness and connectors are free of damage.

Inspect the wiring harness from the ECU to the high pressure pump sensor connector.

Verify that the wiring harness is free of damage, corrosion, abrasion and incorrect attachment.

- A. The connectors are secure and the wiring harness is free of damage. Continue with Step 3.
 - B. The connectors or the wiring harness has damage. Repair or replace the wiring harness or connectors as required.
3. Check the high pressure pump sensor resistance.

Place the key switch OFF.

Disconnect the wiring harness from the high pressure pump.

Use a multimeter to measure the resistance from the high pressure pump sensor pin 1 to pin 2.

The resistance should be **2.0 - 4.0 Ω**.

- A. If the resistance is correct, continue with Step 4.
 - B. If the resistance is incorrect, replace the supply pump.
4. Check the wiring harness.

Place the key switch OFF.

3764-Engine controller main relay circuit (Terminal 30) - Early opening defect of main relay

Control Module : ECU

Context:

When retrieving this fault code using Service Tool D, display code is P0686. The Engine Control Unit (ECU) controls the ECU main relay operation dependant on the key switch. When the key switch is turned to the ON position, the ECU will provide ground on the control circuit of the ECU main relay.

Cause:

The ECU has sensed the ECU main relay circuit has failed.

Possible failure modes:

1. The ECU main relay failed.
2. The key switch failed.
3. The wiring harness failed.
4. The ECU has failed internally.

Solution:

1. Check for voltage at the ECU.

Place the key switch OFF.

Disconnect the wiring harness from the ECU.

Use a multimeter to perform the following checks.

There should be no voltage with the key switch OFF.

From	To	Value
Connector X-002B pin 5	Chassis ground	There should be no voltage.
Connector X-002B pin 6	Chassis ground	There should be no voltage.

- A. If there is voltage, continue with Step 2.
- B. If there is no voltage, the fault may be intermittent and not currently active. Continue with Step 6.
2. Use the Service Tool D data monitor function to verify the "Key Switch" status.

Place the key switch ON.

Place the key switch OFF.

The "Key Switch" data should state OFF when the key switch is OFF.

- A. If the status is incorrect, continue with Step 3.
- B. If the status is correct, Continue with Step 4.
3. Check the key switch circuit.

Place the key switch OFF.

Use a multimeter to perform the following checks.

There should be no voltage with the key switch OFF.

3951-Exhaust gas temperature 1 sensor - Signal too high

Control Module : ECU

NOTE: The exhaust gas temperature sensor 1 is also known as the Diesel Oxidation Catalyst (DOC) inlet temperature sensor.

Context:

When retrieving this fault code using Service Tool D, display code is P0428. The Engine Control Unit (ECU) provides a sensor reference voltage of **5.0 V** from the ECU connector X-002A pin 34 and a ground reference from the ECU X-002A pin 15. The sensor resistance and signal level will vary with the exhaust gas temperature at the ECU connector X-002A pin 34. The higher the exhaust gas temperature is, the lower the resistance and signal level will be. The lower the exhaust gas temperature is, the higher the resistance and signal level will be.

Cause:

The ECU is sensing a signal level greater than **4.9 V** in the exhaust gas temperature sensor circuit.

Possible failure modes:

1. The exhaust gas temperature sensor has failed internally.
2. The exhaust gas temperature sensor circuit wiring is shorted to a high source.
3. The ECU has failed internally.

Solution:

1. Verify that the fault is present and active.

Use the Service Tool D to check the "Exhaust Gas Temperature" and "Exhaust Gas Temperature Sensor Output Voltage". See **Electrical system Computer support tools - Overview Data Monitoring Screen (55.000)**.

Exhaust gas temperature	Voltage output
20 °C (68.0 °F)	2.2 - 2.5 V
40 °C (104.0 °F)	1.3 - 1.7 V
60 °C (140.0 °F)	0.7 - 1.0 V
80 °C (176.0 °F)	0.4 - 0.7 V

- A. If there is greater than **4.9 V**, continue with Step 2.
- B. If the voltage is in range, the fault may be intermittent and not currently active. Continue with Step 6.
2. Verify that the wiring harness and connectors are free of damage.

Inspect the wiring harness from the ECU to DOC inlet temperature sensor connector.

Verify that the wiring harness is free of damage, corrosion, abrasion and incorrect attachment.

- A. The connectors are secure and the wiring harness is free of damage. Continue with Step 3.
- B. The connectors or the wiring harness has damage. Repair or replace the wiring harness or connectors as required.
3. Check the sensor.

Place the key switch OFF.

Disconnect the wiring harness from the sensor.

Measure the resistance from the DOC inlet temperature sensor connector from pin 1 to pin 2.

Exhaust gas temperature	Resistance value
20 °C (68.0 °F)	2.0 - 3.0 Ω
40 °C (104.0 °F)	0.9 - 1.5 Ω

3959-Injector 2 and/or 3 - Shorted to high source

Control Module : ECU

Context:

When retrieving this fault code using Service Tool D, display code is P2151. The Engine Control Unit (ECU) has four injector driver circuits. Each of these circuits regulates an injector.

Cause:

The ECU has sensed the common power supply to injector 2 and injector 3 is shorted to a high source.

Possible failure modes:

1. The wiring harness is faulty.
2. The ECU has failed internally.

Solution:

1. Verify that the fault is present and active.

Use the Service Tool D to check the fault code is present.

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

B. If the fault is no longer present, the fault may be intermittent and not currently active. Continue with Step 4.

2. Verify that the wiring harness and connectors are free of damage.

Inspect the wiring harness from the ECU to the injector 2 connector.

Inspect the wiring harness from the ECU to the injector 3 connector.

Verify that the wiring harness is free of damage, corrosion, abrasion and incorrect attachment.

A. The connectors are secure and the wiring harness is free of damage. Continue with Step 3.

B. The connectors or the wiring harness has damage. Repair or replace the harness or connectors as required.

3. Check the wiring harness for a short to high source.

Place the key switch OFF.

Disconnect the wiring harness from injector 2.

Disconnect the wiring harness from injector 3.

Disconnect the wiring harness from the ECU.

Use a multimeter to perform the following checks.

From	To	Value
Connector X-002A pin 1	Chassis ground	There should be no continuity.
Connector X-002A pin 3	Chassis ground	There should be no continuity.
Connector X-002A pin 25	Chassis ground	There should be no continuity.
Connector X-002A pin 26	Chassis ground	There should be no continuity.

A. If the wiring harness test passes, see **Electronic module - Electrical test Engine Control Unit (ECU) verification (55.640)** to verify the ECU is working properly.

B. If the wiring test fails, locate and repair the broken wiring.

3968-Incorrect injector codes

Control Module : ECU

Context:

When retrieving this fault code using Service Tool D, display code is P1601. Each injector is marked with an individual code known as a Quick Response (QR) code. The QR code contains correction data for compensating for various tolerances. When an injector is replaced the QR code will need to be entered using the Service Tool D.

Cause:

Incorrect entry of QR code data.

Possible failure modes:

1. The software could be faulty.
2. The ECU has failed internally.

Solution:

1. Use the Service Tool D to verify the fault is active.

Read in the QR data with the "Injector Correction" utility. See **Electrical system Computer support tools - Overview — Utility (55.000)**.

Verify that the data is correct by checking the QR code with the "Injector Correction."

- A. If the data is incorrect, continue with Step 2.
 - B. If the data is correct, the fault may be intermittent and not currently active. Continue with Step 3.
2. Clear the fault.
 - A. If the fault is still present, see **Electronic module - Electrical test Engine Control Unit (ECU) verification (55.640)** to verify the ECU is working properly.
 - B. If the fault is no longer present, the fault has been corrected.
 3. 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.

(1) Turn the key switch OFF.

(2) Disconnect the Instrument Cluster connector X-C23 and the hydraulic oil temperature sensor connector.

(3) Measure the resistance from Hydraulic Oil Temperature Sensor signal wire X-C23 pin 16 to chassis ground. The resistance should be greater than **20,000 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The resistance is greater than **20,000 Ω**. Go to Step 4.

B. The resistance is less than **20,000 Ω**. There is a short circuit to chassis ground. Repair or replace the harness as required. Return to Step 1 to confirm elimination of the fault.

4. Measure the resistance of the Temperature Sensor

(1) Measure the resistance of the temperature sensor to chassis ground.

Hydraulic Oil Temperature Sensor Open Circuit Resistance Measurements	
Temperature	Resistance in ohms (± 10%)
110 °C (230 °F)	130 Ω
105 °C (221 °F)	151 Ω
100 °C (212 °F)	175 Ω
95 °C (203 °F)	202 Ω
92 °C (198 °F)	223 Ω
88 °C (190 °F)	258 Ω
85 °C (185 °F)	280 Ω
81 °C (178 °F)	323 Ω
78 °C (172 °F)	358 Ω
74 °C (165 °F)	412 Ω
68 °C (154 °F)	511 Ω
16 °C (61 °F)	4250 Ω

A. The resistance measurements are within the values from the table. The measured resistance is greater than **30 Ω**. Temporarily replace the Instrument Cluster and retest. Go to Step 1.

B. The resistance measurements are not within range. The measured resistance is less than **30 Ω**. Temporarily replace the temperature sensor and retest. Go to Step 1 to confirm elimination of fault.

Mechanical Units F5H engine

Wiring harnesses - Electrical schematic sheet 21 Instrument Cluster, Mechanical Units (55.100.DP-C.20.E.21)

Wiring harnesses - Electrical schematic sheet 10 Cab to Chassis Interface, Mechanical Units (55.100.DP-C.20.E.10)

EH Units F5H engine

Wiring harnesses - Electrical schematic sheet 26 Instrument Cluster, EH Units (55.100.DP-C.20.E.26)

Wiring harnesses - Electrical schematic sheet 12 Cab to Chassis Interface, EH Units (55.100.DP-C.20.E.12)

Small mechanical machines ISM engine

Wiring harnesses - Electrical schematic sheet 25 Instrument Cluster - Mechanical Units (55.100.DP-C.20.E.25)

Wiring harnesses - Electrical schematic sheet 14 Bulkhead Connection - Mechanical Units (55.100.DP-C.20.E.14)

Small EH machines ISM engine

Wiring harnesses - Electrical schematic sheet 26 Instrument Cluster - EH Units (55.100.DP-C.20.E.26)

Wiring harnesses - Electrical schematic sheet 12 Bulkhead Connection - EH Units (55.100.DP-C.20.E.12)

Medium mechanical machines ISM engine

Wiring harnesses - Electrical schematic sheet 21 Instrument Cluster - Mechanical Units (55.100.DP-C.20.E.21)

Wiring harnesses - Electrical schematic sheet 10 Bulkhead Connection - Mechanical Units (55.100.DP-C.20.E.10)

Medium EH machines ISM engine

Wiring harnesses - Electrical schematic sheet 26 Instrument Cluster - EH Units (55.100.DP-C.20.E.26)

Wiring harnesses - Electrical schematic sheet 12 Bulkhead Connection - EH Units (55.100.DP-C.20.E.12)

4072-Forward Pump Control Valves (Directional) - Solenoid Left (B) Supply Short to Ground

L218 TIER 4B Final [NDM449275 -]	NA Electro hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Electro hydraulic controls

Context:

The UCM has sent a signal to the Left Drive Pump Forward Solenoid to energize, but there is no voltage detected. Diagnostic Trouble Code 4072 has an error priority of Red. Forward ground drive is disabled while Diagnostic Trouble Code 4072 is active.

Cause:

The UCM has sent a signal to the Left Drive Pump Forward Solenoid to energize, but there is no voltage detected. The fault is activate while the hydraulics are enabled and Aux Override is disabled and Parking Brake is off and solenoid output pin, X-CN3B pin 33 current is high.

Possible failure modes:

1. Shorted wire in the circuit.
2. The Left Drive Pump Forward Solenoid has failed.
3. The UCM has an internal failure.

Solution:

1. Verify that the fault code is active.

Connect the Electronic Service Tool to the service tool connector.

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

- A. The fault code is not recorded again. OK to return the machine to service.
 - B. Fault code 4072 is recorded again. Go to step 2.
2. Verify that the wiring and connectors are free of damage.

Inspect the UCM and the Left Drive Pump Forward connections. All connections should be secure, tight, free of corrosion, abrasion and damage.

Inspect the harness from the UCM to the Left Drive Pump Forward solenoid. Verify that the harness is free of damage, corrosion, abrasion and incorrect attachment.

 - A. The connectors are secure and the harness is free of damage. Go to step 3.
 - B. The connectors or the harness has damage. Repair or replace the harness or connectors as required. Return to step 1 to confirm elimination of fault.
 3. Measure the resistance of the signal wire to chassis ground.

Turn the ignition switch OFF.

Disconnect UCM connector X-CN3B, X-CN2B and the Left Drive Pump Forward solenoid connector X-13.

Measure the resistance between X-CN3B pin 33 and chassis ground. The resistance should be greater than **20,000 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

Measure the resistance between X-CN2B pin 25 and chassis ground. The resistance should be greater than **20,000 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

- A. Both resistance measurements are greater than **20,000 Ω**. Go to step 4.
- B. One or both resistance measurements is less than **20,000 Ω**. There is a short circuit to chassis ground. Repair or replace the harness as required. Return step 1 to confirm elimination of the fault.

- B. The resistance is greater than **10 Ω**. There is an open circuit in the solenoid signal or solenoid ground line. Repair or replace the harness as required. Return to step **1** to confirm elimination of the fault.

4. Test the UCM.

Leave the jumper wire installed between X-16 pin 1 and X-16 pin 2.

Reconnect UCM connector X-CN2A and X-CN1A.

Turn the ignition switch ON.

Activate the hydraulics while monitoring the fault code screen. Fault code 4371 should no longer be active. Fault code 4372 should become active.

- A. Fault code 4372 is active and fault code 4371 is no longer active. Temporarily replace the solenoid and retest. Return to step **1** to confirm elimination of the fault.

- B. Fault code 4371 is still active. Fault code 4372 did not become active. Temporarily replace the UCM and retest. Return to step **1** to confirm elimination of the fault.

EH machines F5H engine

Wiring harnesses - Electrical schematic sheet 09 EH Pump/ Hydraulics, EH Units (55.100.DP-C.20.E.09)

Wiring harnesses - Electrical schematic sheet 19 Unit Control Module, EH Units (55.100.DP-C.20.E.19)

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module, EH Units (55.100.DP-C.20.E.20)

Small EH machines ISM engine

Wiring harnesses - Electrical schematic sheet 19 Unit Control Handle - EH Units (55.100.DP-C.20.E.19)

Wiring harnesses - Electrical schematic sheet 09 ET Pump/ Hydraulics - EH Units (55.100.DP-C.20.E.09)

Medium EH machines ISM engine

Wiring harnesses - Electrical schematic sheet 19 Unit Control Module - EH Units (55.100.DP-C.20.E.19)

Wiring harnesses - Electrical schematic sheet 09 ET Pump/ Hydraulics - EH Units (55.100.DP-C.20.E.09)

4431-Park Brake Pressure Switch - Pressure Switch (Plausibility Check With Solenoid Valve)

L218 TIER 4B Final [NDM449275 -]	NA Electro hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Electro hydraulic controls

Context:

UCM has sensed disagreement between the park brake pressure switch and the park brake solenoid. Diagnostic Trouble Code 4431 has an error priority of amber.

There are no restrictions while Diagnostic Trouble Code 4431 is active.

Cause:

UCM has sensed disagreement between the park brake pressure switch and the park brake solenoid. The fault is active while engine is running and the park brake pressure switch input X-CN2B pin 13 is ON and the solenoid current output X-CN3A pin 4 is less than **1 A** or

The park brake pressure switch input X-CN2B pin 13 is OFF and the solenoid current output X-CN3A pin 4 is greater than **1 A**.

Possible failure modes:

1. Low charge pressure.
2. Open or shorted wire in the circuit.
3. Failure of the park brake solenoid.
4. Failure of the park brake pressure switch.
5. Failure of the UCM.

Solution:

1. Verify that the fault code is active.

Connect the Electronic Service Tool to the service tool connector.

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

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

B. Fault code 4431 is recorded again. Go to step 2.

2. Verify the charge pressure.

Verify the charge pressure is approximately **2482 kPa (360 psi)** at low idle.

Verify the charge pressure is approximately **2758 kPa (400 psi)** at full throttle.

A. Charge pressure is in the correct range and fault code 4431 is still active. Go to step 3.

B. Charge pressure is not correct. Repair the cause of low charge pressure and retest. Return to step 1 to confirm elimination of the fault.

3. Verify that the wiring and connectors are free of damage.

Inspect the UCM, the park brake solenoid and the park brake switch connections. All connections should be secure, tight, free of corrosion, abrasion and damage.

Inspect the harness from the UCM to the park brake solenoid and the park brake switch. Verify that the harness is free of damage, corrosion, abrasion and incorrect attachment.

A. The connectors are secure and the harness is free of damage. Go to step 4.

B. The connectors or the harness has damage. Repair or replace the harness or connectors as required. Return to step 1 to confirm elimination of fault.

4. Use EST to test the system.

4741-Left Swash Plate Angle Sensor - Pin A Short to Ground/ Open Circuit

L218 TIER 4B Final [NDM449275 -]	NA Electro hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Electro hydraulic controls

Context:

The UCM has sensed that the swash plate angle sensor signal has failed low. Diagnostic Trouble Code 4741 has an error priority of Amber.

Limp home ground drive operating mode is enabled while Diagnostic Trouble Code 4741 is active.

Cause:

The UCM has sensed that the swash plate angle sensor signal has failed low. The fault is active while the engine is on and the Left Swash Plate Angle Sensor voltage, X-CN3A pin 9 is less than **0.2 V**.

Possible failure modes:

1. A short circuit to chassis ground.
2. An open circuit in the sensor signal wire.
3. Failure of the Swash Plate Angle Sensor.
4. The UCM has an internal failure.

Solution:

1. Verify that the fault code is active.

Connect the Electronic Service Tool to the service tool connector.

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

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

B. Fault code 4741 is recorded again. Go to step **2**.

2. Verify that the wiring and connectors are free of damage.

Inspect the UCM, the Left Hand Swash Plate sensor connection and the Right Hand Swash Plate sensor connection. All connections should be secure, tight, free of corrosion, abrasion and damage.

Inspect the harness from the UCM to the swash plate sensors. Verify that the harness is free of damage, corrosion, abrasion and incorrect attachment.

A. The connectors are secure and the harness is free of damage. Go to step **3**.

B. The connectors or the harness has damage. Repair or replace the harness or connectors as required. Return to step **1** to confirm elimination of fault.

3. Measure the voltage at the sensor.

Turn the ignition switch OFF.

Disconnect the Left Hand Swash Plate Sensor connector X-94.

Turn the ignition switch ON.

Measure the voltage between X-94 pin 5 and X-94 pin 1. The voltage should be approximately **12 V**. Wiggle the harness during measurement to reveal an intermittent condition.

Measure the voltage between X-94 pin 2 and X-94 pin 6. The voltage should be approximately **12 V**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The voltage measurement is approximately **12 V**. Go to step **4**.

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.

Small EH machines

Wiring harnesses - Electrical schematic sheet 19 Unit Control Handle - EH Units (55.100.DP-C.20.E.19)
Wiring harnesses - Electrical schematic sheet 20 Unit Control Module - EH Units (55.100.DP-C.20.E.20)
Wiring harnesses - Electrical schematic sheet 09 ET Pump/ Hydraulics - EH Units (55.100.DP-C.20.E.09)
Wiring harnesses - Electrical schematic sheet 02 Accessory Power Distribution - EH Units (55.100.DP-C.20.E.02)

Medium EH machines

Wiring harnesses - Electrical schematic sheet 19 Unit Control Module - EH Units (55.100.DP-C.20.E.19)
Wiring harnesses - Electrical schematic sheet 20 Unit Control Module - EH Units (55.100.DP-C.20.E.20)
Wiring harnesses - Electrical schematic sheet 09 ET Pump/ Hydraulics - EH Units (55.100.DP-C.20.E.09)
Wiring harnesses - Electrical schematic sheet 02 Accessory Power Distribution - EH Units (55.100.DP-C.20.E.02)

5053-Loader Pilot Interlock Valve (On/Off) - Solenoid Supply Short to Power

L218 TIER 4B Final [NDM449275 -]	NA Electro hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Electro hydraulic controls

Context:

Diagnostic Trouble Code 5053 has an error priority of Red.
Loader hydraulics are disabled while Diagnostic Trouble Code 5053 is active.

Cause:

The UCM has sent a signal to the Loader Pilot Interlock solenoid to energize, but there is no voltage detected. The fault is active while hydraulics are enabled and the loader pilot interlock solenoid output, X-CN2A pin 4 is greater than **3 A**.

Possible failure modes:

1. Short circuit in the solenoid wiring.
2. The loader pilot interlock valve solenoid has failed.
3. The UCM has an internal failure.

Solution:

1. Verify that the fault code is active.

Connect the Electronic Service Tool to the service tool connector.

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

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

B. Fault code 5053 is recorded again. Go to step **2**.

2. Verify that the wiring and connectors are free of damage.

Inspect the UCM and the loader pilot interlock connections. All connections should be secure, tight, free of corrosion, abrasion and damage.

Inspect the harness from the UCM to the loader pilot interlock. Verify that the harness is free of damage, corrosion, abrasion and incorrect attachment.

A. The connectors are secure and the harness is free of damage. Go to step **3**.

B. The connectors or the harness has damage. Repair or replace the harness or connectors as required. Return to step **1** to confirm elimination of fault.

3. Measure the resistance through the solenoid circuit.

Turn the ignition switch OFF.

Disconnect UCM connector X-CN2A.

Disconnect solenoid connector X-PLTLK.

Measure the resistance between X-CN2A pin 4 and chassis ground. The resistance should be greater than **20,000 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The resistance measurement is greater than **20,000 Ω**. Go to step **4**.

B. The resistance measurement is less than **20,000 Ω**. There is a short circuit to chassis ground in the wiring. Repair or replace the harness as required. Return to step **1** to confirm elimination of the fault.

4. Measure the solenoid resistance.

5124-Right Joystick F-B Axis - In Range Fault

L218 TIER 4B Final [NDM449275 -]	NA Electro hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Electro hydraulic controls

Context:

Diagnostic Trouble Code 5124 has an error priority of Amber.

Limp Home Ground Drive operating mode is enabled with Diagnostic Trouble Code 5124.

Cause:

The UCM has sensed that the Right Joystick F-B signal has failed. The fault is active while the voltage on X-CN4A pin 17 and X-CN1B pin 13 is less than **0.2 V** or the voltage is greater than **4.8 V**.

Normal operating voltage of the sensor output is **0.5 V** to **4.5 V**. Output of the sensor in the neutral position is approximately **2.5 V**.

Possible failure modes:

1. An open circuit in the signal wire.
2. A short circuit in the signal wire.
3. Failure of the Right Hand Control Module.
4. The UCM has an internal failure.

Solution:

1. Verify that the fault code is active.

Connect the Electronic Service Tool to the service tool connector.

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

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

B. Fault code 5124 is recorded again. Go to step 2.

2. Verify that the wiring and connectors are free of damage.

Inspect the UCM and the Right Joystick connections. All connections should be secure, tight, free of corrosion, abrasion and damage.

Inspect the harness from the UCM to the Right Joystick. Verify that the harness is free of damage, corrosion, abrasion and incorrect attachment.

A. The connectors are secure and the harness is free of damage. Go to step 3.

B. The connectors or the harness has damage. Repair or replace the harness or connectors as required. Return to step 1 to confirm elimination of fault.

3. Measure the voltage of the signal wire to chassis ground.

Turn the ignition switch OFF.

Disconnect UCM connectors X-CN4A and X-CN1B. Disconnect the Right Joystick connector X-UJMR.

Turn the ignition switch ON.

Measure the voltage between X-UJMR pin 3 and chassis ground. The voltage should be less than **0.5 V**. Wiggle the harness during measurement to reveal an intermittent condition.

Measure the voltage between X-UJMR pin 9 and chassis ground. The voltage should be less than **0.5 V**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The voltage is less than **0.5 V**. Go to step 4.

Wiring harnesses - Electrical schematic sheet 17 Right Hand Control Handle - EH Units (55.100.DP-C.20.E.17)

Medium EH machines

Wiring harnesses - Electrical schematic sheet 19 Unit Control Module - EH Units (55.100.DP-C.20.E.19)

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module - EH Units (55.100.DP-C.20.E.20)

Wiring harnesses - Electrical schematic sheet 13 Bulkhead Connection - EH Units (55.100.DP-C.20.E.13)

Wiring harnesses - Electrical schematic sheet 14 Bulkhead Connection - EH Units (55.100.DP-C.20.E.14)

Case machines

Wiring harnesses - Electrical schematic sheet 17 Right Hand Control Handle - EH Units (55.100.DP-C.20.E.17)

New Holland machines

Wiring harnesses - Electrical schematic sheet 17 Right Hand Control Handle - EH Units (55.100.DP-C.20.E.17)

Turn the ignition switch OFF.

Disconnect UCM connector X-CN4B.

Disconnect connector X-403.

Measure the resistance between X-CN4B pin 21 and chassis ground. The resistance should be greater than **20,000 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The resistance is greater than **20,000 Ω**. Go to step 5.

B. The resistance is less than **20,000 Ω**. There is a short circuit to chassis ground. Repair or replace the harness as required. Return to step 1 to confirm elimination of the fault.

5. Check for an open circuit in the signal wire.

Fabricate a jumper that will connect between X-403 pin 11 and chassis ground.

Connect the jumper wire between X-403 pin 11 and chassis ground. The chassis ground connection must be clean and free of paint, dirt, oil, and grease.

Measure the resistance between X-CN4B pin 21 and chassis ground. The resistance should be less than **10 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The resistance is less than **10 Ω**. Go to step 6.

B. The resistance is greater than **10 Ω**. There is an open circuit in the signal wire. Repair or replace the harness as required. Return to step 1 to confirm elimination of the fault.

6. Test the UCM.

Disconnect the jumper wire.

Reconnect UCM connector X-CN1B.

Remove pin 10 and pin 11 from connector X-403.

Use a jumper wire with alligator clips to short X-403 pin 10 to X-403 pin 11.

Reconnect X-403 on to the joystick.

Turn the ignition switch ON.

Use EST to access the fault code screen. Fault code 5144 should no longer be active. Fault code 5145 is now active.

A. Fault code 5144 is no longer active. Fault code 5145 is now active. Replace the aux thumbwheel and retest. Return to step 1 to confirm elimination of the fault.

B. Fault code 5144 is active. Fault code 5145 did not become active. Replace the UCM and retest. Return to step 1 to confirm elimination of the fault.

Small EH machines

Wiring harnesses - Electrical schematic sheet 19 Unit Control Handle - EH Units (55.100.DP-C.20.E.19)

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module - EH Units (55.100.DP-C.20.E.20)

Wiring harnesses - Electrical schematic sheet 13 Bulkhead Connection - EH Units (55.100.DP-C.20.E.13)

Wiring harnesses - Electrical schematic sheet 14 Bulkhead Connection - EH Units (55.100.DP-C.20.E.14)

Case machines

Wiring harnesses - Electrical schematic sheet 17 Right Hand Control Handle - EH Units (55.100.DP-C.20.E.17)

New Holland machines

Wiring harnesses - Electrical schematic sheet 17 Right Hand Control Handle - EH Units (55.100.DP-C.20.E.17)

Medium EH machines

Wiring harnesses - Electrical schematic sheet 19 Unit Control Module - EH Units (55.100.DP-C.20.E.19)

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module - EH Units (55.100.DP-C.20.E.20)

Wiring harnesses - Electrical schematic sheet 13 Bulkhead Connection - EH Units (55.100.DP-C.20.E.13)

Wiring harnesses - Electrical schematic sheet 14 Bulkhead Connection - EH Units (55.100.DP-C.20.E.14)

Case machines

B. The voltage is greater than **0.5 V**. There is a short circuit to another voltage source. Repair or replace the harness as required. Return to step **1** to confirm elimination of fault.

4. Measure the resistance of the signal wire to chassis ground.

Turn the ignition switch OFF.

Disconnect the UCM connector X-CN4A and X-CN2B. Disconnect the Left Joystick connector X-UJML.

Measure the resistance of X-UJML pin 2 to chassis ground. The resistance should be greater than **20,000 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

Measure the resistance of X-UJML pin 8 to chassis ground. The resistance should be greater than **20,000 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The resistance is greater than **20,000 Ω**. Go to step **5**.

B. The resistance is less than **20,000 Ω**. There is a short circuit to chassis ground. Repair or replace the harness as required. Return to step **1** to confirm elimination of fault.

5. Measure the resistance of the signal wire.

Use a jumper wire with alligator clips on both ends to short connector X-CN4A pin 25 to chassis ground. The chassis ground connection must be clean and free of rust, dirt, oil and paint.

Measure the resistance between connector X-UJML pin 2 to chassis ground. The resistance should be less than **10 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

Connect the jumper wire between connector X-CN2B pin 14 and chassis ground. The chassis ground connection must be clean and free of rust, dirt, oil and paint.

Measure the resistance between connector X-UJML pin 8 to chassis ground. The resistance should be less than **10 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The resistance is less than **10 Ω**. Go to step **6**.

B. The resistance is greater than **10 Ω**. There is an open circuit in the signal wire. Repair or replace the harness as required. Return to step **1** to confirm elimination of fault.

6. Measure the voltage to the sensor.

Turn the ignition switch OFF.

Disconnect the Left Joystick connector X-UJML. Reconnect the UCM connector(s).

Turn the ignition switch ON.

Measure the voltage between X-UJML pin 1 and X-UJML pin 4. The voltage should be approximately **5 V**. Wiggle the harness during measurement to reveal an intermittent condition.

Measure the voltage between X-UJML pin 7 and X-UJML pin 10. The voltage should be approximately **5 V**. Wiggle the harness during measurement to reveal an intermittent condition.

5215-Left Joystick F-B Axis - Pin B Short to Power

L218 TIER 4B Final [NDM449275 -]	NA Electro hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Electro hydraulic controls

Context:

Diagnostic Trouble Code 5215 has an error priority of Amber.

Limp home ground drive operating mode is enabled with Diagnostic Trouble Code 5215.

Cause:

The UCM has sensed that the signal has failed high. The fault is active when the ignition is ON and the voltage is greater than **4.8 V**.

Possible failure modes:

1. Shorted wire in the circuit.
2. Failure of the Left Hand Control Module.
3. The UCM has an internal failure.

Solution:

1. Verify that the fault code is active.

Connect the Electronic Service Tool to the service tool connector.

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

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

B. Fault code 5215 is recorded again. Go to step **2**.

2. Verify that the wiring and connectors are free of damage.

Inspect the UCM and the Left Joystick connections. All connections should be secure, tight, free of corrosion, abrasion and damage.

Inspect the harness from the UCM to the Left Joystick. Verify that the harness is free of damage, corrosion, abrasion and incorrect attachment.

A. The connectors are secure and the harness is free of damage. Go to step **3**.

B. The connectors or the harness has damage. Repair or replace the harness or connectors as required. Return to step **1** to confirm elimination of fault.

3. Measure the voltage on the signal wire to chassis ground.

Turn the ignition switch OFF.

Disconnect the UCM connector X-CN2B. Disconnect the Left Joystick connector X-UJML.

Turn the ignition switch ON.

Measure the voltage of X-UJML pin 9 to chassis ground. The voltage should be less than **0.5 V**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The voltage is less than **0.5 V**. Go to step **4**.

B. The voltage is greater than **0.5 V**. There is a short circuit to another voltage source. Repair or replace the harness as required. Return to step **1** to confirm elimination of fault.

4. Measure the resistance of the signal wire.

Use a jumper wire with alligator clips on both ends to short connector X-CN2B pin 31 to chassis ground. The chassis ground connection must be clean and free of rust, dirt oil and paint.

Disconnect UCM connectors X-CN3A and X-CN2B.

Measure the resistance between X-CN3A pin 22 and chassis ground. The resistance should be greater than **20,000 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

Measure the resistance between X-CN2B pin 7 and chassis ground. The resistance should be greater than **20,000 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The resistance is greater than **20,000 Ω**. Temporarily replace the UCM and retest. Return to step **1** to confirm elimination of the fault.

B. The resistance is less than **20,000 Ω**. There is a short circuit in the wiring. Repair or replace the harness as required. Return to step **1** to confirm elimination of the fault.

F5H engine

Wiring harnesses - Electrical schematic sheet 19 Unit Control Module, EH Units (55.100.DP-C.20.E.19)

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module, EH Units (55.100.DP-C.20.E.20)

Wiring harnesses - Electrical schematic sheet 11 Loader Valve and Sensors, EH Units (55.100.DP-C.20.E.11)

Small EH machines ISM engine

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module - EH Units (55.100.DP-C.20.E.20)

Wiring harnesses - Electrical schematic sheet 11 Loader Valve And Sensors - EH Units (55.100.DP-C.20.E.11)

Medium EH machines ISM engine

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module - EH Units (55.100.DP-C.20.E.20)

Wiring harnesses - Electrical schematic sheet 11 Loader Valve And Sensors - EH Units (55.100.DP-C.20.E.11)

- B. One or more of the voltage measurements are greater than **0.5 V**. There is a short circuit to another voltage source. Repair or replace the harness or connectors as required. Return to step **1** to confirm elimination of fault.

F5H engine

Wiring harnesses - Electrical schematic sheet 19 Unit Control Module, EH Units (55.100.DP-C.20.E.19)

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module, EH Units (55.100.DP-C.20.E.20)

Wiring harnesses - Electrical schematic sheet 11 Loader Valve and Sensors, EH Units (55.100.DP-C.20.E.11)

Small EH machines ISM engine

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module - EH Units (55.100.DP-C.20.E.20)

Wiring harnesses - Electrical schematic sheet 11 Loader Valve And Sensors - EH Units (55.100.DP-C.20.E.11)

Medium EH machines ISM engine

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module - EH Units (55.100.DP-C.20.E.20)

Wiring harnesses - Electrical schematic sheet 11 Loader Valve And Sensors - EH Units (55.100.DP-C.20.E.11)

Schematic legend			
(1)	EHF Extend UCM Connector X-CN3A pin 19	(4)	EHF Extend Connector X-19
(2)	EHF Return UCM Connector X-CN2B pin 8	(5)	EHF Retract Connector X-40
(3)	EHF Retract UCM Connector X-CN3A pin 6		

(1) Inspect the UCM and EHF Extend solenoid connections. All connections should be secure, tight, free of corrosion, abrasion and damage.

(2) Inspect the harness from the UCM to the EHF Extend solenoid. Verify that the harness is free of damage, corrosion, abrasion and incorrect attachment.

A. The connectors are secure and the harness is free of damage. Go to Step 3.

B. The connectors or the harness has damage. Repair or replace the harness or connectors as required. Return to Step 1 to confirm elimination of fault.

3. Measure the resistance through the harness.

(1) Fabricate a jumper wire that will connect between the EHF Extend solenoid connector X-19 pin 1 and X-19 pin 2.

(2) Turn the key switch OFF.

(3) Disconnect UCM connectors X-CN3A and X-CN2B.

(4) Use the jumper wire to short X-19 pin 1 to X-19 pin 2.

(5) Measure the resistance between X-CN3A pin 19 and X-CN2B pin 8. The resistance should be less than **10 Ω**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The resistance is less than **10 Ω**. Go to Step 4.

B. The resistance is greater than **10 Ω**. There is an open circuit in the solenoid signal or solenoid ground line. Check splice SP-193. Repair or replace the harness as required. Return to Step 1 to confirm elimination of the fault.

4. Test UCM

(1) Leave the jumper wire installed between X-19 pin 1 and X-19 pin 2

(2) Reconnect UCM connectors X-CN3A and X-CN2B.

(3) Turn the key switch ON.

(4) Activate the hydraulics while monitoring the fault code screen. Fault code 5371 should no longer be active. Fault code 5372 should become active.

A. Fault code 5372 is active and fault code 5371 is no longer active. Temporarily replace the solenoid and retest. Return to Step 1 to confirm elimination of the fault.

B. Fault code 5371 is still active. Fault code 5372 did not become active. Temporarily replace the UCM and retest. Return to Step 1 to confirm elimination of the fault.

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module, EH Units (55.100.DP-C.20.E.20)

Wiring harnesses - Electrical schematic sheet 32 Enhanced High Flow, EH Units (55.100.DP-C.20.E.32)

Wiring harnesses - Electrical schematic sheet 19 Unit Control Module, EH Units (55.100.DP-C.20.E.19)

5501-Loader Arm Spool Sensor - Sensor Short to Ground/ Open Circuit

L218 TIER 4B Final [NDM449275 -]	NA Electro hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Electro hydraulic controls

Context:

Diagnostic Trouble Code 5501 has an error priority of White.

Limp home loader functions are enabled while Diagnostic Trouble Code 5501 is active.

Cause:

The UCM has sensed that the loader position sensor signal, X-CN3B pin 13 has failed low. The fault is active when the engine is ON and loader position sensor signal is less than **0.2 V**.

Possible failure modes:

1. Short circuit in the wiring.
2. Open circuit in the wiring.
3. The loader valve spool sensor has failed.
4. The UCM has an internal failure.

Solution:

1. Verify that the fault code is active.

Connect the Electronic Service Tool to the service tool connector.

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

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

B. Fault code 5501 is recorded again. Go to step **2**.

2. Verify that the wiring and connectors are free of damage.

Inspect the UCM, the loader solenoid and loader position sensor connection. All connections should be secure, tight, free of corrosion, abrasion, and damage.

Inspect the harness from the UCM to the loader solenoids and loader position sensor. Verify that the harness is free of damage, corrosion, abrasion, and incorrect attachment.

A. The connectors are secure and the harness is free of damage. Go to step **3**.

B. The connectors or the harness has damage. Repair or replace the harness or connectors as required. Return to step **1** to confirm elimination of fault.

3. Measure the voltage at the sensor.

Disconnect the loader position sensor.

Turn the ignition switch ON.

Measure the voltage between X-22 pin 1 and X-22 pin 3. The voltage should be approximately **5 V**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The voltage is approximately **5 V**. Go to step **4**.

B. The voltage is less the **4.5 V**. There is a problem in the supply voltage to the sensor. Check UCM connector X-CN1A pin 8. Verify the chassis ground connection from X-10 is secure. Repair or replace the harness as required. Return to step **1** to confirm elimination of the fault.

4. Measure the resistance of the signal wire to chassis ground.

Wiring harnesses - Electrical schematic sheet 20 Unit Control Module - EH Units (55.100.DP-C.20.E.20)
Wiring harnesses - Electrical schematic sheet 11 Loader Valve And Sensors - EH Units (55.100.DP-C.20.E.11)

5701-Pattern Switch - Short to Ground/ Open Circuit

L218 TIER 4B Final [NDM449275 -]	NA Electro hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Electro hydraulic controls

Context:

Diagnostic Trouble Code 5701 has an error priority of White.

The selected joystick pattern is locked and cannot be changed while Diagnostic Trouble Code 5701 is active.

Cause:

The UCM has sensed the voltage at X-CN1B pin 15, X-CN2B pin 20 and X-CN2B pin 21 is less than **1.5 V**.

Possible failure modes:

1. Shorted wire in circuit.
2. Open wire in circuit.
3. Faulty Drive Pattern Select Switch.
4. UCM has internal failure.

Solution:

1. Verify that the fault code is active.

Connect the Electronic Service Tool to the service tool connector.

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

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

B. Fault code 5701 is recorded again. Go to step **2**.

2. Verify that the wiring and connectors are free of damage.

Inspect the UCM and Drive Pattern Selector Switch connections. All connections should be secure, tight, free of corrosion, abrasion and damage.

Inspect the harness from the UCM to the Drive Pattern Selector Switch. Verify that the harness is free of damage, corrosion, abrasion and incorrect attachment.

A. The connectors are secure and the harness is free of damage. Go to step **3**.

B. The connectors or the harness has damage. Repair or replace the harness or connectors as required. Return to step **1** to confirm elimination of fault.

3. Measure the voltage at the switch.

Turn the ignition switch OFF.

Remove the Drive Pattern Switch (ISO/ H Pattern) from the right hand post.

Turn the ignition switch ON.

Measure the voltage from X-95 pin 5 to chassis ground. The voltage should be approximately **12 V**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The voltage is approximately **12 V**. Go to step **4**.

B. The voltage is less than **10 V**. There is a problem in the battery supply to the switch. Repair as required. Return to step **1** to confirm elimination of fault.

4. Measure the resistance of the signal wire to chassis ground.

Turn the ignition switch OFF.

9156-Hyd Enable Switch - Hyd Enable Button Error from AIC

L218 TIER 4B Final [NDM449275 -]	NA Electro hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Electro hydraulic controls

Context:

Diagnostic Trouble Code 9156 has an error priority of amber.

Loader limp home and ground drive limp home operating modes are enabled while Diagnostic Trouble Code 9156 is active.

Cause:

The UCM is receiving conflicting information about the hydraulic enable button. The fault is active when the ignition is on and hydraulic enable pin voltage is opposite of value transmitted from instrument cluster.

Possible failure modes:

1. Shorted wire in circuit.
2. Open wire in circuit.
3. Failure of the instrument cluster.
4. Failure of the UCM.

Solution:

1. Verify that the fault code is active.

Connect the Electronic Service Tool to the service tool connector.

To check for fault code: Start and operate machine.

- A. The fault code is not recorded again. OK to return the machine to service.
- B. Fault code 9156 is recorded again. Go to **1350-Hyd Enable Switch - Implausible State (Hardwire vs CAN) (55.640)**.

9406-CAN - Can Communication Lost (EH Machines): Loss Of All CAN Communication From UCM

L218 TIER 4B Final [NDM449275 -]	NA Electro hydraulic controls
L220 TIER 4B Final [NDM456673 -]	NA Electro hydraulic controls

Context:

CAN bus communications between modules on the data link have been lost. This fault code may be displayed with other CAN bus fault code messages.

Cause:

CAN bus communications between modules on the data link have been lost.

Possible failure modes:

1. CAN data link wiring or circuits open.
2. CAN data link wiring or circuits shorted.
3. Faulty CAN Data Link device.
4. Faulty instrument cluster.
5. Faulty ECU.

Solution:

1. Verify that the fault code is active.

Use the Electronic Service Tool to verify that the CAN data link faults are ACTIVE.

To check for fault codes: Start and operate the machine. Wiggle the harness to reveal an intermittent condition.

If three or more fault codes are active, such as 1051 through 1059 or 3096, 3334, 3339 or 3358, this is an indication of a problem in the CAN bus circuit, continue with this procedure. If one or two CAN bus fault codes are active, this is an indication of an intermittent connection in the CAN circuit. Check the wiring and connectors to verify they are secure and free of damage, corrosion, abrasion or incorrect attachment.

- A. CAN bus fault codes are not recorded again and are no longer ACTIVE. OK to return the machine to service.
- B. CAN bus fault codes are present and ACTIVE. Refer to **1051-Timeout of CAN message EEC1, 5 seconds without message (55.408)**

Arm - Repair

L218	
L220	

When the pivot pins fail or the retaining hardware for the bucket release device or the bucket cylinders is loose for an extended period of time, the tapered hole in the bosses become damaged and requires replacement. In this procedure, you will find directions for replacing the upper and lower bosses on the loader arm. Bosses are to be replaced only one at a time. Do not attempt to replace more than one boss at the same time. You will not be able to use the boss alignment tool, part number **380100288**, which is required for this procedure if you attempt to replace more than one boss at a time. All welding procedures are to be performed by a certified welder. Protect your work area from moisture, low temperatures, and excessive wind when repairing the bosses on the loader arm.

Prior operation:

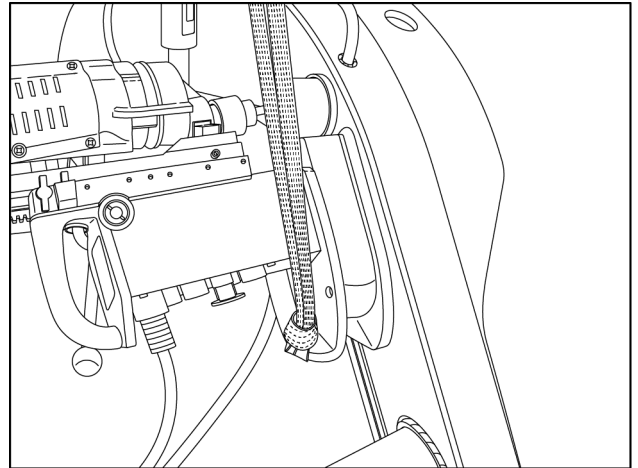
Bucket release device - Remove (82.300)

Prior operation:

Remove the bucket cylinders.

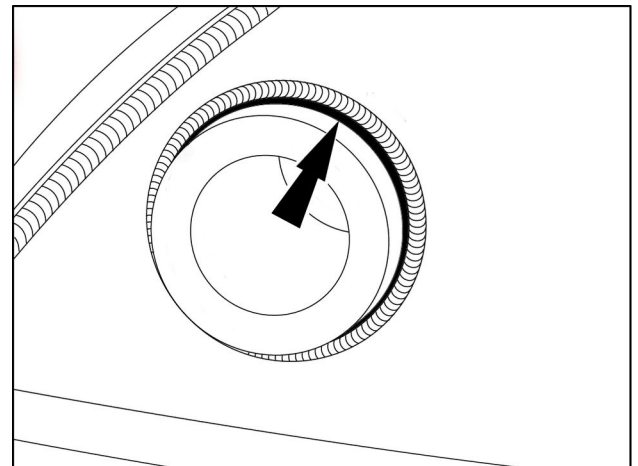
Upper boss repair

1. Attach a magnetic hole drill to the loader arm.



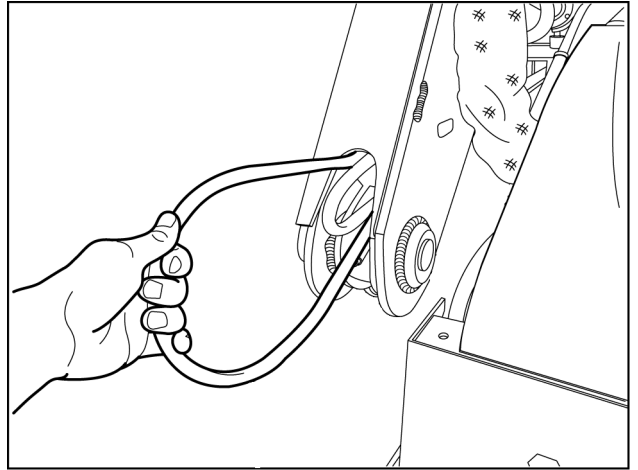
RAIL14SSL0303BA 1

2. Cut the welds that attach the boss to the loader arm.



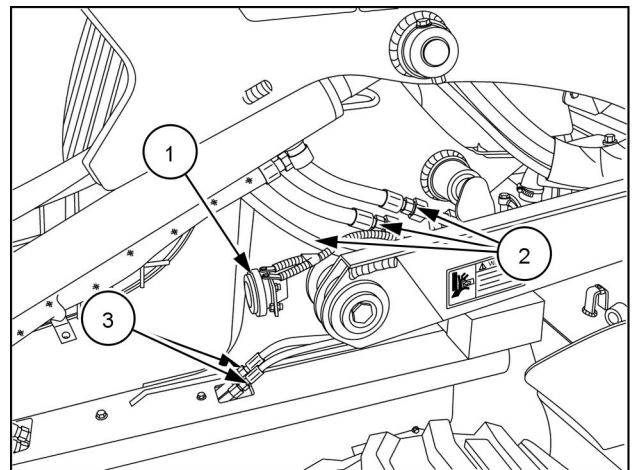
RAIL14SSL0304BA 2

11. Push the hydraulic coupler hoses through the loader arm (if applicable).



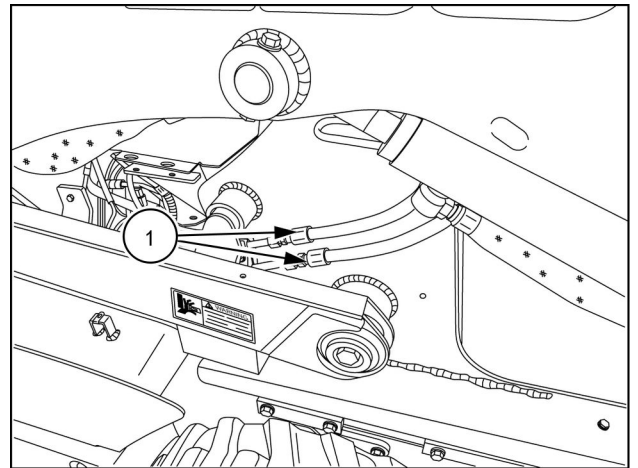
RAPH15SSL0014BA 7

12. Connect the auxiliary hoses (2).
13. Install the horn (1).
14. Connect the hydraulic coupler hoses (3) (if applicable).



RAPH12SSL0323AA 8

15. Connect the bucket cylinder hoses (1).



RAPH12SSL0313AA 9

16. Remove the lifting device.

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