750M
Tier 4A (interim)
Crawler Dozer

PIN NCDC75000 and above; PIN NDDC70000 and above;
PIN NEDC70000 and above; PIN NFDC70000 and above;
PIN NFC101000 and above

SERVICE MANUAL

Part number 51418565
2nd edition English
November 2017
Replaces part number 47907863

CASE

Torque - Standard torque data for hydraulics

NOTICE: *Hydraulic connections require a minimum assembly torque in order to provide zero leakage at rated pressure with adequate fatigue resistance. Too much torque on a hydraulic connection can lead to leakage or failure.*

NOTICE: *There are several different kinds of parallel thread ports, including those using metric threads, inch threads, and British Standard Pipe Parallel (BSPP) threads. None of these port systems are interchangeable, and using the wrong connector in a port will not provide an adequate seal, even if it is possible to install the part.*

NOTE: *Hand install and hand tighten all connections before using tools to set the torque. This will reduce the possibility of thread damage.*

Torques for Metric O-Ring Boss (ORB) stud ends and port connections

Metric Thread	S-Series (Heavy Duty)		L-Series (Light Duty)	
	Ferrous	Non-Ferrous	Ferrous	Non-Ferrous
M8x1	**10.5 N·m (7.7 lb ft)**	**6.3 N·m (4.6 lb ft)**	**8.5 N·m (6.3 lb ft)**	**5 N·m (3.7 lb ft)**
M10x1	**21 N·m (15.5 lb ft)**	**12.5 N·m (9.2 lb ft)**	**15.5 N·m (11.4 lb ft)**	**9.3 N·m (6.9 lb ft)**
M12x1.5	**37 N·m (27.3 lb ft)**	**22 N·m (16.2 lb ft)**	**27 N·m (19.9 lb ft)**	**16 N·m (11.8 lb ft)**
M14x1.5	**47 N·m (34.7 lb ft)**	**28 N·m (20.7 lb ft)**	**37 N·m (27.3 lb ft)**	**22 N·m (16.2 lb ft)**
M16x1.5	**58 N·m (42.8 lb ft)**	**35 N·m (25.8 lb ft)**	**42 N·m (31.0 lb ft)**	**25 N·m (18.4 lb ft)**
M18x1.5	**74 N·m (54.6 lb ft)**	**44 N·m (32.5 lb ft)**	**47 N·m (34.7 lb ft)**	**28 N·m (20.7 lb ft)**
M22x1.5	**105 N·m (77.4 lb ft)**	**63 N·m (46.5 lb ft)**	**63 N·m (46.5 lb ft)**	**38 N·m (28.0 lb ft)**
M27x2	**178 N·m (131.3 lb ft)**	**107 N·m (78.9 lb ft)**	**105 N·m (77.4 lb ft)**	**63 N·m (46.5 lb ft)**
M30x2	**225 N·m (166.0 lb ft)**	**135 N·m (99.6 lb ft)**	**136 N·m (100.3 lb ft)**	**82 N·m (60.5 lb ft)**
M33x2	**325 N·m (239.7 lb ft)**	**195 N·m (143.8 lb ft)**	**168 N·m (123.9 lb ft)**	**101 N·m (74.5 lb ft)**
M42x2	**345 N·m (254.5 lb ft)**	**207 N·m (152.7 lb ft)**	**220 N·m (162.3 lb ft)**	**132 N·m (97.4 lb ft)**
M48x2	**440 N·m (324.5 lb ft)**	**264 N·m (194.7 lb ft)**	**273 N·m (201.4 lb ft)**	**164 N·m (121.0 lb ft)**
M60x2	**525 N·m (387.2 lb ft)**	**315 N·m (232.3 lb ft)**	**330 N·m (243.4 lb ft)**	**198 N·m (146.0 lb ft)**
NOTE: *Final torque tolerance +/– **10%** of the given torque specification.*				

Torques for Metric O-Ring Boss (ORB) port plugs

Metric Thread	Ferrous		Non-Ferrous
	Internal Hex	External Hex	
M8x1	**8.5 N·m (6.3 lb ft)**	**10.5 N·m (7.7 lb ft)**	**6.3 N·m (4.6 lb ft)**
M10x1	**16 N·m (11.8 lb ft)**	**21 N·m (15.5 lb ft)**	**12.5 N·m (9.2 lb ft)**
M12x1.5	**23 N·m (17.0 lb ft)**	**37 N·m (27.3 lb ft)**	**22 N·m (16.2 lb ft)**
M14x1.5	**47 N·m (34.7 lb ft)**		**28 N·m (20.7 lb ft)**
M16x1.5	**58 N·m (42.8 lb ft)**		**35 N·m (25.8 lb ft)**
M18x1.5	**74 N·m (54.6 lb ft)**		**44 N·m (32.5 lb ft)**
M22x1.5	**105 N·m (77.4 lb ft)**		**63 N·m (46.5 lb ft)**
M27x2	**178 N·m (131.3 lb ft)**		**107 N·m (78.9 lb ft)**
M30x2	**225 N·m (166.0 lb ft)**		**135 N·m (99.6 lb ft)**
M33x2	**325 N·m (239.7 lb ft)**		**195 N·m (143.8 lb ft)**
M42x2	**345 N·m (254.5 lb ft)**		**207 N·m (152.7 lb ft)**
M48x2	**440 N·m (324.5 lb ft)**		**264 N·m (194.7 lb ft)**
M60x2	**525 N·m (387.2 lb ft)**		**315 N·m (232.3 lb ft)**
NOTE: *Final torque tolerance +/– **10%** of the given torque specification.*			

Torque values for inch O-Ring Boss (ORB) port plugs

		Ferrous		Non-Ferrous
SAE dash size	UN/UNF thread size	Internal hex N·m (lb ft) ± 10%	External hex N·m (lb ft) ± 10%	N·m (lb ft) ± 10%
2	5/16-24	7.5 (5.5)	12.5 (9.2)	7.5 (5.5)
3	3/8-24	14.5 (10.7)	21 (15.5)	12.5 (9.2)
4	7/16-20	21 (15.5)	37 (27.3)	22 (16.2)
5	1/2-20	28 (20.7)	42 (31)	25 (18.4)
6	9/16-18	47 (34.7)	47 (34.7)	28 (20.7)
8	3/4-16	89 (65.6)	89 (65.6)	53 (39.1)
10	7/8-14	116 (85.6)	116 (85.6)	70 (51.6)
12	1-1/16-12	176 (129.8)	176 (129.8)	106 (78.2)
14	1-3/16-12	247 (182.2)	247 (182.2)	148 (109.2)
16	1-5/16-12	284 (209.5)	284 (209.5)	170 (125.4)
20	1-5/8-12	357 (263.3)	357 (263.3)	214 (157.8)
24	1-7/8-12	441 (325.3)	441 (325.3)	265 (195.5)
32	2-1/2-12	536 (395.3)	536 (395.3)	322 (237.5)

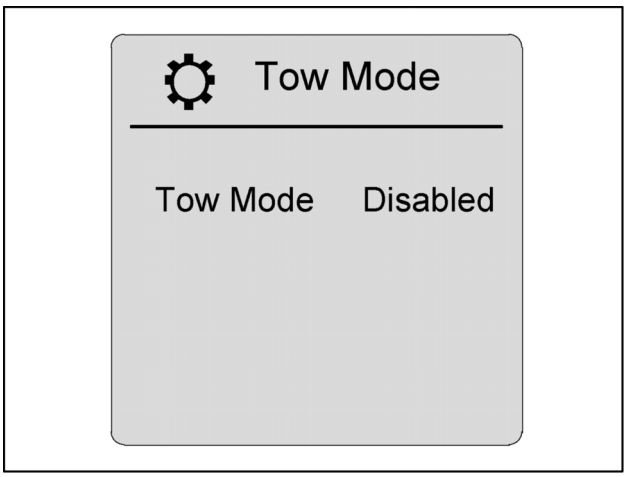
Torque values for four-bolt flange connections (Metric Screws, Class 10.9)

Metric size mm	Imperial size in	Screw code 61	Code 61 N·m (lb ft) ± 10%	Screw code 62	Code 62 N·m (lb ft) ± 10%
13	1/2	M8 x 1.25	34 (25.1)	M8 x 1.25	34 (25.1)
19	3/4	M10 x 1.5	74 (54.6)	M10 x 1.5	74 (54.6)
25	1	M10 x 1.5	74 (54.6)	M12 x 1.75	137 (101)
32	1-1/4	M10 x 1.5	74 (54.6)	M12 x 1.75	137 (101)
				M14 x 1.5	189 (139.4)
38	1-1/2	M12 x 1.75	137 (101)	M16 x 2	310 (228.6)
51	2	M12 x 1.75	137 (101)	M20 x 2.5	575 (424.1)
64	2-1/2	M12 x 1.75	137 (101)	M24 x 3	575 (424.1)
76	3	M16 x 2	310 (228.6)	M30 x 3.5	680 (501.5)
89	3-1/2	M16 x 2	310 (228.6)	–	–
102	4	M16 x 2	310 (228.6)	–	–
127	5	M16 x 2	310 (228.6)	–	–

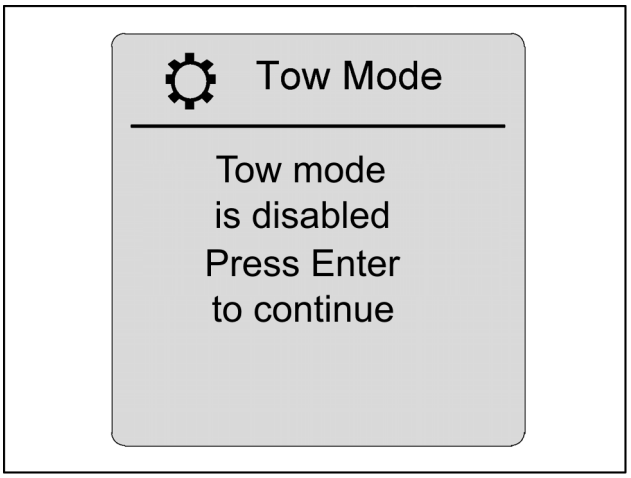
Torque values for four-bolt flange connections (Metric Screws, Class 8.8)

Metric size mm	Imperial size in	Screw code 61	Code 61 N·m (lb ft) ± 10%	Screw code 62	Code 62 N·m (lb ft) ± 10%
13	1/2	M8 x 1.25	29 (21.4)	M8 x 1.25	29 (21.4)
19	3/4	M10 x 1.5	57(42)	M10 x 1.5	57(42)
25	1	M10 x 1.5	57(42)	M12 x 1.75	100 (73.8)
32	1-1/4	M10 x 1.5	57(42)	M12 x 1.75	100 (73.8)
				M14 x 1.5	160 (118)
38	1-1/2	M12 x 1.75	100 (73.8)	M16 x 2	250 (184.4)
51	2	M12 x 1.75	100 (73.8)	M20 x 2.5	500 (368.8)
64	2-1/2	M12 x 1.75	100 (73.8)	M24 x 3	575 (424.1)
76	3	M16 x 2	250 (184.4)	M30 x 3.5	680 (501.5)
89	3-1/2	M16 x 2	250 (184.4)	–	–
102	4	M16 x 2	250 (184.4)	–	–
127	5	M16 x 2	250 (184.4)	–	–

9. Change the Tow Mode from “Enabled” to “Disabled” by highlighting and pressing the enter switch.



RAIL12DOZ0592AA 24

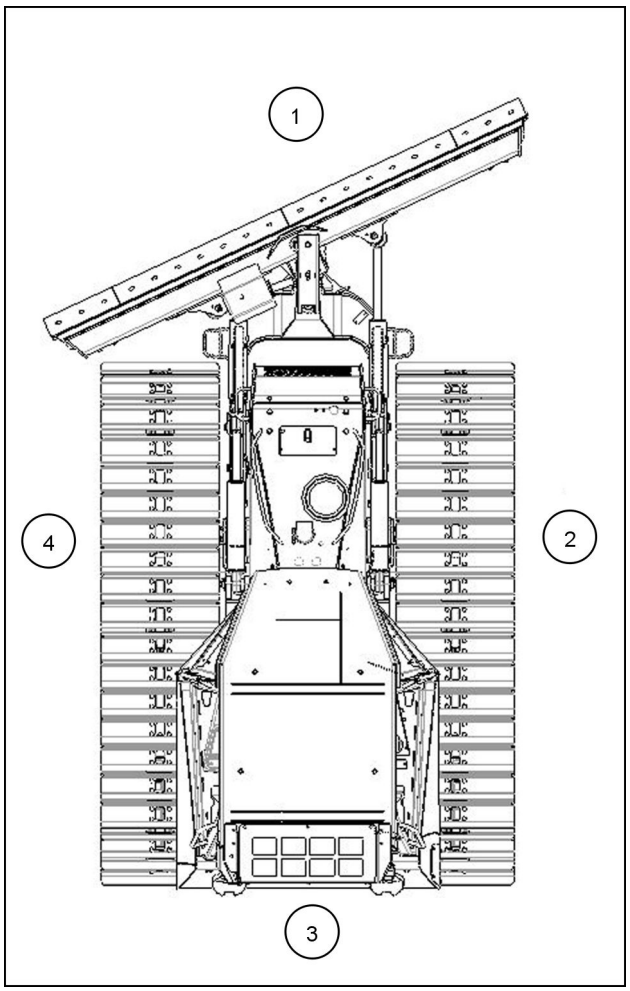


RAIL12DOZ0823AA 25

Product identification - Machine orientation

The terms right-hand, left-hand, front, and rear are used in this manual to indicate the sides as they are seen from the operator's seat.

1. Front
2. Right
3. Rear
4. Left



RAPH13DOZ0888CA 1

Contents

Engine - 10

Engine and crankcase - 001

SERVICE

Fuel-water separator filter - Drain fluid - Drain condensation

⚠ WARNING

Fuel vapors are explosive and flammable.
Do not smoke while handling fuel. Keep fuel away from flames or sparks. Shut off engine and remove key before servicing. Always work in a well-ventilated area. Clean up spilled fuel immediately. Failure to comply could result in death or serious injury.

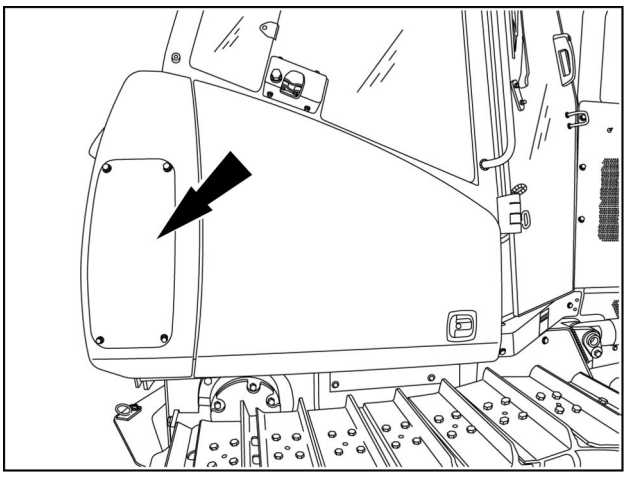
W0904A

Drain water and sediment from the fuel prefilter every 50 hours and every 50 thereafter or more often if conditions so require or if fuel quality is poor.

Prior operation:
Keep all unauthorized personnel clear of the area. Park the machine on level ground, in neutral with the parking brake applied, and the attachment lowered to the ground, turn off the engine, remove the key, and verify that engine components have cooled or avoid contact. Make sure that all residual pressure is relieved from circuits before beginning maintenance.

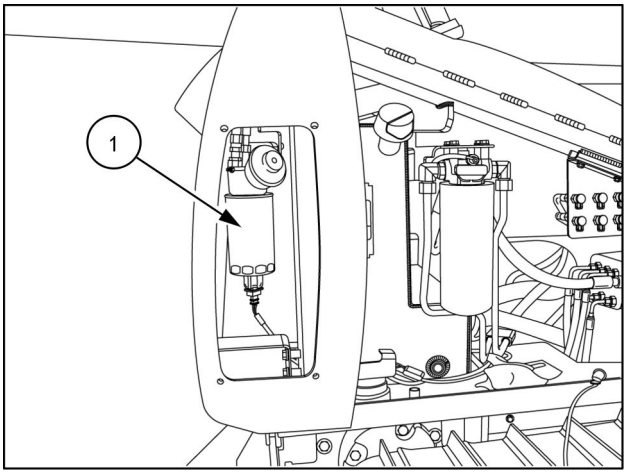
Drain fuel filter condensation

1. Locate the fuel prefilter behind the bolt-on access panel on the right-hand side of the machine.



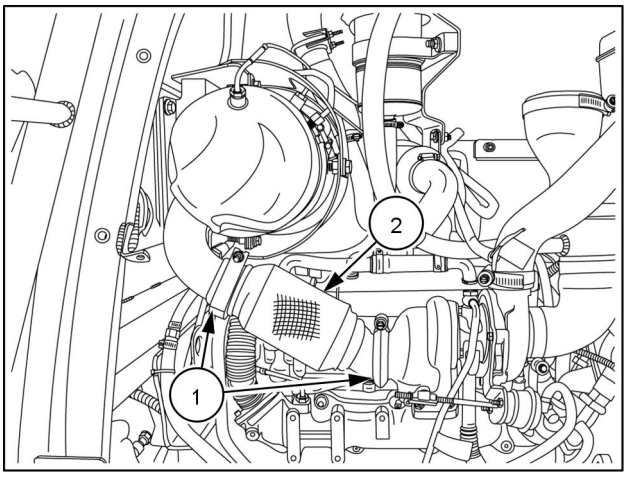
RAIL13DOZ0262AA 1

2. Remove the bolts and access panel to access the fuel prefilter **(1)**.



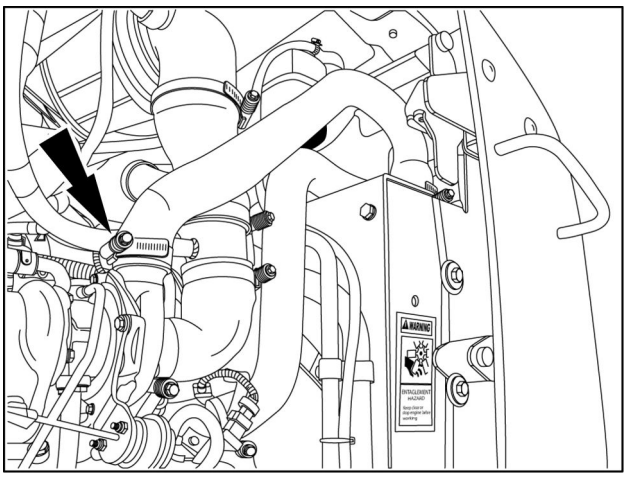
RAIL13DOZ0394AA 2

8. Remove two clamps **(1)** and remove turbocharger to diesel oxidation catalyst flex tube **(2)**. Close all openings to prevent contamination or damage.



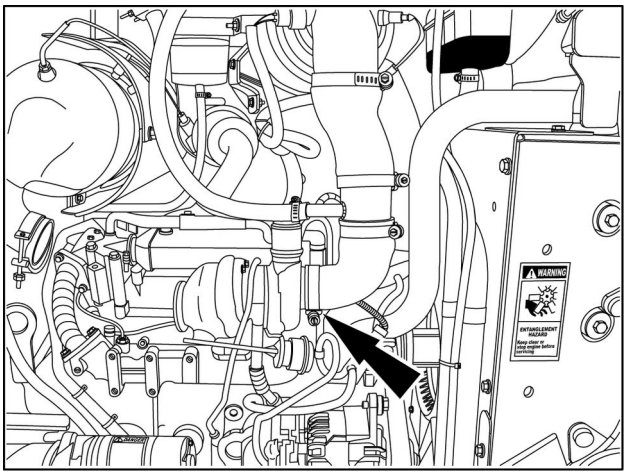
RAIL13DOZ0307BA 3

9. Loosen clamp and remove aftercooler tube from turbocharger. Close all openings.



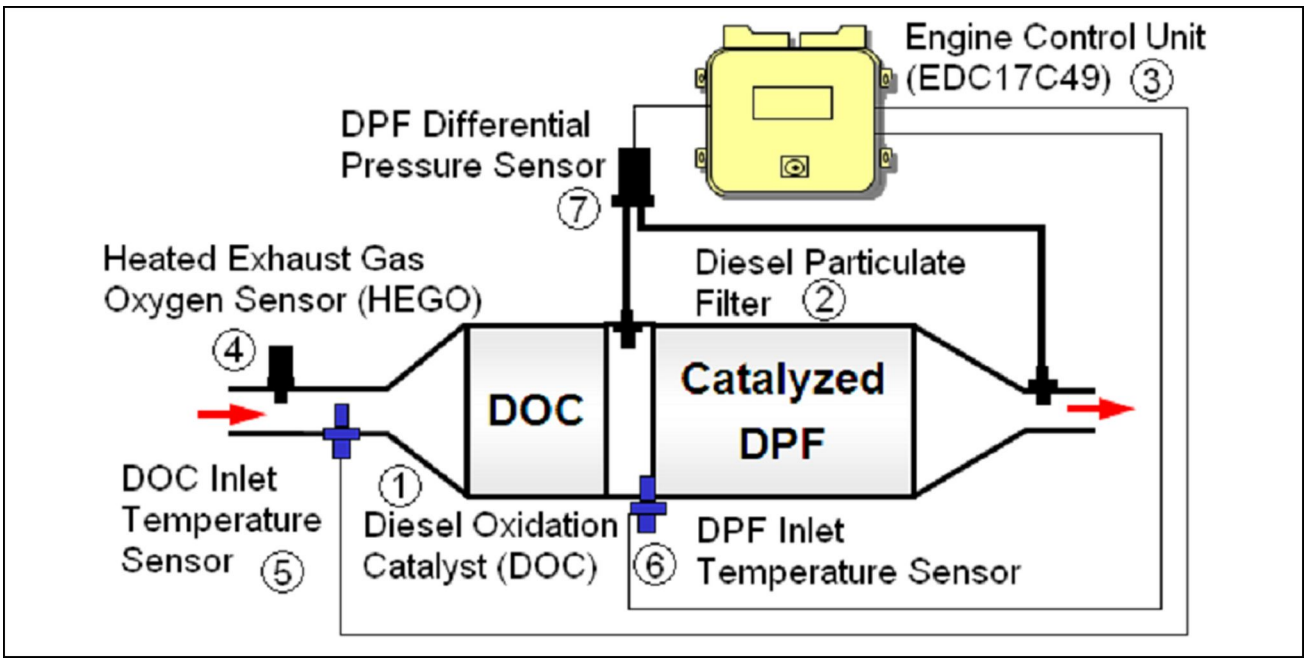
RAIL13DOZ0380AA 4

10. Loosen clamp and remove clean air tube from turbocharger. Close all openings.



RAIL13DOZ0382AA 5

NOTICE: *Always install new sealing washers between oil supply tube and turbocharger. Never reuse sealing washers.*

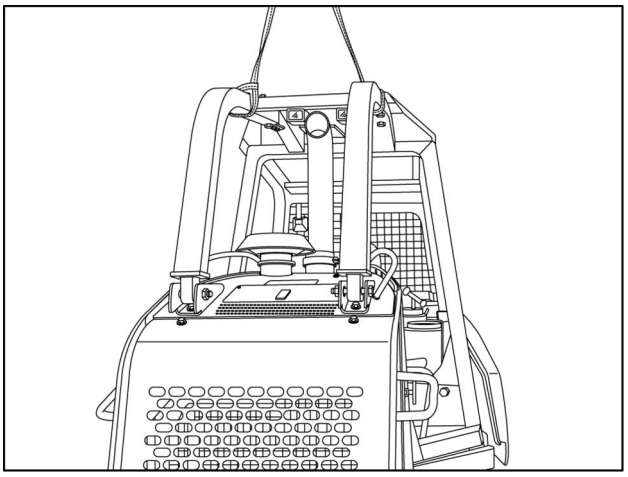


RAIL12TLB0079EA 9

Diagram #1

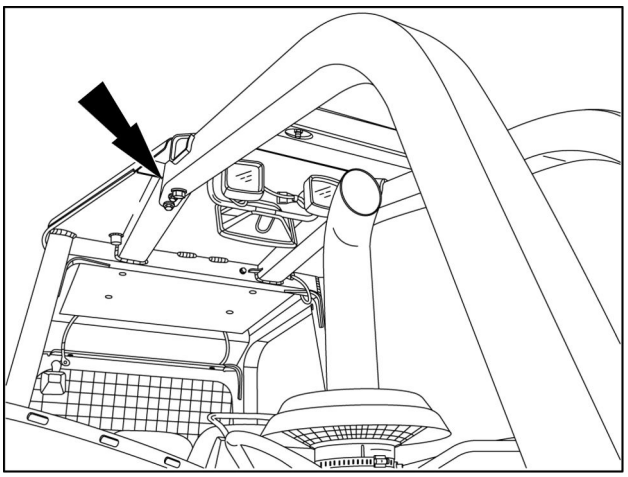
1. Diesel Oxidation Catalyst (DOC)	6. DPF Inlet Temperature Sensor
2. Diesel Particulate Filter (DPF)	7. DPF Differential Pressure Sensor
3. Engine Control Unit (EDC17C49)	8. DPF Inlet Pressure Sensor
4. Heated Exhaust Gas Oxygen Sensor (HEGO)	9. DPF Outlet Pressure Sensor
5. DOC Inlet Temperature Sensor	

8. Attach an appropriate lifting device to brush guard.



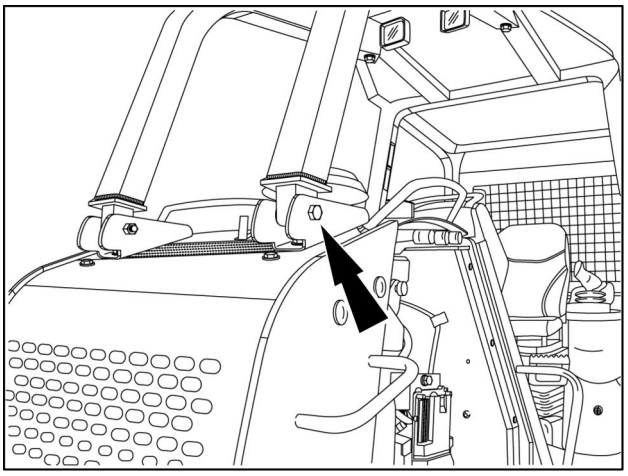
RAIL13DOZ0694AA 3

9. Remove two upper brush guard mounting bolts.



RAIL13DOZ0293BA 4

10. Remove two lower brush guard mounting bolts. Remove brush guard.



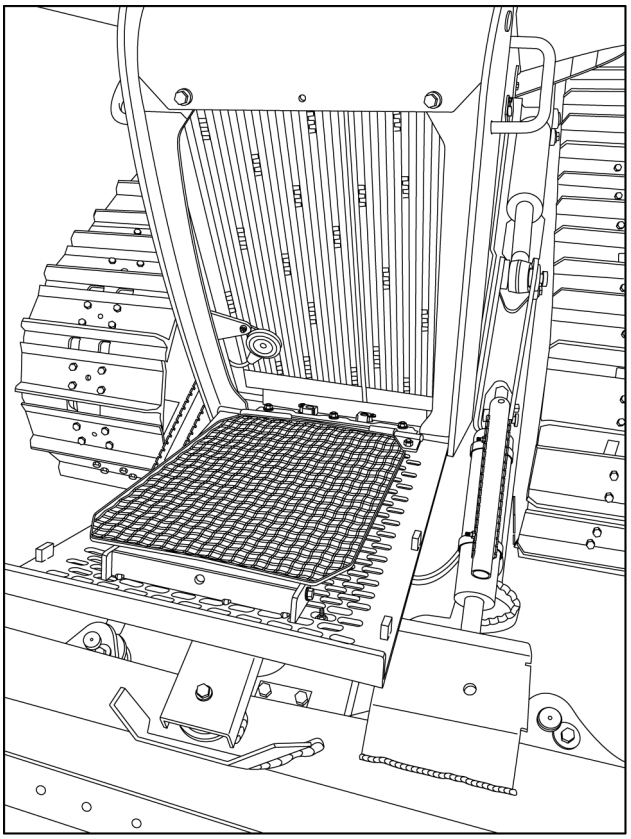
RAIL13DOZ0294BA 5

2. The coolant drain is located under the right side of the radiator. Remove the bolts that hold the grille in place. Tilt the grille out for access.

NOTE: *The panel is heavy, use care during access.*

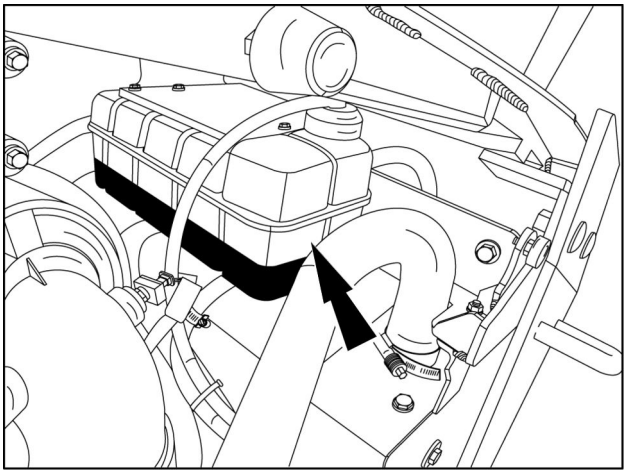
NOTE: *If the machine is so equipped, and the special draining equipment is available, use the engine coolant environmental drain. Locate the drain on the left-hand side of the machine behind the engine access door.*

3. Place a suitable container of the proper capacity under the drain.
4. Open the drain cap, and drain the coolant from the system.
5. Secure the drain cap after all the coolant is drained.
6. Use a system cleaning product to clean and flush the system. Contact your authorized dealer for system cleaning products.
7. Follow the cleaning product instructions. After the system has been cleaned and flushed, close and secure the drain valve.



RAIL13DOZ1253AA 2

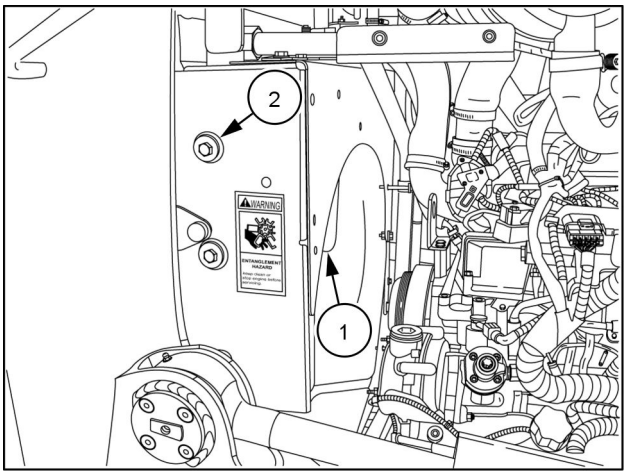
8. Fill with the proper mix and amount of antifreeze/ coolant and water for the system and for the prevailing weather conditions.
9. Start the engine, and let it run at low idle until the engine reaches operating temperature.
10. Allow the system to cool. Check the coolant level at the coolant reservoir.



RAIL13DOZ0282AA 3

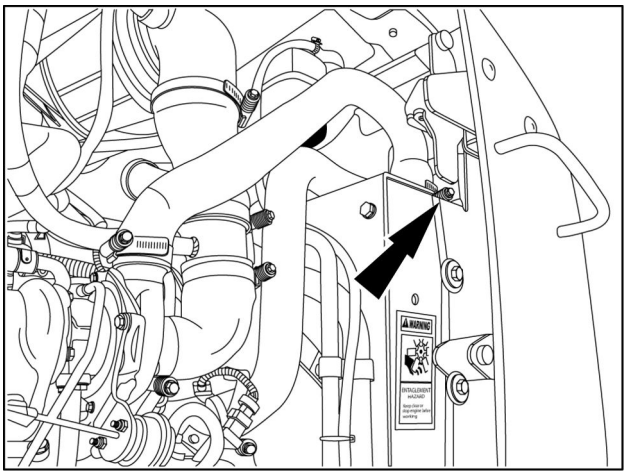
Aftercooler - Install

1. Install aftercooler **(1)** with four mounting bolts **(2)**.



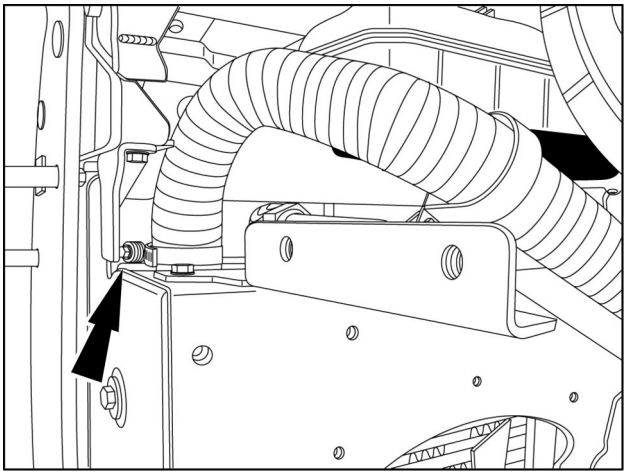
RAIL13DOZ0357AA 1

2. Install aftercooler inlet hose and tighten clamp.



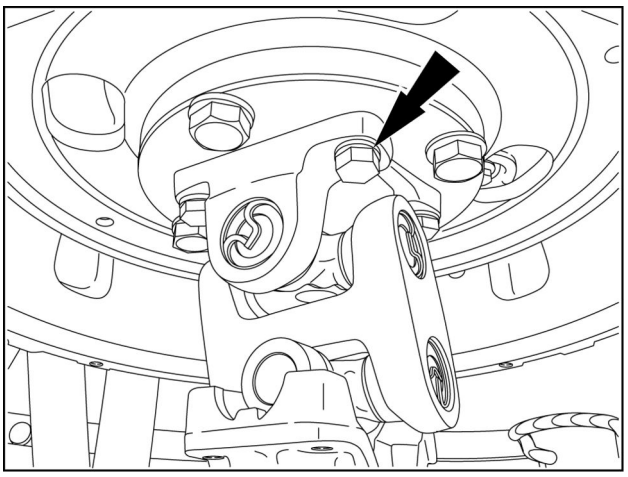
RAIL13DOZ0380AA 2

3. Install aftercooler outlet hose and tighten clamp.



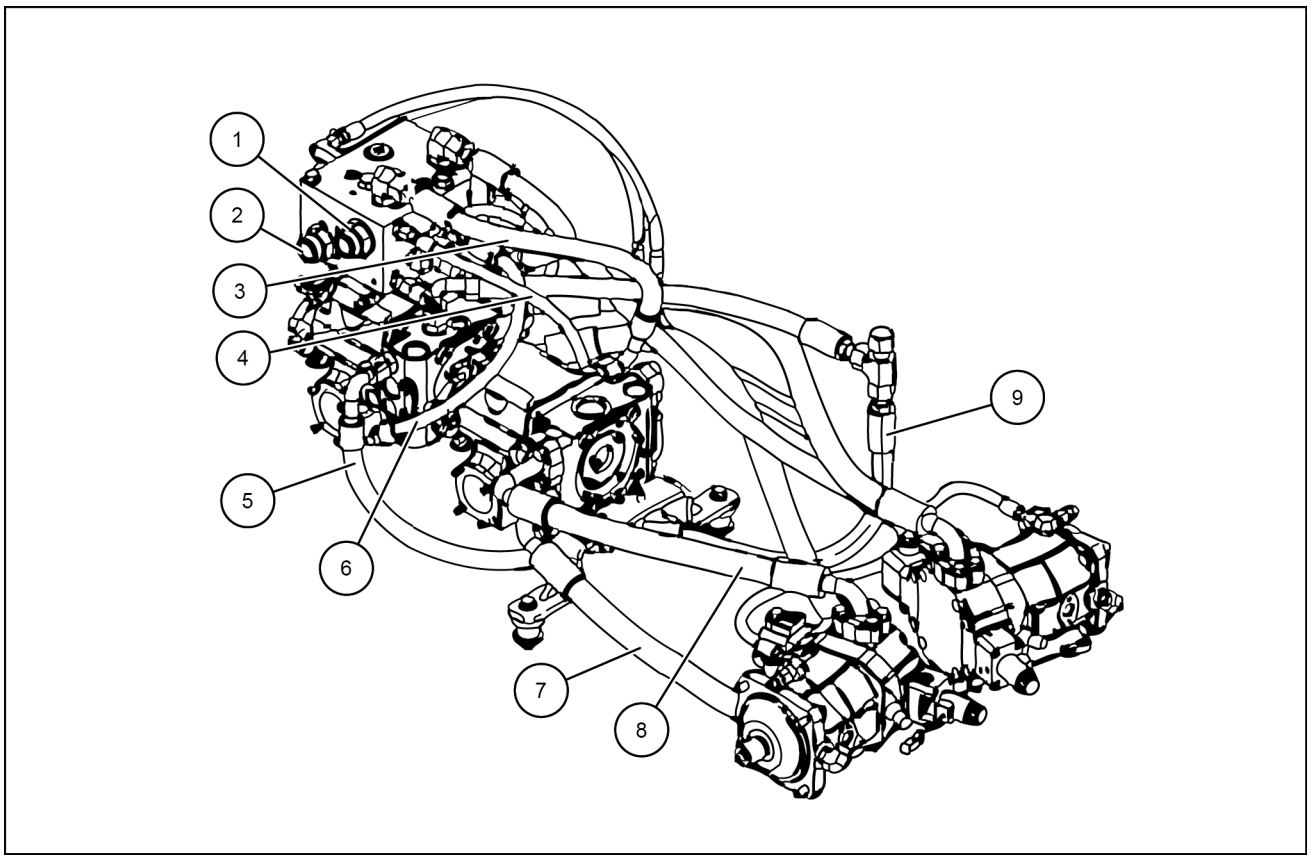
RAIL13DOZ0356AA 3

9. Move driveshaft yoke toward pump.
10. Remove four driveshaft bolts and lock washers and remove driveshaft.



RAIL13DOZ0520AA 4

11. Repair or replace components as necessary.



RAIL13DOZ0917FA 2

Hydrostatic Left Rear View

(1) COOLER IN PORT	**(6)** HOSE, PUMP G TO MANIFOLD P
(2) COOLER OUT PORT	**(7)** HOSE, REAR PUMP TO LEFT HAND MOTOR (BOTTOM)
(3) HOSE, REAR PUMP TO MANIFOLD TP2	**(8)** HOSE, REAR PUMP TO LEFT HAND MOTOR (TOP)
(4) HOSE, PS TO MANIFOLD	**(9)** HOSE, FILTER TO REAR PUMP FE
(5) HOSE, HYDROSTATIC PUMP FILTER OUTLET	

NOTE: *Not all components are shown on the drawing for clarity purposes.*

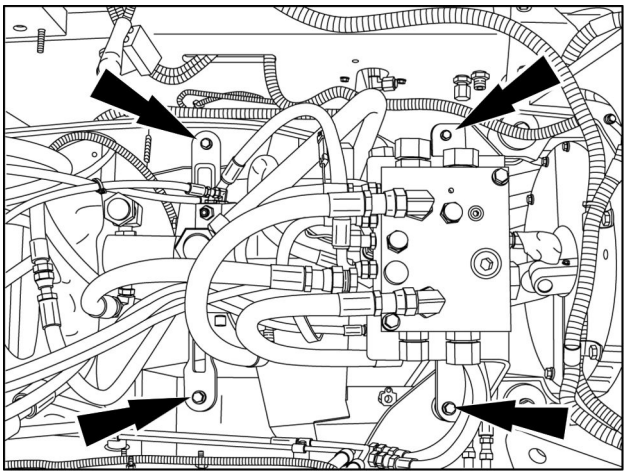
Hydrostatic circuit supply pump - Install

NOTICE: *Always install new O-rings or seals between pumps. Never reuse O-rings or seals when assembling pumps.*

1. Assemble hydrostatic circuit supply pumps and charge pump to hydraulic pump assembly.

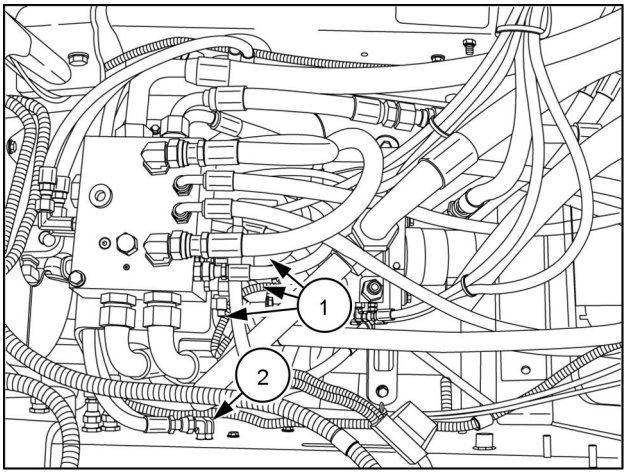
NOTICE: *Hydraulic pump assembly weighs approximately* ***181 kg*** *(****400 lb****). Use proper lifting equipment to prevent personal injury or property damage.*

2. Attach an appropriate lifting device to hydraulic pump assembly.
3. Install hydraulic pump assembly to machine and engage driveshaft at pump input. Install four hydraulic pump assembly mounting bolts, washers, and nuts. Grease driveshaft yoke.



RAIL13DOZ0698AA 1

4. Tighten hydraulic pump assembly mounting bolts to **68 – 81 N·m** (**50 – 60 lb ft**).
5. Remove lifting device from hydraulic pump assembly.
6. Connect three electrical connectors **(1)** to manifold block and two electrical connectors to underside of hydraulic pump assembly.



RAIL13DOZ0697AA 2

7. Apply a vacuum to hydraulic system.
8. Connect all hydraulic hoses to manifold block and hydraulic pumps.
9. Tighten hydraulic hose split flange bolts to **20 – 27 N·m** (**180 – 240 lb in**).
10. Route blade control hydraulic hoses **(2)** through hydraulic pump assembly mounting bracket and connect at left side of machine.
11. Remove vacuum from hydraulic system.

Contents

Hydrostatic drive - 29

Hydrostatic transmission - 202

SERVICE

Contents

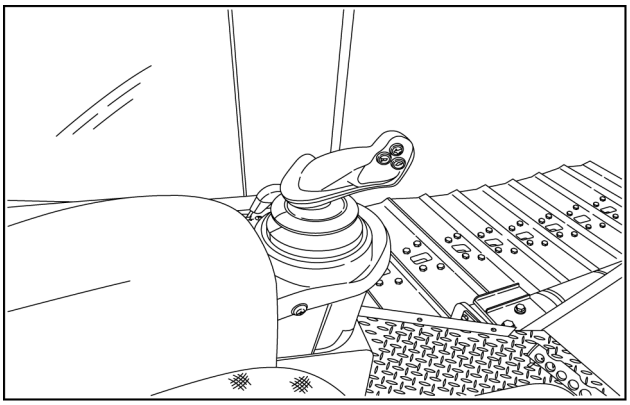
Hydraulic systems - 35

Hydraulic systems - Pressure setting - Main relief valve

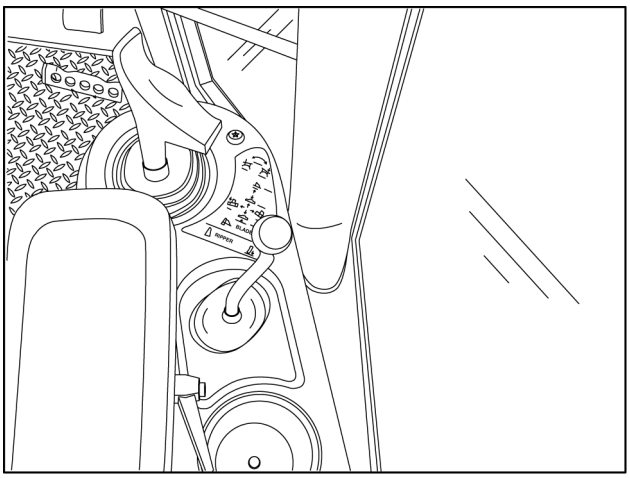
1. Remove the cover from the main relief valve and loosen the lock nut on the adjusting screw.
2. Turn the adjusting screw into the main relief valve to increase the pressure or out of the main relief valve to decrease the pressure.
3. Refer to **Hydraulic systems - Pressure test (35.000)** and check the pressure setting. Adjust the main relief valve again as necessary.
4. When the pressure setting is correct, prevent the adjusting screw from turning while the lock nut is tightened. Install the cover on the main relief valve.

Releasing pressure in the hydraulic system

1. Park the machine on firm, level ground, lower the attachments to the ground, and stop the engine. Set the park brake.
2. Keep all unauthorized personnel clear of the machine. Turn the ignition switch key to the ON position. Do not start the engine.
3. Operate the control levers from right to left and front to rear approximately a dozen times. Turn the ignition key to the OFF position.



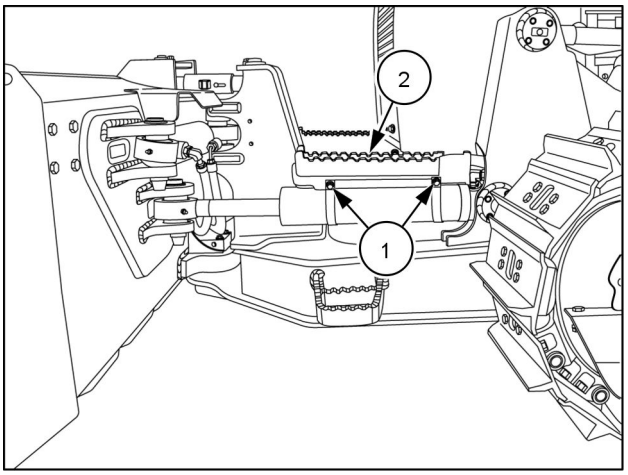
RAPH12DOZ0079AA 1



RAIL13DOZ1242AA 2

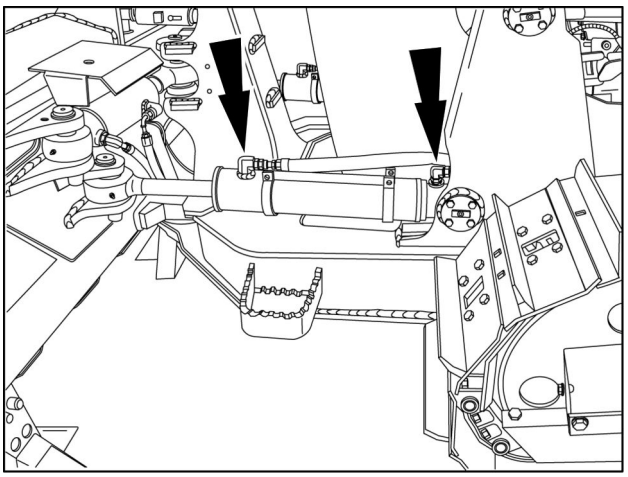
Blade swiveling cylinder - Remove

1. Park machine on a firm, level surface.
2. Lower all equipment to the ground.
3. Engage parking brake and shut engine off.
4. Relieve system of hydraulic pressure by actuating all hydraulic functions. Remove key when complete.
5. Turn master battery disconnect switch to the OFF position.
6. Remove bolts, washers, and nuts **(1)** and remove step **(2)** from blade swiveling cylinder.



RAIL13DOZ0690AA 1

7. Apply a vacuum to hydraulic system.
8. Disconnect two hydraulic hoses from blade swiveling cylinder. Cap and plug all openings to prevent fluid loss or contamination.



RAIL13DOZ0688AA 2

9. Remove vacuum from hydraulic system.

Contents

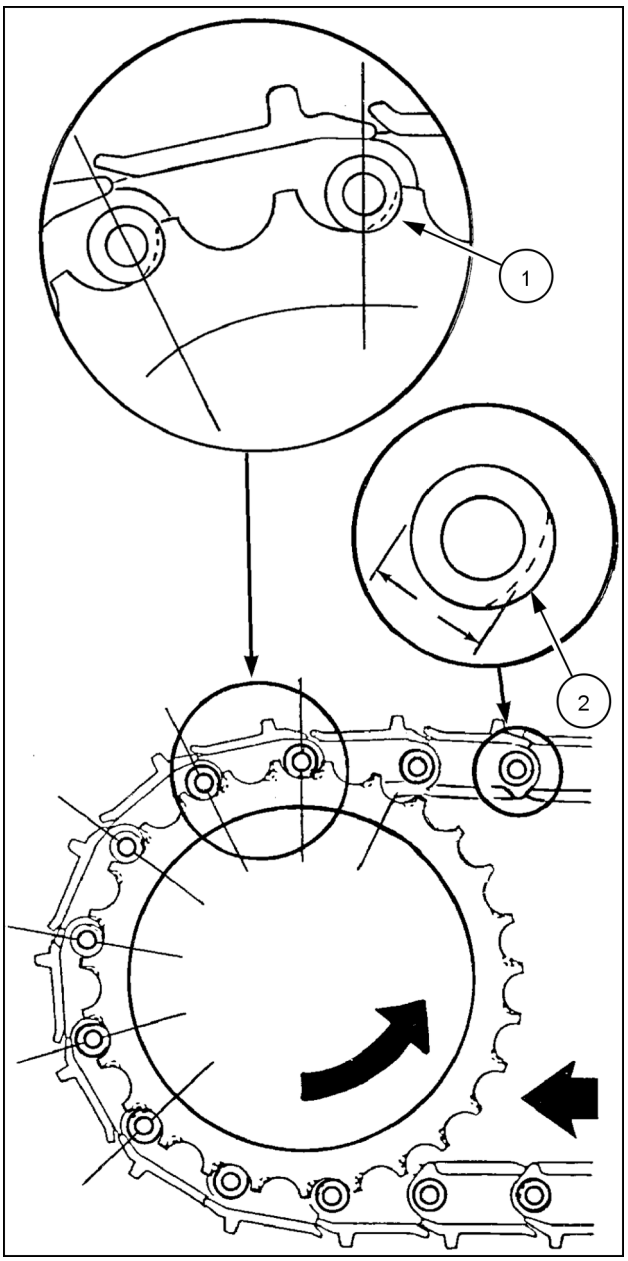
Tracks and track suspension - 48

Track frame and driving wheels - 130

Sprocket reverse drive side wear (machine traveling in reverse)

Reverse drive side wear can be the most severe wear you can have with the socket teeth and bushings. When you move in reverse, the sprocket teeth contact the chain bushings close to the 12 o'clock position. Most of the torque, required to move the machine, transfers to the track between the 12 and 11 o'clock position. At this time, the bushing rotates against the sprocket. A pocket forms on the reverse side of the sprocket tooth where the rotating bushing makes contact. This contact causes accelerated wear, especially when you travel at high speeds.

- Reverse wear of the sprocket **(1)**.
- Reverse wear of the bushing **(2)**.

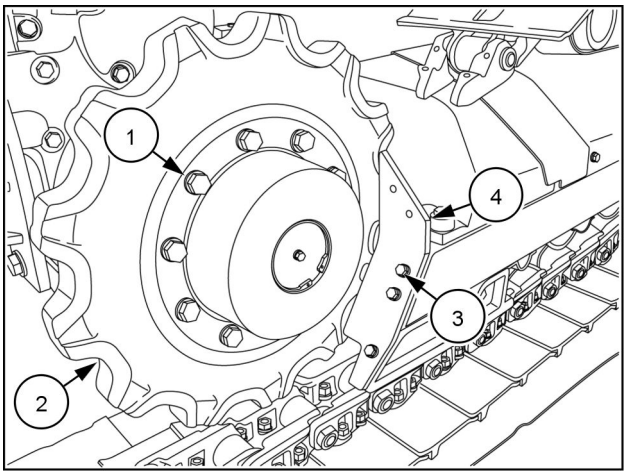


RAPH13DOZ1047CA 15

Sprocket - Install

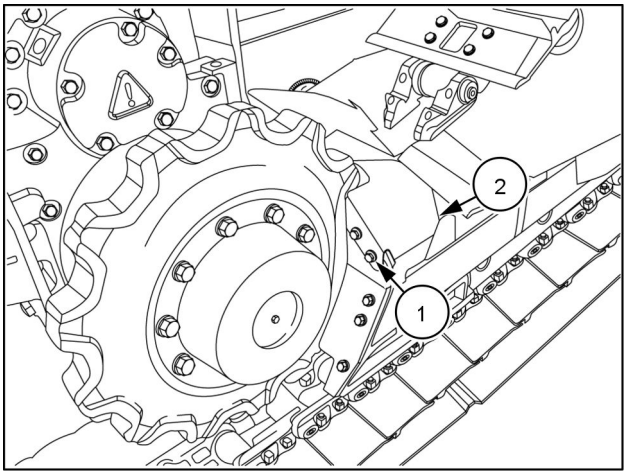
NOTICE: *Drive sprocket weighs approximately* ***91 kg*** *(****200 lb****). Use proper lifting equipment to prevent injury or property damage.*

1. Attach an appropriate lifting device to drive sprocket.
2. Apply **LOCTITE® 242®** to 10 drive sprocket mounting bolts **(1)**. Install drive sprocket **(2)** with 10 bolts and shims as noted during removal. Tighten bolts to **136 N·m** (**100 lb ft**).



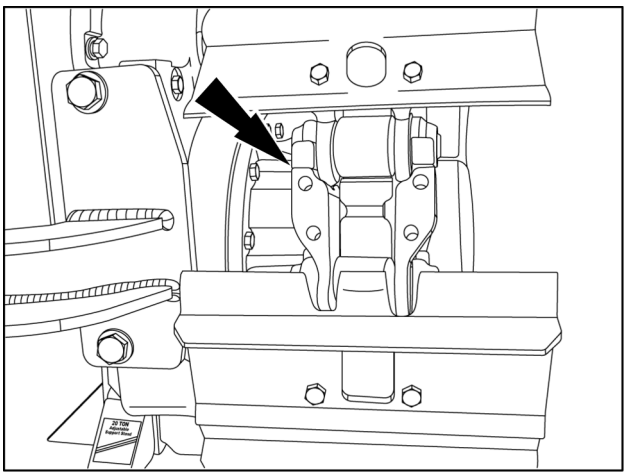
RAIL13DOZ0506AA 1

3. Remove lifting device from drive sprocket.
4. Lower machine to track.
5. Apply **LOCTITE® 242®** to three rock guard bolts **(3)** and install rock guard **(4)**.
6. Apply **LOCTITE® 242®** to four track frame cover bolts **(1)** and install track frame cover **(2)**.



RAIL13DOZ0299BA 2

7. Use an appropriate lifting device to install upper section of track to drive sprocket. Join upper and lower master link halves.



RAIL13DOZ0303BA 3

Track chain - Static description - Track shoe wear

Track shoes

The wear that is measured on the track shoes is the height of the grouser. There are three types of track shoes (1) one bar, (2) two bar, or (3) three bar grouser. Assemble the rulers in the kit to make a depth gauge. If your machine has single bar grousers, tighten the track chain before measuring. Refer to the following illustration and measure several track shoes on each side of the machine. Measure the wear 1/3 the distance from the outer end of the track shoe. Make a record of the measurements on the Track Component Appraisal Form. When finished, adjust the track for correct tension.

Grouser wear

The following illustration shows wear of the grouser. This wear is normal and unavoidable. The greatest cause of grouser wear is track slipping. This is non-productive and can be controlled by reducing track speed and using the correct type track shoe for the job. Excessive wear of the grousers will reduce the strength of the track shoes increasing the probability of track shoe bending.
Wear on the corners of the grousers usually indicates rough terrain with high impact conditions. If the shoes are too wide, the corners can chip or bend.

Cracked or broken shoes

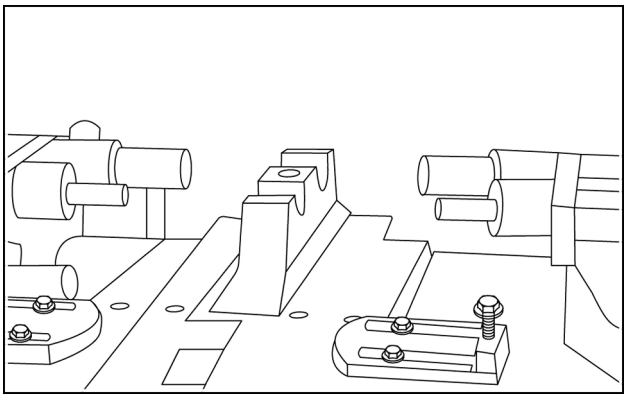
Cracked or broken shoes can be caused by various conditions. Some of the causes can be terrain, impact loads, speed, shoes that are too wide for the conditions, or structural problems for a track shoe that has lost most of the grouser bar/s. Always try to use the narrowest track shoe possible.

Bolt holes to large

If the mounting bolts are loose, the bolt holes can become larger. If this happens, the track shoes and mounting hardware must be replaced. Conditions that cause hardware to loosen can be (1) hardware that was not torqued correctly, (2) track shoes that are too wide, or (3) turning resistance in rocky terrain. When installing new track shoes, links, and hardware, always clean the mating surface of all paint, rust and dirt. Always use the recommended bolt torque. (Don’t over torque.)

Track chain Chain - Disassemble For reference only

1. Install the carrier and driver needed to disassemble the track chain.

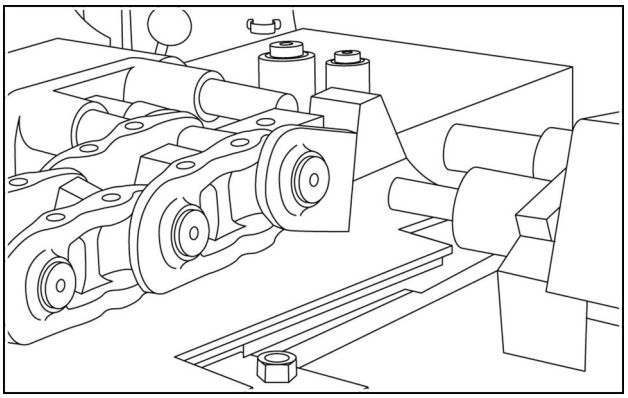


RCPH09CWL291AAD 1

2. Put the track chain on the table so that the track shoe surface is up and pin half of the master link will be the first link disassembled.

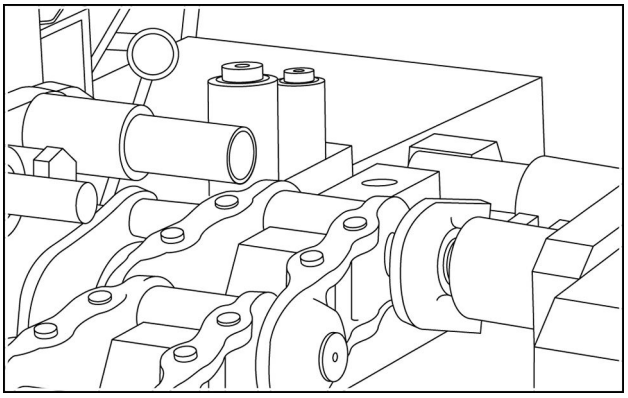
NOTICE: *Before pressing a bushing and pin out of the link, make sure that the drivers are aligned with the pin and bushing to prevent damage to the bores in the link.*

3. Put the bushing in the first notch in the carrier and actuate one of the rams to press that pin out of a link.



RCPH09CWL081AAD 2

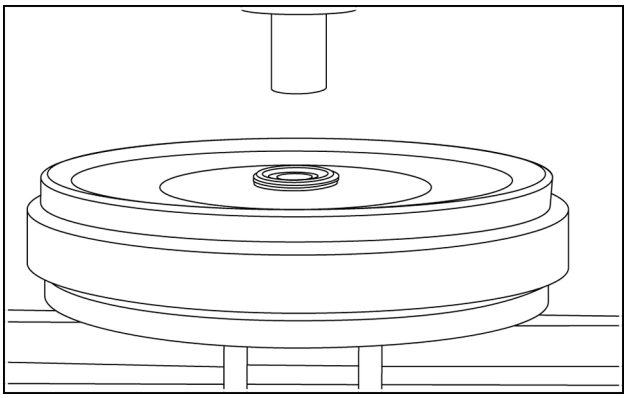
4. Retract the ram and remove the link from the driver.
5. Actuate the other ram and press the pin out of the other link.



RCPH09CWL086AAD 3

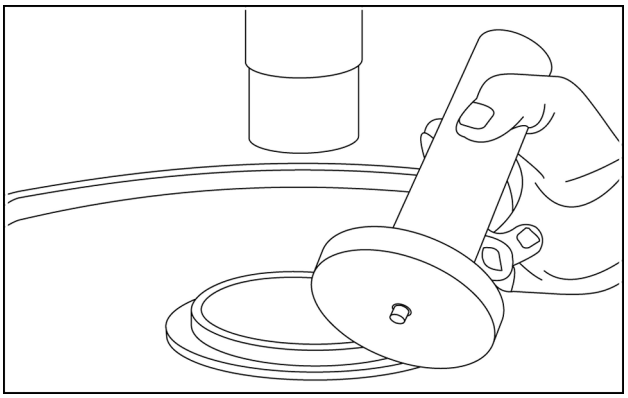
6. Retract the ram and remove the link from the driver and the pin from the bushing.
7. Move the track chain forward one bushing.
8. Actuate one of the rams to press the pin and bushing out of a link.
9. Retract the ram and remove the link from the driver.

12. Put the idler wheel in the press for removal of the other bushing.



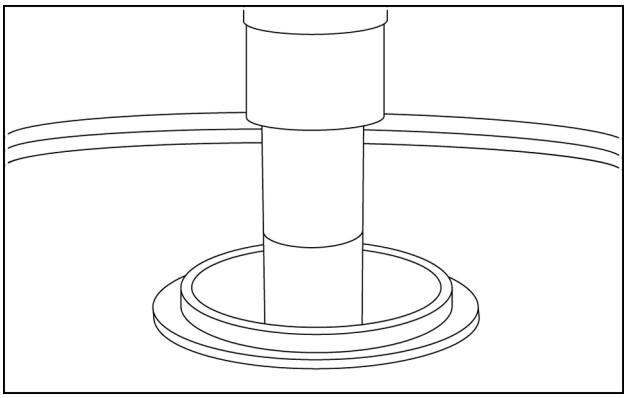
RCPH09CWL149AAD 8

13. Install an acceptable driver on top of the bushing.



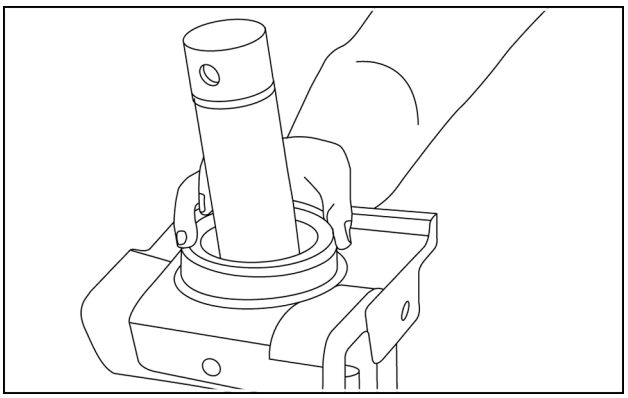
RCPH09CWL151AAD 9

14. Press the bushing out of the idler wheel.



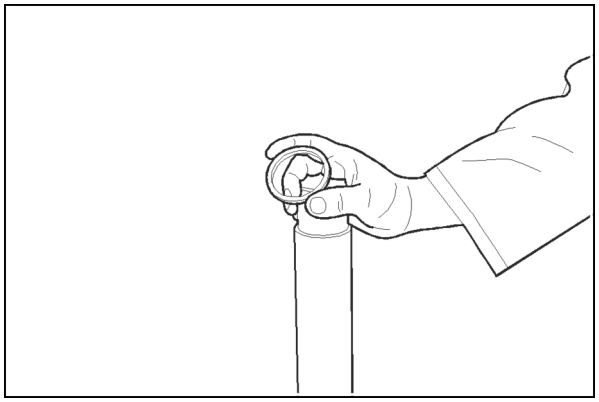
RCPH09CWL150AAD 10

15. Remove the metal ring and the rubber ring from the bracket and shaft assembly.



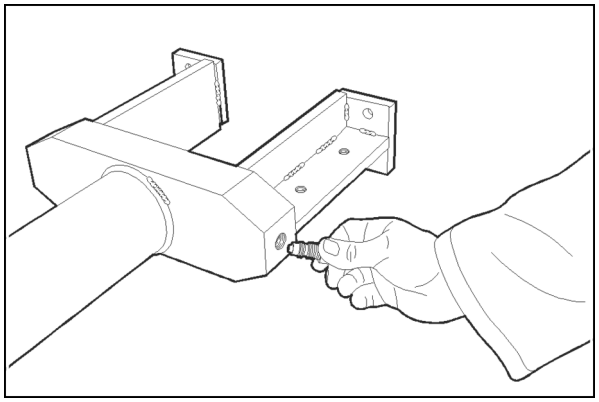
RCPH09CWL280AAD 11

9. Remove the backup ring from the piston.



BD07M008-01 8

10. Remove the valve.



BD07M010-01 9

11. Remove the grease from the bore of the cylinder.

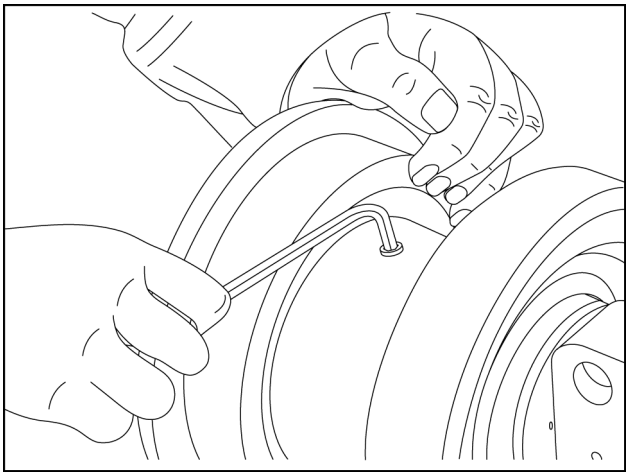
Next operation:
Tension cylinder - Visual inspection (48.134).

Track roller Lower roller - Disassemble

Prior operation:
Track roller Lower roller - Remove (48.138).

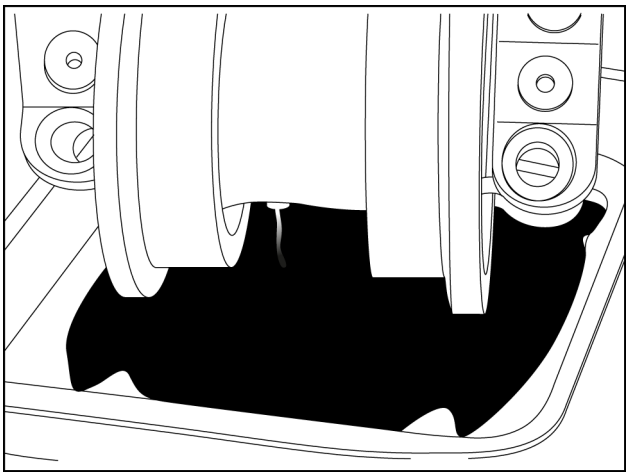
1. Clean the track roller with cleaning solvent.
2. Loosen and remove the plug from the track roller.

NOTE: *It may be necessary to heat the plug to break the Loctite loose.*



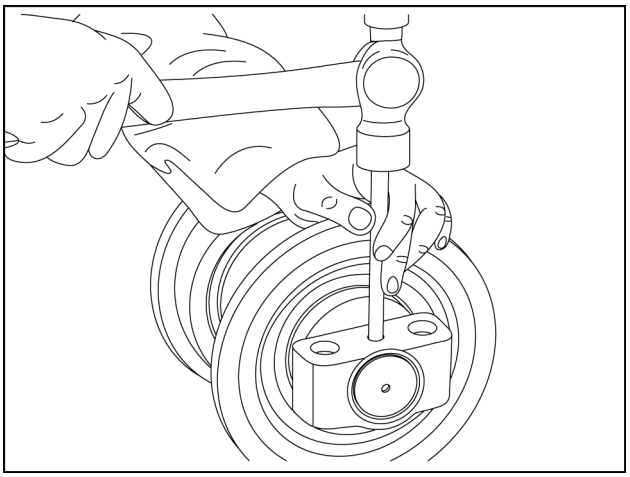
RAIL15DOZ0132AA 1

3. Drain the oil from the track roller.



RAIL15DOZ0133AA 2

4. Use a hammer and punch and remove one of the roll pins that hold the end caps in place.



RAIL15DOZ0134AA 3

Track roller Lower roller - Filling

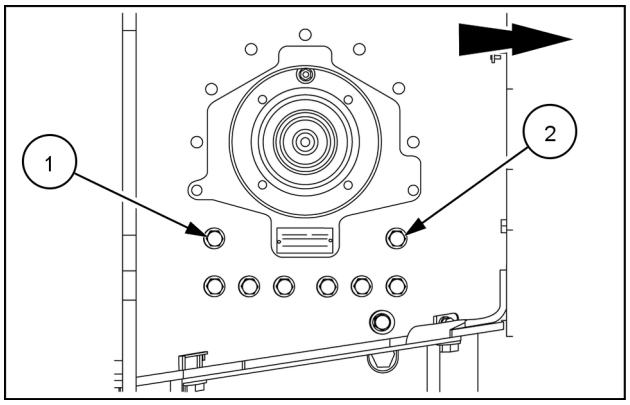
Prior operation:
Track roller Lower roller - Leakage test (48.138).

1. Turn the shaft so that the mounting surface of the end cap is down and the filler opening is up.
2. Fill the roller with the lubricant, refer to **Capacities ()** .
3. Connect an air line that can be controlled to a maximum pressure of 275 kPa, 2.7 bar (40 psi) to the filler hole.
4. Open the valve for the air line to push the lubricant into the outer ends of the roller.
5. Close the valve and disconnect the air line from the roller.
6. Check the oil fill volume by positioning the roller so the oil fill hole is at the top of the roller.
7. Insert a dip stick into the oil fill hole until it contacts the tip of the roller or the idler shaft.
8. The dip stick should read an oil volume level of 5.0 to 8.0 mm (0.195 to 0.315 in) above the top of the shaft.
9. Install and tighten the plug.

Next operation:
Track roller Lower roller - Install (48.138).

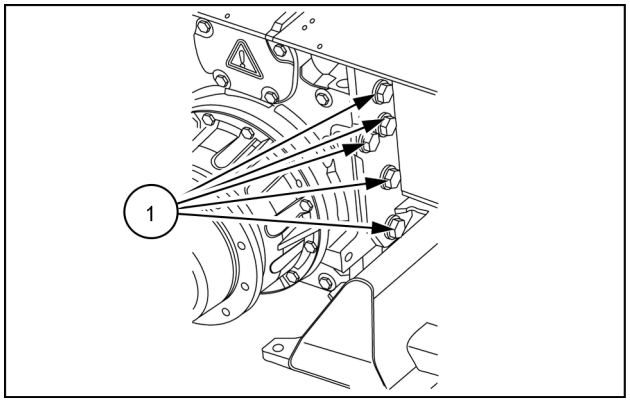
11. Tighten only bolts **(1)** and **(2)** located inside the chassis rear cover to a torque of **40 N·m** (**30 lb ft**).

NOTE: *Do not tighten any other bolts during this step. The arrow points towards the rear of the machine.*



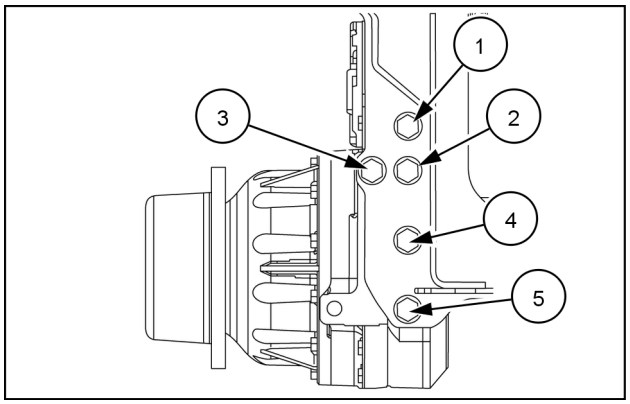
RAIL17DOZ0242AA 8

12. Install the five front final drive unit mounting bolts **(1)**.



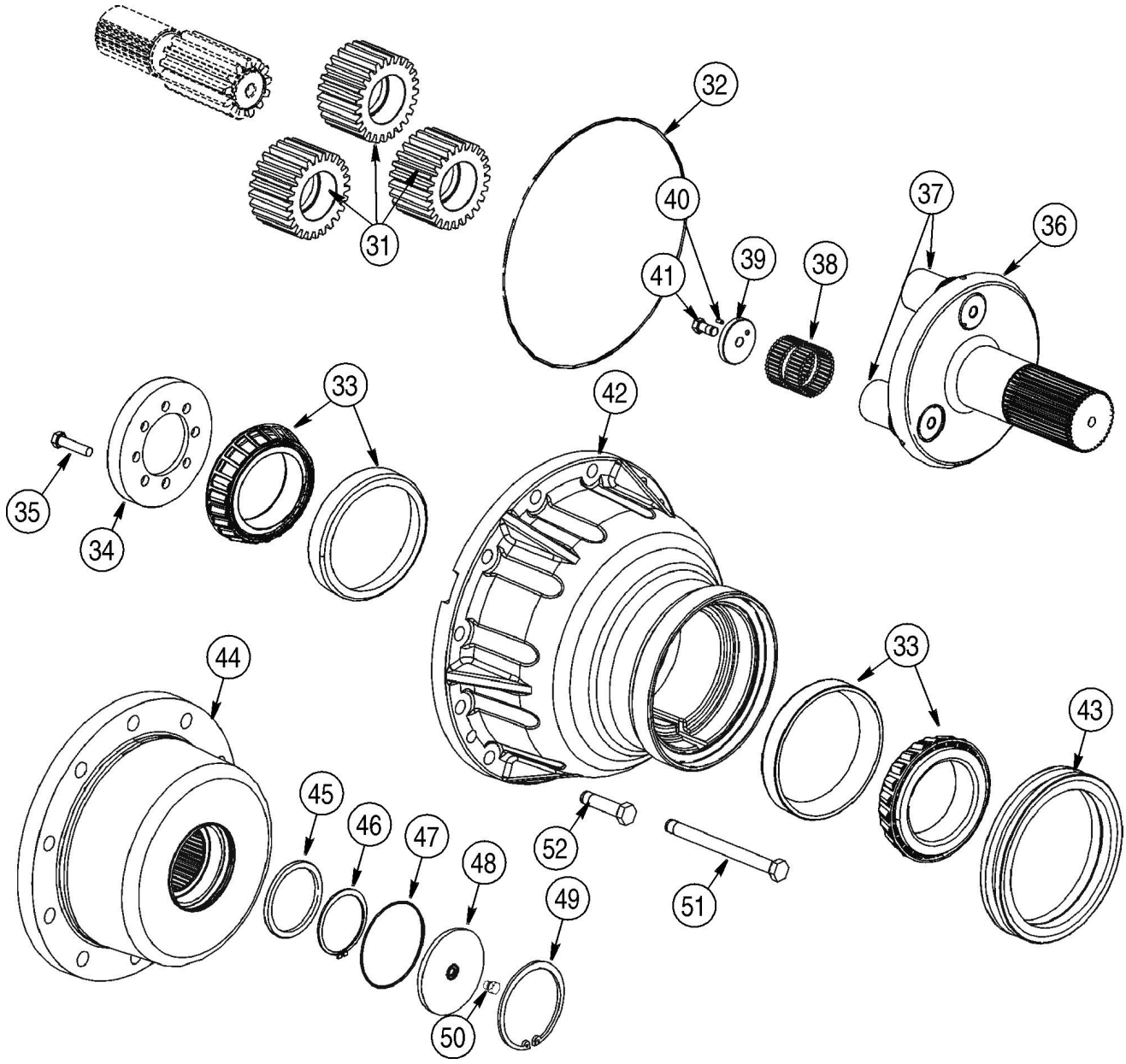
RAIL17DOZ0243AA 9

13. Tighten the five front mounting bolts to a torque of **135 N·m** (**100 lb ft**) in the numbered sequence shown.



RAIL17DOZ0244AA 10

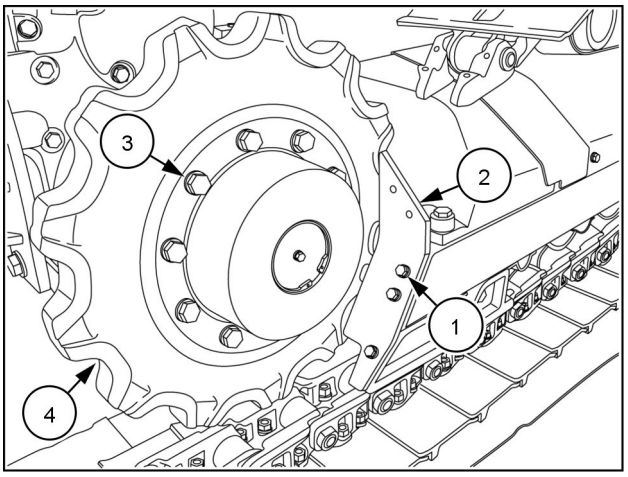
Planetary final drive unit - Assemble - Planetary drive



BC02J005 1

31. Planetary gears (3)	42. Wheel hub housing
32. O-ring wheel hub	43. Two piece face seal
33. Wheel hub bearings	44. Wheel hub
34. Bearing retainer plate	45. Spacer washer
35. Bearing retainer plate bolts (8)	46. External retaining ring
36. Planetary hub	47. O-ring
37. Planet gear pins	48. Wheel hub end plate
38. Bearing 66 per gear	49. Internal retaining ring
39. Pin washer (3)	50. Wheel end plate puller plug
40. Dowel pins (3)	51. Locking bolts (6)
41. Locking bolts (3)	52. Locking bolts (6)

15. Remove three bolts **(1)** and remove rock guard **(2)**.



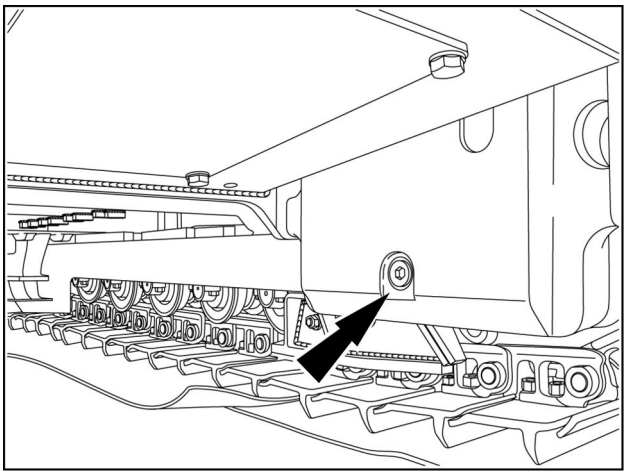
RAIL13DOZ0506AA 7

NOTICE: *Drive sprocket weighs approximately* ***91 kg*** *(****200 lb****). Use proper lifting equipment to prevent personal injury or property damage.*

16. Attach an appropriate lifting device to drive sprocket.
17. Remove 10 mounting bolts **(3)** from drive sprocket **(4)** and remove drive sprocket and shims, noting quantity and location of shims for installation.

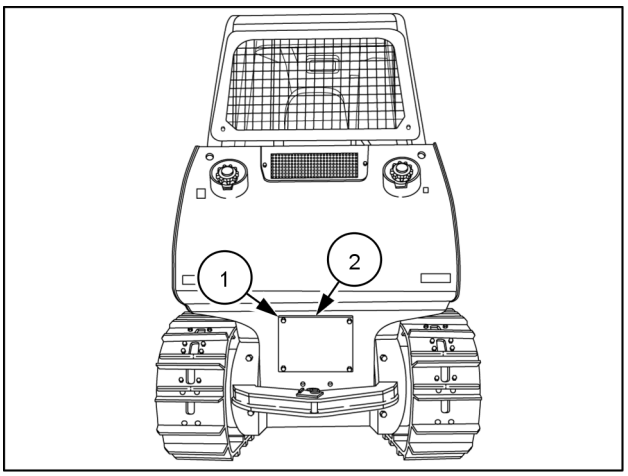
NOTICE: *Dropbox and final drive assembly oil capacity is approximately* ***11 l*** *(****3 US gal****).*

18. Remove drain plug from dropbox and drain dropbox. Install drain plug when dropbox has completed draining.



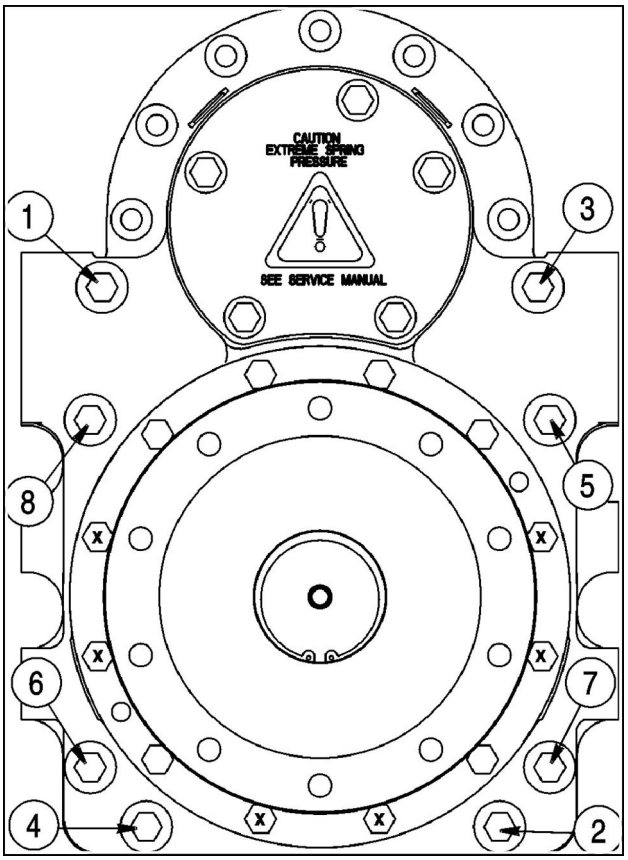
RAIL13DOZ0514AA 8

19. Remove four bolts and washers **(1)** and remove drive motor compartment access panel **(2)**.



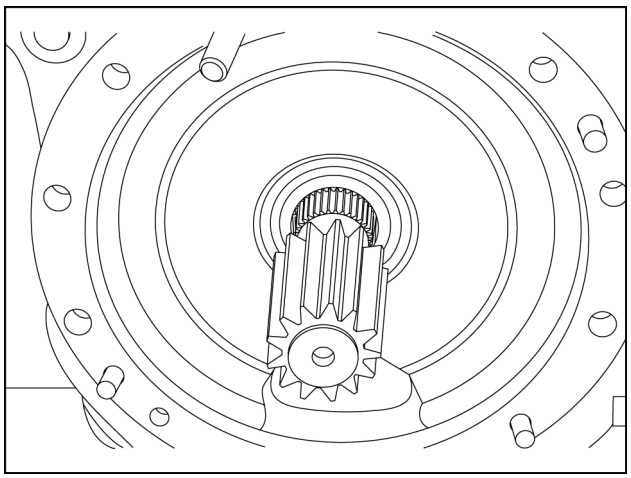
RAIL13DOZ0324AA 9

6. Using the torque pattern, torque the eight bolts **(29)** to **196 – 250 Nm** (**145 – 184 lb ft**).



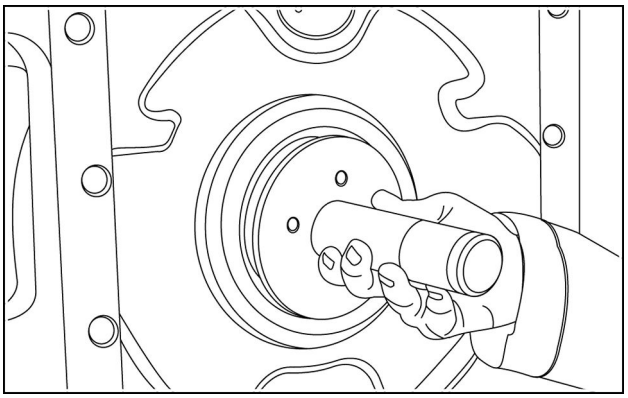
BC02M145 4

7. Turn off and disconnect the vacuum pump, replace the vent in the hydraulic reservoir.
8. Install the sun shaft **(15)** into the lower gear **(14)**.



RAIL15DOZ0181AA 5

5. Use lower gear bearing tool 380001452 with driver handle 380000847 to install the bearing cup for the lower gear in the sandwich housing.



RCPH09CWL222AAD 5

Ventilation - Testing

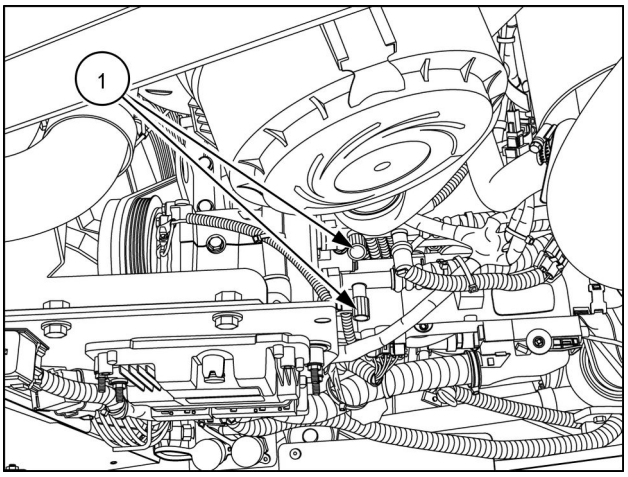
NOTE: *For wiring diagram refer to* ***Harnesses and connectors - Electrical schematic sheet 17 - Leveling Control (55.100)***, ***Harnesses and connectors - Electrical schematic sheet 18 - HVAC (55.100)*** .

Test N°1	
Test Point	**Condition** Put the master disconnect switch in the ON position. **Check** Terminal 1 connector X-064 and ground.
Expected Result	**Result** Continuity
Other Result (Possible Cause)	**Action** Bad ground circuit. Check from (-) terminal on blower motors to X-064 pin 1 to ground.

Test N°2	
Test Point	**Condition** Put the ignition switch in the RUN position. Turn mode switch to heat position. Turn the blower switch to the High position. **Check** Motor + terminal to ground.
Expected Result	**Result** 24 volts
Other Result (Possible Cause)	**Action** If the test is good and the blower motor does not work, replace the blower motor. If the blower motor works on HIGH but not on LOW or MEDIUM, test the blower motor speed resistors and blower switch. Bad wire between blower motor and fuse block or bad 25A fuse at J/Case. Check from motors (+) terminal to blower fan relay pin 87, Blower fan relay pin 30 to connector X-064 pin 3, X-064 pin 3 to X-061 pin 3, **X-013** pin 3 to **X-005** pin 21, or faulty AC relay K-015.

Test N°3	
Test Point	**Condition** No fan on Low/Medium/Medium high. Put the ignition switch in the RUN position. Turn mode switch to heat position. Turn the blower switch to the Low/Medium/Medium high position (position where fan does not work). **Check** For power at mode switch connector X-073 pin 4 and pin 5.
Expected Result	**Result** 24 volts.
Other Result (Possible Cause)	**Action** If there is power at connector X-073 pin 4 but not pin 5, replace the Mode switch. Check for power at X-072 pin E, A, B with fan speed in those positions. If there is power at those pins, replace the fan speed resistor. Note: Connector X-072 Pin A-Medium fan speed Pin C- High fan speed Pin E- Low fan speed Pin B- Medium high fan speed Pin D- Power In

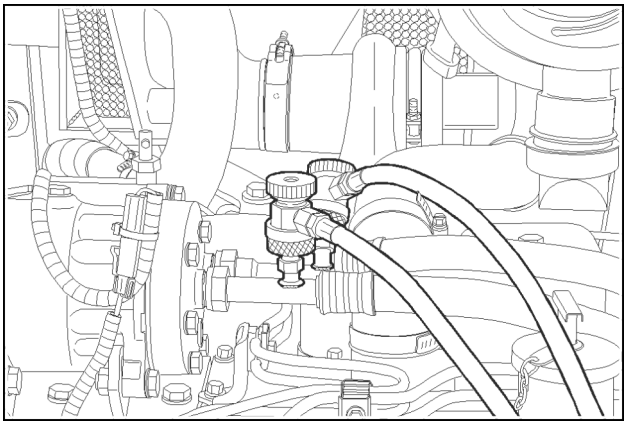
9. Disconnect the hoses from the service ports **(1)** and install the caps.



RAIL15DOZ0106AA 9

10. Replace the receiver-drier if one or more of the following conditions occurs before you remove the air and moisture from the system.
(A.) The system has been opened for service before.
(B.) Receiver-drier has operated two or more years.
(C.) Disassembly of compressor shows small particles of moisture removing material (gold or brown particles).
(D.) Large system leak (broken hose, break in line).
(E.) Too much air or moisture in system.
(F.) Removal of compressor caused the system to be open (uncapped) longer than 5 minutes.

11. Make sure the charging station manifold gauge valves are in the closed position. Connect the hose from the low pressure gauge to the port on the suction hose. Connect the hose from the high pressure gauge to the port on the discharge hose. Turn in both thumbscrews to depress the service valves.



RCPH09CWL015BAD 10

12. Removal of air and moisture from the system is necessary after the refrigerant has been removed from the system after the system has been opened for maintenance. Air enters the system when the system is opened. Air has moisture that must be removed to prevent damage to the system components.

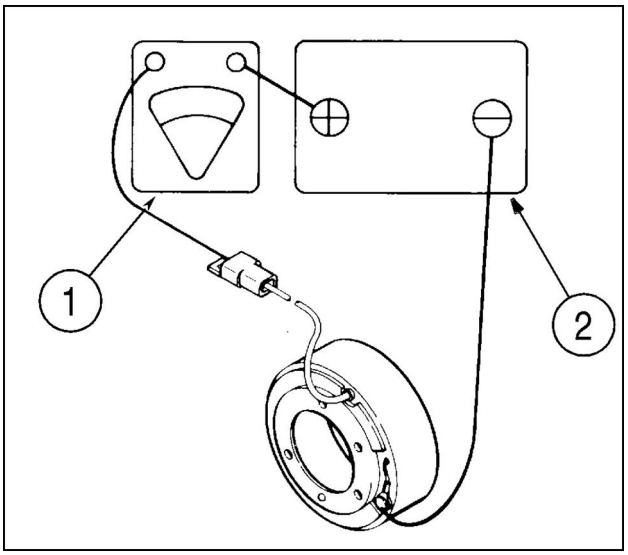
13. Air and moisture are removed from the system by a vacuum pump. A vacuum pump is on the only equipment made that will lower the pressure in a system enough to change the moisture to a vapor so that the moisture can be removed.

NOTE: *Refer to the vacuum pump manufacturer's user manual for additional information.*

Air-conditioning compressor Magnetic clutch - Electrical test

Prior operation:
Air-conditioning compressor Magnetic clutch - Disassemble (50.200)

1. Use a ammeter, voltmeter and a **12 V** battery to check the amperage of the clutch coil. The current draw must be **3.6 – 4.2 A** at **12 V**.
   (1) Ammeter
   (2) 12 V Battery

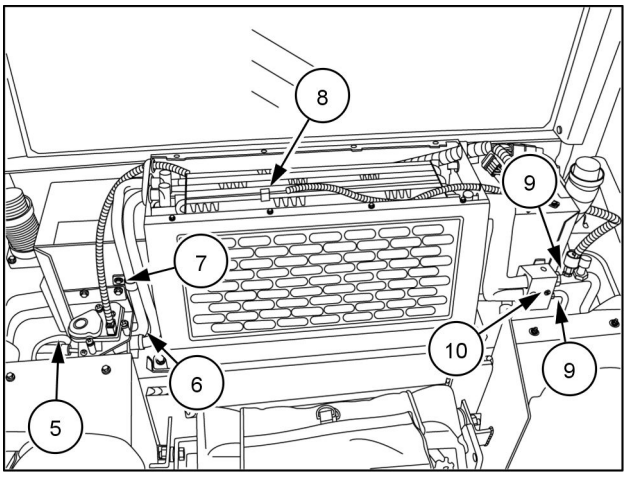


102L7 1

2. A reading of more than **4.2 A** indicates a short within the coil.
3. No amperage reading indicates an open circuit in the coil.
4. Repair or replace the clutch coil or compressor if the amperage reading is not correct.

Next operation:
Air-conditioning compressor Magnetic clutch - Assemble (50.200)

18. Remove heater hose **(5)** from heater core pipe **(6)**. Close all openings.
19. Remove heater pipe clamp **(7)**.
20. Remove temperature sensor **(8)**.
21. Disconnect air conditioning supply and return tubes **(9)** from expansion valve. Close all openings.
22. Remove mounting bolt **(10)** from expansion valve.



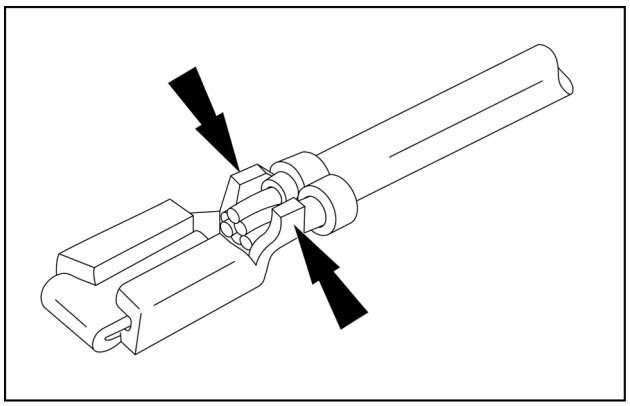
RAIL12DOZ0937BA 6

NOTE: *Air conditioning evaporator/heater core must be removed as a unit.*

23. Remove air conditioning evaporator/heater core from machine, taking care to prevent damage to pipes.
24. Repair or replace components as necessary.

Intermittent circuit

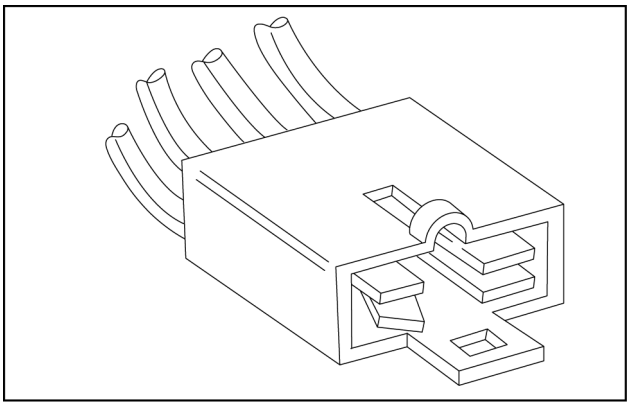
- The terminal is not crimped on the wire(s).



RAIL14SSL0596AA 10

Intermittent circuit

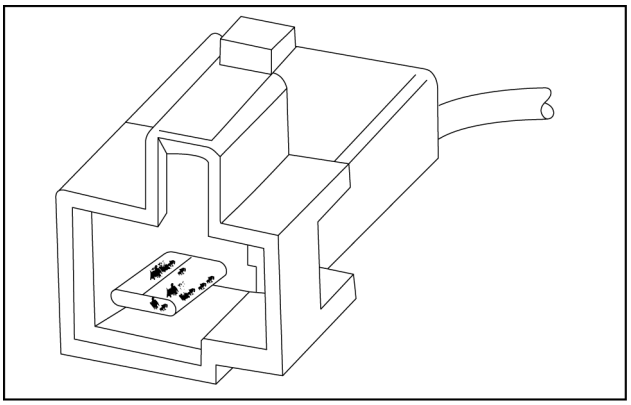
- Bent pins may cause a short circuit if the two terminals do not contact.
- The male and female connectors may not make contact because of the bent pin.



RAIL14SSL0597AA 11

Intermittent circuit

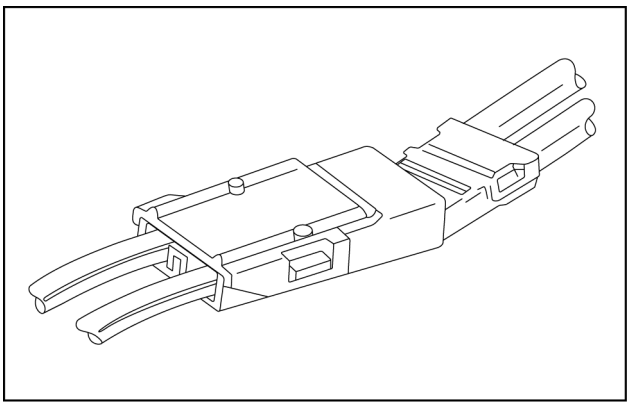
- Corrosion on the pin(s) is Indicated by a layer of greenish-white powder appearing on the pins.
- Corroded pins may overheat because of increased resistance due to corrosion.



RAIL14SSL0598AA 12

Intermittent circuit

- Partially disconnected connectors make contact with only some terminals.



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Grounding guidelines

A return path is necessary in an electrical circuit. In CNHi applications, the ground points are equivalent to the battery negative terminal.

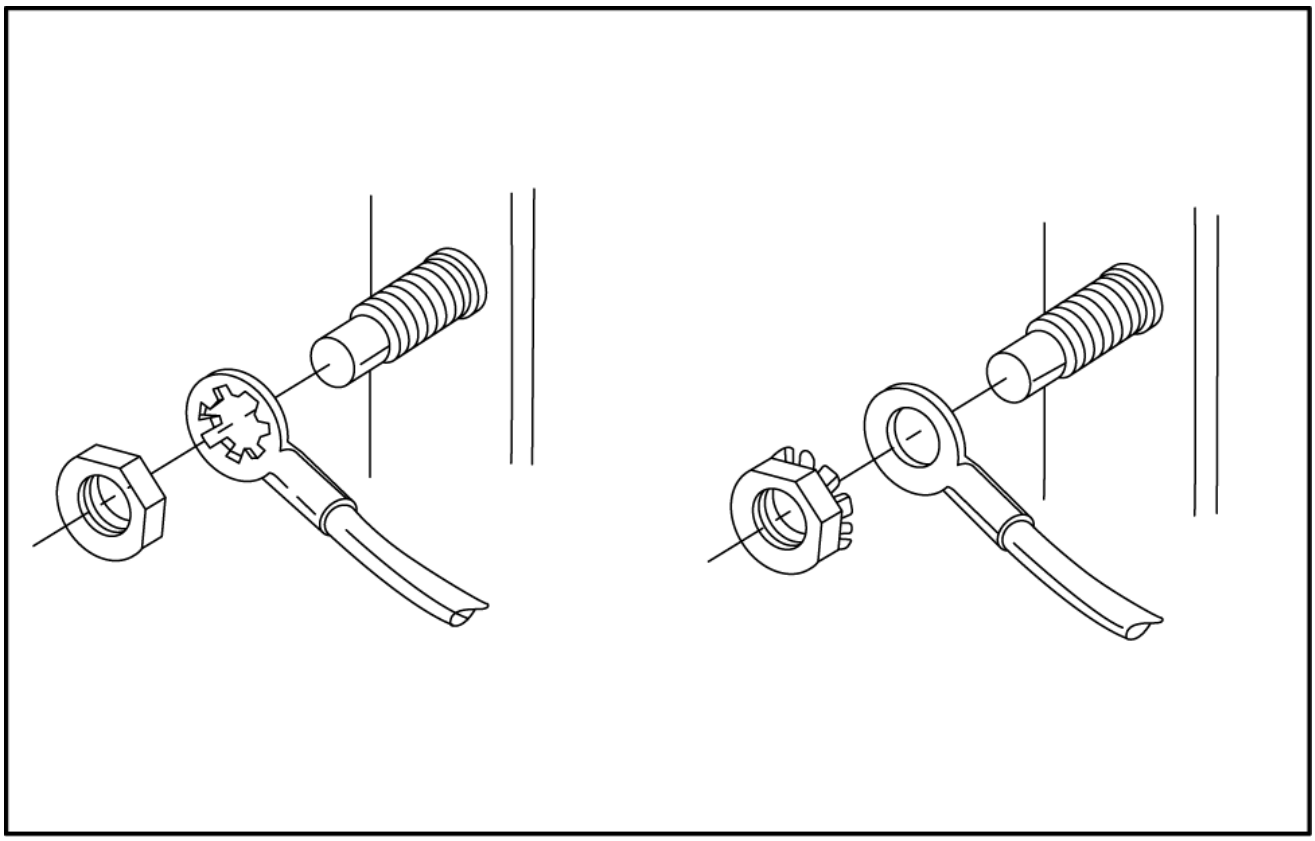
The electrical system should be properly grounded.

Use plated ground fasteners (studs, ring terminals, etc.) for better corrosion resistance.

The ground fasteners must be compatible with the ground terminals to reduce galvanic corrosion. Do not use rivets or sheet metal screws for grounding.

Grounding surfaces must be free of sealants, paint and/or any non-conductive coatings.

Whenever possible, use ring terminals with an anti-rotation feature. In case of terminals without an anti-rotation feature, use lock washers.



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Harnesses and connectors - Electrical schematic sheet 04 - Engine Control

Item	Description
1	Engine control unit (ECU) battery unswitched +12V
2	Equalizer
3	Engine control unit (ECU) relay
4	Engine control unit (ECU)
5	Air temperature sensor
6	Engine interface – turbine temperature sensor
7	Differential pressure sensor
8	Gas temperature sensor 1
9	Gas temperature sensor 2
10	Glow plug control unit (GCU)
11	Lambda sensor
12	Water in fuel sensor
13	Starter relay
14	Crank signal
15	Ignition relay
16	ECU ground
17	GCU battery +12V
18	Engine interface to glow plugs
19	Engine interface switched battery +12V

Harnesses and connectors - Electrical schematic sheet 14 - Instrument Cluster

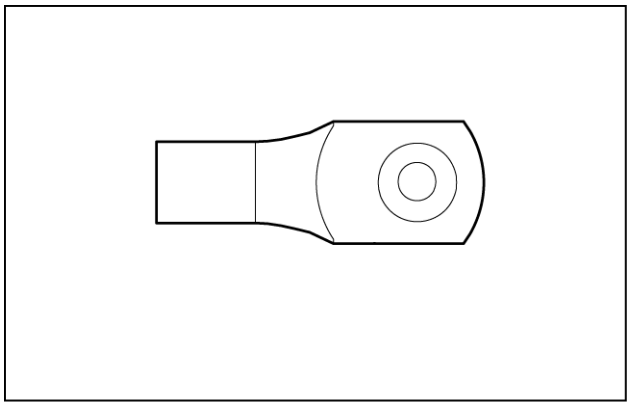
Item	Description
1	Instrument cluster battery +24V
2	Up/down switch
3	Enter/escape switch
4	Instrument cluster
5	Menu down signal
6	Menu up signal
7	Menu enter signal
8	Menu escape signal
9	Unswitched power – battery +24V
10	Unswitched power – battery +24V
11	Ignition power
12	Crank signal
13	Alternator D+
14	Transmission filter restriction signal
15	Hydraulic oil filter restriction signal
16	Air filter restriction signal
17	Charge pressure switch signal
18	Charge pressure switch
19	Air filter restriction switch
20	Hydraulic filter restriction switch
21	Transmission oil filter restriction switch
22	Crank signal to ignition switch

Harnesses and connectors - Electrical schematic sheet 24 - CAN Bus System

Item	Description
1	Instrument cluster
2	To engine controller
3	CAN 1 HI
4	CAN 1 LO
5	Lazer guided system module
6	Universal control module (UCM) – CAN 2
7	Diagnostic port
8	Diagnostic B+
9	Universal control module (UCM) – CAN 1
10	To telematics

CONNECTOR X-GND4 - ECU GND

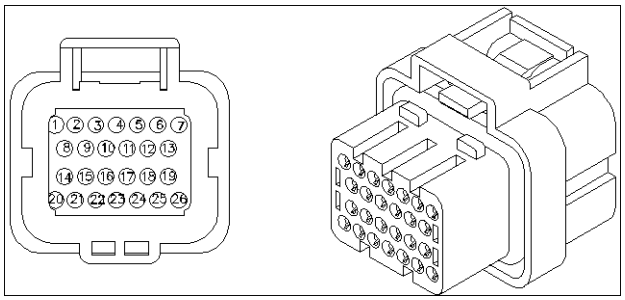
CONNECTOR X-GND4 - ECU GND			
PIN NUMBER	**WIRE NUMBER**	**CIRCUIT REFERENCE**	**ELECTRICAL SCHEMATIC FRAME**
1	G133 (BK)	ECU GROUND	3



RING TERMINAL 10

CONNECTOR X-021 - UCM - CN4A

CONNECTOR X-021 - UCM - CN4A			
PIN NUMBER	**WIRE NUMBER**	**CIRCUIT REFERENCE**	**ELECTRICAL SCHEMATIC FRAME**
20	G069 (BK)	UCM GROUND	9
26	G070 (BK)	UCM GROUND	9



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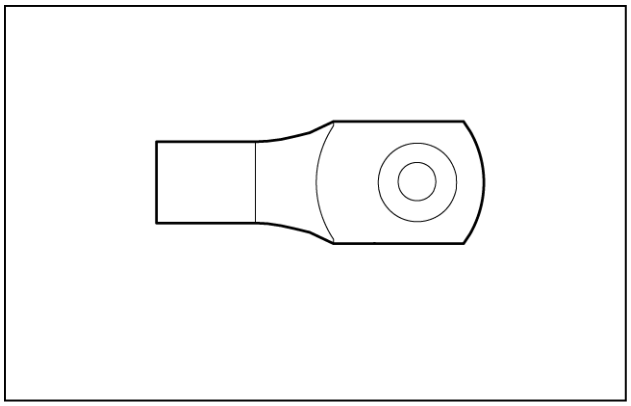
Wire connectors - Component diagram 09

CONNECTOR X-090 - TO MAIN

CONNECTOR X-090 - TO MAIN			
PIN NUMBER	**WIRE NUMBER**	**CIRCUIT REFERENCE**	**ELECTRICAL SCHEMATIC FRAME**
AA1	P100 (RD)	CRANK SIGNAL	2
AA2	6006 (TN)	FRONT/REAR WASHER PUMP SIGNAL	12
AA3	6023 (TN)	LEFT/RIGHT WASHER PUMP SIGNAL	13
AA4	2132 (BL)	ALTERNATOR D+	14
AA5	K271 (GY)	BRAKE SOLENOID SIGNAL	6
AA6	E680 (YE)	K LINE	24
AA7	2032 (GY)	TRANS FILTER RESTRICTION SIG-NAL	14
AA8	S056 (OR)	BRAKE PRESS SW SWITCHED +24V	6
AB1	2112 (WH)	HYD OIL FILTER RESTR SIGNAL	14
AB2	1242 (OR)	AIR FILTER RESTRICTION SIGNAL	14
AB3	2052 (LB)	CHARGE PRESSURE SW SIGNAL	14
AB4	1052 (YE)	HYD OIL TEMP SIGNAL	15
AB5	E270 (YE)	STARTER RELAY COIL SIGNAL	2
AB6	E530 (YE)	STARTER RELAY COIL SIGNAL	2
AB7	4020 (WH)	A/C HIGH PRESSURE SW	18
AC2	E240 (YE)	CAN 1 HI	24
AC3	E250 (GN)	CAN 1 LO	24
AC4	S169 (YE)	CRANK SIGNAL	4
AC5	8003 (WH)	HORN SWITCHED +24V	24
AC6	M201 (WH)	R SEED SENSOR FREQ	21
AC7	H161 (WH)	R SPEED SENS DIR	21
AC8	G076 (BL)	R SPEED SENSOR GROUND	21
AD1	S112 (OR)	IGNITION ON	1
AD2	M281 (WH)	L SEED SENSOR FREQ	21
AD3	H111 (WH)	L SPEED SENS DIR	21
AD4	G078 (BL)	L SPEED SENSOR GROUND	21
AD5	C051 (WH)	L PUMP FWR	21
AD6	A211 (GY)	FWD PUMP RETURN	21
AD7	C061 (WH)	L PUMP REV	21
AD8	S164 (OR)	SWITCHED 12V	
BA1	S097 (OR)	SPEED SENSORS SWITCHED +24V	21
BA2	C191 (WH)	R PUMP FWD	21
BA3	C221 (GY)	REV PUMP RETURN	21
BA4	C251 (WH)	R PUMP REV	21
BA5	H061 (WH)	R MOTOR SIGNAL	21
BA6	C211 (GY)	R/L MOTOR RETURN	21
BA7	H191 (WH)	L MOTOR SIGNAL	21
BB1	C102 (YE)	BRAKE PRESS SWITCH	6

CONNECTOR X-135 - STARTER

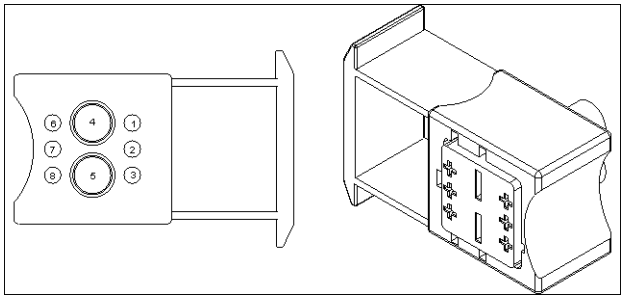
CONNECTOR X-135 - STARTER			
PIN NUMBER	**WIRE NUMBER**	**CIRCUIT REFERENCE**	**ELECTRICAL SCHEMATIC FRAME**
1	P004 (RD)	ALTERNATOR-STARTER	2



RING TERMINAL 5

CONNECTOR X-213 - GCU

CONNECTOR X-213 - GCU			
PIN NUMBER	**WIRE NUMBER**	**CIRCUIT REFERENCE**	**ELECTRICAL SCHEMATIC FRAME**
1	1580 (WH)	GLOW PLUG	4
2	1610 (WH)	GLOW PLUG	4
3	E220 (YE)	GLOW PLUG FEEDBACK SIGNAL	4
4	P089 (RD)	GCU BATT+ 12V	4
5	E411 (BK)	GLOW PLUG UNIT GROUND	4
6	1570 (WH)	GLOW PLUG	4
7	1600 (WH)	GLOW PLUG	4
8	E520 (YE)	GLOW PLUG UNIT COMMAND SIGNAL	4



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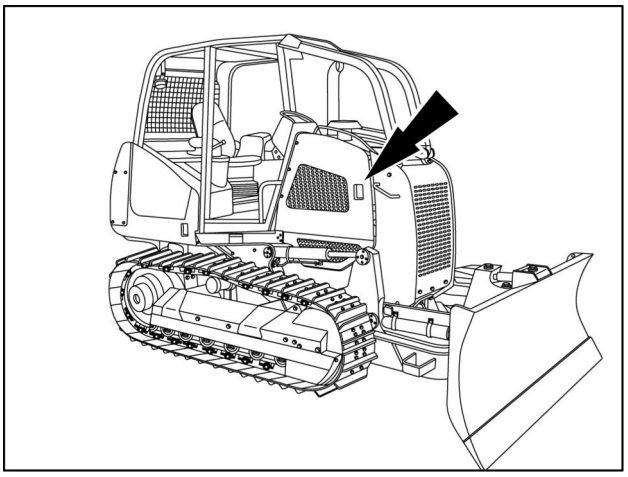
Key	Schematic Designation	Fuse or relay function	Amperage	Electrical schematic sheet #
1	F-036	ECU B+ fuse	20 A	4
2	F-031	ECU B+ fuse	7.5 A	4
3	F-009	LAMBDA SENSOR\ENGINE INTERFACE B+ fuse	7.5 A	4
4	K-005	ECU B+ relay	12V - 70 A	4

5. Close right side engine access door.



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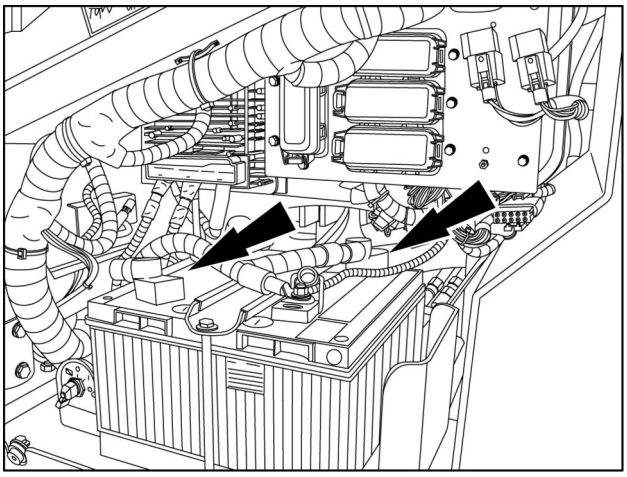
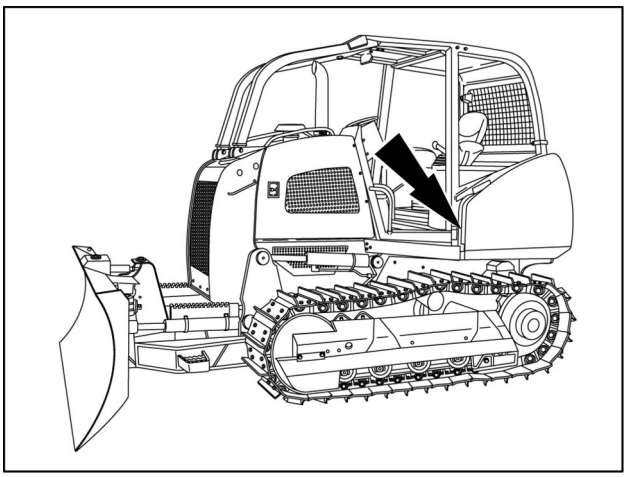
4. Connect negative (-) cable to each battery. Torque the nuts to **21.5 – 24.0 N·m** (**15.9 – 17.7 lb ft**).



RAIL13DOZ0503AA 4

5. Close battery access door.



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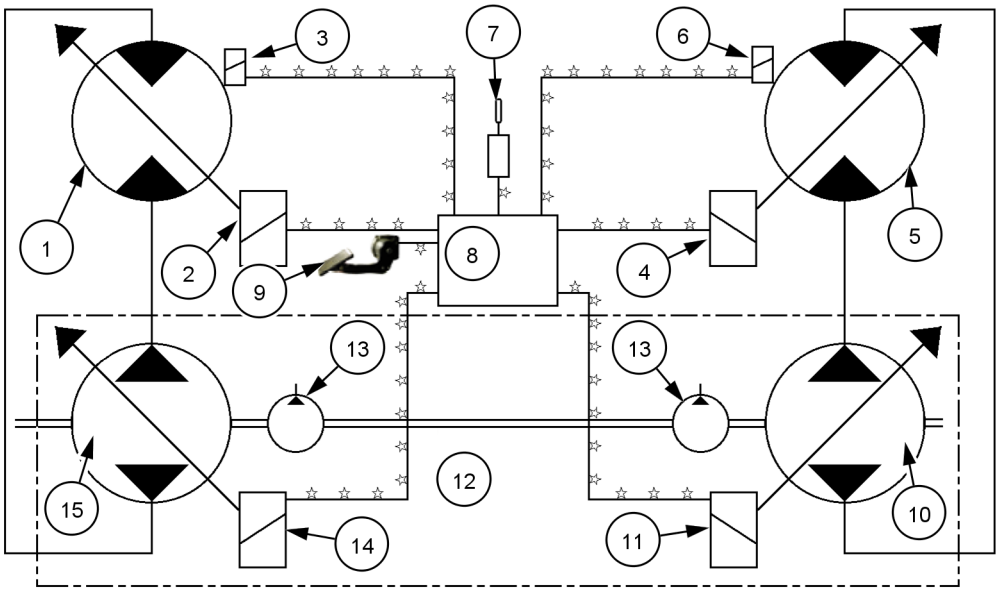
DIAGNOSTIC

Hydrostatic Drive System Left Control Joysitck

The track drive system for all of the M Series Crawler/Dozer models is a hydrostatic drive system. This system consists of a tandem piston pump assembly with a separate drive motor for each track. The pumps and motors are electrically controlled.

Operator control commands are delivered to the universal control module (UCM) **(8)** from sensors in the left control handle **(7)** and the brake pedal **(9)**. The UCM processes these operator input commands and then sends variable control signals to each pump control solenoid **(11)** and **(14)** and the motor control solenoids **(2)** and **(4)**. For the UCM to properly control the hydrostatic travel system, the left control lever output signal needs to be calibrated. The UCM needs to recognize when the lever is in neutral and in either the full forward or full reverse location. For steering, the UCM needs to recognize the full left and full right lever positions. The left Joystick calibration function “teaches” the UCM the left lever functions. The service technician or operator can calibrate the left joystick any time there is a functional problem with the hydrostatic travel system.



RAIL12DOZ544FA 3

1103 - Throttle Sensor: Signal Short to Power

Context:
The UCM detects a short circuit to another voltage source in the throttle circuit, X-016 pin 18. The throttle will operate in limp home mode while Diagnostic Trouble Code 1103 is active.

Cause:
The UCM detects a short circuit to another voltage source in the throttle signal circuit, X-016 pin 18.

Possible failure modes:

1. A short circuit in the throttle signal wiring or circuits.
2. Faulty throttle sensor.
3. Faulty UCM.

Solution:

1. Verify that the fault code is active.

   (1) Connect the Electronic Service Tool to the service tool connector.

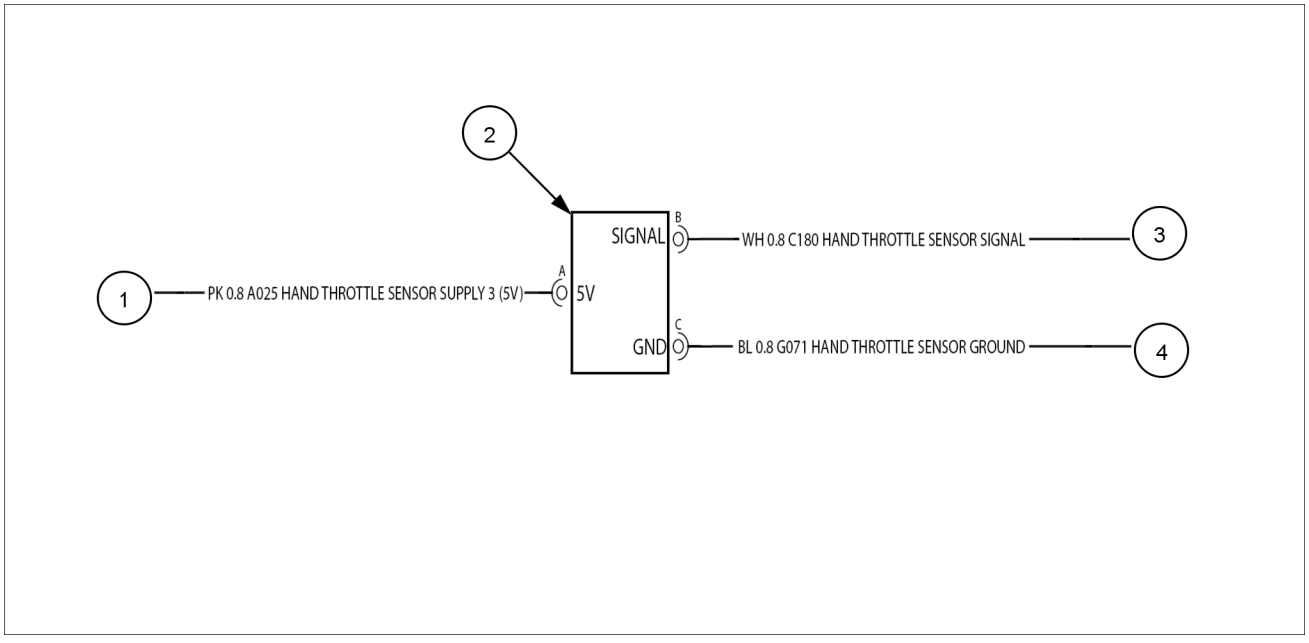
   (2) To check for fault code: Start and operate machine.

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

   B. Fault code 1103 is recorded again. Go to Step **2**.
2. Verify that the wiring and connectors are free of damage.

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

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



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Harnesses and connectors - Electrical schematic sheet 09 - UCM (55.100-C.20.E.09)
Harnesses and connectors - Electrical schematic sheet 21 - Drive Train \ Pumps (55.100-C.20.E.21)

B. The voltage is greater than **30 V**. There is a problem in the battery supply, charging circuit to the UCM. Verify that the UCM ground connection is free of paint, oil, grease, dirt, and debris. Return to **1** to confirm elimination of the fault.

Harnesses and connectors - Electrical schematic sheet 09 - UCM (55.100-C.20.E.09)
Harnesses and connectors - Electrical schematic sheet 01 - Power Distribution \ Charging System (55.100-C.20.E.01)

1829 - Overall UCM Current Draw Above Normal

Context:
The combined UCM current is greater than a predefined limit.

Cause:
The combined UCM current is greater than normal. This fault code may be active with 1809 and other fault codes such as high engine temperatures or low battery voltages.

Possible failure modes:

1. A problem in the voltage supply to the UCM.
2. Faulty UCM.

Solution:

1. Verify that the fault code is active.

   (1) Connect the Electronic Service Tool to the service tool connector.

   (2) To check for fault code: Start and operate machine.

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

   B. Fault code 1829 is recorded again along with other codes such as fault code 3007 high coolant temperature or fault code 1408 low battery voltage troubleshoot these codes first.

   C. Fault code 1829 is recorded again. No other codes are present. Go to Step **2**.
2. Verify the harness is not damaged

   (1) Turn the ignition switch OFF.

   (2) Verify the minus battery connections from the battery to the frame are tight and secure.

   (3) Verify the connections from battery to the UCM are tight and secure.

   (4) Verify the harness is free of damage, abrasion, corrosion, and incorrect attachment from the battery to the UCM.

   A. The harness is not damaged and all connections are secure. Temporarily replace the UCM and retest. Return to Step **1** to confirm elimination of the fault.

   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.

Harnesses and connectors - Electrical schematic sheet 09 - UCM (55.100-C.20.E.09)
Harnesses and connectors - Electrical schematic sheet 03 - Grounding (55.100-C.20.E.03)

3010 - Boost Temp Signal - Shorted to high source

Context:
The Engine Control Unit (ECU) generated an error from a fault associated with the Boost Pressure sensor. The Boost Pressure sensor is an integrated sensing device used to sense both temperature and pressure. This fault is related to the temperature sensing function of the device. This error could result from a signal out of range or a signal that is either erratic or intermittent. When the ECU determines that the Boost Pressure sensor value is not valid, it will substitute a default value of **29.96 °C** (**86 °F**).

Cause:
The Boost Pressure sensor signal to the ECU is out of range of the upper threshold limit.

Possible failure modes:

1. Faulty sensor.
2. Faulty electrical wiring or connection.
3. Faulty ECU, supply voltages or grounds.

Solution:

1. Check electrical connections and wiring. Remove Boost Pressure sensor connector LDFT and inspect housing body/latch, pins and wiring harness for damage. Also, inspect connector portion of the Boost Pressure sensor.

   A. If damage is determined after careful inspection, repair wiring and/or replace connector parts to ensure a good and sound electrical connection. Replace Boost Pressure sensor if damaged.

   B. If no damage is determined, proceed to step **2**.

2. Check Open Circuit Voltages for Boost Pressure sensor. Place the ignition switch OFF. Remove connector LDFT from Boost Pressure sensor and check for voltages (DC) between connector pins outlined in the table below. Use the test lead labeled "Air Press/Temp Sensor" from the Tier II (NEF) Diagnostic Repair Kit **380040185** to access the pins on the connector.

Test Type	From	To	Expected Results
1. Voltage	LDFT (Pin 3)	LDFT (Pin 1)	Approx. **5 volts**
2. Voltage	LDFT (Pin 2)	LDFT (Pin 1)	Approx. **5 volts**
3. Voltage	LDFT (Pin 4)	LDFT (Pin 1)	Approx. **5.4 volts**

   A. If the voltage test sequence is successful, proceed to step **4**.

   B. If the voltage test sequence is not successful, proceed to step **3**.

3. Check for Faulty Wiring. Place the ignition switch OFF. Remove and perform continuity/shorts tests between connectors LDFT and 2 on engine wiring harness. Flex harness during test to check for any intermittent operation. Use the test lead labeled "Air Press/Temp Sensor" from the Tier II (NEF) Diagnostic Repair Kit **380040185** to be able to access the pins on the sensor connector LDFT. Also, use the **0.4 mm** (**0.017 in**) diameter test probes from the repair kit when connecting the digital multi-meter (DMM) to connector 2. Make sure the DMM's test lead resistance is taken into account when making continuity measurements. See test table below.

   Important Note:
   Check and verify that the Vehicle Status is correct. Potential ECU damage could result when removing main ECU connectors if this is not followed.

Test Type	From:	To:	Expected Results
1. Continuity	LDFT (Pin: 1)	2 (Pin: 25)	Approx. **0 – 0.10 ohms**
2. Continuity	LDFT (Pin: 2)	2 (Pin: 36)	Approx. **0 – 0.10 ohms**
3. Continuity	LDFT (Pin: 3)	2 (Pin: 33)	Approx. **0 – 0.10 ohms**
4. Continuity	LDFT (Pin: 4)	2 (Pin: 34)	Approx. **0 – 0.10 ohms**
5. Shorts	2 (Pin: 36)	2 (Pin: 25, 34, 33)	Open Circuit
6. Shorts	2 (Pin: 25)	2 (Pin: 34, 33)	Open Circuit
7. Shorts	2 (Pin: 34)	2 (Pin: 33)	Open Circuit

D. If the voltages and ground paths are not correct, refer to schematic and determine root cause of power or continuity problem(s).

Harnesses and connectors - Electrical schematic sheet 04 - Engine Control (55.100-C.20.E.04)

3059 - ECM afterrun was interrupted

NOTICE: *Fault Code 3059 is stored in historical information. For multiple occurrences of this fault proceed with the following tests.*

Cause:

1. Faulty reading from component.
2. Connectors not mated fully, pins not pushed into connector fully, bent pin or broken wire at rear of connector.
3. Wiring or circuits open.
4. Wiring or circuits shorted.
5. Connector pins corroded or dirty.

Solution:

1. Verify that the fault code is still active.
   Prior to clearing fault codes write down all fault codes, number of occurrences, and engine hours at last occurrence.

   (1) Turn ignition switch to ON position.

   (2) Clear all fault codes.

   (3) To check for fault code: Start and operate machine.

   A. If fault code 3059 is recorded again, go to Step **2**.

   B. If the fault is not recorded again, return the unit to service.
2. Measure the ECU unswitched input voltage

   (1) Turn ignition OFF. Disconnect Engine Control Unit (ECU) connector X-212 from engine controller.

   (2) Inspect pins on Engine Control Unit (ECU) connector and on engine controller. Clean connections.

   (3) Turn the ignition ON.

   (4) Measure the voltage from pins 1, 3, 5, and 28 on ECU connector X-212 to ground (ECU connector X-212 pins 2, 4, and 6). The voltage should be approximately **14.5 V**.

   A. If the voltage is not correct, check the fuses and wiring to the ECU. Return to Step **1** to confirm elimination of fault.

   B. If the voltage is correct, go to Step **3**.
3. Test alternator.

   A. If the alternator test fails, replace the alternator. Return to Step **1** to confirm elimination of fault.

   B. If the alternator tests good, go to Step **4**.
4. Replace the engine control module.

   (1) Remove and replace engine control module.

   A. Return to Step 1 to confirm elimination of fault. If fault is recorded again, contact Technical Services Group for assistance.

Harnesses and connectors - Electrical schematic sheet 01 - Power Distribution \ Charging System (55.100-C.20.E.01)
Harnesses and connectors - Electrical schematic sheet 04 - Engine Control (55.100-C.20.E.04)

B. If there was no continuity on either pin to chassis ground, there is a short to ground condition in the engine injector harness between connector VC2 and ECU harness connector 3.Locate and repair the grounded conductor.

4. Remove the injector (valve) cover and disconnect the injector harness from Cylinder #4 injector at connector INJ4 terminal 1 (high side ring terminal) Use a multi-meter to check for continuity, on the Cylinder #4 injector, from terminal 1 to chassis ground. There should not be continuity.

   A. If there is continuity, the Cylinder #4 injector solenoid coil has failed, replace the injector.

   B. If there is no continuity, there is a short to ground condition in the Cylinder #4 injector circuit, between connector INJ4 and connector VC2. Locate and repair the grounded conductor.

5. Disconnect the engine injector harness from the injector cover at connector VC2 and use a multi-meter to check the resistance on the injector cover side of connector VC2 between pins 1 and 2. There should be **0.4 – 0.5 Ω**.

   A. If the resistance was within range, there is a short circuit condition in the engine injector harness between connector VC2 and ECU harness connector 3, locate and repair the short circuit.

   B. If the resistance was lower than range minimum, continue with step **6**.

6. Remove the injector (valve) cover and disconnect the injector harness from the Cylinder #4 injector at connector INJ4 terminal 1 (high side ring terminal) Use a multi-meter to check for continuity, on the Cylinder #4 injector, from terminal 1 to terminal 2. There should be **0.4 – 0.5 Ω**.

   A. If the resistance was within range, there is a short circuit condition in the injector harness, between connector INJ4 and connector VC2. Locate and repair the shorted conductors.

   B. If the resistance was lower than minimum range, the Cylinder #4 injector solenoid coil has failed. Replace the injector.

Note: Electric valve connector X-215 cylinder pin outs are as follows: (cylinder 1- A B, 2- G H, 3- C D, 4- E F)
Harnesses and connectors - Electrical schematic sheet 05 - Engine Control (55.100-C.20.E.05)

3102 - Rail pressure sensor CP3 - Shorted to low source

Context:
The engine control unit (ECU) has sensed that the Fuel Pressure sensor signal is too low. The test frequency of the sensor is every **10 ms** and if the signal is below **0.25 V** for over **200 ms**, the error is set. Once set the ECU will, instead of using the peak rail pressure value of the last **10 ms** and the current rail pressure, output a substitute value from a curve (MAP) in the ECU depending on engine speed and injection quantity.

Cause:
The Rail Pressure sensor signal is too low.

Possible failure modes:

1. Faulty Rail Pressure sensor.
2. Faulty circuit wiring, shorted to low source.
3. Faulty ECU, hardware or software.

Solution:

1. Disconnect the engine sensor harness from the ECU at ECU engine connector 2 and place the Key switch in the "On" position. Use a multi-meter check the voltage on the ECU from pin 13 to pin 12. There should be **5 V**.

   A. If there is **5 V** reconnect ECU engine connector and continue with step **2**

   B. If there is less than **5 V**, there is a failure inside the ECU, replace the ECU.
2. Disconnect the engine sensor harness from the Fuel Pressure sensor and place the Key switch in the "On" position. Use a multi-meter check the voltage on the engine harness side of Fuel pressure sensor connector RDS4 from pin 3 to pin 2. There should be **5 V**.

   A. If there is **5 V** leave the Fuel pressure sensor connector disconnected and continue with step **3**

   B. If there is less than **5 V**, there is a short to low source in the sensor circuit wiring, leave the Fuel pressure sensor connector disconnected and continue with step **4**
3. Disconnect the engine sensor harness from the ECU at ECU engine connector 2. Use a multi-meter to test for continuity between the engine sensor harness side of ECU engine connector 2 pin 14 and ground and also between Fuel pressure sensor connector RDS4 pin 1 and ground. There should be no continuity.

   A. If there is continuity on either or both tests, there is a short to low source in the sensor signal wire, locate and repair the short to low source.

   B. If there is no continuity, either the sensor has failed or the ECU is faulty. Replace the common rail pressure sensor and if the fault reoccurs reload the ECU software. If the fault reoccurs after replacing the sensor and reloading software, replace the ECU .
4. Disconnect the engine sensor harness from the ECU at ECU engine connector 2. Use a multi-meter to test for continuity between the engine sensor harness side of ECU engine connector 2 pin 13 and ground and also between Fuel pressure sensor connector RDS4 pin 3 and ground. There should be no continuity.

   A. If there is continuity, on either or both tests, there is a short to low source in the sensor source wire. Locate and repair the short to low source.

   B. If there is no continuity, on either or both tests, there is a short to low source in the sensor ground reference wire. Locate and repair the short to low source.

Harnesses and connectors - Electrical schematic sheet 05 - Engine Control (55.100-C.20.E.05)

Test Type	From	To	Expected Results
1. Voltage	ODFT (Pin 3)	ODFT (Pin 1)	Approx. **5 volts**
2. Voltage	ODFT (Pin 2)	ODFT (Pin 1)	Approx. **5 volts**
3. Voltage	ODFT (Pin 4)	ODFT (Pin 1)	Approx. **5.4 volts**

A. If the voltage test sequence is successful, proceed to step **5**.

B. If the voltage test sequence is not successful, proceed to step **6**.

5. Operation: Oil temp / press sensor Test
Vehicle Status: Key Off Engine Off.

Remove ODFT connector and test resistance of Oil temp / press sensor using the table of resistance vs. temp. below. Approximate the engine oil temperature when performing test. Use a multi-meter between pins 1 and 2.

Engine Oil Temperature	Resistance Value (between pins 1 and 2)
-40 °C (**-40 °F**)	**70 kOhm**
-20 °C (**-4 °F**)	**25 kOhm**
0 °C (**32 °F**)	**7.5 kOhm**
20 °C (**68 °F**)	**4.5 kOhm**
40 °C (**104 °F**)	**1.5 kOhm**
60 °C (**140 °F**)	**750 ohms**
80 °C (**176 °F**)	**550 ohms**
100 °C (**212 °F**)	**320 ohms**
120 °C (**248 °F**)	**130 ohms**

A. If the resistance measurement does not approximately match the table, replace the sensor.

B. If the resistance measurement does approximately match the table, proceed to step **6**.

6. Operation: Check for Faulty Wiring.
Vehicle status: Key Off Engine Off.

Remove and perform continuity tests between connectors ODFT and ECU on engine wiring harness. Flex harness during test to check for any intermittent operation. See test table below.
Important Note: Check and verify that the Vehicle Status is correct. Potential ECU damage could result when removing main ECU connectors if this is not followed.

Test Type	From	To	Expected Results
1. Continuity	ODFT (Pin: 1)	2 (Pin: 24)	Approx. **0 – 0.10 ohms**
2. Continuity	ODFT (Pin: 2)	2 (Pin: 28)	Approx. **0 – 0.10 ohms**
3. Continuity	ODFT (Pin: 3)	2 (Pin: 32)	Approx. **0 – 0.10 ohms**
4. Continuity	ODFT (Pin: 4)	2 (Pin: 27)	Approx. **0 – 0.10 ohms**
5. Short Circuit	2 (Pin: 28)	2 (Pin: 24, 27, 32)	Open Circuit
6. Short Circuit	2 (Pin: 24)	2 (Pin: 27, 32)	Open Circuit
7. Short Circuit	2 (Pin: 27)	2 (Pin: 32)	Open Circuit

A. If continuity/shorts test is successful, go to step **7**.

B. If continuity/shorts test is unsuccessful, find and repair the damaged section(s) of the wiring harness.

7. Operation: Check for ECU Voltages and Ground Continuity.
Vehicle Status (when removing connector 1): Key Off Engine Off.
Vehicle Status (when performing test): Key On Engine Off.
Vehicle Status (when replacing connector 1): Key Off Engine Off.

Use product schematic for a reference, remove connector from the ECU and check for voltage and continuity at the appropriate pins defined in the test table below.
Important Note:
Check and verify that the Vehicle Status is correct for each operation. Potential ECU damage could result when removing and replacing main ECU connectors if this is not followed.

3211 - Bank 1 - Injector Cable Short Circuit Low Side To Ground

NOTE: *This diagnostic procedure requires a good quality Digital Multi-meter (DMM) to accurately measure resistance. The DMM must measure to a resolution of* ***0.1 ohms****. The required measurements are as low as* ***0.4 ohms*** *(typical injector solenoid coil resistance is* ***0.4 – 0.5 Ω****) and any DMM inaccuracies will cause the technician to inaccurately troubleshoot.*

NOTE: *Ensure the DMM's test lead resistance is considered when measuring resistance. Touch the leads together on the lowest Ohms scale and record the resistance measurement. Subtract this value from all future resistance measurements.*

Context:
The Engine Control Unit (ECU) has determined a short circuit exists in an injector cable in Bank 1 (cylinders 1 and 4). A power stage component (internal to the ECU) energizes the injection system transistors while monitoring the current flow.

Cause:
The Engine Control Unit (ECU) has determined that there is a fault associated with the current monitoring of the injector output power driver stage.

Possible failure modes:

1. Faulty wiring.
2. Faulty injector 1.
3. Faulty injector 4.
4. Faulty ECU.

Solution:

1. Verify the fault is present.

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

   B. If the fault is not present, check for an intermittent fault.
2. Verify that the wiring harness and connectors are free of damage.

   Inspect the wiring harness from the ECU to the injector 1 connector.

   Inspect the wiring harness from the ECU to the injector 4 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 for a short to ground on the injectors.

   Place the key switch OFF.

   Disconnect the wiring harness from the ECU.

   Use a multimeter to measure resistance from the wiring harness injector 1 connector between pin 32 and ground, and injector 4 pin 48 and ground. There should be no continuity.

   A. If there is continuity on any of the pins to chassis ground, record the pin number and continue with step **4**.

   B. If there is no continuity, the ECU may have failed. Try reloading the ECU software and if the fault reoccurs, replace the ECU.
4. Check the cylinder injector 1 coil resistance through the wiring harness.

   Place the key switch OFF.

3237 - Number of Injections Limited - by Software

Context:
This fault has occurred because the desired number of injections is greater than maximum number of injections per cycle, depending on battery voltage and power requirements for energizing. Check battery voltage, and check power supply of booster banks. If battery voltage is low, charge battery and recheck. If battery does not hold a charge, replace the battery. If the power supply of the booster banks is insufficient, check for other faults present. Resolve those faults.

3260 - Low side power - open load

NOTE: *The low side driver power stage is internal to the Engine Control Unit (ECU).*

Context:
The crank relay (starter control relay) supplies power to the starter motor to crank the engine. The diagnostic function of the low side driver monitors for an open load in the circuit.

Cause:
The ECU senses the crank relay (starter control relay) low side driver circuit is open.

Possible failure modes:

1. The crank relay (starter control relay) has failed.
2. The wiring harness is faulty.
3. The ECU has an internal failure.

Solution:

1. Verify fault is present and in an active state.

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

   B. If the fault is inactive or not present, the fault may have been intermittent. Check for an intermittent fault.
2. Verify that the wiring harness and connectors are free of damage.

   Inspect the wiring harness from the ECU to the crank relay (starter control relay) K-003.

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

   Make sure all connections are secure and locked.

   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 relay control circuit.

   Place the key switch OFF.

   Remove the relay K-003.

   Use a multimeter to check for continuity on the relay from pin 85 to pin 86.

   There should be continuity.

   A. If there is continuity, leave the relay removed. Continue with Step **4**.

   B. If the relay test fails, replace the relay.
4. Check the wiring harness for an open circuit.

   Place the key switch OFF.

   Disconnect the wiring harness from the ECU.

   Use a multimeter to check for continuity from the wiring harness side of the K-003 relay cavity pin 85 to the ECU wiring harness connector X-212 pin 27.

   Use a multimeter to check for continuity from the wiring harness side of the K-003 relay cavity pin 86 to the ECU wiring harness connector X-212 pin 53.

Harnesses and connectors - Electrical schematic sheet 01 - Power Distribution \ Charging System (55.100-C.20.E.01)
Harnesses and connectors - Electrical schematic sheet 04 - Engine Control (55.100-C.20.E.04)
Harnesses and connectors - Electrical schematic sheet 05 - Engine Control (55.100-C.20.E.05)

3369 - Torque reduction due to smoke reduction

Context:
This fault is for informational purposes only and is active because there has been a torque limitation set by the Engine Control Unit (ECU) A-9000. The (ECU) A-9000 monitors air/fuel ratio. If the ECU A-9000 determines that the ratio is too lean, a torque limitation of 25 % will be active to prevent engine damage. Though no action is necessary due to this error, if the power reduction occurred due to an actual defect, the error triggering the torque limitation should also be in fault memory. Use the Electronic Service Tool (EST) to check for related faults. Diagnose the related faults first and then return to this fault, 3369 (DTC 19E-Min). Also, see the list below of possible mechanical failures that may have caused this fault. See Fuel injection system - Poor quality for more information on troubleshooting a lean air/fuel ratio condition.

Cause:
The ECU A-9000 has set a torque limitation due to a lean air/fuel ratio.

Solution:

1. Operating in extreme high altitudes, greater than an altitude of **1800 m** (**5906 ft**) .
2. Operating in low ambient pressure conditions, less than an ambient pressure of **0.78 bar** (**11.31 psi**) .
3. Faulty lambda sensor B-9123, drifted.
4. Faulty Exhaust Gas Recirculation (EGR) actuator, stuck or inoperative.
5. Faulty turbocharger wastegate Y-9008, sticking or stuck open.
6. Faulty turbocharger, low efficiency.
7. Faulty air induction, leakage or blockage.
8. Faulty intake manifold pressure sensor B-9001. At key ON there should be approximately the value of ambient pressure.
9. Faulty ECU A-9000, software.

Disconnect the glow plug connector.

Measure the resistance between the glow plug and chassis ground. The chassis ground connection must be clean and free of paint, oil and dirt. The resistance should be approximately **1 Ω**.

A. The resistance is approximately **1 Ω**. There is a problem in the wiring to the glow plug. Repair or replace as required. Return to step **1** to confirm elimination of the fault.

B. The resistance is less than **0.75 Ω**. Temporarily replace the glow plug and retest. Return to step **1** to confirm elimination of the fault.

C. The resistance is greater than **20,000 Ω**. There is an open circuit in the glow plug. Temporarily replace the glow plug and retest. Return to step **1** to confirm elimination of the fault.

Harnesses and connectors - Electrical schematic sheet 04 - Engine Control (55.100-C.20.E.04)

3655 - Fueling limited due to other engine fault detected, see other fault codes

Context:
No actions necessary due to this failure alone. If power reduction occurred due to an actual defect, the failure triggering the torque limitation should also be in the failure memory. Follow troubleshooting of this root fault.

3673 - Short circuit over load error for H-bridge

Context:
The ECU had detected a short circuit in the ERG valve drive circuit.

Cause:
The ECU had detected a short circuit in the ERG valve drive circuit.

Possible failure modes:

1. Wiring shorted.
2. Faulty ECU.

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 3673 is recorded again. Go to step **2**.
2. Verify that the wiring and connectors are free of damage.

   Inspect the ECU and the EGR valve. All connections should be secure, tight, free of corrosion, abrasion and damage.

   Inspect the harness from the ECU to the EGR valve. 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 harness to chassis ground.

   Turn the ignition switch OFF.

   Disconnect the EGR valve connector. Disconnect the ECU connector.

   Measure the resistance between ECU connector X-216 pin 50 and ECU connector X-216 pin 35. 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 in the wiring harness. Repair or replace the harness as required. Return to step **1** to confirm elimination of the fault.
4. Measure the resistance of the valve to chassis ground.

   Turn the ignition switch OFF.

   Disconnect the EGR valve connector.

   Measure the resistance between the EGR valve, motor plus pin and chassis ground. The resistance should be greater than **20,000 Ω**.

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

Disconnect the glow plug connector.

Measure the resistance between the glow plug and chassis ground. The chassis ground connection must be clean and free of paint, oil and dirt. The resistance should be approximately **1 Ω**.

A. The resistance is approximately **1 Ω**. There is a problem in the wiring to the glow plug. Repair or replace as required. Return to step **1** to confirm elimination of the fault.

B. The resistance is less than **0.75 Ω**. Temporarily replace the glow plug and retest. Return to step **1** to confirm elimination of the fault.

C. The resistance is greater than **20,000 Ω**. There is an open circuit in the glow plug. Temporarily replace the glow plug and retest. Return to step **1** to confirm elimination of the fault.

Harnesses and connectors - Electrical schematic sheet 04 - Engine Control (55.100-C.20.E.04)

A. If any of the above tests fail. Locate and repair damaged wiring harness.

B. If the all the above test are correct, continue with step **5**.

5. Check the injection system for any leaks or damages.

   A. If the injectors or system has any leakages, repair or replace damage component.

   B. If the injection system is in good condition, continue with step **6**.

6. Check the EGR valve. Remove the EGR valve, and check if the valve is stuck open.

   A. If the EGR valve is stuck open, clean or replace the EGR valve.

   B. If the EGR valve is in good condition, place the EGR valve back onto the machine. Re-flash the ECU software. Check to verify the fault has cleared. If the fault has not cleared. Replace the ECU.

Harnesses and connectors - Electrical schematic sheet 04 - Engine Control (55.100-C.20.E.04)

Measure the resistance from the fuel metering unit supply pin to chassis ground. The resistance should be greater **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 ECU 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 to chassis ground in the wiring. Repair or replace the wiring as required. Return to step **1** to confirm elimination of the fault.

Harnesses and connectors - Electrical schematic sheet 05 - Engine Control (55.100-C.20.E.05)

3758 - Level 2 Monitoring: Diagnosis fault check to report the error to demand for an ICO due to an error in the post injection 3 efficiency factor

Context:
The Engine Control Unit (ECU) monitors the injection cycle.

Cause:
Post injection 3 efficiency is plausible.

Possible failure modes:

1. Faulty ECU.

Solution:

1. Verify the fault is still active and present.
   A. If the fault is still active, try to update the ECU software with the proper data set. If the fault is still present, replace the ECU.
   B. If the fault is not present, the fault may be intermittent. Check for an intermittent fault. If no faults are found, clear the fault code. Return the machine to service.

3799 - Pressure Relief valve: pressure relief valve is forced to open, perform pressure shock

Context:
This code is not an actual failure. A rail pressure shock test was detected. Clear code and return machine to proper use.

3822 - Short circuit to battery on Out2 error for H-bridge

Context:
Short circuit to battery on Out2 error for H-bridge. The ECU had detected a short circuit to an external power source.

Cause:
The TVA valve drive circuit is shorted to positive battery.

Possible failure modes:

1. Wiring shorted to positive battery source.
2. Faulty ECU

Solution:

1. Verify that the fault code is active.

   (1) Use the Electronic Service Tool to clear all fault codes. Prior to clearing fault codes write down all fault codes, number of occurrences, and engine hours at last occurrence.

   (2) To check for fault codes: Start and operate machine.

   A. Fault code 3822 is not recorded again. OK to return the machine to service.

   B. Fault code 3822 is active and recorded again. Go to Step **2**.
2. Verify that the wiring and connectors are free of damage.

   (1) Inspect the ECU and the TVA valve. All connections should be secure, tight, free of corrosion, abrasion and damage.

   (2) Inspect the harness from the ECU to the TVA valve. 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 through the wiring harness

   (1) Turn the key switch OFF.

   (2) Disconnect the TVA valve connector. Disconnect the ECU connector.

   (3) Turn the key switch ON.

   (4) Measure the voltage from ECU connector X-216 pin 49 to chassis ground. The voltage should be less than **0.5 V**. Wiggle the harness during measurement to reveal an intermittent condition.

   (5) Measure the voltage from ECU connector X-216 pin 34 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**. Temporarily replace the ECU and retest. Return to Step **1** to confirm elimination of the fault.

   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 the fault.

Harnesses and connectors - Electrical schematic sheet 05 - Engine Control (55.100-C.20.E.05)

(3) Measure the voltage between ECU connector X-212 pin 83 to chassis ground. The voltage should be less than **0.2 V**. Wiggle the harness during measurement to reveal an intermittent condition.

A. The voltage is less than **0.2 V**, go to Step **5**.

B. The voltage is greater than **0.2 V**, the wire is shorted to another voltage source. Repair or replace the wire as required. Go to Step **1** to confirm elimination of the fault.

5. Measure the resistance of the sensor.

(1) Turn the key switch OFF

(2) Disconnect the Temperature Sensor #2 connector.

(3) Measure the resistance of the Exhaust Gas Temperature Sensor pin 1 to pin 2. The resistance should be approximately **175 – 250 Ω**.

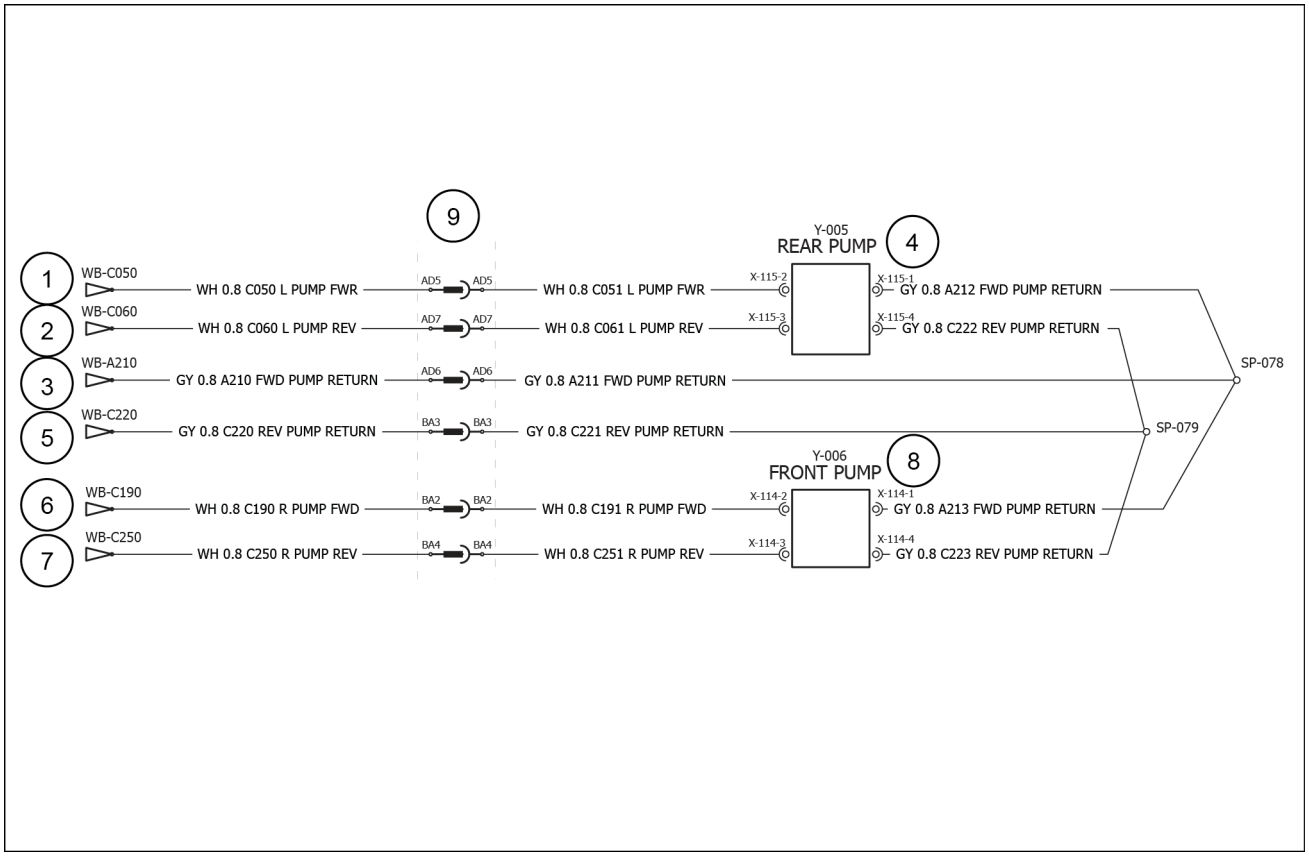
A. The resistance is within the specified range. Temporarily replace the ECU and retest. Go to Step **1** to confirm the elimination of the fault.

B. The resistance is not within the specified range. Temporarily replace the Temperature Sensor and retest. Go to Step **1** to confirm the elimination of the fault.

Harnesses and connectors - Electrical schematic sheet 04 - Engine Control (55.100-C.20.E.04)

3915 - Pressure Relief Valve: Averaged rail pressure is outside the expected range with open PRV

Context:
The engine control unit (ECU) has determined that the Pressure Relief Valve (PRV) is not opening completely or there is a restriction at the PRV connections. Remove the PRV valve and check for any damages. If PRV is damaged, replace the valve.



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Schematic legend			
(1)	UCM connector X-016 Pin 5 L Pump FWD	**(6)**	UCM connector X-016 Pin 19 R Pump FWD
(2)	UCM connector X-016 Pin 6 L Pump REV	**(7)**	UCM connector X-016 Pin 25 R Pump REV
(3)	UCM connector X-014 Pin 21 FWD Pump RTN (Both)	**(8)**	Front Pump Connector X-114
(4)	Rear Pump Connector X-115	**(9)**	Connector X-001/ X-090
(5)	UCM connector X-016 Pin 22 REV Pump RTN (Both)		

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.

(1) Turn the ignition switch OFF.

(2) Disconnect UCM connector X-016.

(3) Disconnect the Left Forward Solenoid.

(4) Turn the ignition switch ON.

(5) Measure the voltage between X-016 pin 5 and chassis ground. The chassis ground connection must be clean and free of paint, oil, and dirt. The voltage should be less than **0.5 V**.

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.

4132 - Left Pump Reverse Solenoid High Side Shorted to Ground

Context:
The UCM detects a short circuit in the Left Reverse Solenoid Circuit, X-016 pin 6. Reverse ground drive is disabled while fault code 4132 is active.

Cause:
There is a short circuit to chassis ground in the Left Reverse Solenoid Circuit, X-016 pin 6

Possible failure modes:

1. Short circuit in the Left Reverse Solenoid circuit.
2. Faulty Left Reverse Solenoid.
3. Faulty UCM.

Solution:

1. Verify that the fault code is active.

   (1) Connect the Electronic Service Tool to the service tool connector.

   (2) To check for fault code: Start and operate machine.

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

   B. Fault code 4132 is recorded again. Go to Step **2**.
2. Verify that the wiring and connectors are free of damage.

   (1) Inspect the UCM and the Left Reverse Solenoid connections. All connections should be secure, tight, free of corrosion, abrasion and damage.

   (2) Inspect the harness from the UCM to the Left Reverse Solenoid. Verify that the harness is free of damage, corrosion, abrasion and incorrect attachment.

(1) Leave the jumper wire installed in connector X-133.

(2) Turn the ignition switch OFF.

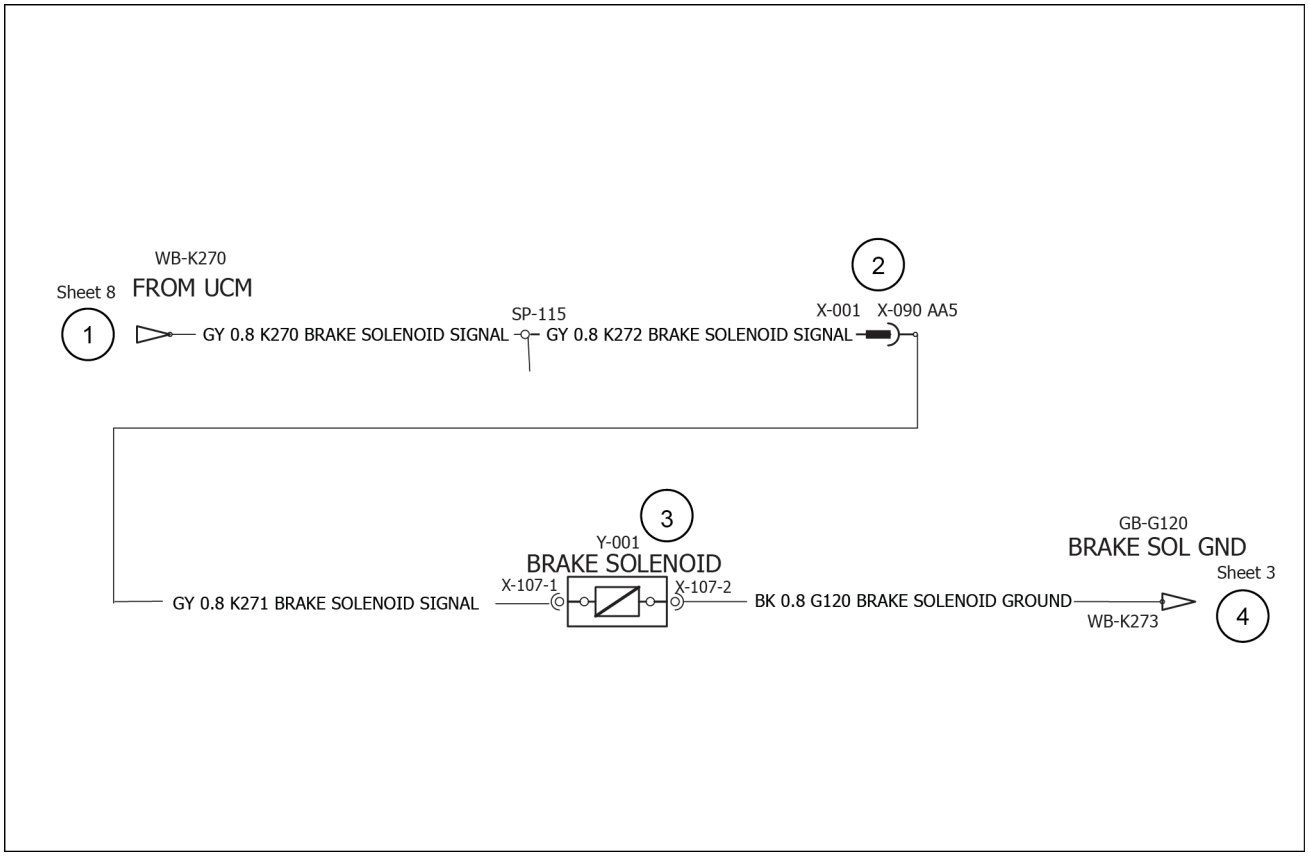
(3) Disconnect UCM connectors X-018 and X-016.

(4) Measure the resistance between X-018 pin 6 and X-016 pin 21. 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**. Temporarily replace the UCM and retest. Return to Step **1** to confirm elimination of the fault.

B. The resistance is greater than **10 Ω**, there is an open circuit in the UCM wiring. Repair or replace the harness as required. Return to Step **1** to confirm elimination of fault.

Harnesses and connectors - Electrical schematic sheet 08 - UCM (55.100-C.20.E.08)
Harnesses and connectors - Electrical schematic sheet 21 - Drive Train \ Pumps (55.100-C.20.E.21)



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Schematic legend			
(1)	UCM connector X-019 Pin 27	**(3)**	Brake Solenoid Connector X-107
(2)	Connector X-001/X-090Pin AA5	**(4)**	Brake Solenoid Ground

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.

(1) Turn the ignition switch OFF.

(2) Disconnect UCM connector X-019.

(3) Disconnect the Park Brake Solenoid.

(4) Turn the ignition switch ON.

(5) Measure the voltage between X-019 pin 27 and chassis ground. The chassis ground connection must be clean and free of paint, oil, and dirt. The voltage should be less than **0.5 V**.

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. Test the circuit.

(1) Turn the ignition switch OFF.

(2) Disconnect the Park Brake Solenoid.

(3) Fabricate a jumper wire that will connect between X-107 pin 1 and X-107 pin 2.

4312 - Pump Reverse Solenoids Shorted to Ground

Context:
The UCM detects a short circuit to ground in the Right Reverse Pump Solenoid Circuit, X-016 pin 25, the Left Reverse Pump Solenoid Circuit, X-016 pin 6, and the Reverse Pump Ground Circuit, X-016 pin 22. Reverse ground drive is disabled while fault code 4312 is active.

Cause:
There is a short circuit to chassis ground in the Reverse Pump Right/Left Solenoid Circuit.

Possible failure modes:

1. Short circuit to ground in the Right Reverse Pump Solenoid circuit, Left Reverse Pump Solenoid circuit, and the Solenoid return line.
2. Faulty Right Reverse Solenoid and Left Reverse Solenoid.
3. Faulty UCM.

Solution:

1. Verify that the fault code is active.

   (1) Connect the Electronic Service Tool to the service tool connector.

   (2) To check for fault code: Start and operate machine.

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

   B. Fault code 4312 is recorded again. Go to Step **2**.
2. Verify that the wiring and connectors are free of damage.

   (1) Inspect the UCM and the Right Reverse and Left Reverse Solenoid connections. All connections should be secure, tight, free of corrosion, abrasion and damage.

   (2) Inspect the harness from the UCM to the Right Reverse Solenoid and Left Reverse Solenoid. Verify that the harness is free of damage, corrosion, abrasion and incorrect attachment.

Schematic legend			
(1)	UCM Connector X-014 UCM Connector X-015	**(3)**	Wire WH B190 removed from connector X-015 Pin 19
(2)	Jumper wire installed between X-014 pin 3 and X-015 pin 19		

(7) Reconnect UCM connector X-015.

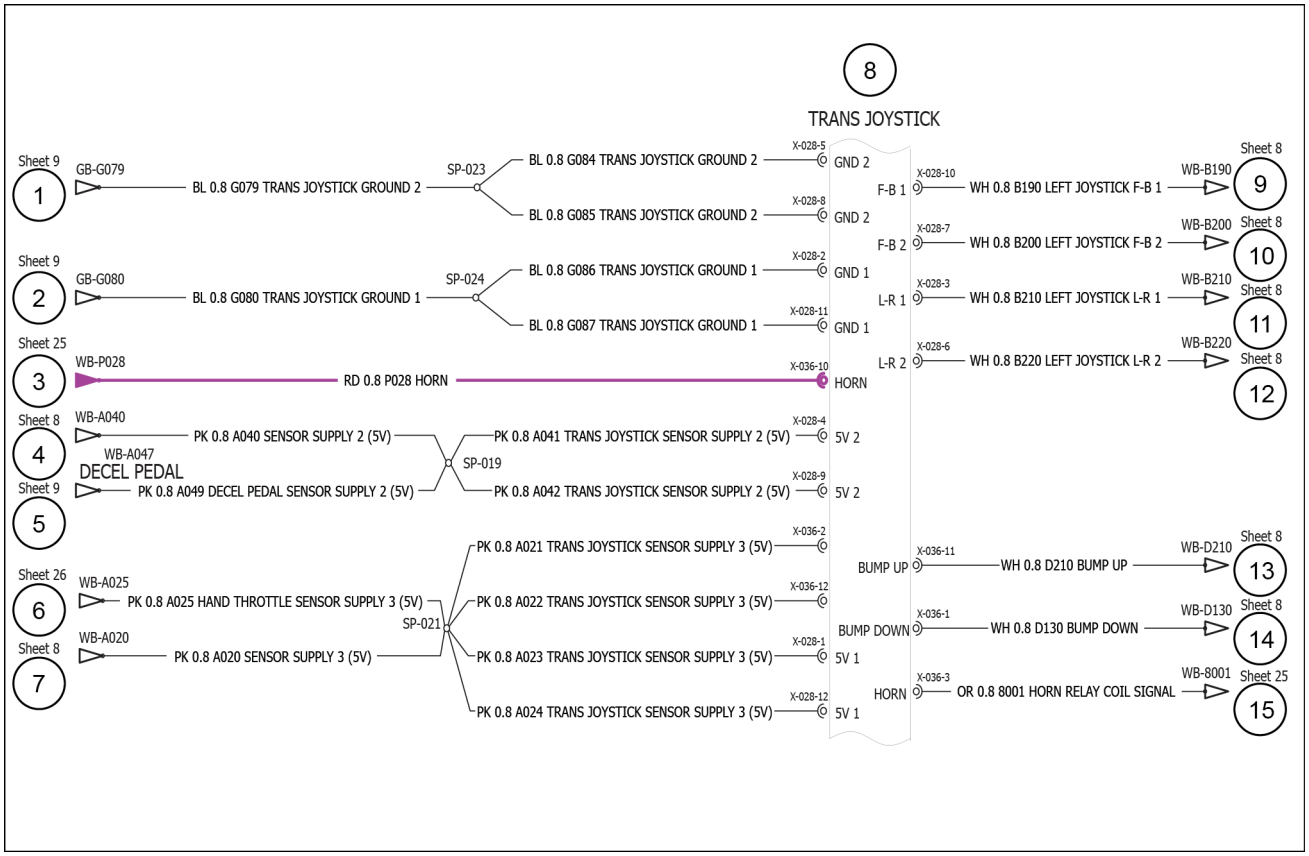
(8) Turn the ignition switch ON. Access the EST fault code screen.

(9) Fault code 4501 should no longer be active. Fault code 4503 is now active.

A. Fault code 4501 is no longer active. Fault code 4503 is now active. Temporarily replace the joystick and retest. Return to Step **1** to confirm elimination of the fault.

B. Fault code 4501 is still present and active. 4503 did not become active. Temporarily replace the UCM and retest. Return to Step **1** to confirm elimination of the fault.

Harnesses and connectors - Electrical schematic sheet 08 - UCM (55.100-C.20.E.08)
Harnesses and connectors - Electrical schematic sheet 09 - UCM (55.100-C.20.E.09)
Harnesses and connectors - Electrical schematic sheet 20 - Drive Train (55.100-C.20.E.20)



RAIL13DOZ0912FA 1

Schematic legend			
(1)	UCM connector X-017 Pin 26, Joystick Ground 2	**(8)**	Transmission Joystick
(2)	UCM connector X-016 Pin 20, Joystick Ground 1	**(9)**	UCM connector X-015 Pin 19, Left Joystick F-B 1
(3)	SP-032 splice connection UCM connector X-014 Pin 4, Joystick Sensor Supply 2 (5V)	**(10)**	UCM connector X-015 Pin 20, Left Joystick F-B 2
(4)	UCM connector X-014 Pin 4, Joystick Sensor Supply 3 (5V)	**(11)**	UCM connector X-015 Pin 21, Left Joystick L-R 1
(5)	X-002 connector Pin 13.	**(12)**	UCM connector X-015 Pin 22, Left Joystick L-R 2
(6)	Hand Throttle Pin A	**(13)**	UCM connector X-017 Pin 21, Bump Up
(7)	UCM connector X-014 Pin 2, Joystick Sensor Supply 1(5V)	**(14)**	UCM connector X-017 Pin 13, Bump Down
		(15)	Connector X-005 Pin 34

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.

(1) Turn the ignition switch OFF.

(2) Disconnect UCM connector X-015.

(3) Disconnect drive joystick connector X-028.

(4) Turn the ignition switch ON.

Schematic legend			
(1)	Switched battery **24 V** Winch relay coil signal	**(5)**	Winch relay ground SP-053
(2)	Unswitched **24 V** Winch relay contact	**(6)**	Winch relay ground connector X-152 1
(3)	Unswitched **24 V** Winch power	**(7)**	UCM connector X-018 Pin 5, Winch high side drive signal
(4)	Winch relay K-007	**(8)**	UCM connector X-019 Pin 4, Winch low side drive signal

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. Test the circuit.

(1) Turn the ignition switch OFF.

(2) Disconnect the connector X-010 X-034.

(3) Remove wire YE H050 from connector X-010.

(4) Reconnect connector X-010 X-034.

(5) Turn the ignition switch ON.

(6) Access the fault code screen on the EST.

(7) Fault code 5182 should no longer be active. Fault code 5184 should be active.

A. Fault code 5182 is no longer active. Fault code 5184 is now active. There is a problem in the wiring between connector X-010 X-034 and the winch solenoid. Repair as required. Return to Step **1** to confirm elimination of the fault.

B. Fault code 5182 is still present and active. Fault code 5184 did not become active. Go to Step **4**.

4. Measure the resistance through the signal wire.

(1) Turn the ignition switch OFF.

(2) Disconnect UCM connector X-018.

(3) Leave wire YE H050 disconnected.

(4) Measure the resistance between X-018 pin 5 and chassis ground. The chassis ground connection must be clean and free of paint, oil, and dirt. 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 to chassis ground in the wiring from the UCM to connector X-010 X-034. Repair or replace the harness as required. Return to Step **1** to confirm elimination of fault.

Harnesses and connectors - Electrical schematic sheet 01 - Power Distribution \ Charging System (55.100-C.20.E.01)
Harnesses and connectors - Electrical schematic sheet 07 - Winch Control (55.100-C.20.E.07)
Harnesses and connectors - Electrical schematic sheet 09 - UCM (55.100-C.20.E.09)

9004 - Memory Error - Triple Redundant: Hour Meter - Location 1 Corrupt

Context:
Diagnostic Trouble Code 9004 has an error priority of White.
There are no restrictions with Diagnostic Trouble Code 9004.

Cause:
The Instrument Cluster has sensed an internal memory corruption that has been automatically fixed.

Possible failure modes:

1. Memory Fault of the Instrument Cluster.

Solution:

1. White errors are not displayed on the Instrument Cluster and are not known to the Owner/Operator. They will appear in the EST fault stack when the technician checks for active trouble codes while troubleshooting another fault. Use the EST to verify fault code 9004 Memory Error - Triple Redundant: Hour Meter - Location 1 is active.

   A. If the fault is active, erase it with the EST.
2. If the fault persists, it may be an indication of a potential future Instrument Cluster failure. Continue normal operations of the machine.

9405 - CAN - DM1 (EH Machines): Loss Of DM1 Message From UCM

Context:
Diagnostic Trouble Code 9405 has an error priority of Amber.
There are no restrictions with Diagnostic Trouble Code 9405.

Cause:
The Instrument Cluster has sensed a loss of CAN message. (The fault is only activated when Ignition is On and no DM1 message is received for 5 seconds.)

Possible failure modes:

1. Shorted or Open wire in circuit.
2. Failure of Instrument Cluster.
3. Failure of UCM.

Solution:

1. Use the machine to recreate conditions for error. Use the EST to verify **9405 – CAN - DM1 (EH Machines) - Loss of DM1 message from UCM** 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. Check for open circuits in the UCM or Instrument Cluster CAN bus circuit.

   A. If the wiring is good, continue with step **3**.

   B. If there is no continuity, there is an open wire condition. Repair or replace wire harness as necessary and return to step **1**.
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 or Instrument Cluster as a failure point. Therefore, all other possibilities should be investigated before the UCM or Instrument Cluster 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.

Harnesses and connectors - Electrical schematic sheet 24 - CAN Bus System (55.100-C.20.E.24)

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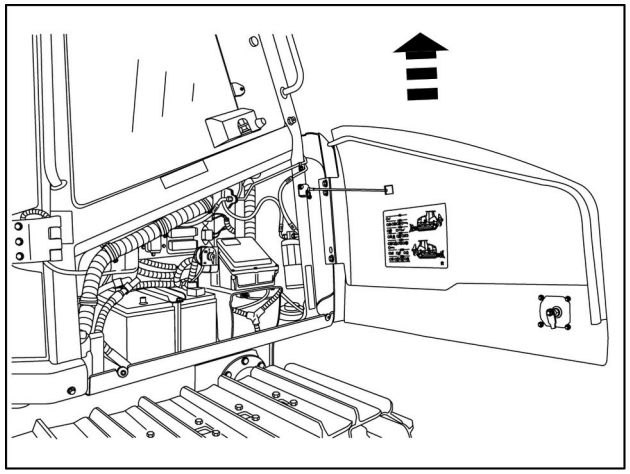
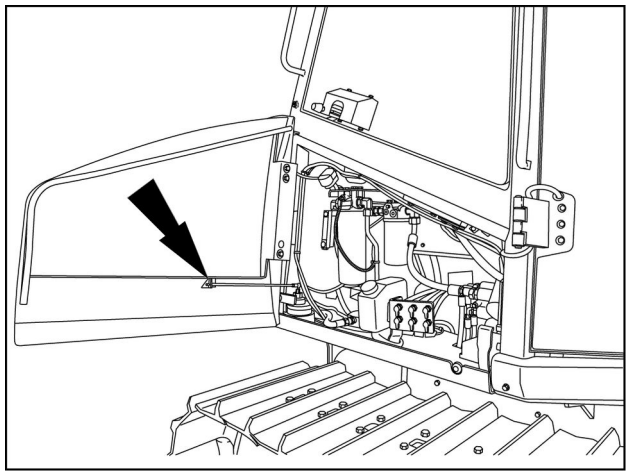
NOTICE: *Battery access door weighs approximately* ***45 kg*** *(****100 lb****). Use caution when removing to prevent personal injury or property damage.*

9. With a helper, lift battery access door off hinge pins and remove battery access door from machine.



RAIL13DOZ1352AA 4

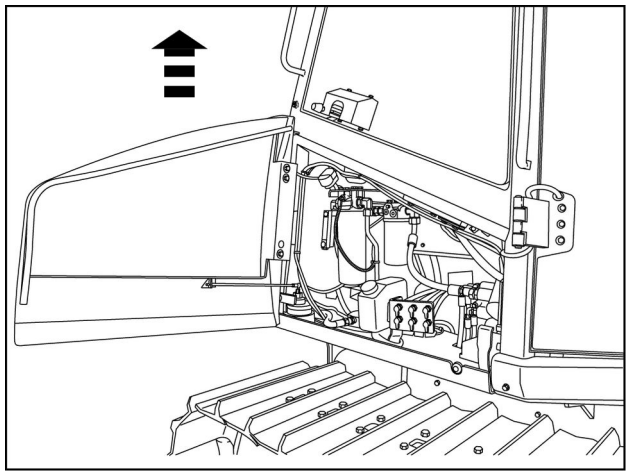
10. Disconnect hydraulic access door strut from machine.



RAIL13DOZ1353AA 5

NOTICE: *Hydraulic access door weighs approximately* ***45 kg*** *(****100 lb****). Use caution when removing to prevent personal injury or property damage.*

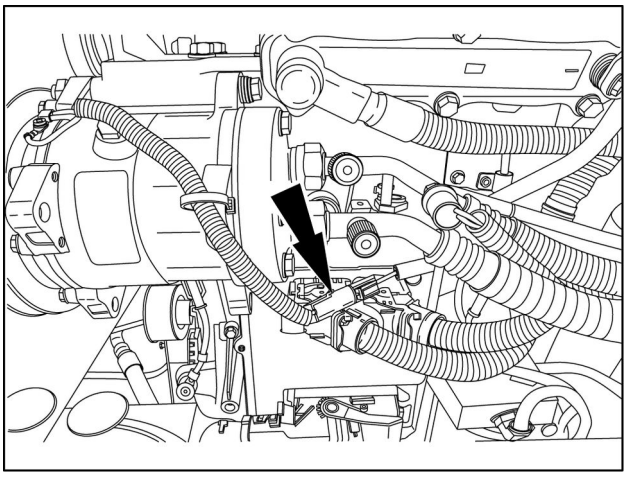
11. With a helper, lift hydraulic access door off hinge pins and remove hydraulic access door from machine.



RAIL13DOZ1353AA 6

NOTICE: *Brush guard weighs approximately* ***64 kg*** *(****140 lb****). Use appropriate lifting equipment to prevent personal injury or property damage.*

32. Connect A/C electrical connector to A/C compressor.

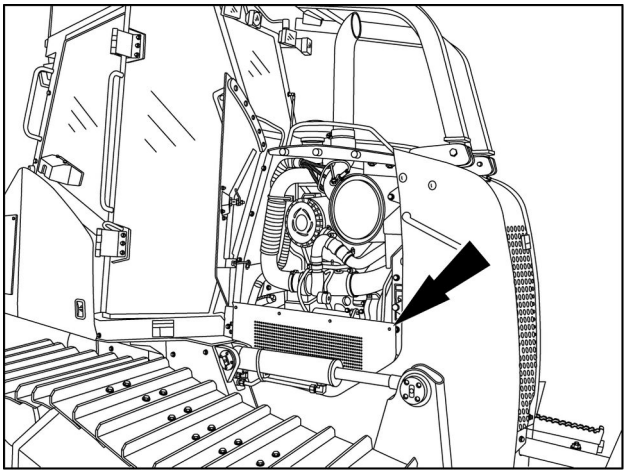


RAIL13DOZ1392AA 24

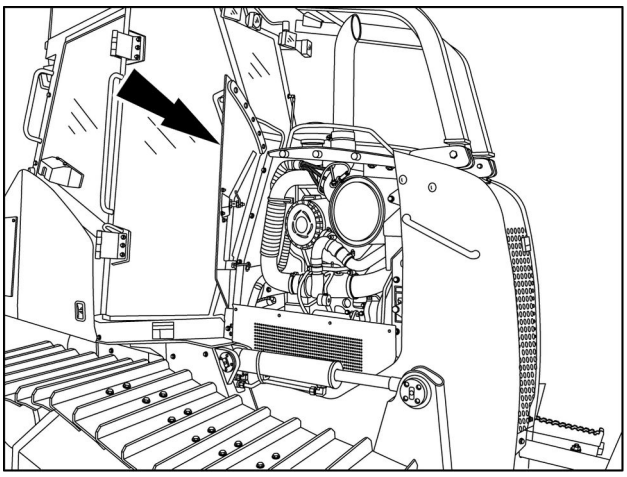
33. Charge A/C system.

34. Install left and right lower engine access panels.

NOTE: *The right lower engine access panel shown. The left access panel is similar.*



RAIL13DOZ1400AA 25



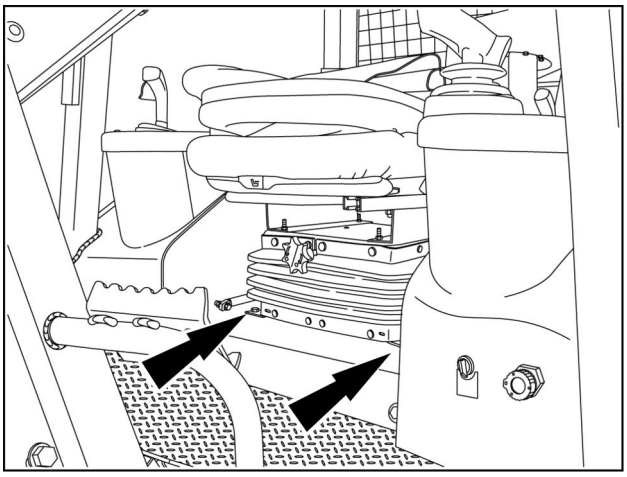
RAIL13DOZ1400AA 26

35. Close left and right engine access doors.

NOTE: *The right engine access door is shown. The left door is similar.*

NOTICE: *Brush guard weighs approximately* ***64 kg*** *(****140 lb****). Use appropriate lifting equipment to prevent personal injury or property damage.*

9. Remove two front seat mounting bolts.

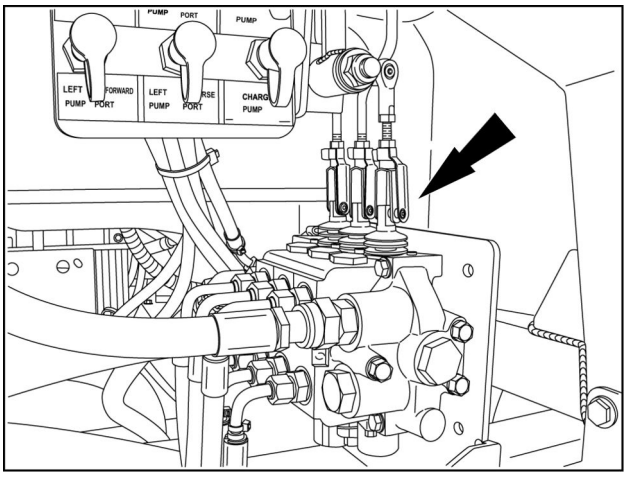


RAIL13DOZ0531AA 4

NOTICE: *Operator seat assembly weighs approximately* ***64 kg*** *(****140 lb****). Use caution to prevent personal injury or property damage.*

10. With an assistant, remove operator seat assembly.
11. Repair or replace components as necessary.

25. Disconnect control levers from valve block.



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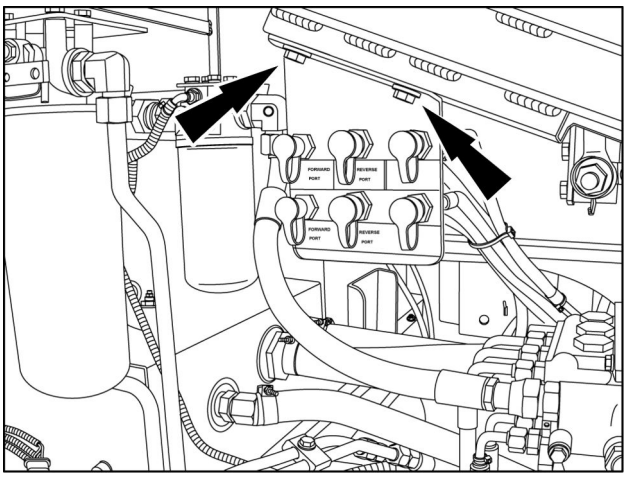
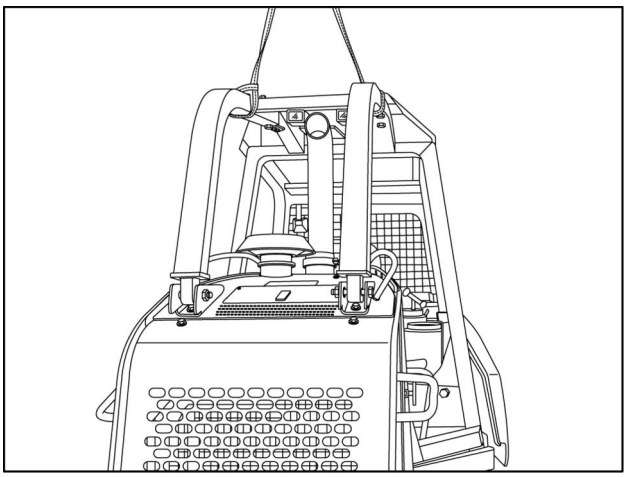
26. Remove hydraulic test port from platform and set aside.



RAIL13DOZ0511AA 16

NOTICE: *Brush guard weighs approximately* ***64 kg*** *(****140 lb****). Use proper lifting equipment to prevent personal injury or property damage.*

27. Attach an appropriate lifting device to brush guard.



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