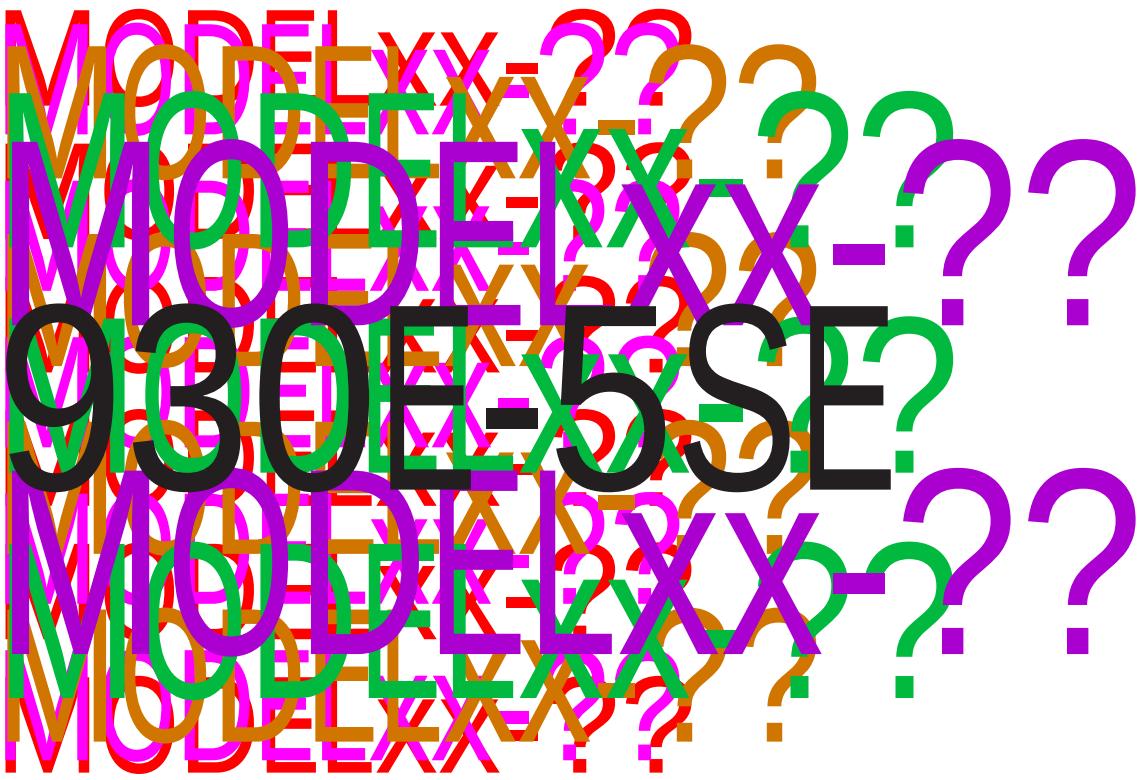
ORIGINAL INSTRUCTIONS
SEBM035301

Shop Manual Supplement



DUMP TRUCK

SERIAL NUMBERS	MODEL DESCRIPTION	SER#
SERIAL NUMBERS	MODELXXXXXXXX	SER# and up
SERIAL NUMBERS	MODELXXXXXXXX	SER# and up
SERIAL NUMBERS	MODELXXXXXXXX	SER# and up
SERIAL NUMBERS	MODELXXXXXXXX	SER# and up
SERIAL NUMBERS	930E-5SE	A50001 and up
	MODELXXXXXXXX	SER# and up
	PC228USLC-1LE0	SER# and up
	MODELXXXXXXXX	SER# and up
	MODELXXXXXXXX	SER# and up
	MODELXXXXXXXX	SER# and up

KOMATSU

How to read the shop manual

- Some attachments and optional parts in this shop manual may not be delivered to certain areas. If one of them is required, consult KOMATSU distributors.
- Materials and specifications are subject to change without notice.
- Shop manuals are divided into the “Chassis volume” and “Engine volume”. For the engine unit, see the engine volume of the engine model mounted on the machine.

Composition of shop manual

This shop manual contains the necessary technical information for services performed in a workshop. For ease of understanding, the manual is divided into the following sections.

00. Index and foreword
This section explains the shop manuals list, table of contents, safety, and basic information.

01. Specification
This section explains the specifications of the machine.

10. Structure, function and maintenance standard
This section explains the structure, function, and maintenance standard values of each component. The structure and function sub-section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting. The maintenance standard sub-section explains the criteria and remedies for disassembly and service.

20. Standard value table
This section explains the standard values for new machine and judgment criteria for testing, adjusting, and troubleshooting. This standard value table is used to check the standard values in testing and adjusting and to judge parts in troubleshooting.

30. Testing and adjusting
This section explains measuring instruments and measuring methods for testing and adjusting, and method of adjusting each part. The standard values and judgment criteria for testing and adjusting are explained in Testing and adjusting.

40. Troubleshooting
This section explains how to find out failed parts and how to repair them. The troubleshooting is divided by failure modes.

50. Disassembly and assembly
This section explains the special tools and procedures for removing, installing, disassembling, and assembling each component, as well as precautions for them. In addition, tightening torque and weight of components are also explained.

90. Diagrams and drawings
This section gives hydraulic circuit diagrams and electrical circuit diagrams.

Revision and distribution

Any additions, revisions, or other change of notices will be sent to KOMATSU distributors. Get the most up-to-date information before you start any work.

Precautions before performing service

Warning tag

Starting the engine or operating the controls while other personnel are performing maintenance on the truck can lead to serious injury and/or death. Always attach the warning tag to the control lever in the operator cab to alert others that you are working on the truck. Attach additional warning tags around the truck as necessary.

These tags are available from your Komatsu distributor. **Warning tag part number**: 09963-A1640

Stopping the engine

- Before performing inspections or maintenance, stop the truck on firm flat ground, lower the dump body, move the directional control lever to PARK, and stop the engine.
- If the engine must be run during service, such as when cleaning the radiator, the directional control lever must be in PARK. Always perform this work with two people. One person must sit in the operator's seat to stop the engine if necessary. During these situations, never move any controls that are not related to the task at hand.
- When servicing the truck, do not to touch any moving parts. Never wear loose clothing or jewelry.
- Put wheel blocks under the wheels to prevent truck movement.
- When performing service with the dump body raised, place the dump lever in the HOLD position and apply the lock (if equipped). Install the body-up safety sling securely.

Proper tools

Only use tools that are suited to the task. Using damaged, low quality, faulty or makeshift tools could cause personal injury.

Handling electrical equipment and hydraulic components

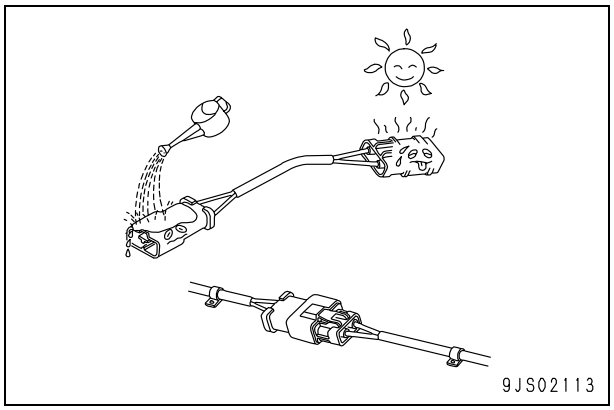
To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct “operation“, “maintenance and inspection“, “troubleshooting“, and “repairs” must be carried out. This section deals particularly with correct repair procedures for mechatronics and is aimed at improving the quality of repairs. For this purpose, it provides information on handling electrical equipment and handling hydraulic equipment (particularly gear oil and hydraulic oil).

Points to remember when handling electrical equipment

1. Handling wiring harnesses and connectors

Wiring harnesses consist of wiring connecting one component to another component, connectors used for connecting and disconnecting one wire from another wire, and protectors or tubes used for protecting the wiring.

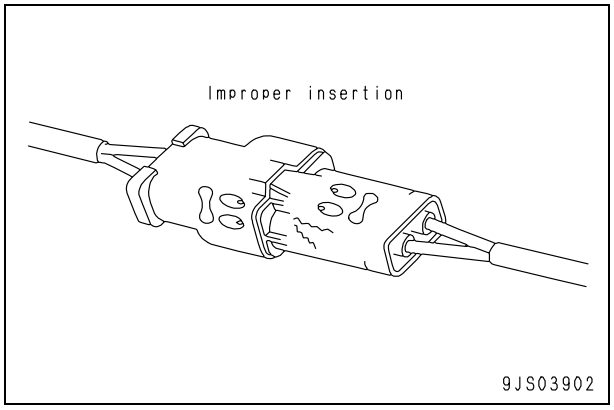
Compared with other electrical components fitted in boxes or cases, wiring harnesses are more likely to be affected by the direct effects of rain, water, heat, or vibration. Furthermore, during inspection and repair operations, they are frequently removed and installed again, so they are likely to suffer deformation or damage. For this reason, it is necessary to be extremely careful when handling wiring harnesses.



2. Main failures occurring in wiring harness

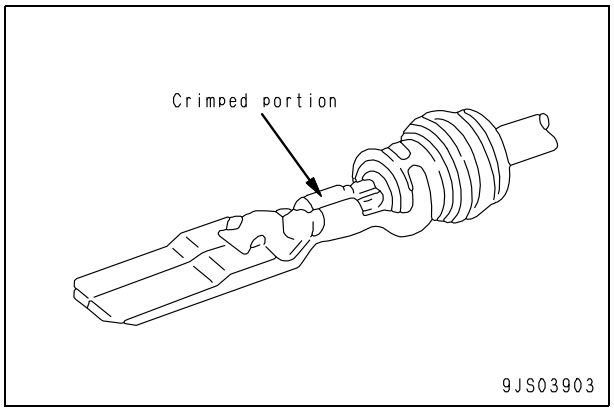
- Defective contact of connectors (defective contact between male and female)

  Problems with defective contact are likely to occur because the male connector is not properly inserted into the female connector, or because one or both of the connectors is deformed or the position is not correctly aligned, or because there is corrosion or oxidization of the contact surfaces. The corroded or oxidized contact surfaces may become shiny again (and contact may become normal) by connecting and disconnecting the connector about 10 times.



- Defective crimping or soldering of connectors

  The pins of the male and female connectors are in contact at the crimped terminal or soldered portion, but if there is excessive force brought to bear on the wiring, the plating at the joint will peel and cause improper connection or breakage.



SAE grade 9 capscrews

The following specifications apply to required tightening torques for SAE hex head and 12-point, grade 9 (170,000 psi minimum tensile) capscrews.

NOTE: Capscrew threads and seats shall be lubricated when assembled. Unless instructions specifically recommend otherwise, these standard torque values are to be used with simple lithium base chassis grease (multi-purpose EP NLGI) or an approved rust preventive grease on the threads.

NOTE: Torques are calculated to give a clamping force of approximately 75% of proof load. The maximum torque tolerance shall be within ±10% of the torque value shown.

Example: 1/2 - 13

1/2 = shank diameter (1/2 inch [0.500 inch])

13 = threads per inch

Table 4: Standard tightening torques for SAE hex head and 12-point, grade 9 capscrews

Capscrew size*	Torque N·m	Torque ft lb	Torque kg·m
1/4 - 20	16	12	1.7
5/16 - 18	33	24	3.3
3/8 - 16	57	42	5.8
7/16 - 14	95	70	9.7
1/2 - 13	142	105	14.5
9/16 - 12	203	150	20.7
5/8 - 11	278	205	28.3
3/4 - 10	488	360	49.7
7/8 - 9	780	575	79.4
1 - 8	1166	860	119
1 - 12	1240	915	126
1 1/8 - 7	1670	1232	170
1 1/8 - 12	1800	1328	184
1 1/4 - 7	2325	1715	237
1 1/4 - 12	2495	1840	254
1 3/8 - 6	3080	2272	313
1 3/8 - 12	3355	2475	342
1 1/2 - 6	4040	2980	411
1 1/2 - 12	4375	3227	445

Class 10.9 capscrews and class 10 nuts

The following specifications apply to required assembly torques for all metric class 10.9 finished hexagon head capscrews and class 10 nuts.

NOTE: Capscrew threads and seats shall be lubricated when assembled. Unless instructions specifically recommend otherwise, these standard torque values are to be used with simple lithium base chassis grease (multi-purpose EP NLGI) or an approved rust preventive grease on the threads.

NOTE: Torques are calculated to give a clamping force of approximately 75% of proof load. The maximum torque tolerance shall be within ±10% of the torque value shown.

In the following table under “Capscrew Size”, the first number represents the shank diameter (mm). The second number represents thread pitch in millimeters.

Example: M20 x 2.25

M20 = shank diameter (20 mm)

2.25 = thread pitch in millimeters

Table 5: Standard tightening torques for metric class 10.9 capscrews and class 10 nuts

Capscrew size*	Torque N·m	Torque ft lb	Torque kg·m
M6 x1	12	9	1.22
M8 x 1.25	30	22	3.06
M10 x 1.5	55	4	5.61
M12 x 1.75	95	70	9.69
M14 x 2	155	114	15.81
M16 x 2	240	177	24.48
M20 x 2.5	465	343	47.43
M24 x 3	800	590	81.6
M30 x 3.5	1600	1180	163.2
M36 x 4	2750	2028	280.5

Specification				Value
Steering System	Type			Fully hydraulic
Suspension	Suspension method		Front axle	Sliding pillar
			Rear axle	Hydro-pneumatic
Tires	Size			56/80 R63
	Min. tire pressure			600 kPa (87 psi)
	Tread (standard tire)		Front wheel	105 mm (4.1 in.)
			Rear wheel	105 mm (4.1 in.)
Brake System	Service brakes (front and rear)			Multiple wet disc
	Parking brake			Multiple dry disc
Hydraulic systems	Hydraulic pumps	Steering/brake pump	Type	Pressure compensated piston type
			Delivery at 1,900 rpm & 19 000 kPa (2,750 psi)	246 liters/min (65 gpm)
		Hoist/brake cooling pump	Type	Tandem gear type
			Delivery at 1,900 rpm & 19 000 kPa (2,750 psi)	931 liters/min (246 gpm)
	Cylinders	Hoist cylinder	Type	3-stage, piston type
			Bore x stroke	1st stage - 355.6 mm x 886.0 mm (14.00 in x 34.88 in) 2nd stage - 298.5 mm x 886.0 mm (11.75 in x 34.88 in) 3rd stage - 241.3 mm x 886.0 mm (9.50 in x 34.88 in)
		Steering cylinder	Type	Piston type, double acting with accumulator assist
			Bore x stroke	165.1 mm x 693.0 mm (6.50 in x 27.28 in)

Bleeddown manifold

Bleeddown manifold (5, Figure 10-1) is located on the outside of the left frame rail just behind the accumulators.

The bleeddown manifold receives oil from the steering/brake pump through a high pressure filter and directs oil to the steering accumulators, flow amplifier, brake apply circuit, and the auxiliary hydraulic system. The manifold also provides hoist circuit control when the body is raised.

Relief valve (4, Figure 10-3) limits the hydraulic supply pressure to the steering and brake circuits to 27 500 kPa (4,000 psi). Relief valve (3) provides maximum pressure protection of 4 100 kPa (600 psi) for the oil returning to the hydraulic tank.

NOTE: The relief valves, steering accumulator bleeddown solenoid, and hoist limit solenoid are factory preset and cannot be individually rebuilt.

Steering accumulator bleeddown solenoid

Each time the key start switch is turned OFF with the truck stopped, steering accumulator bleeddown solenoid (2, Figure 10-3) is energized. When the solenoid is energized, all hydraulic steering pressure (including the accumulators) is bled back to the hydraulic tank. However, brake pressure and auxiliary hydraulic system pressure will not bleeddown due to internal check valves in the brake manifold, bleeddown manifold and auxiliary hydraulic system.

After approximately 90 seconds, the solenoid will de-energize to close the return port to the hydraulic tank. By this time, all the oil in the accumulators should be returned to the hydraulic tank. At startup, the steering circuit and brake circuit will be charged. Steering system pressure switch (10, Figure 10-3) will activate a low steering pressure warning until steering pressure reaches 17 926 kPa (2,600 psi).

If steering pressure falls below 15 858 kPa (2,300 psi) during operation, the low steering pressure warning will be activated until pressure returns to normal.

Quick disconnect ports

Two quick disconnect ports on the bleeddown manifold allow service personnel to connect an external hydraulic supply to allow operation of the truck steering and service brakes if the steering/brake pump or engine is not operational.

The external supply is connected to port (5, Figure 10-2) and the return is connected to port (6) on top of the bleeddown manifold. This feature should only be used for an emergency to allow operation of the truck to return to the shop for service or to move the truck out of haul road traffic.

Flow amplifier

Flow amplifier (4, Figure 10-1), located on the left frame rail in front of the accumulators, provides the steering circuit with the high volume of oil required for the steering cylinders.

The flow amplifier uses the amount of flow from the steering control unit to determine a proportional amount of flow to send from the bleeddown manifold to the steering cylinders.

DUMP TRUCK

930E

Machine model	Serial number
930E-5	A40004 and up
930E-5SE	A50001 and up

10 Structure and functions
Hoist circuit

Power down operation

Refer to Figure 10-9.

When the operator moves the hoist control lever to lower the body, the hoist pilot valve is positioned to direct the oil in pilot supply ports (12) through down pilot ports (15) to the top of rod end spool (7).

Pilot pressure increases to move the spool down, compressing the bottom spring. Movement of the spool connects high pressure passage (19) to the rod end (annulus area) of the hoist cylinders. At the same time, flow control valve (2) is forced to close as pilot pressure increases, thus directing the incoming pump oil to the hoist cylinders through rod end spool (7) and the check valve in the overcenter manifold rather than back to the hydraulic tank. Oil flow to the brake cooling circuit ceases when the flow control valve closes.

If the body is at the maximum up position, the hoist limit switch has the hoist limit solenoid activated, which closes raise pilot port (14) on the hoist valve. Power down pilot pressure in ports (15) pushes open pilot operated check valve (21) so the pilot pressure in ports (14) is open to the tank through the pilot valve spool.

As oil attempts to return from the head end of the hoist cylinders, it initially encounters closed base end spool (8). Pressure increases on the bottom end of the spool, causing it to move upward. This allows the returning oil to enter low pressure passage (20), build up 179 kPa (26 psi) to open primary low pressure relief valve (22) and exit the hoist valve through tank return port (10) to the tank.

As the dump body descends and the hoist limit solenoid is no longer activated, pilot operated check valve (21) is no longer necessary. Power down relief valve (16) limits the power down pressure to 10 400 kPa (1,500 psi).

Wheel brake lock circuit operation

The primary function of the wheel brake lock is to provide a means for the operator to hold the truck while at the shovel or dump. **The brake lock only applies the rear service brakes.** It may also provide a secondary means of stopping the truck in the event of a brake valve malfunction.

During normal operations, the wheel brake lock will function only when:

- the control power is ON,
- the key start switch is ON,
- and the parking brake is not activated (directional control lever is not in PARK).

If the wheel brake lock is applied while the truck is moving, the brake lock function will remain applied after the truck is stopped regardless of the conditions stated above (except the control power must be ON for the wheel brake lock to function). The operator must deactivate the wheel brake lock.

When the wheel brake lock switch on the dash panel is activated, brake lock solenoid valve (5, Figure 10-6) and pressure reducing valve (6) will apply unmodulated pressure oil at 17 200 kPa (2,500 psi) to fully actuate the rear brakes. Shuttle valve (2, Figure 10-2) or (Figure 10-3) in the rear brake line provides the independence from the brake valve for brake application.

Brake warning circuit operation

The brake warning circuit will activate a low brake pressure warning message, a red warning light and an audible alarm in the operator cab to alert the operator to low brake pressures. Several electrical sensors, a relay and delay timer are used to detect brake system problems.

- **Brake warning relay**
  When the wheel brake lock switch is ON, the brake warning relay is energized and switches the electrical connection from the terminal to brake lock degradation switch (5, Figure 10-2) or (Figure 10-3). When the wheel brake lock switch is OFF, the relay is de-energized and switches the connection from the brake lock degradation switch to the terminal.
- **System supply pressure switch**
  The system supply pressure switch is located on the pump pressure sensing manifold. When system supply pressure drops below 15 800 kPa (2,300 psi), the low brake pressure warning will activate.
- **Low brake pressure switch**
  Low brake pressure switch (8, Figure 10-6) is located on the brake manifold in the hydraulic brake cabinet. When the brake accumulator with the lower pressure falls below 12 700 kPa (1,850 psi), the low brake pressure warning will activate.
- **Brake lock degradation switch**
  Brake lock degradation switch (5, Figure 10-2) or (Figure 10-3) is located on a junction manifold in the hydraulic brake cabinet. When the wheel brake lock switch is ON, brake lock solenoid (5, Figure 10-6) or and the brake warning relay are energized. The brake warning relay switches the electrical connection from the terminal to the brake lock degradation switch. If the brake lock apply pressure is less than 6 900 kPa (1,000 psi), a path to ground will be completed and the low brake pressure warning will activate.

730E Dump truck
830E Dump truck
930E Dump truck

Form No. CEN10109-02

General information

The automatic lubrication (auto lube) system is a pressurized lubricant delivery system which delivers a controlled amount of lubricant to designated lube points such as:

- steering cylinder pins
- tie rod pins
- body pivot pin
- hoist cylinder pins
- rear suspension pins
- sway bar pins

The system is controlled by logic in the interface module (IM), which signals a solenoid valve to operate a hydraulic motor powered grease pump. The solenoid valve is equipped with a manual override switch that, when actuated, activates the pump when power is not being supplied to the motor.

Hydraulic oil for pump operation is supplied through the auxiliary hydraulic system. Grease pump (5, Figure 10-1) is driven by the rotary motion of hydraulic motor (9), which is then converted to reciprocating motion through an eccentric crank mechanism. The pump is a positive displacement, double-acting type as grease output occurs on both the up and the down stroke.

Integrated pump control manifold (7) is incorporated with the motor to control input flow and pressure. Relief valve (3) in vent valve (4) protects the pump from high pressures. The relief valve is set at 27 580 kPa (4,000 psi). A pressure gauge can be installed in the plugged port on top of the manifold to check the hydraulic oil pressure to the inlet of the hydraulic motor. Normal stall pressure is 2 415 - 2 585 kPa (350 - 375 psi).

When the grease supply is replenished through the service center, the grease passes through grease filter (10) to remove contaminants before it flows into reservoir (1). A bypass indicator on the filter alerts service personnel when the filter requires replacement.

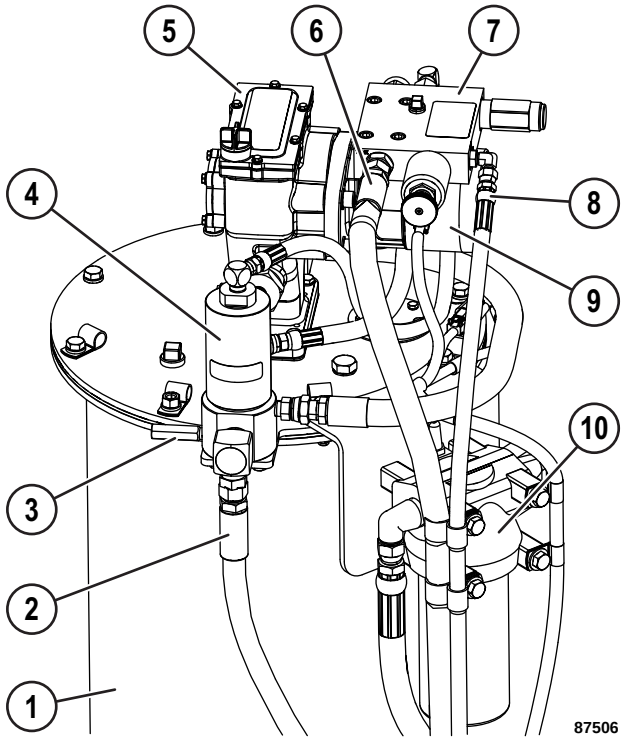


FIGURE 10-1. AUTO LUBE PUMP AND RESERVOIR COMPONENTS

1. Reservoir
2. Main Grease Supply Line
3. Relief Valve
4. Vent Valve
5. Grease Pump
6. Hydraulic Oil Supply
7. Pump Control Manifold
8. Hydraulic Oil Return
9. Hydraulic Motor
10. Grease Filter

Truck model						930E-5SE
Check item			Measurement conditions		Unit	Standard value
Operating force and stroke	Accelerator pedal		Operating force	• Point at 150 mm (6 in.) from fulcrum of pedal • Starting to depress	N (lb)	29.3 + 13.0/-0 (6.6 + 2.9/-0)
				• Full		58.7 + 0/-13.3 (13.2 + 0/-3.0)
			Stroke	• Starting to depress to Full	mm (in.)	45 ± 5 (1.8 ± 0.2)
	Brake pedal		Operating force	• Retarding	N (lb)	44.5 ± 4.0 (10.0 ± 0.9)
				• Braking		300.5 ± 189.5 (67.55 ± 42.6)
			Stroke	• Retarding	Degrees	17.5 ± 1.0
				• Braking		17.5 ± 1.0
	Directional control lever		Operating force	• Measuring point: Center of grip	N (lb)	Max. 29.4 (Max. 6.61)
			Stroke		mm (in.)	24.5 ± 2 (0.96 ± 0.08)
	Hoist lever	Operating force	Float to Raise	• Measuring point: Center of grip • Initial	N (lb)	Max. 35.3 (Max. 7.94)
				• Full		Max. 24.5 (Max. 5.51)
			Raise to Hold			Must return smoothly when engine speed is at high idle.
			Hold to Raise	• Initial		Max. 35.3 (Max. 7.94)
				• Full		Max. 24.5 (Max. 5.51)
			Hold to Lower	• Initial		Max. 35.3 (Max. 7.94)
				• Full		Max. 24.5 (Max. 5.51)
			Lower to Float			Must return smoothly when engine speed is at high idle.
		Stroke	Raise to Hold	• Measuring point: Center of grip	mm (in.)	44.8 ± 1.9 (1.76 ± 0.08
			Hold to Lower			

⚠CAUTION

All accumulators must be properly precharged with dry nitrogen before the engine is started. Otherwise, permanent damage to the accumulators will result.

NOTE: The brake accumulators and the auxiliary system accumulator do not have pressure switches to monitor for low precharge. These accumulator precharge pressures must be verified manually.

16. Open bleed valve (2, Figure 30-3) on auxiliary hydraulic manifold (3).
17. Start the engine and operate at low idle for no more than 30 seconds. At low idle with 21°C (70° F) oil:
    - The pressure at the hoist filters should be approximately 552 kPa (80 psi).
    - The pressure at steering pump test port GPA (1, Figure 30-9) should be approximately 690 kPa (100 psi).
    - The pressure at the front and rear brake cooling test ports should be approximately 172 kPa (25 psi) or less.

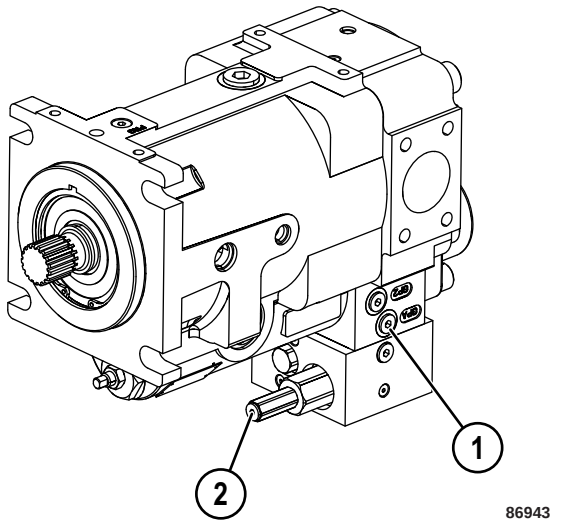


FIGURE 30-9. STEERING PUMP

1. Test Port GPA 2. Unloader Adjuster

⚠CAUTION

Do not operate at low idle for more than 30 seconds. Steering pump pressure at test port GPA needs to be at or above 1 725 kPa (250 psi) during the flushing process to provide adequate pump internal lubrication. Steering pump damage will result if pressure is below 1 725 kPa (250 psi). This applies to all steps of the checkout procedure.

NOTE: Do not turn the steering wheel or apply the brakes at any time during this checkout procedure until directed to do so.

18. If the oil pressures are not correct, stop the engine. Locate and repair the problem before proceeding. If the pressures are correct, proceed to the next step. **Do not turn the steering wheel or apply the brakes at this time.**
19. With engine at a speed that is fast enough to provide at least 1 725 kPa (250 psi) at steering pump test port GPA, move the hoist control lever to the POWER UP or POWER DOWN position. The front and rear brake cooling oil supply pressures should be 0 kPa (0 psi) when the hoist control lever is in POWER UP or POWER DOWN, This confirms that the hoist valve is functioning properly.

    If the pressures do not drop to 0 kPa (0 psi), the hoist valve may be plumbed incorrectly. Stop the checkout procedure and check all plumbing, including all pilot lines. If there is a plumbing error, repeat this step again. If no plumbing error was found or if the pressures still do not drop to 0 kPa (0 psi), replace the hoist valve and repeat this step again.

**** Record on Data Sheet***

Hoist cylinder leakage test

After the hoist cylinder is assembled, perform the following tests to verify that performance is within acceptable limits.

1. With the rod fully extended, piston leakage must not exceed 164 cm^3/min. (10 in^3/min.) at 17 237 kPa (2,500 psi), port to port.
2. With the rod fully retracted, piston leakage must not exceed 328 cm^3/min. (20 in^3/min.) at 17 237 kPa (2,500 psi), port to port.
3. Rod seal leakage must not exceed one drop of oil in eight cycles of operation.

Steering cylinder leakage test

After the steering cylinder is assembled, perform the following tests to verify that performance is within acceptable limits.

1. Piston leakage must not exceed 2.5 cm^3/min. (0.15 in^3/min.) at 20 700 kPa (3,000 psi) port to port.
2. Rod seal leakage must not exceed one drop of oil in eight cycles of operation.
3. Piston break-away force must not exceed 690 kPa (100 psi).

Parking brake checkout

NOTE: The parking brakes are spring applied and hydraulic pressure released. When the parking brakes are applied, the parking brake solenoid is de-energized and the hydraulic lines are vented. When the parking brakes are released, the parking brake solenoid is energized to supply pressurized hydraulic oil to the parking brakes.

42. Relocate a pressure gauge to parking brake release pressure test port PK3 (2, Figure 30-6).
43. Start the engine and allow the pressure at low accumulator pressure test port LAP1 to increase to a minimum of 18 960 kPa (2,750 psi). Continue operating the engine at low idle.
44. Move the directional control lever from PARK to NEUTRAL. The parking brake status light should turn off.

    Verify that parking brake release pressure at test port PK3 is 18 960 - 21 375 kPa (2,750 - 3,100 psi) and equal to the pressure at test port LAP1.

    **** Record on Data Sheet***
45. Cycle the parking brake several times by moving the directional control lever between NEUTRAL and PARK to ensure crisp application and release of oil pressure and proper function of the status light.

    Verify that parking brake release pressure at test port PK3 is 0 - 35 kPa (0 - 5 psi) within two seconds of moving the lever to PARK.

    **** Record on Data Sheet***

    If the parking brake does not function correctly, ensure that all parking brake circuit plumbing is correct.

Parking brake control logic checkout

Keep the speed signal from the VID panel at 0 kph (0 mph). If any of the following steps are not successfully completed, find and correct the problem.

NOTE: The parking brake will not apply if the truck speed is above 0.8 kph (0.5 mph). If the parking brake is selected and the truck speed is less than 0.8 kph (0.5 mph), the following sequence will occur:

- ***From 0 - 1 second:*** *Brake lock is applied, parking brake is released.*
- ***From 1 - 1.5 seconds:*** *Brake lock is applied, parking brake is applied.*
- ***After 1.5 seconds:*** *Brake lock is released, parking brake is applied.*

This sequence uses the service brakes to completely stop the truck before allowing the parking brake to apply.

46. Move the directional control lever to PARK, then stop the engine by turning the key start switch to the OFF position. Wait for two minutes for the steering accumulators to bleed down completely.
47. Relocate pressure gauges to the following test ports: front brake pilot (BF), rear brake pilot (BR), parking brake release (PK3) and brake lock (PP3).
48. Start the engine and allow the pressure at low accumulator pressure test port LAP1 to increase to a minimum of 18 960 kPa (2,750 psi). Continue operating the engine at low idle. Ensure that the brake lock switch is off.

64f. Pressures with lever in NEUTRAL, brake lock ON, truck moving:

Parking brake pressure, PK3	(2750 - 3100 psi)_____
Brake lock pressure, PP3	(2500 ± 100 psi)_____
Front brake pressure, BF	(0 psi)_____
Rear brake pressure, BR	(2500 ± 100 psi)_____

i. Pressures with lever in PARK, brake lock ON, truck not moving:

Parking brake pressure, PK3	(0 psi)_____
Brake lock pressure, PP3	(2500 ± 100 psi)_____
Front brake pressure, BF	(0 psi)_____
Rear brake pressure, BR	(2500 ± 100 psi)_____
Fault code A272 displayed? (circle one)	(Yes) YES NO
Fault code A274 displayed? (circle one)	(Yes) YES NO

j. Pressures with lever in PARK, brake lock OFF, truck not moving:

Rear brake pressure, BR	(0 psi)_____
Brake lock pressure, PP3	(0 psi)_____
Parking brake pressure PK3	(0 psi)_____
Fault codes displayed?	(none) _____

68. Number of brake pedal applications before fault code A261 occurs: (6 or more)_____

Name of Technician or Inspector Performing Checkout: _____

Badge number: _____

Date & shift completed: _____

Installing a bladder accumulator from storage

Refer to Bladder accumulator charging procedure to install the nitrogen charging kit on the accumulator and to check the precharge pressure.

- If the precharge pressure is between 172 kPa (25 psi) and 690 kPa (100 psi), set the regulator to 690 kPa (100 psi) and slowly charge the accumulator to 690 kPa (100 psi). Disconnect the nitrogen charging kit from the accumulator and install the accumulator on the truck. Charge the accumulator to the correct operating precharge pressure. Refer to Table 1.
- If the precharge pressure is less than 172 kPa (25 psi), slowly drain off all of the precharge pressure and use the following procedure:
  1. Remove the nitrogen charging kit from the accumulator.
  2. Lay the accumulator on a suitable work bench so the valve port at the bottom of the accumulator is higher than the top end of the accumulator. Remove the protective cap from the valve port.
  3. Pour approximately 2 liters (64 oz.) of clean C-4 hydraulic oil into the accumulator through the valve port. Allow time for the oil to run down the inside of the accumulator to reach the other end.
  4. Lay the accumulator flat on the work bench (or floor) and slowly roll the accumulator two complete revolutions. This will thoroughly coat the accumulator walls with a film of oil that is necessary for bladder lubrication during the charging procedure.
  5. Stand the accumulator upright. Charge the accumulator to 690 kPa (100 psi). Refer to Bladder accumulator charging procedure for the proper charging procedure.
  6. Remove the nitrogen charging kit. Install the protective cap on the valve port.
  7. Install the accumulator on the truck.
  8. Charge the accumulator to the correct operating precharge pressure listed in Table 1. Refer to Bladder accumulator charging procedure for the proper charging procedure.

Bladder accumulator leak testing

Leak testing entails checking for internal and external leaks at high pressure. A source of 24 130 kPa (3,500 psi) hydraulic pressure and nitrogen precharge pressure of 9 653 kPa (1,400 psi) will be required. A small water tank is necessary for a portion of the test.

1. Remove protective cap (1, Figure 30-1) from the gas valve.
2. Close inlet valve (4, Figure 30-2) on control manifold (6).
3. Connect the nitrogen charging kit to nitrogen container (8). Open the valve on the container.
4. Turn the “T” handle on charging valve adapter (2) all the way out (counterclockwise).
5. Close the bleed valve at the bottom of the accumulator.
6. Attach the charging valve adapter (2) to the charging valve on the accumulator. Ensure the hose does not loop or twist. Tighten the swivel nut on the charging valve adapter finger-tight.
7. Turn the “T” handle on charging valve adapter (2) clockwise to open the accumulator gas valve. Do not turn the “T” handle all the way down as it will damage the valve core.
8. Set the regulator (5) for 690 kPa (100 psi), then slightly open inlet valve (4) on control manifold (6) to slowly fill the accumulator. After 690 kPa (100 psi) is obtained, the charging rate can be increased until the accumulator is fully charged to 9 653 kPa (1,400 psi).
9. Close inlet valve (4) on control manifold (6) then turn the “T” handle on charging valve adapter (2) fully counterclockwise to close the accumulator gas valve.
10. Submerge the accumulator assembly under water and observe it for 20 minutes. No leakage (oil or bubbles) is permitted from the gas valve at the top or the valve port at the bottom. If leakage is present, proceed to Step 16.
11. Hold the gas valve on the accumulator stationary. Loosen the swivel nut on the charging valve adapter to remove the nitrogen charging kit.
12. Install protective cap (1, Figure 30-1) on the gas valve.

Front suspensions

NOTE: The dump body must be empty and resting on the truck frame before performing the following procedures.

1. Park the truck on a hard, level surface. Place the directional control lever in PARK.
2. Place wheel chocks in front of and behind both sets of rear tires to prevent roll away.

NOTE: Do not place wheel chocks around the front tires. The front tires will roll forward and backward a small amount as the suspension travels up and down during the suspension charging process.

NOTE: 860E model trucks, which have parking brakes at both the front and rear wheels, must have hydraulic pressure to disengage parking brakes. The engine must be running and the directional control lever must be placed in NEUTRAL for this procedure.

3. Throughly clean the charging valve area on top of each front suspension. Remove the protective covers from the charging valves.

⚠WARNING

When support blocks are in place, they must be secured with a strap or by other means to avoid accidental discharge. An unsecured support block could fly loose as weight is applied, presenting the possibility of serious injury to nearby personnel and/or damage to the equipment. Overhead clearance may be reduced rapidly and suddenly when nitrogen pressure is released.

4. Position and secure the oiling support blocks 180 degrees apart as shown in Figure 30-13. When nitrogen pressure is released, the suspensions will lower and rest on the blocks.

NOTE: Ensure that the blocks do not mar or scratch the plated surfaces of the pistons or damage wiper seals in the lower bearing retainer. If using locally manufactured support blocks, the blocks must seat on the spindle and the cylinder housing as shown in Figure 30-13, not on the capscrew heads. Komatsu charging blocks, as shown in Figure 30-10, are designed to distribute the load across multiple capscrews.

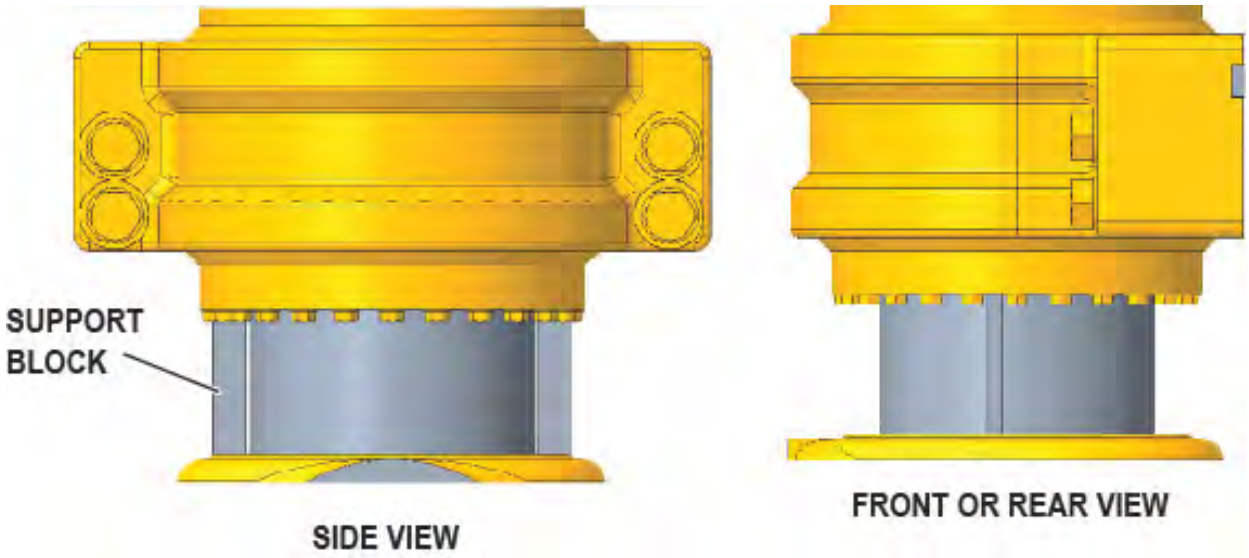


FIGURE 30-13. FRONT SUSPENSION

General information on system checkout

The electrical system checkout procedures are intended to help the technician diagnose problems in the 24V control and lighting systems. The technician should read the checkout procedures to become familiar with the procedures and all the warnings and cautions before performing any steps. The checkout procedures begin by checking the basic system before checking individual components.

A data sheet is included in this section to record the test information obtained during the electrical system checkout procedure. The data sheet is designed to be printed or copied, then used during the checkout procedure.

⚠WARNING

This checkout procedure must be performed by qualified, trained personnel that have knowledge of the operation of the truck and the stored energy systems. Personnel must observe all established precautions where the checkout procedure is being performed. All potentially stored energy within the truck must be released before performing any troubleshooting.

⚠CAUTION

Before starting the engine, always sound the horn once prior to cranking. Block wheels of the truck to prevent possible roll away before performing this procedure

⚠DANGER

DANGEROUS VOLTAGE LEVELS ARE PRESENT WHEN THE TRUCK IS RUNNING AND CONTINUE TO EXIST AFTER SHUTDOWN IF THE REQUIRED SHUTDOWN PROCEDURES ARE NOT FOLLOWED.

Before attempting repairs or working near drive system components, the following precautions and truck shutdown procedure must be followed:

- ***DO NOT step on or use any power cable as a hand hold when the engine is running.***
- ***NEVER open any electrical control cabinet covers or touch the retarding grid elements. Additional drive system safety checks must be performed by a technician trained to service the system before working on drive system components.***
- ***ALL removal, repairs and installation of drive system electrical components, and cables must be performed by an electrical maintenance technician properly trained to service the drive system.***
- ***IN THE EVENT OF A DRIVE SYSTEM MALFUNCTION, a qualified technician must inspect the truck and verify the drive system does not have dangerous voltage levels present before repairs are started.***
- ***THE DC LINK VOLTAGE LIGHTS MUST NOT BE ILLUMINATED WHEN TEST OR REPAIRS ARE INITIATED. It requires approximately five minutes after the truck is shut down before the DC link voltage has dissipated.***

⚠WARNING

Power cables must be cleated in wood or other non-ferrous materials. Do not repair cable cleats by encircling the power cables with metal clamps or hardware. Always inspect power cable insulation prior to servicing the cables. Replace cables that have broken insulation.

NOTES

PLM IV system checkout data sheet

Machine Model _____ Unit Number _____ Serial Number _____

Step 3 - PLM IV controller input voltage 24VDC? _____

Step 5 - Pressure sensor supply voltage 18 ± 1VDC? _____

Step 9 - Green light functions properly? _____

Amber light functions properly? _____

Red light functions properly? _____

Step 11 - PLM IV software version _____

Step 12a - Left front suspension pressure _____

Right front suspension pressure _____

Left rear suspension pressure _____

Right rear suspension pressure _____

Step 12b - Inclinometer reading _____

Step 12c - Body up input functions properly? _____

Step 12d - Brake lock input functions properly? _____

Step 12e - Speed input functions properly? _____

Name of Technician or Inspector Performing Checkout: _____

Badge number: _____

Date & shift completed: _____

The window below is an example of a failed attempt at receiving a GPS signal.

In the event of a failure, click **Back**, check the connections and the antenna, then retest. If successful, click **Back** to complete the test.

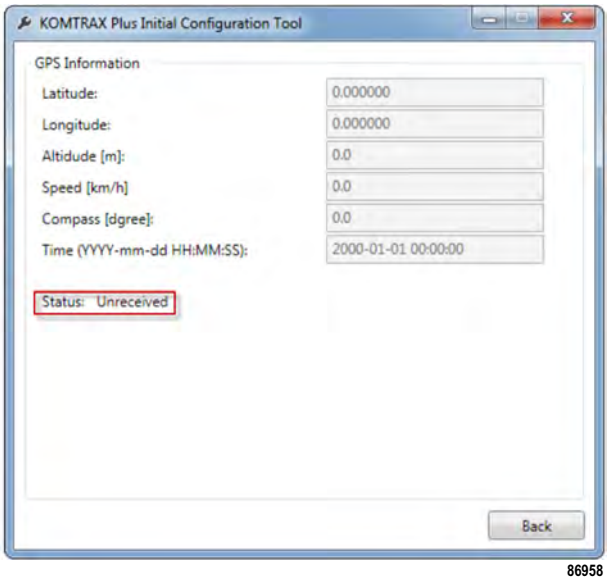


FIGURE 30-16. GPS INFORMATION WINDOW - FAILED

Iridium satellite system opening

The following procedure must be completed outside with an unobstructed view of the sky. The purpose is to verify that the Iridium system is functioning properly and to establish communication.

NOTE: Do not perform this procedure if the truck is not equipped with the Iridium satellite system.

1. Verify that an Iridium modem is installed.
2. Park the truck away from buildings and any objects that obstruct a clear view of the sky. Turn the engine start switch to ON. Wait approximately five minutes for the KOMTRAX Plus II system to acquire signals from the GPS satellites and the Iridium satellites.
3. Establish an ethernet connection between the service computer and the KOMTRAX Plus II controller.
4. Open the *KOMTRAX Plus Initial Configuration Tool*.
5. Click **Destination Configuration** on the main menu.

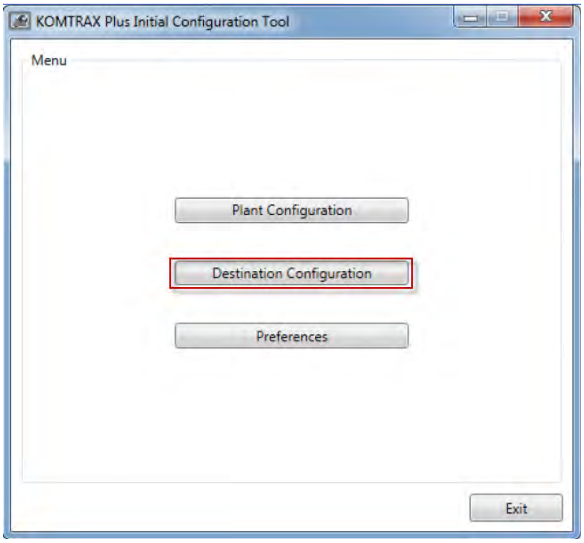


FIGURE 30-17. MAIN MENU

Configuring the NanoStation access point

NOTE: Each mine site will require at least one access point because the KWB operates in infrastructure wireless mode.

1. Connect POE adapter (2, Figure 30-1) to NanoStation access point (1) by using a CAT 5E network cable. Ensure that the cable is in the POE port as shown.
2. Connect POE adapter (2) to service computer (3) by using another CAT 5E network cable. Ensure that the cable is in the LAN port as shown.
3. Change the service computer's wired LAN settings to the following:

   IP address: **192.168.1.100**

   Net mask: **255.255.0.0**
4. Open an internet browser (Google Chrome™ is recommended), type **192.168.1.20** into the address bar, then press the Enter key.
5. Proceed to the website regardless of any security messages.

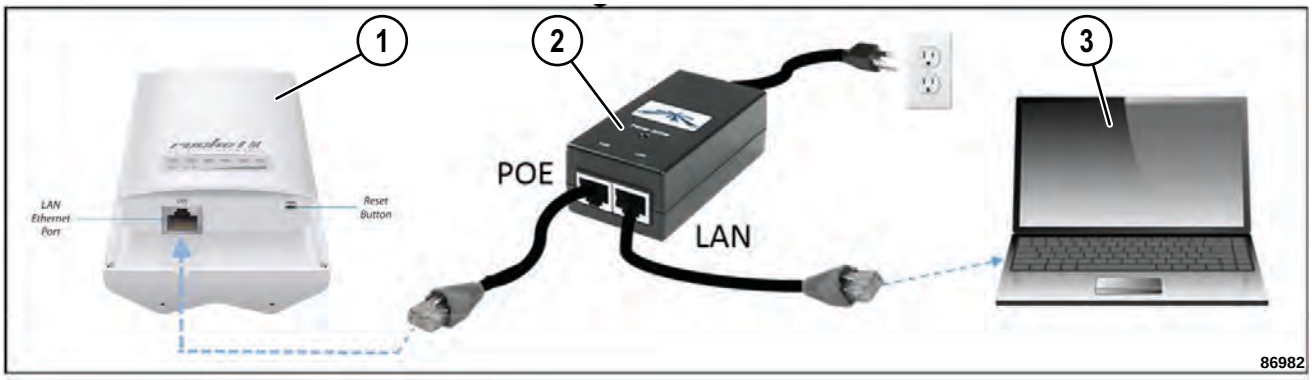


FIGURE 30-6. KWB POE ADAPTER CONNECTIONS

1. NanoStation Access Point
2. Power over Ethernet (POE) Adapter
3. Service Computer

Detecting leaks

Refrigerant leaks are probably the most common cause of air conditioning problems, resulting from improper or no cooling, to major internal component damage. Leaks most commonly develop in two or three places. The first is around the compressor shaft seal, often accompanied by an indication of fresh refrigerant oil. If a system is not operated for a while (winter months), the shaft seal may dry out and leak slightly. The centrifugal force of the clutch pulley spinning can also cause the problem. When the system is operated and lubricant wets the seal, the leak may stop. Such leaks can often be located visually or by feeling with your fingers around the shaft for traces of oil. The R-134a itself is invisible, odorless, and leaves no trace when it leaks, but has a great affinity for refrigerant oil.

A second common place for leaks is the nylon and rubber hoses where they are crimped or clamped to the fittings, or where routing allows abrasion. Other threaded joints or areas where gaskets are used should be visually and physically examined. Moving your fingers along the bottom of the condenser and evaporator, particularly near the drain hole for the condensate will quickly indicate the condition of the evaporator. Any trace of fresh oil here is a clear indication of a leak.

Usually, a 50% charged system is enough to find most leaks. If the system is empty, connect the manifold gauge set to the system and charge at least 1.6 kg (3.5 lbs) of refrigerant into the system.

⚠WARNING

Use extreme caution when leak testing a system while the engine is running. In its natural state, refrigerant is a harmless, colorless gas. But when combined with an open flame, it will generate toxic fumes (phosgene gas) which can cause serious injuries or death.

Several methods are available for detecting refrigerant leaks.

NOTE: The refrigerant is heavier than air and will move downward when it leaks. Apply pickup hose or test probe on the under-surface of all components to locate leaks.

- An electronic leak detector (see Figure 30-2) can be used to detect leaks. As the test probe is moved into an area where traces of refrigerant are present, a visual or audible announcement indicates a leak. Audible units usually change tone or speed as intensity changes.
- Tracer dyes are available that can be added to the system as refrigerant is added. The system is then operated to thoroughly circulate the dye. As refrigerant escapes, it leaves a trace of the dye at the point of leakage, which is then detected using an ultraviolet light (“black light”), revealing a bright fluorescent glow.
- Soap and water can be mixed together and applied to system components. Bubbles will appear to pinpoint the specific location of leaks.

After determining the location or source of leak(s), repair or replace leaking component(s).

NOTE: The length of the hose will affect the refrigerant capacity. When replacing hoses, always use the same hose length, if possible.

⚠CAUTION

Before system assembly, check the compressor oil level and fill to specifications.

NOTES

9. Return to the Main Menu, then select the CAMERA SETTING button on the screen. The All Camera Position screen will appear (see Figure 30-6). Adjust the values, as needed.

10. Record the values, the select the SAVE button to store the data.

**** Record on Data Sheet***

Confirm that the correct values are stored by selecting the BACK button, which returns to the Main Menu screen. Select the CAMERA SETTING button again and confirm the stored values.

FIGURE 30-6. CAMERA SETTING SCREEN

11. Return to the Main Menu, then select the RADAR SETTING button on the screen. Record the values from each of the three tabs: Area, Threshold, All Radar Position (see Figure 30-7 through Figure 30-9). Adjust the values, as needed.

12. Record the values, then select the SAVE button to store the data.

**** Record on Data Sheet***

Confirm that the correct values are stored by selecting the BACK button, which returns to the Main Menu screen. Select the RADAR SETTING button again and confirm the stored values.

Placement of calibration sheets

Both ends of the truck's front lower platform are defined as base points "a" and "b." The measured mid-point of "a" and "b" is "c" (see Figure 30-14).

The front calibration sheet is constructed so that the side of the front calibration sheet may pass along "a" and "b", and the center of the front calibration sheet may be set to "c."

After the front calibration sheet is in place, use stakes to secure the four corners to the ground.

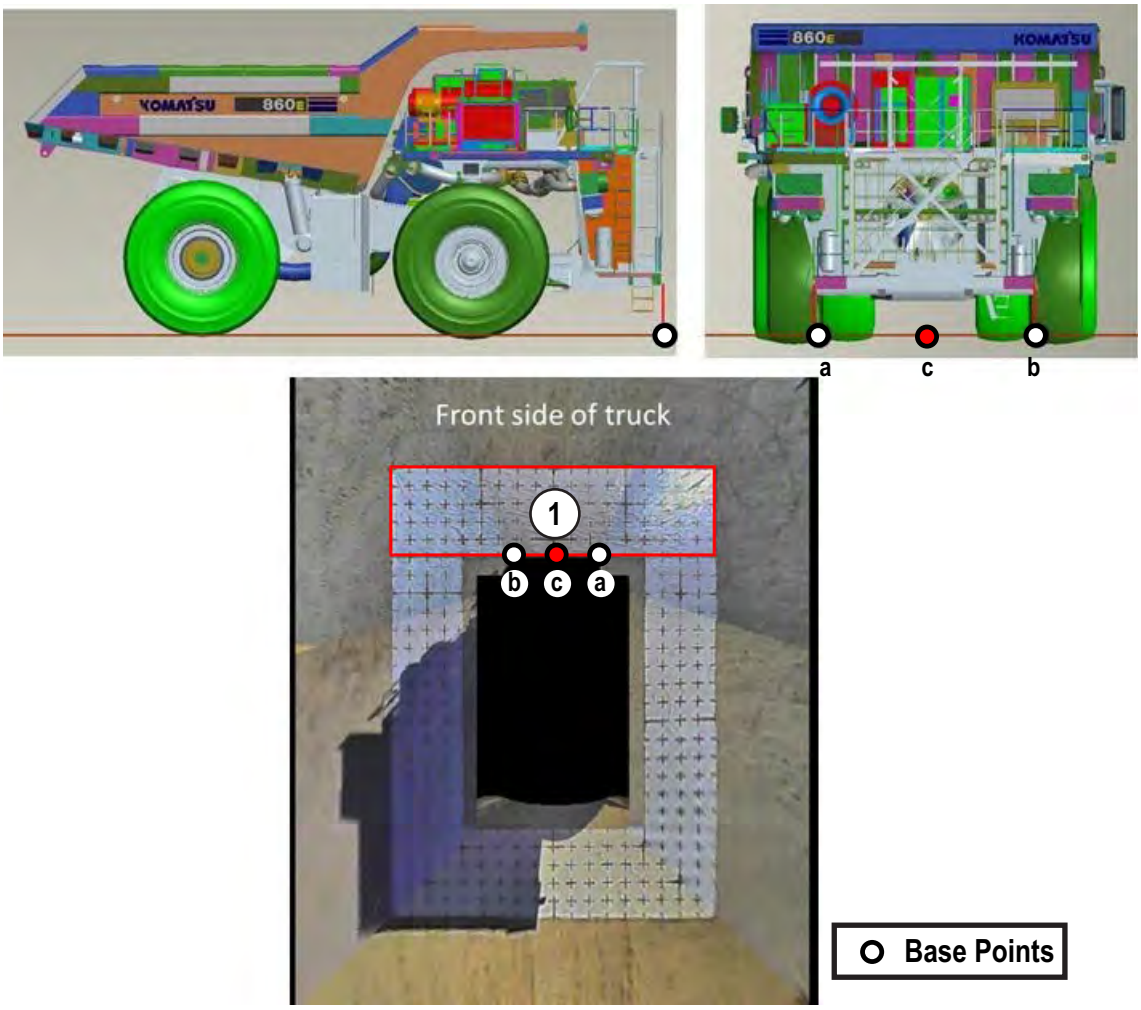
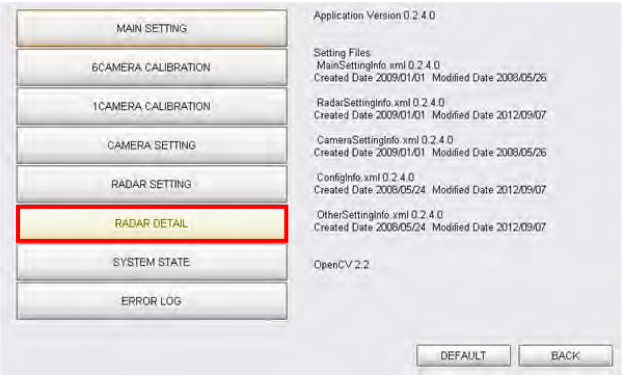


FIGURE 30-14. FRONT CALIBRATION SHEET BASE POINTS

4. Select the RADAR DETAIL button. See Figure 30-40.

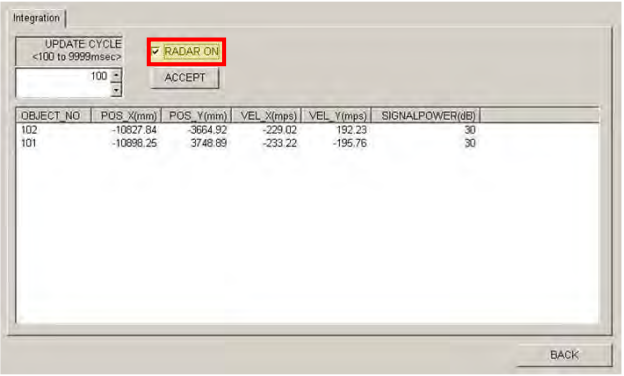


85261

FIGURE 30-40. RADAR DETAIL SCREEN

5. Select RADAR ON. See Figure 30-41.

- If no OBJECT is displayed, adjustments are not necessary. Proceed to step 7.
- If an OBJECT is displayed, adjustment is required. Proceed to step 6.



85262

FIGURE 30-41. INTEGRATION SCREEN

6. Take note of the OBJECT NO column, then select the BACK button. In the maintenance screen, select RADAR SETTING. See Figure 30-42.

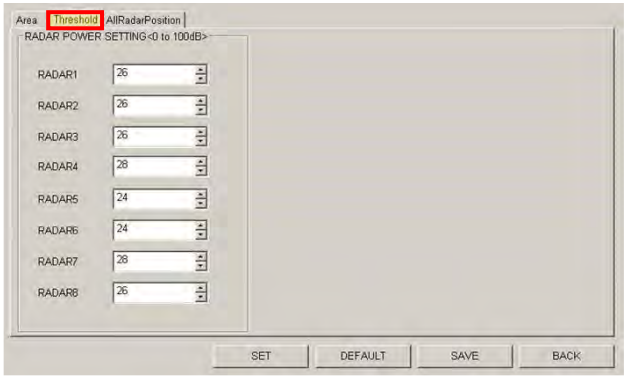
85263

FIGURE 30-42. RADAR DETAIL SCREEN

a. When the RADAR SETTING screen is displayed, select the Threshold tab. See Figure 30-43.

b. Increase the number of the RADAR POWER SETTING of the radar that corresponds to the OBJECT NO from the previous screen, then select SAVE.

Example: OBJECT NO 102 = RADAR2
CHANGE RADAR2 POWER SETTING 26 to 28



85264

FIGURE 30-43. THRESHOLD SCREEN

c. To verify whether the OBJECT is still displayed, repeat steps 4 and 5. Continue adjusting the RADAR POWER SETTING until the OBJECT is no longer displayed. Then proceed to step 7.

730E Dump truck
830E Dump truck
930E Dump truck
980E Dump truck

Form No. CEN30114-00

NOTES

Fault Code A009

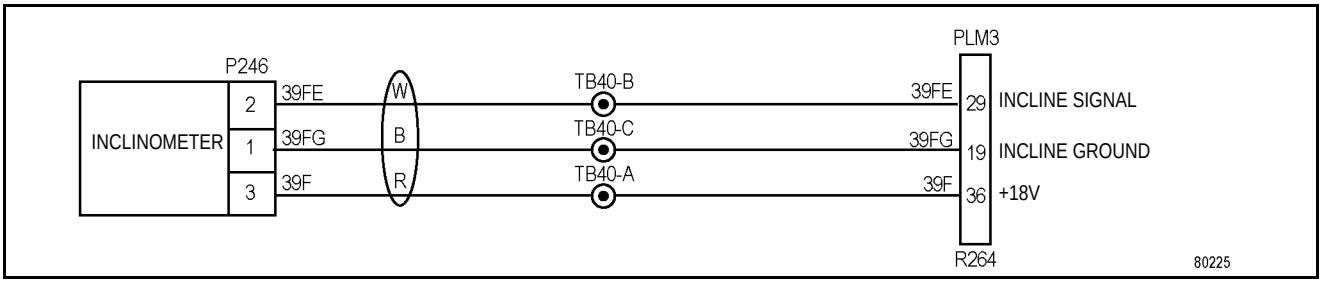
Operator Action	None
Description	Incline sensor signal high.
Fault Conditions	Sets if incline signal is out of range high (sensor voltage less than 0.565 volts). Resets if reading returns to normal.
Operator Alerting System Response	Repair Monitor Display Operator Action: None Display Fault Description: INCLINE SENSOR HIGH Display Fault Code: A009
Resulting Problem(s)	Bad payload computation.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table

1. This fault is generated by PLM in response to a problem in the sensor circuit. This sensor circuit may have a related fault that can be used to resolve the problem. Refer to the Troubleshooting Instructions for the active parameter fault(s).
2. If there are no active parameter fault codes, then based on the truck's setup while this fault is active, determine which of the parameters in the Table is not shown in its expected state on the IM Realtime Data Monitor program. Refer to the schematic to identify which item(s) may be causing the parameter(s) to be in the unexpected state. Troubleshoot these items.
3. If this fault is not currently active or if no parameters are currently in the unexpected state and the malfunction is still unresolved, then check each of the parameters in the Table for proper functionality. Troubleshoot all item(s) related to the parameter(s) which are found to be malfunctioning.

Parameter	**Expected State and/or Related Fault(s)**
Incline Sensor (PLM 36, 29, 19)	Sensor voltage <0.565: Failed high Sensor voltage >5.08: Failed low Sensor voltage >0.565 but <5.08: Valid readings Fault(s): A010

Related circuit diagram



Fault Code A104

Description	Hydraulic Oil Temp - Tank Sensor High
Fault Conditions	Sets if: Temperature reading rises to 133°C (271°F) Sensor signal is 4.90 V or above Resets if: Temperature reading drops to 107°C (225°F) Sensor signal returns to normal or drops below 4.77 V
Resulting Problem(s)	Loss of monitoring of the Hydraulic Tank Temperatures with potential for damage if temperatures also go high
Alert to Operator	**Display Fault Description**: TNK OIL TEMP SENS HI **Display Operator Action**: None
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault is generated by IM in response to a problem in the sensor circuit. This sensor circuit may have a related fault that can be used to resolve the problem.
Component/Circuit Schematic Search	Sensor Hydraulic Tank Temp (**730E, 830E**)
	Sensor Brake Temp RH Rear (**930E, 980E**)
Expected State	Sensor data: The voltage increases as the temperature increases. Normal reading: 0.016 to 4.89 V.

Fault Code A139

Description	A139 is a low fuel level warning for storage by KOMTRAX Plus and for use by A310.
Fault Conditions	Sets after 15 seconds of fuel level readings below 10% of full if the key start switch is on, low voltage due to cranking is not sensed, and the fuel level sensor is not high. Resets after 1 minute if fuel level recovers to 15% of full.
Resulting Problem(s)	Possible running out of fuel on haul road. Possible engine damage.
Alert to Operator	**Display Operator Action**: None **Display Fault Description**: None
Related Information	1.A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. The primary correction for this fault is to add fuel to the tank.
Component/Circuit Schematic Search	Sensor Fuel Level **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: Normal reading: 0.57 to 8.2 V. Incorrect reading: 0.56 V or below. Incorrect reading: 8.3 V or above.

Fault Code A166

Description	Left rear hydraulic oil temperature sensor is low.
Fault Conditions	Sets if sensor temperature reading drops to -51ºC (-60ºF) [.016 V] for 3 seconds or remains 10ºC (18ºF) below ambient temperature for 15 minutes after the engine runs. Resets if sensor temperature reading rises to -46ºC (-51ºF) [.032 V] for 3 seconds and recovers to within 10ºC (18ºF) of ambient temperature.
Resulting Problem(s)	Loss of monitoring of the left rear brake temperature begins a compromise of the brake system temperature monitoring that can only worsen if other sensors are lost.
Alert to Operator	**Display Fault Description**: LR OIL TEMP SENS LO **Display Operator Action**: None
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault is generated by IM in response to a problem in the sensor circuit. This sensor circuit may have a related fault that can be used to resolve the problem. 3. The primary correction for this fault is to correct any external wiring or replace the sensor.
Component/Circuit Schematic Search	Sensor Brake Temp LH Rear (**930E, 980E)**
Expected State	Sensor data: Normal reading: 0.016 to 4.89 V.

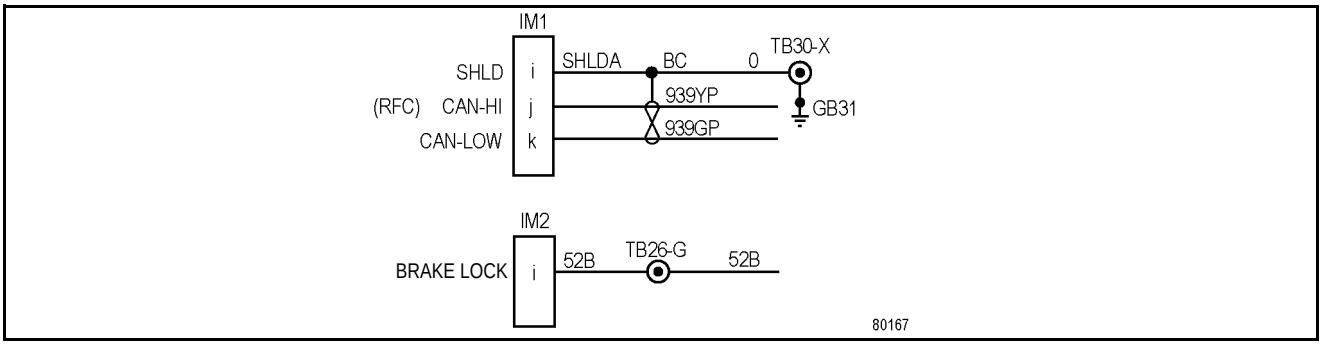
Fault Code A196

Description	Left rear hydraulic oil temperature is high.
Fault Conditions	Sets at 120ºC (248ºF) [4.13 V] after 5 seconds. Resets at 103ºC (217ºF) [3.78 V] after 5 seconds or at steering bleed.
Resulting Problem(s)	Excessively hot oil can cause equipment damage and may reduce service brake effectiveness.
Alert to Operator	Warning Monitor Indicator Lamp Alarm Buzzer **Display Fault Description**: HOT HYD OIL LR **Display Operator Action**: STOP: PARK: RUN ENG
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault is generated by IM in response to a problem in the sensor circuit. This sensor circuit may have a related fault that can be used to resolve the problem.
Component/Circuit Schematic Search	Sensor Brake Temp LH Rear (**930E, 980E)**
Expected State	Sensor data: Normal reading: 0.016 to 4.89 V.

Fault Code A214

Description	The parking brake should have released but is detected as not having released.
Fault Conditions	Sets if: Park brake does not release after the engine has been running for 90 seconds. Keyswitch (OR) is on. Selector switch Park is off. Park Brake Request input off for 3 seconds. Resets if: Keyswitch (OR) is turned off. Engine stops running. Park brake releases for 3 seconds. Selector switch (Park) input is on for 3 seconds. Park Brake Request input is on for 3 seconds. Park brake release is defined as follows: Park brake set pressure switch is open. Park brake release pressure switch is closed.
Resulting Problem(s)	Operation of the truck may be prevented or the parking brake may be damaged.
Alert to Operator	Park Brake Status Lamp On Alarm Buzzer **Display Fault Description**: PARK BRAKE ON **Display Operator Action**: STOP: PRK: PWR‾: CHK
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault is generated by IM in response to a problem in the sensor circuit. This sensor circuit may have a related fault that can be used to resolve the problem.
Component/Circuit Schematic Search	Switch Park Brake Release Pressure **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: 0: Parking brake pressure switch indicating high pressure and a released parking brake. 1: Parking brake pressure switch indicating lower pressure and an applied parking brake.

Related circuit diagram



Fault Code A249

Description	Red warning lamp in the dash display is shorted.
Fault Conditions	Sets if the red warning lamp feedback voltage is high for 400 ms with the red warning lamp on. Resets at power down.
Resulting Problem(s)	Warnings will be audible only.
Alert to Operator	Warning Monitor Indicator Lamp Alarm Buzzer **Display Fault Description**: RED WARN LAMP FLT **Display Operator Action**: GO TO SHOP NOW
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault's logic contains no additional external parameters. The red warning lamp feedback connection is made internally. 3. Check wiring and connections between interface module (IM) and the dash display, the wiring within the display to the red warning lamp, and the lamp itself.
Component/Circuit Schematic Search	Red Warning Lamp **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: 0: Red lamp is off. 1: Red lamp is on.
Component/Circuit Schematic Search	Red Warning Lamp Feedback **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: The IM monitors voltage on input IM1G for lamp feedback. Shorted reading: 3.75 V or above for 400 ms with the lamp on. Normal reading: 3.75 V or below for 400 ms with the lamp on.

Fault Code A266

Description	Shift lever was not in Park while attempting to crank engine.
Fault Conditions	Sets if selector switch is not in Park or is in Forward, Neutral, or Reverse while attempting to crank engine. Resets if selector switch is put in Park or cranking attempt is stopped.
Resulting Problem(s)	IM will not permit cranking if selector switch is not in park.
Alert to Operator	Alarm Buzzer **Display Fault Description**: CAN'T CRANK **Display Operator Action**: PUT SELECTOR IN PARK
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault is generated by IM in response to a problem in the sensor circuit. This sensor circuit may have a related fault that can be used to resolve the problem.
Component/Circuit Schematic Search	Selector Switch Park **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: The IM receives input on IM3T for park position. 0: Shift lever is not in Park. 1: Shift lever is in Park.
Component/Circuit Schematic Search	Selector Switch (not in park) **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: The IM receives input on IM2N for FNR position. 0: Shift lever is not in forward, neutral, or reverse. 1: Shift lever is in forward, neutral, or reverse.

Fault Code A280

Description	Steering accumulator bleed down switch is defective.
Fault Conditions	Sets if steering accumulator bleed pressure switch comes on with engine running and steering pressure normal. Resets if steering accumulator bleed pressure switch deactuates.
Resulting Problem(s)	Improper bleed may not be reported.
Alert to Operator	Warning Monitor Indicator Lamp Alarm Buzzer **Display Fault Description**: BAD STRG BLED SW **Display Operator Action**: GO TO SHOP NOW
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault is generated by IM in response to a problem in the sensor circuit. This sensor circuit may have a related fault that can be used to resolve the problem.
Component/Circuit Schematic Search	Switch Steering Bleed Pressure **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: 0: Accumulator is bled. 1: Accumulator is not completely bled.

Fault Code A303

Description	Shift lever is defective.
Fault Conditions	Sets if selector switch (FNR) and selector switch (Park) operate simultaneously for 1 second. Resets if conditions change for 1 second.
Resulting Problem(s)	Control of truck and parking brake will be defective.
Alert to Operator	Warning Monitor Indicator Lamp Alarm Buzzer **Display Fault Description**: SHIFTER DEFECTIVE **Display Operator Action**: STOP: PARK: PWR↓
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault is generated by IM in response to a problem in the sensor circuit. This sensor circuit may have a related fault that can be used to resolve the problem.
Component/Circuit Schematic Search	Selector Switch Park **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: The IM receives input on IM3T for park position. 0: Shift lever is not Park. 1: Shift lever is in Park.
Component/Circuit Schematic Search	Selector Switch (not in park) **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: The IM receives input on IM2N for FNR position. 0: Shift lever is not in Forward, Neutral, or Reverse. 1: Shift lever is in Forward, Neutral, or Reverse.

Fault Code A328

Description	Drive system not powered up.
Fault Conditions	Sets if drive system does not power up within 30 seconds after engine is running. Resets if conditions change for 2 seconds.
Resulting Problem(s)	Drive system can neither retard nor propel without control power.
Alert to Operator	Warning Monitor Indicator Lamp Alarm Buzzer **Display Fault Description**: NO DRIVE SYS POWER **Display Operation Action**: STOP: PRK
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. Check wiring from drive system control power to the interface module. 3. Check control power wiring, relay, and drive circuitry from drive system.
Component/Circuit Schematic Search	GE CNTRL PWR ON SIG **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: The IM receives control power signal from drive system on input IM3M. 0: Control power is off. 1: Control power is on.

Fault Code A345

Description	Engine speed limited by drive system.
Fault Conditions	Sets when drive system transmits an Engine Speed Limited message on CAN/RPC. Resets when drive system clears the Engine Speed Limited message on CAN/RPC.
Resulting Problem(s)	Performance will be limited.
Alert to Operator	Alarm Buzzer **Display Fault Description**: ENG SPD LIMIT BY GE **Display Operator Actio**n: MAX SPEED LIMITED
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault is developed within the drive system and transmitted to IM via CAN/RPC. 3. Troubleshoot the drive system and check for malfunction in CAN/RPC.
Component/Circuit Schematic Search	CAN/RPC connection **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: The IM should receive ENG SPD LIMIT BY GE messages from the drive system on CAN inputs (IM1i,j,k).

Fault Code A358

Description	Overload on output 1P.
Fault Conditions	Sets if driver chip detects over current or over temp on output 1P. Output is turned off when overload is detected. Resets at power down.
Resulting Problem(s)	The steering bleed circuit might not work properly, therefore, causing a threat to operators and mechanics.
Alert to Operator	Warning Monitor Indicator Lamp Alarm Buzzer **Display Fault Description**: STG BLEED CKT FAULT **Display Operator Action**: GO TO SHOP NOW
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault is generated by IM in response to a problem in the sensor circuit. This sensor circuit may have a related fault that can be used to resolve the problem.
Component/Circuit Schematic Search	Solenoid Steering Bleed Down **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: 0: Steering bleed valve is off. This is expected in normal running operation. 1: Steering bleed valve is on. This is expected after engine start switch OFF initiates steering bleed operation. **Status - Open Load:** Expected with engine start switch on. No problem. Otherwise, unexpected. Troubleshoot. **Status - Normal:** Expected only with keyswitch OFF and steering bleed in process. Troubleshoot if found with key ON. **Status - Shorted to Ground:** Unexpected. Troubleshoot. **Status - Overload:** Unexpected. Troubleshoot.

Fault Code A400

Description	Tire 1 (Front Left) High Pressure RED Fault.
Fault Conditions	Sets if: Pressure hardware max is on. Pressure limit RED max is on. Pressure band RED high is on and Bad Value Sensor Error / Not Connected Fault is not on. Resets when conditions change or steering bleed comes on.
Resulting Problem(s)	Potential tire damage.
Alert to Operator	Warning Monitor Indicator Lamp Alarm Buzzer **Display Fault Description**: #1 TIRE PRESSURE HI **Display Operator Action**: STOP: PARK: PWR↓
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault is based entirely on data transmitted by the Tire Monitor.
Component/Circuit Schematic Search	CAN/RPC Connection **(830E, 930E)**
Expected State	Sensor data: IM receives Tire 1 Data from Tire Monitor on CAN/RPC (IM1i,j,k).

Fault Code A413

Description	Tire 2 (Front Right) High Temperature RED Fault.
Fault Conditions	Sets if Temp limit RED is on and Bad Value Sensor Error / Not Connected Fault is not on. Resets if conditions change or if steering bleed comes on.
Resulting Problem(s)	Potential Tire Damage
Alert to Operator	Warning Monitor Indicator Lamp Alarm Buzzer **Display Fault Description**: #2 TIRE TEMP HI **Display Operator Action**: STOP: PARK: PWR↓
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault is based entirely on data transmitted by the Tire Monitor.
Component/Circuit Schematic Search	CAN/RPC Connection **(830E, 930E)**
Expected State	Sensor data: IM receives Tire 2 Data from Tire Monitor on CAN/RPC (IM1i,j,k).

Fault Code A426

Description	Tire 4 (Rear Left Inboard) Low Pressure RED Fault.
Fault Conditions	Sets if: Pressure hardware min is on. Pressure limit RED low is on. Pressure band RED low is on and Bad Value Sensor Error / Not Connected Fault is not on. Resets when conditions change or steering bleed valve comes on.
Resulting Problem(s)	Potential tire damage.
Alert to Operator	Warning Monitor Indicator Lamp Alarm Buzzer **Display Fault Description**: #4 TIRE PRESSURE LO **Display Operator Action**: STOP: PARK: PWR↓
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault is based entirely on data transmitted by the Tire Monitor.
Component/Circuit Schematic Search	CAN/RPC Connection **(830E, 930E)**
Expected State	Sensor data: IM receives Tire 4 Data from Tire Monitor on CAN/RPC (IM1i,j,k).

Fault Code A439

Description	Tire 5 (Rear Right Inboard) Bad Value Sensor Error / Not Connected Fault.
Fault Conditions	Sets if Last Tag Status Input is equal to 2. Resets if not equal to 2.
Resulting Problem(s)	Tire data is bad.
Alert to Operator	**Display Fault Description**: TIRE #5 BAD VALUE **Display Operator Action**: None
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault is based entirely on data transmitted by the Tire Monitor.
Component/Circuit Schematic Search	CAN/RPC Connection **(830E, 930E)**
Expected State	Sensor data: IM receives Tire 5 Data from Tire Monitor on CAN/RPC (IM1i,j,k).

NOTES

No.	Cause	Procedure, measuring location, criteria and remarks
26	Check for air in the DEF	Check for air in the DEF. - If air is detected in the DEF, then check the following components for damage or leaks. Repair as necessary. Aftertreatment 1 DEF dosing unit 1 supply line Aftertreatment DEF tank fittings. Aftertreatment DEF tank stand pipe. - If air is not detected in the DEF, then go to step 27.
27	Check pressure of the aftertreatment 1 DEF dosing unit 1	Connect the DEF pressure line to the inlet of the aftertreatment 1 DEF dosing valve 1. Install the DEF pressure gauge between the outlet of the aftertreatment 1 DEF dosing unit 1 and the pressure line. This is the supply line between DEF dosing unit 1 and DEF dosing valve 1. - If DEF pressure is less than the specification, then go to step 28. - If DEF pressure is not less than the specification, then a restricted pressure line has been detected. Clean or replace the pressure line, as necessary.
28	Check pressure of the aftertreatment 1 DEF dosing unit 1	Install the DEF pressure gauge between the outlet of the aftertreatment 1 DEF dosing unit 1 and the pressure line. This is the supply line between the DEF dosing unit 1 and the DEF dosing valve 1. - If DEF pressure is greater than the specification, then go to step 30. - If DEF pressure is not greater than the specification, then go to step 29.
29	Check aftertreatment 1 DEF dosing unit 1 for blockage	Disconnect the aftertreatment 1 DEF dosing valve 1 pressure line from the dosing valve 1. The pressure line runs between the DEF dosing unit 1 and DEF dosing valve 1. Disconnect the aftertreatment 1 DEF dosing valve 1 pressure line from the DEF dosing unit 1. Inspect the aftertreatment 1 DEF dosing unit 1 outlet fitting for signs of buildup or blockage. Inspect the aftertreatment 1 DEF dosing unit 1 filter for signs of buildup or blockage. Inspect the aftertreatment 1 DEF dosing unit 1 inlet fitting screen for signs of buildup or blockage. - If DEF dosing unit 1 is blocked or restricted, then Clean the aftertreatment 1 DEF dosing unit 1 outlet or inlet fitting, if needed. Replace the aftertreatment 1 DEF dosing unit 1 filter and screen. - If DEF dosing unit 1 is not blocked or restricted, then a malfunctioning aftertreatment 1 DEF dosing unit 1 has been detected. Replace the aftertreatment 1 DEF dosing unit 1.

No.	Cause	Procedure, measuring location, criteria and remarks
4	Check operation of DEF tank heater control valve	Turn engine start switch ON, start and idle the engine, then verify the proper operation of the aftertreatment diesel exhaust fluid tank heater control valve. Use electronic service tool to perform the “Diesel Exhaust Fluid Doser System Heater Test” under the “ECM Diagnostic Tests” menu. Use the Diesel Exhaust Fluid Tank Heater option in the test menu to override the tank heater control valve to ON. Make sure the tank heater control valve is operating correctly, not stuck closed or slow to respond, and able to fully open. Make sure the tank heater control valve is installed correctly, and not reversed. - If DEF tank heater control valve is operating correctly, then go to step 5. - If DEF tank heater control valve is not operating correctly, repair or replace the DEF tank heater control valve.
5	Cummins ECM diagnostic tests or ECM calibration out of date	Refer to Cummins technician.

Wiring Diagram Information

	Schematic	Reference Location(s)
730E-10	58D-06-0171x	SH6: B7
830E-5	58E-06-02310- 58E-06-02315	SH8: B7
830E-5	58E-06-02316- 58E-06-0231x	SH6: B7
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH9: B7 SH10: B7
930E-5 /5SE	58F-06-02316- 58F-06-0231x	SH7: B7 SH8: B7
980E-5	58B-06-02390- 58B-06-02392	SH8: B8
980E-5	58B-06-02393- 58B-06-0239x	SH6: B8

Fault Code CA3146

Fault Description	Aftertreatment SCR Outlet Temperature Sensor Circuit -Voltage Above Normal or Shorted to High Source. High signal voltage detected at the SCR outlet temperature sensor circuit.
Operator Action	Follow digital display instructions. The aftertreatment SCR temperature sensor module reported the aftertreatment SCR intake temperature signal was out of range high. Diesel exhaust fluid injection into the aftertreatment system is disabled. Engine torque will be reduced if the engine is operated for an extended period of time with this fault active.
Related Information	The aftertreatment SCR (selective catalytic reduction) temperature sensor module is a smart device that communicates with the engine control module via the J1939 data link. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the J1939 data link. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intake temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and can not be replaced individually. Possible causes of this fault code include: A malfunctioning aftertreatment SCR intake temperature sensor
Component Location	The SCR temperature sensor module is located below and to the rear of the SCR canisters. The SCR canisters are part of each engine bank exhaust system, replacing the mufflers of a non-TierIV exhaust system.

No.	Cause	Procedure, measuring location, criteria and remarks
1	Fault codes	Check for active fault codes. Fault Code CA4152, 4164, 4165, 4166, or 4261 active? - If CA4261 is active, refer to Cummins technician. - For all other fault codes, go to appropriate fault code troubleshooting guide. If no other codes are active, A malfunctioning aftertreatment selective catalytic reduction (SCR) temperature sensor module has been detected. Replace the aftertreatment SCR temperature sensor module. Refer to procedure 019-449 in the Associated Procedures Table.
2	Cummins ECM calibration out of date	Refer to Cummins technician.

No.	Cause	Procedure, measuring location, criteria and remarks
4	Pin-to-Ground short circuit	Measure the resistance between the aftertreatment DEF dosing unit command Signal pin of the Komatsu harness connector and engine block ground. - If greater than 100k ohms, then go to step 5. - If not greater than 100k ohms, then a pin-to-ground short circuit has been detected in the harness. Repair or replace the damaged section of the harness.
5	Pin-to-Ground short circuit	Measure the resistance between the aftertreatment DEF dosing unit Supply pin of the Komatsu harness connector and engine block ground. - If greater than 100k ohms, then go to step 6. - If not greater than 100k ohms, then a pin-to-ground short circuit has been detected in the harness. Repair or replace the damaged section of the harness.
6	Pin-to-Pin short circuit	Measure the resistance between the aftertreatment DEF dosing unit command Signal pin of the Komatsu harness ECM connector and all other pins in the Komatsu harness ECM connector. Measure the resistance between the aftertreatment DEF dosing unit Supply pin of the Komatsu harness ECM connector and all other pins in the Komatsu harness ECM connector. - If greater than 100k ohms, then replace the aftertreatment DEF dosing unit. - If not greater than 100k ohms, then a pin-to-pin short circuit has been detected in the harness. Repair or replace the damaged section of the harness.
7	Cummins ECM or ECM calibration out of date	Refer to Cummins technician.

Wiring Diagram Information

	Schematic	Reference Location(s)
730E-10	58D-06-0171x	SH7: K15
830E-5	58E-06-02310- 58E-06-02315	SH9: K15
830E-5	58E-06-02316- 58E-06-0231x	SH7: K15
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH11: K19
930E-5 /5SE	58F-06-02316- 58F-06-0231x	SH9: K19
980E-5	58B-06-02390- 58B-06-02392	SH9: J12 SH9: N12
980E-5	58B-06-02393- 58B-06-0239x	SH7: J12 SH7: N12

Wiring Diagram Information

	Schematic	Reference Location(s)
730E-10	58D-06-0171x	SH7: K15
830E-5	58E-06-02310- 58E-06-02315	SH9: K15
830E-5	58E-06-02316- 58E-06-0231x	SH7: K15
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH11: K19
930E-5 /5SE	58F-06-02316- 58F-06-0231x	SH9: K19
980E-5	58B-06-02390- 58B-06-02392	SH9: J12 SH9: N12
980E-5	58B-06-02393- 58B-06-0239x	SH7: J12 SH7: N12

No.	Cause	Procedure, measuring location, criteria and remarks
5	Check J1939 data link harness	Disconnect the OEM harness connector from the ECM. Check for dirty or damaged connector pins. Clean or repair connector pins, if possible.
6	Check for open circuit in J1939 data link harness	Disconnect the aftertreatment DEF tank level/temperature/quality sensor from the OEM harness. Disconnect the OEM harness connector from the ECM. Measure the resistance between the J1939 data link (+) wire at the aftertreatment DEF tank level/temperature/quality sensor wiring harness connector and the SAE J1939 (+) wire at the ECM OEM harness connector. Measure the resistance between the J1939 data link (+) wire at the aftertreatment DEF tank level/temperature/quality sensor wiring harness connector and the SAE J1939 (+) wire at the ECM OEM harness connector. - If less than 10 ohms, then go to step 7. - If not less than 10 ohms, then an open circuit has been detected in the J1939 data link.
7	Check for short circuit in J1939 data link harness	Disconnect the aftertreatment DEF tank level/temperature/quality sensor from the OEM wiring harness. Disconnect the DEF dosing unit from the OEM wiring harness. Disconnect the OEM harness connector from the ECM. Measure the resistance between the J1939 data link (+) wire at the ECM OEM harness connector and all other pins in the connector. Measure the resistance between the J1939 data link (-) wire at the ECM OEM harness connector and all other pins in the connector. Disregard any resistance between 50 and 70 ohms between the J1939 data link (+) and the SAE J1939 data link (-) pins. - If resistance is greater than 100k ohms, then go to step 8. - If resistance is not greater than 100k ohms, then a short circuit has been detected in the J1939 data link harness. Troubleshoot the OEM harness and all interconnects. Repair or replace the malfunctioning component.
8	Check for short circuit to ground in J1939 data link harness	Disconnect the aftertreatment DEF tank level/temperature/quality sensor from the OEM wiring harness. Disconnect the DEF dosing unit from the OEM harnesses. Disconnect the OEM harness connector from the ECM. Measure the resistance between the J1939 data link (+) wire at the ECM OEM harness connector and ground. Measure the resistance between the J1939 data link (-) wire at the ECM OEM harness connector and ground. - If resistance is greater than 100k ohms, then go to step 9. - If resistance is not greater than 100k ohms, then a short circuit to ground has been detected in the J1939 data link harness. Troubleshoot the OEM harness and all interconnects. Repair or replace the malfunctioning component.

Fault Code CA4119

Fault Description	Aftertreatment 2 SCR Catalyst Outlet Gas Temperature – Voltage Above Normal or Shorted to High Source. High signal voltage detected at the Selective Catalytic Reduction (SCR) outlet temperature sensor circuit.
Operator Action	Follow digital display instructions. The aftertreatment SCR temperature sensor module reported the aftertreatment SCR outlet temperature signal was out of range high. Diesel exhaust fluid (DEF) injection into the aftertreatment system is disabled. Engine torque will be reduced if the engine is operated for an extended period of time with this fault active.
Related Information	The aftertreatment SCR (selective catalytic reduction) temperature sensor module is a smart device that communicates with the engine control module via the J1939 data link. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the J1939 data link. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intake temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and can not be replaced individually. Possible causes of this fault code include: A malfunctioning aftertreatment SCR outlet temperature sensor
Component Location	The SCR temperature sensor module is located below and to the rear of the SCR canisters. The SCR canisters are part of each engine bank exhaust system, replacing the mufflers of a non-TierIV exhaust system.

No.	Cause	Procedure, measuring location, criteria and remarks
1	Fault codes	Check for active fault codes. Fault Code CA5725, 5727, 5728, 5729, or 5731 active? - If CA5731 is active, refer to Cummins technician. - For all other fault codes, go to appropriate fault code troubleshooting guide. If no other codes are active, a malfunctioning aftertreatment 2 selective catalytic reduction temperature sensor module has been detected. Replace the aftertreatment 2 selective catalytic reduction temperature sensor module.
2	Cummins ECM calibration out of date	Refer to Cummins technician.

Fault Code CA4166

Fault Description	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module – Data Valid but Above Normal Operating Range – Moderately Severe Level. High internal temperature detected in the SCR temperature sensor module.
Operator Action	Follow digital display instructions. Possible reduced engine performance.
Related Information	The aftertreatment SCR (selective catalytic reduction) temperature sensor module is a smart device that communicates with the engine control module via the J1939 data link. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the J1939 data link. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intake temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and cannot be replaced individually. The aftertreatment SCR temperature sensor module reported the internal circuit board temperature was too high. This fault code indicates the internal temperature of the aftertreatment SCR temperature sensor module was too high. Troubleshoot the exhaust system for leaks, missing heat shields, or dirt and debris that could lead to overheating of the aftertreatment SCR temperature sensor module.
Component Location	The SCR temperature sensor module is mounted to the rear and below the aftertreatment SCR catalysts.

No.	Cause	Procedure, measuring location, criteria and remarks
1	Fault codes	Fault Code CA4166 active or more than three inactive counts? - If Yes, then go to step 2. - If No, then go to step 4
2	In properly mounted sensor module.	Verify the aftertreatment SCR temperature sensor module is properly mounted. - If Yes, go to step 3. - If No, relocate and/or secure the module correctly.
3	Obstructed or restricted air flow sensor module.	Check the aftertreatment SCR temperature sensor module mounting area for air flow obstructions. - If there are signs of air flow restriction or excessive heat to temperature sensor module, then repair the cause of the restricted air flow. - If there are no signs of air flow restriction or excessive heat to temperature sensor module, then go to step 4.
4	Cummins ECM or ECM calibration out of date	Refer to Cummins technician.

Fault Code CA4243

Fault Description	Aftertreatment 1 diesel exhaust fluid (DEF) temperature 2 sensor circuit – Abnormal rate of change.
Operator Action	Follow digital display instructions.
Related Information	The aftertreatment DEF temperature sensor is a smart device used to measure the temperature of DEF in the tank. It performs its own internal diagnostics and reports malfunctions back to the engine control module (ECM) via the J1939 data link. The aftertreatment diesel exhaust fluid quality sensor is used to measure the concentration of the aftertreatment diesel exhaust fluid in the tank.
Component Location	The DEF temperature sensor is mounted to the bottom of each of the DEF tank head units inside the DEF tank. The DEF tank is located on the outside face of the fuel tank on the RH side of the truck.

No.	Cause	Procedure, measuring location, criteria and remarks
1	Malfunctioning DEF temperature sensor	Measure the aftertreatment DEF tank temperature using an infrared thermometer or thermocouple. If the temperature is within 5.6°C or 10°F of the measured value, then go to step 2. If the temperature is NOT within 5.6°C or 10°F, unplug DEF harness connector for DEF tank head unit and plug it into another DEF tank head unit.
2	DEF harness	Ensure harness is pinned correctly, no damage to connector, and run continuity check on wires.
3	Cummins ECM calibration	Refer to Cummins technician.

Wiring Diagram Information

	Schematic	Reference Location(s)
730E-10	58D-06-0171x	SH7: K15
830E-5	58E-06-02310- 58E-06-02315	SH9: K15
830E-5	58E-06-02316- 58E-06-0231x	SH7: K15
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH11: K19
930E-5 /5SE	58F-06-02316- 58F-06-0231x	SH9: K19
980E-5	58B-06-02390- 58B-06-02392	SH9: J12 SH9: N12
980E-5	58B-06-02393- 58B-06-0239x	SH7: J12 SH7: N12

No.	Cause	Procedure, measuring location, criteria and remarks
6	Pin-to-Ground short circuit	Disconnect the DEF harness connector from the ECM. Disconnect the aftertreatment 2 DEF dosing valve from the DEF harness. Measure the resistance between the aftertreatment DEF dosing valve Signal pin of the DEF harness ECM connector and ground. Measure the resistance between the aftertreatment DEF dosing valve return pin of the harness ECM connector and ground. - If greater than 100K ohms, then go to step 7 - If less than 100K ohms, then an open signal circuit has been detected in the harness. Repair or replace the damaged section of harness.
7	Pin-to-Pin short circuit in the harness	Disconnect the DEF harness connector from the ECM. Disconnect the aftertreatment 2 DEF dosing valve from the DEF harness. Measure the resistance between the aftertreatment DEF dosing valve Signal pin of the DEF harness ECM connector and all other pins in the harness connector. - If greater than 100K ohms, then go to step 8 - If less than 100K ohms, then an open signal circuit has been detected in the harness. Repair or replace the damaged section of harness.
8	Cummins ECM or ECM calibration out of date	Refer to Cummins technician.

Wiring Diagram Information

	Schematic	Reference Location(s)
730E-10	58D-06-0171x	SH7: M15
830E-5	58E-06-02310- 58E-06-02315	SH9: M15
830E-5	58E-06-02316- 58E-06-0231x	SH7: M15
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH11: M19
930E-5 /5SE	58F-06-02316- 58F-06-0231x	SH9: M19
980E-5	58B-06-02390- 58B-06-02392	SH9: L12 SH9: P12
980E-5	58B-06-02393- 58B-06-0239x	SH7: L12 SH7: P12

Fault Code CA4467

Fault Description	Aftertreatment 2 Diesel Exhaust Fluid Pressure 1 – Data Valid but Above Normal Operating Range – Moderately Severe Level. The diesel exhaust fluid dosing valve has detected a blockage in the diesel exhaust fluid return flow.
Operator Action	Follow digital display instructions. DEF injection is disabled. Engine torque is reduced if operated for an extended period of time. Engine torque will be severely reduced. Engine will only idle or will shut down.
Related Information	The ECM provides a 5-volt supply and a ground to the aftertreatment DEF pressure sensor. The pressure sensor provides a signal to the ECM on the sensor signal circuit. This sensor signal voltage changes, based on the aftertreatment DEF pressure supplied by the dosing unit. The ECM will detect a low signal voltage at low DEF pressures, and a high signal voltage at high DEF pressures. The Engine Control Module (ECM) detected the aftertreatment diesel exhaust fluid pressure was greater than a threshold. Possible causes of this fault code include: Blocked, restricted, or frozen DEF dosing valve return line or return line connector. Blocked or restricted DEF dosing valve outlet
Component Location	The DEF pressure sensor in internal to the DEF dosing valve, and cannot be serviced separately. Trucks with a QSK50 or QSK60 engine the DEF dosing valve is mounted to the front top of the SCR. The SCR is located between the frame rails above the rear axle. Trucks with a QSK 78 engine the DEF dosing valves are mounted to the reaction pipes directly upstream of the SCRs.

No.	Cause	Procedure, measuring location, criteria and remarks
1	Fault codes	If fault code CA4467 is active and CA3571, 3572, 3596, 5278, 5935, 5936, 5864, or 5865 is active or inactive with more than one count logged in the last 25 engine hours? - If yes, then go to appropriate fault code. - If no, then go to step 2
2	Check for crossed connections	Check for cross-connection of components, refer to Cummins procedure 011-107. Trace the DEF pressure line from the dosing unit, and verify it is connected to the correct dosing valve. - If yes than correct the crossed system - If no than refer to step 3
3	Check the aftertreatment DEF lines and fittings	Turn engine start switch off and wait 30 seconds for DEF system pressure to leak down. Install the DEF pressure gauge between the outlet of the dosing valve and the return line (this is the return line between the dosing valve and tank). Check DEF pressure from the service tool gauge. - If DEF pressure is greater than 70 kPa (10 psi) then go to step 5. - If DEF pressure is less than 70 kPa (10 psi) then go to step 4.

No.	Cause	Procedure, measuring location, criteria and remarks
10	Dirty/Damaged power relay connector pins	Disconnect the aftertreatment power relay from the harness. Check for dirty or damaged connector pins on the aftertreatment power relay connector pins. Clean or repair connector pins, if possible.
11	Check voltage of aftertreatment power relay	Disconnect the aftertreatment power relay from harness. Measure the voltage from the aftertreatment power relay battery voltage SUPPLY pin in the aftertreatment power relay connector of the engine harness and engine block ground. - If voltage is within 1 VDC of battery, then go to step 12. - If voltage is not within 1 VDC of battery voltage, then an open circuit has been detected in the aftertreatment power battery voltage supply circuit before the power relay. Troubleshoot all harnesses connected in series to determine which one contains the open circuit. Repair or replace the damaged section of harness.
12	Check power relay	Disconnect the aftertreatment power relay from the engine harness. Install a jumper wire from pin 85 on the aftertreatment power relay to battery (+). Connect a jumper wire from pin 86 on the aftertreatment power relay to chassis ground. Measure the resistance between pin 30 and pin 87 on the aftertreatment power relay. - If resistance is less than 10 ohms, then an open circuit or short circuit to ground has been detected in the aftertreatment DEF tank level sensor power supply circuit. Burned out in-line fuse on the DEF tank level sensor power supply circuit. Open circuit or short to ground in the DEF tank level sensor power supply circuit. Replace the inline fuse if it is burned out. Troubleshoot all harnesses connected in series to determine which on contains the open or shorted circuit. Repair or replace the damaged section of harness. - If resistance is not less than 10 ohms, then replace the aftertreatment power relay.
13	Check the J1939 data link 4	Disconnect the DEF harness connector from the ECM. Check for dirty or damaged connector pins. A damaged connection has been detected in the ECM connector or the DEF harness connector. Clean the connector and pins. Repair the damaged harness, connector, or pins, if possible.
14	Check for open circuit in J1939 data link harness	Disconnect the DEF harness and engine harness at the aftertreatment 1 connector. Disconnect the DEF harness connector from the ECM. Measure the resistance between the SAE J1939 data link 4 (+) wire at the engine harness aftertreatment 1 connector and the SAE J1939 data link 4 (+) wire at the ECM DEF harness connector. Measure the resistance between the SAE J1939 data link 4 (−) wire at the engine harness aftertreatment 1 connector and the SAE J1939 data link 4 (−) wire at the ECM DEF harness connector. - If resistance is less than 10 ohms, then go to step 15. - If resistance is not less than 10 ohms, then an open circuit has been detected in the J1939 data link 4. Repair or replace the damaged section of engine harness.

Fault Code CA4769

Fault Description	Aftertreatment 1 diesel exhaust fluid (DEF) tank level sensor – abnormal rate of change. A valid DEF tank level reading has NOT been received.
Operator Action	Follow digital display instructions. Engine torque will be reduced if the engine is operated for an extended period with this fault active. Engine torque will be severely reduced. Engine will only idle or will shut down.
Related Information	The aftertreatment DEF tank level sensor is a smart device used to measure the level of DEF in the tank. Possible causes of this fault code include: A malfunctioning aftertreatment diesel exhaust fluid tank level sensor Tampering of the aftertreatment diesel exhaust fluid tank level sensor
Component Location	The DEF tank level sensor is integral to the DEF tank head units inside the DEF tank. The DEF tank is located on the outside face of the fuel tank on the RH side of the truck.

No.	Cause	Procedure, measuring location, criteria and remarks
1	Fault codes	Check for active fault codes. Is fault codes CA1668, 1669, 4679, 4732, 4738 or 4739 active or inactive with more than 1 count in the last 25 engine hours. - If yes, then go to the appropriate fault code troubleshooting tree. - If no, then got to step 2.
2	Fault codes	Check for active fault codes. Is fault code CA4769 active or inactive with more than 1 count in the last 25 engine hours. - If yes, then an internal error has been detected in the aftertreatment diesel exhaust fluid (DEF) tank level sensor. Replace the aftertreatment DEF tank level sensor. - If no, then repair complete.
3	Cummins ECM or ECM calibration out of date	Refer to Cummins technician.

Wiring Diagram Information

	Schematic	Reference Location(s)
730E-10	58D-06-0171x	SH7:D7
830E-5	58E-06-02310- 58E-06-02315	SH9:D7
830E-5	58E-06-02316- 58E-06-0231x	SH7:D7
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH11:D7
930E-5 /5SE	58F-06-02316- 58F-06-0231x	SH9:D7
980E-5	58B-06-02390- 58B-06-02392	SH9:C8
980E-5	58B-06-02393- 58B-06-0239x	SH7:C8

Fault Code CA5727

Fault Description	Aftertreatment 2 Selective Catalytic Reduction (SCR) Temperature Sensor Module – Voltage Above Normal or Shorted to High Source. High battery supply voltage detected at the SCR temperature sensor module.
Operator Action	Follow digital display instructions. Possible reduced engine performance.
Related Information	The aftertreatment SCR (selective catalytic reduction) temperature sensor module is a smart device that communicates with the engine control module via the J1939 data link. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the J1939 data link. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intake temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and cannot be replaced individually. The aftertreatment SCR temperature sensor module reported high battery supply voltage. Possible causes of this fault code include: Incorrect Battery System Voltage setting in INSITE Incorrect sensor for the application (12 VDC versus 24 VDC) High battery voltage supply
Component Location	The SCR temperature sensor module is mounted to the rear and under each SCR canister.

No.	Cause	Procedure, measuring location, criteria and remarks
1	Fault codes	Check for active fault codes. Fault code 441 or 442 active? - If yes, then go to the appropriate fault code. - If no, then go to step 2.
2	Dirty/Damaged sensor connector pins	Disconnect the SCR temperature sensor module from the DEF harness. Check for dirty or damaged connector has been detected in the sensor or harness connector. Clean or repair connector pins, if possible.
3	Check voltage of sensor module	Disconnect the aftertreatment 2 SCR temperature sensor module from the DEF harness. Measure the voltage between the aftertreatment SCR temperature sensor module battery voltage supply circuit and the aftertreatment SCR temperature sensor module battery voltage return circuit at the aftertreatment SCR temperature sensor module wiring harness connector. Check the voltage at engine start switch on while cranking the engine and with the engine at idle. - If voltage is greater than 30 VDC, then go to step 7. - If voltage is not greater than 30 VDC, then go to step 4

No.	Cause	Procedure, measuring location, criteria and remarks
4	DEF dosing valve	Disconnect the DEF harness connector from the ECM. Disconnect the aftertreatment 1 DEF dosing valve 2 from the DEF harness. Measure the resistance between the DEF harness aftertreatment 1 DEF dosing valve 2 connector Return pin to the ECM connector aftertreatment 1 DEF dosing valve 2 Return pin. - If resistance is less 10 ohms, then go to step 5. - If resistance is not less than 10 ohms, an open return circuit has been detected. Repair or replace the damaged section of the harness.
5	Pin-to-Ground short circuit	Disconnect the DEF harness connector from the ECM. Disconnect the aftertreatment 1 DEF dosing valve 2 from the DEF harness. Measure the resistance between the aftertreatment 1 DEF dosing valve 2 Signal pin of the DEF harness ECM connector and ground. Measure the resistance between the aftertreatment 1 DEF dosing valve 2 Return pin of the DEF harness ECM connector and ground. - If greater than 100K ohms, then go to step 6 - If less than 100K ohms a pin-to-ground short circuit has been detected. Repair or replace the damaged section of harness.
6	Pin-to-Pin short circuit in the harness	Disconnect the DEF harness connector from the ECM. Disconnect the aftertreatment 1 DEF dosing valve 2 from the DEF harness. Measure the resistance between the aftertreatment 1 DEF dosing valve 2 Signal pin of the DEF harness ECM connector and all other pins in the harness connector. - If greater than 100K ohms, then go to step 7 - If less than 100K ohms a pin-to-pin short circuit has been detected in the harness. Repair or replace the damaged section of harness.
7	Cummins ECM or ECM calibration out of date	Refer to Cummins technician.

Wiring Diagram Information

	Schematic	Reference Location(s)
730E-10	58D-06-0171x	SH7: K15
830E-5	58E-06-02310- 58E-06-02315	SH9: K15
830E-5	58E-06-02316- 58E-06-0231x	SH7: K15
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH11: K19
930E-5 /5SE	58F-06-02316- 58F-06-0231x	SH9: K19
980E-5	58B-06-02390- 58B-06-02392	SH9:J12 SH9:N12
980E-5	58B-06-02393- 58B-06-0239x	SH7:J12 SH7:N12

Fault Code CA5768

Fault Description	Aftertreatment 2 diesel exhaust fluid (DEF) dosing unit 2 Circuit – voltage above normal or shorted to high source. High signal voltage detected at the DEF dosing unit.
Operator Action	Follow digital display instructions. DEF injection is disabled. Engine torque is reduced if operated for an extended period of time. Engine torque will be severely reduced. Engine will only idle or will shut down.
Related Information	The aftertreatment DEF dosing unit filters and pressurizes DEF for the DEF dosing valve. The DEF dosing unit uses a diaphragm type pump to create DEF pressure. The engine control module (ECM) provides a battery voltage supply and a ground to the DEF dosing unit. The ECM also supplies a signal to the dosing unit to control the DEF output. This signal changes, based on the DEF pressure being commanded. The Engine Control Module (ECM) detected the aftertreatment diesel exhaust fluid dosing unit signal voltage was greater than a calibratible value or the diesel exhaust fluid dosing unit supply was shorted to battery or open circuit. Possible causes of this fault code include: Supply wire shorted to battery or open. Control signal wire shorted to battery voltage. A malfunctioning aftertreatment DEF dosing unit.
Component Location	The dosing units are located on the underside of the DEF tank.

No.	Cause	Procedure, measuring location, criteria and remarks
1	Fault codes	Check for active fault code. Fault Code 5768 is active? - If yes, then go to step 2 - If no, then go to step 6
2	Dirty/Damaged sensor connector pins	Disconnect the dosing unit from the DEF harness. Check for dirty or damaged connector pins on the DEF dosing unit. Clean or repair connector pins, if possible.
3	DEF dosing unit 2	With the dosing unit still disconnected, disconnect the DEF harness from the engine harness. Measure the resistance between the DEF harness aftertreatment 2 DEF dosing unit 2 Supply pin and the DEF harness ECM connector aftertreatment 2 DEF dosing unit 2 Supply pin. - If resistance is less 10 ohms, then go to step 4. - If resistance is not less than 10 ohms, an open signal circuit has been detected. Repair or replace the damaged section of the harness.
4	Pin-to-Pin short circuit in the DEF dosing unit 2	Disconnect the aftertreatment 2 DEF dosing unit 2 from the DEF harness. Disconnect the DEF harness connector from the ECM. Measure the resistance between the aftertreatment 2 DEF dosing unit 2 Supply pin of the DEF harness ECM connector and all other pins in the harness connector. - If greater than 100K ohms, then go to step 5. - If less than 100K ohms, then repair or replace the damaged section of harness.

Fault Code CA5774

Fault Description	Aftertreatment 2 Diesel Exhaust Fluid Pressure 2 Sensor Circuit - Current Below Normal or Open Circuit. A circuit error has been detected in the aftertreatment diesel exhaust fluid pressure sensor circuit.
Operator Action	Follow digital display instructions.
Related Information	The aftertreatment diesel exhaust fluid dosing valve is controlled by the ECM. When the engine control module (ECM) commands DEF dosing, the ECM sends a pulse width modulated (PWM) signal to the dosing valve, which opens the dosing valve and allows DEF to be sprayed into the exhaust stream. The Engine Control Module (ECM) detected the aftertreatment diesel exhaust fluid pressure sensor circuit was shorted high, shorted low, or open. Possible causes of this fault code include: A malfunctioning aftertreatment DEF dosing valve
Component Location	The aftertreatment diesel exhaust fluid pressure sensor is internal to the aftertreatment diesel exhaust fluid dosing valve and can not be serviced separately. Trucks with a QSK50 or QSK60 engine the DEF dosing valve is mounted to the front top of the SCR. The SCR is located between the frame rails above the rear axle. Trucks with a QSK 78 engine the DEF dosing valves are mounted to the reaction pipes directly upstream of the SCRs.

No.	Cause	Procedure, measuring location, criteria and remarks
1	Dirty/Damaged dosing valve pins	Disconnect the aftertreatment 2 DEF dosing valve 2 from the DEF harness. Disconnect the DEF harness from the engine harness. Check for dirty or damaged connector pins on the DEF dosing valve. Clean or repair connector pins, if possible.
2	Open circuit in the harness	Disconnect the DEF harness connector from the engine harness aftertreatment 2 connector. Disconnect the aftertreatment 2 DEF dosing valve 2 from the DEF harness. Measure the resistance from the DEF harness aftertreatment 2 DEF dosing valve 2 connector sensor RETURN pin to the DEF harness aftertreatment 2 connector DEF dosing valve 2 sensor RETURN pin. - If less than 10 ohms, then go to step 3 - If not less than 10 ohms an open return circuit has been detected in the harness. Repair or replace the damaged section of harness.
3	Pin-to-Pin short circuit in the harness	Disconnect the DEF harness connector from the engine harness aftertreatment 2 connector. Disconnect the aftertreatment 2 DEF dosing valve 2 from the DEF harness. Measure the resistance between the aftertreatment 2 DEF dosing valve 2 sensor Return pin in the DEF harness aftertreatment 2 connector and all other pins in the connector. - If greater than 100K ohms, then go to step 4. - If less than 100K ohms a pin-to-pin short circuit has been detected in the harness. Repair or replace the damaged section of harness.
4	Dirty/Damaged harness connector	Disconnect the engine harness from the ECM. Check for dirty or damaged connector on the ECM harness and DEF harness. Repair the damaged harness, connector, or pins, if possible.

Fault Code CA5887

Fault Description	Aftertreatment 1 Selective Catalytic Reduction (SCR) system cleaning required – Data valid but above normal operating range – least severe level. Aftertreatment SCR system cleaning is required.
Operator Action	Follow digital display instructions.
Related Information	The engine control module (ECM) monitors engine operating conditions and SCR temperature over time to determine the condition of the SCR catalyst. This fault code is triggered if the ECM detects high levels of hydrocarbon adsorption and/or high levels of coke accumulation in the SCR catalyst.
Component Location	The SCRs are located between the frame rails above the rear axle.

No.	Cause	Procedure, measuring location, criteria and remarks
1	Hydrocarbons and/or coke in SCRs	Operate engine under load with SCR intake temperature above 250°C (482°F) until CHM lamp clears.
2	Cummins ECM calibration	Refer to Cummins technician.

Wiring Diagram Information

	Schematic	Reference Location(s)
730E-10	58D-06-0171x	SH6:D19 SH6: E19
830E-5	58E-06-02310- 58E-06-02315	SH8:D19 SH8: E16
830E-5	58E-06-02316- 58E-06-0231x	SH6:D19 SH6: E16
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH9: D18 SH10: D19 SH9: E18 SH10: E19
930E-5 /5SE	58F-06-02316- 58F-06-0231x	SH7: D18 SH8: D19 SH7: E18 SH8: E19
980E-5	58B-06-02390- 58B-06-02392	SH8:D15 SH8:F15
980E-5	58B-06-02393- 58B-06-0239x	SH6:D15 SH6:F15

Wiring Diagram Information

	Schematic	Reference Location(s)
730E-10	58D-06-0171x	SH6:D19 SH6: E19
830E-5	58E-06-02310- 58E-06-02315	SH8:D19 SH8: E16
830E-5	58E-06-02316- 58E-06-0231x	SH6:D19 SH6: E16
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH9: D18 SH10: D19 SH9: E18 SH10: E19
930E-5 /5SE	58F-06-02316- 58F-06-0231x	SH7: D18 SH8: D19 SH7: E18 SH8: E19
980E-5	58B-06-02390- 58B-06-02392	SH8:D15 SH8:F15
980E-5	58B-06-02393- 58B-06-0239x	SH6:D15 SH6:F15

Steering circuit troubleshooting chart

TROUBLE	POSSIBLE CAUSE	SUGGESTED CORRECTIVE ACTION
Slow steering, hard steering or loss of power assist	1. Overloaded steering axle 2. Malfunctioning relief valve preventing adequate system pressure build-up 3. Worn or malfunctioning pump 4. Restricted high pressure filter or suction strainer	1. Reduce axle loading. 2. Check system pressure. Adjust or replace relief valve. 3. Replace pump. 4. Replace filter element or clean strainer.
Drift - truck veers slowly in one direction.	1. Rod end of cylinder slowly extends without turning the steering wheel 2. Worn or damaged steering linkage	1. A small rate of extension may be normal on a closed center system. 2. Inspect and replace linkage if necessary. Check alignment or toe-in of the front wheels.
Wander - truck will not stay in straight line	1. Air in system due to low oil level, pump cavitation, leaking fitting, pinched hoses 2. Loose cylinder piston 3. Broken centering springs (spool valve, steering valve) 4. Worn mechanical linkage 5. Bent linkage or cylinder rod 6. Severe wear in steering control unit	1. Correct oil supply problem or bleed air. 2. Repair or replace steering cylinder. 3. Repair or replace steering control unit. 4. Repair or replace. 5. Repair or replace defective components. 6. Repair or replace steering control unit.
Slip - a slow movement of steering wheel fails to steer front wheels	1. Leakage of steering cylinder piston seals 2. Worn steering control unit meter	1. Repair or replace steering cylinder. 2. Replace steering control unit.
Spongy or soft steering	1. Low oil level 2. Air in hydraulic system. Probably air trapped in cylinders or lines.	1. Service hydraulic tank and check for leakage. 2. Bleed air from system.
Erratic steering	1. Air in system due to low oil level, cavitating pump, leaky fittings, pinched hose, etc. 2. Loose steering cylinder piston	1. Correct condition and add oil as necessary. 2. Repair or replace steering cylinder.
Free wheeling - steering wheel turns freely with no back pressure - front wheels do not steer	1. Splines of steering column/steering control unit coupling may be disengaged or damaged 2. No flow to steering control unit: a. Low oil level b. Ruptured hose c. Broken steering control unit gerotor drive pin	1. Repair or replace steering column or coupling. 2. Repair as required: a. Add oil and check for leakage. b. Replace hose. c. Repair or replace steering control unit.

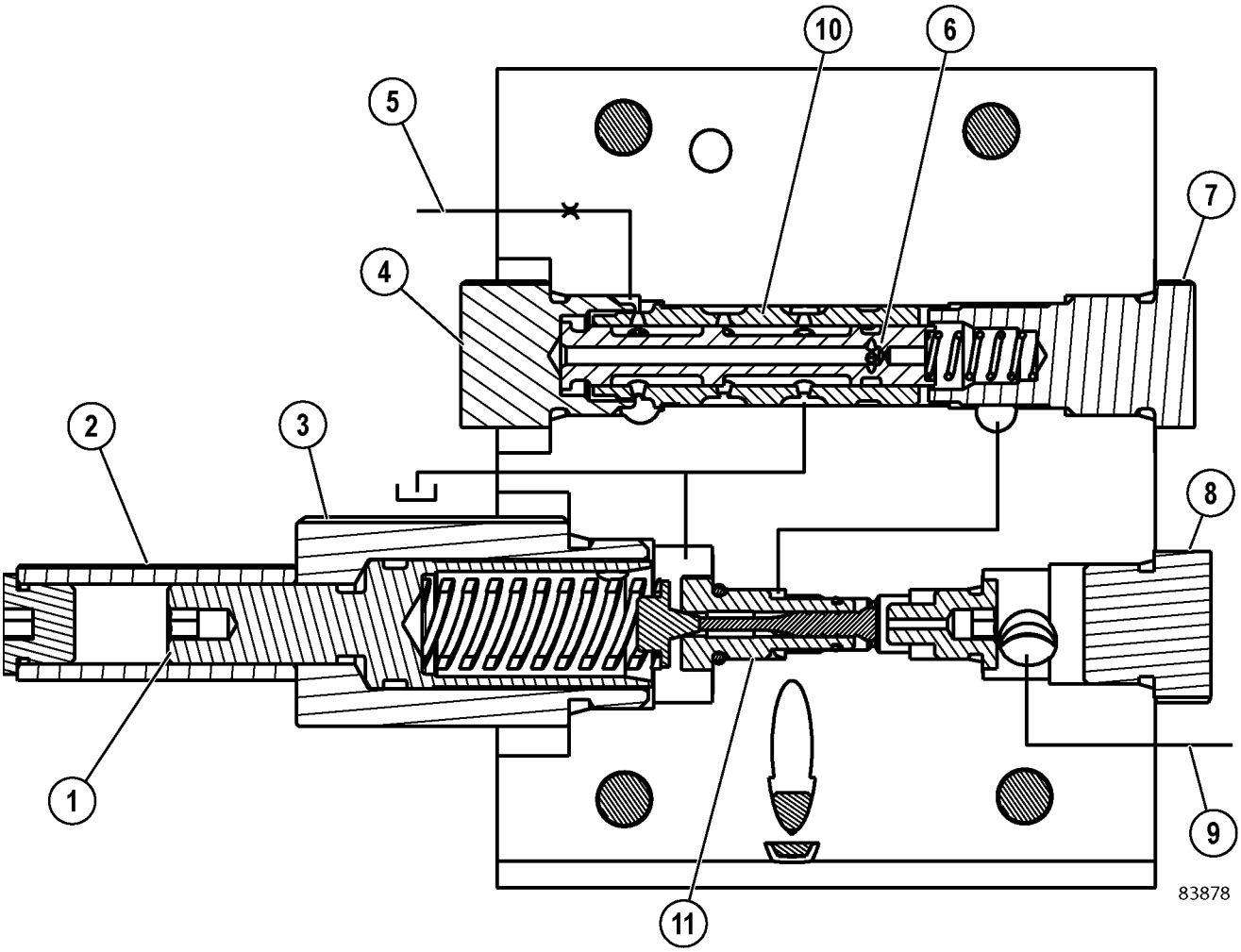


FIGURE 40-3. CONTROL VALVE ASSEMBLY

1. Adjustment Screw
2. Locking Cap
3. Unload Valve Bonnet
4. Cap (Spool)
5. Pressure (From Pump)
6. 4-Way Valve Spool (with Orifices)
7. Cap (Spring Access)
8. Cap
9. Accumulator Feedback Port (ACC)
10. Valve Sleeve
11. Unload Valve Seat

KOMVISION TROUBLESHOOTING					
KAC CODE	SUB CODE	FAULT PART	PHENOMENON NAME	ACTION	KLTD CODE
CM0505	-	UWB Radar 5	VERSION FAULT	Exchange the Radar5. It may be caused by disconnection when the disconnection error has occurred simultaneously. Please cancel a disconnection error first.	DQ15KM
CM0600	-	UWB Radar 6	ERR_SENS_TEMP_HIGH (107 degrees or more)	Exchange the Radar6	DQ16NR
CM0601	RC04	UWB Radar 6	ERR_SENS_VOLTAGE_INPUT	Exchange the Radar6	DQ16MA
CM0601	RC01	UWB Radar 6	ERR_SENS_SENSITIVITY_LOW_ EXTERNAL	Exchange the Radar6	DQ16MA
CM0601	RC02	UWB Radar 6	ERR_SENS_BLOCKAGE	Please check whether the radar is interrupted by something. If there is nothing that is interrupted, Exchange the Radar6	DQ16MA
CM0601	RC03	UWB Radar 6	ERR_SENS_SENSITIVITY_LOW_ EXTERNAL_NO_VEL	Exchange the Radar6	DQ16MA
CM0602	-	UWB Radar 6	HARNESS_FAULT	Exchange the Radar6	DQ16KQ
CM0603	RA01	UWB Radar 6	ERR_SENS_SENSITIVITY_LOW_ INTERNAL	Exchange the Radar6	DQ16KT
CM0603	RA02	UWB Radar 6	ERR_SENS_HARDWARE_FAILURE_ INIT	Exchange the Radar6	DQ16KT
CM0603	RA03	UWB Radar 6	ERR_SENS_CALIBRATION_FAILUR E	Exchange the Radar6	DQ16KT
CM0603	RA04	UWB Radar 6	ERR_SENS_HARDWARE_FAILURE_ ONLINE	Exchange the Radar6	DQ16KT
CM0604	RB01	UWB Radar 6	COMMUNICATION_ERROR	Please check whether there are any abnormalities in a controller. If there are no abnormalities in a controller, Exchange the Radar6	DQ16KR
CM0604	RB02	UWB Radar 6	ERR_SENS_CAN_MESSAGE_ MISSING_OR_CONTENT_INVALID	Exchange the Radar6	DQ16KR
CM0604	RB03	UWB Radar 6	ERR_SENS_CAN_SYNC_TIMING_ INVALID	Exchange the Radar6	DQ16KR
CM0605	-	UWB Radar 6	VERSION FAULT	Exchange the Radar6 It may be caused by disconnection when the disconnection error has occurred simultaneously. Please cancel a disconnection error first.	DQ16KM
CM0700	-	UWB Radar 7	ERR_SENS_TEMP_HIGH ?107 degrees or more?	Exchange the Radar7	DQ17NR
CM0701	RC04	UWB Radar 7	ERR_SENS_VOLTAGE_INPUT	Exchange the Radar7	DQ17MA
CM0701	RC01	UWB Radar 7	ERR_SENS_SENSITIVITY_LOW_ EXTERNAL	Exchange the Radar7	DQ17MA

Diagnostics mode

Access the diagnostics mode through the control panel.

NOTE: For control panels without ON/OFF switches, use the temperature units (°C/°F) switch.

1. Power on the system.
2. Press the ON switch three times in rapid succession to access the error codes.
3. Once the error codes have been accessed, hold the ON switch for five seconds to access the advanced diagnostics.
4. Once advanced diagnostics has been accessed, hold the ON switch for five seconds to display the firmware versions of the control panel and electronic control unit (ECU).

Error codes

NOTE: For control panels without ON/OFF switches, use the temperature units (°C/°F) switch.

The digital display shows any active error codes. Press the ON switch again repeatedly to scroll through the active error codes.

If no switches are pressed for five seconds, the system will exit the diagnostics mode and return to normal operation.

Error Code	Description
E0	No faults
E1	Cab sensor shorted
E2	Cab sensor open
E3	Evaporator probe shorted
E4	Evaporator probe open
E5	Duct sensor shorted
E6	Duct sensor open
E13	Water valve actuator error
E17	Electronics or communication error
E18	Clutch open
E19	Clutch shorted

Advanced diagnostics

Advanced diagnostics shows real-time system information on the control panel display to help the service technician diagnose some system problems.

"CAB" is displayed when advanced diagnostics is accessed. After a few seconds, the real-time cab temperature is displayed. This value, and any other value that is displayed on the control panel, will continuously update. Press the ON switch to scroll through all of the available diagnostics information.

NOTE: For control panels without ON/OFF switches, use the temperature units (°C/°F) switch.

To exit advanced diagnostics, press the OFF switch.

NOTE: For control panels without ON/OFF switches, use the temperature units (°C/°F) switch to cycle back to normal operation mode or turn OFF the truck's keyswitch.

Diagnostic Code	Description
CAB	Cab air temperature (°F or °C)
EVAP	Evaporator core temperature (°F or °C)
DUCT	Duct air temperature (°F or °C)
HEAT	Water valve command (% of valve open)
A-C	Compressor clutch request (On/Off)
FAN	Blower fan speed (% of maximum fan speed)
DEF	Defrost mode active (On/Off)
CLUT	Clutch current (DC Amps)
VOLT	System voltage (DC Volts)

NOTE: The system can be operated normally while in the advanced diagnostics mode so that the technician can evaluate the response of the system.

Special tool group

Part number	Description	Qty.	Use
58B-06-00800	Custom meter kit (0-2000VDC)	1	Control cabinet capacitor discharge
58C-98-00310	12-point socket - 1 1/4", 1" square drive	1	Steering arm installation
58F-EP-AK540	Suspension block kit	1	Suspension oiling and charging
58F-00-50180	Puller tool kit	1	Spindle removal
58B-98-40050	Floating seal installation tool, H-75	1	Floating seal (rear wheel hub)
58F-98-50000	Floating seal installation tool, H-171	1	Floating seal (front hub)
58F-98-40910	Floating seal installation tool, HEL-127	1	Floating seal (brakes)
EF9302	Brake wear indicator	4	Brake wear measurement
EH4638	Alignment sleeve	1	Steering linkage installation
EH7817	Alignment tool	1	Steering linkage installation
EH8687	Roller assembly	2	Power module removal and installation
EK3798	Brake assembly tool group	1	Brake assembly and installation
PB8326	Offset box end wrench - 1 7/16"	1	Operator cab removal and installation
PB9067	Bulkhead connector	2	Auxiliary battery power source
PC2061	Belt tensioner gauge	1	Belt adjustment
PC2525	Serial cable - 6 foot	1	Diagnostics/data cable
TR0532	Extension - 8" 1" square drive	1	Various
TR0533	Extension - 17" 1" square drive	1	Various
TZ2100	6-point socket - 1 7/8" 1" square drive	1	Various
TZ2727	6-point socket - 2 1/4" 1" square drive	1	Various
TZ2729	12-point socket - 1 1/4" 1"square drive	1	Various
TZ2730	Adapter - 1 1/2" to 1" square drive	1	Various
TZ2731	Adapter - 1" to 3/4" square drive	1	Various
TZ2733	Tubular handle	1	Various
TZ2734	Torque adapter - 3/4"	1	Various
XB5777	Steering bypass hose	1	Hydraulic system flushing
XB7075	Fitting assembly	1	

5. If removed, install adapter ring (2) onto the outer rim. Lubricate all stud threads and nut seating flanges with a lithium based grease that does not contain molybdenum disulphide. Install and tighten inner flanged nuts (3) in the following sequence (see Figure 50-5):
   a. Install six nuts at the 12 o'clock and six nuts at the 6 o'clock positions. Tighten each nut to **2 325 ± 136 N·m (1,715 ± 100 ft lb)**.
   b. Install three nuts directly below the 3 o'clock and three nuts directly above the 9 o'clock positions. Tighten the nuts to **2 325 ± 136 N·m (1,715 ± 100 ft lb)**.
   c. Install three nuts directly above the 3 o'clock and three nuts directly below the 9 o'clock positions. Tighten these nuts to **2 325 ± 136 N·m (1,715 ± 100 ft lb)**.
   d. Install the remaining nuts and tighten in a clockwise direction to **2 325 ± 136 N·m (1,715 ± 100 ft lb)**.
   e. Retighten all nuts in a clockwise direction to **2 325 ± 136 N·m (1,715 ± 100 ft lb)**.
6. Grip the outer wheel assembly with the tire handler and install it onto the wheel hub. Ensure that the tire inflation hose bracket is aligned with inner tire inflation extension (5, Figure 50-4).
7. Lubricate all stud threads and nut seating flanges with a lithium based grease that does not contain molybdenum disulphide. Install and tighten outer flanged nuts (4) in the following sequence (see Figure 50-5):
   a. Install six nuts at the 12 o'clock and six nuts at the 6 o'clock positions. Tighten each nut to **2 325 ± 136 N·m (1,715 ± 100 ft lb)**.
   b. Install three nuts directly below the 3 o'clock and three nuts directly above the 9 o'clock positions. Tighten the nuts to **2 325 ± 136 N·m (1,715 ± 100 ft lb)**.
   c. Install three nuts directly above the 3 o'clock and three nuts directly below the 9 o'clock positions. Tighten these nuts to **2 325 ± 136 N·m (1,715 ± 100 ft lb)**.
   d. Install the remaining nuts and tighten in a clockwise direction to **2 325 ± 136 N·m (1,715 ± 100 ft lb)**.
   e. Retighten all nuts in a clockwise direction to **2 325 ± 136 N·m (1,715 ± 100 ft lb)**.
8. Install tire inflation hose outer extension (1, Figure 50-4). Secure the tire inflation hoses to the clamps on the outer rim.
9. Remove the blocks from under the truck and lower the truck to the ground.
10. Operate the truck for one load and retighten the flanged nuts.
    - Retighten outer flanged nuts (4) and (6) to **2 325 ± 136 N·m (1,715 ± 100 ft lb)**.
    - Retighten inner flanged nuts (3) to **2 325 ± 136 N·m (1,715 ± 100 ft lb)**.

8. Use the tire lever to push in the bead seat band so that its edge fits with the tire bead.

⚠WARNING

Keep fingers away during installation.

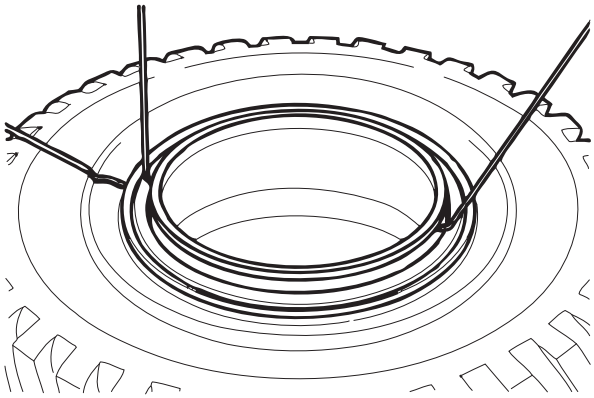


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FIGURE 50-46.

9. Install O-ring in the O-ring groove of the rim.

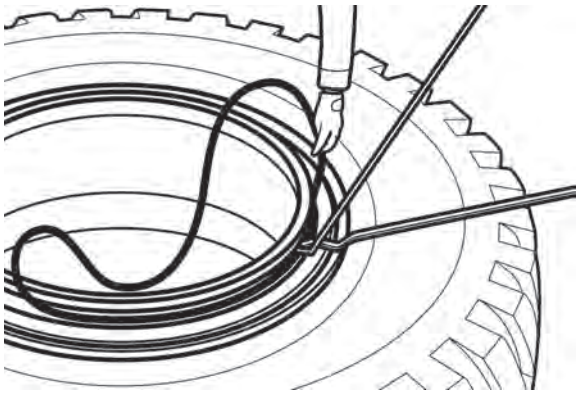

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FIGURE 50-47.

10. Install the lock ring. Refer to **"Installing the lock ring"**.
11. Starting opposite the lock ring gap, lightly tap the lock ring with a soft metal or hard plastic hammer in both directions back to the lock ring gap to ensure that the lock ring is clamped into the lock ring groove.
12. Ensure that the combinations, facings, and positions of rim components are correct.

Disassembly

1. Remove the wheel hub and spindle. Refer to "Removal and installation of front wheel hub and spindle".
2. Remove any dirt and mud from the assembly.
3. Remove remaining 12-point capscrews (1, Figure 50-65) and hardened flat washers (2) that secure steering arm (3) to spindle (4).

   Loosen the capscrews using a circular pattern in torque increments of **678 N·m (500 ft lb)**. Do not attempt to remove each capscrew in one sequence. Run a tap (1 1/4" - 12 UNF) in the threads after the capscrews are removed.

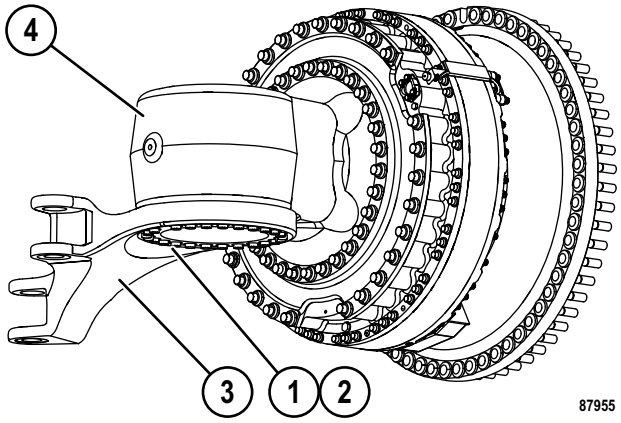

FIGURE 50-65. STEERING ARM REMOVAL

1. 12-Pt. Capscrews
2. Hardened Flat Washers
3. Steering Arm
4. Spindle

NOTE: To aid in the complete disassembly of the wheel hub and spindle assembly, use a fabricated spindle stand to support the assembly in a vertical position (hub cover up).

4. Disconnect the wheel speed sensor from cable bracket (1, Figure 50-66). Loosen capscrews (3) and flat washers (4), then remove wheel speed sensor (2) from sensor bracket (5).

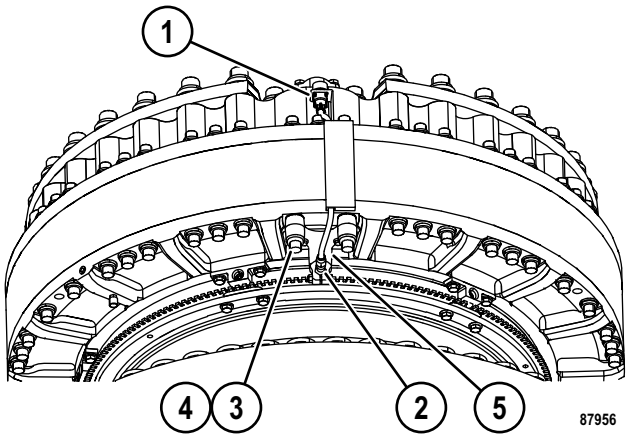

FIGURE 50-66. WHEEL SPEED SENSOR REMOVAL

1. Cable Bracket
2. Wheel Speed Sensor
3. Capscrew
4. Flat Washer
5. Sensor Bracket

5. Remove catchment tank (13, Figure 50-67).

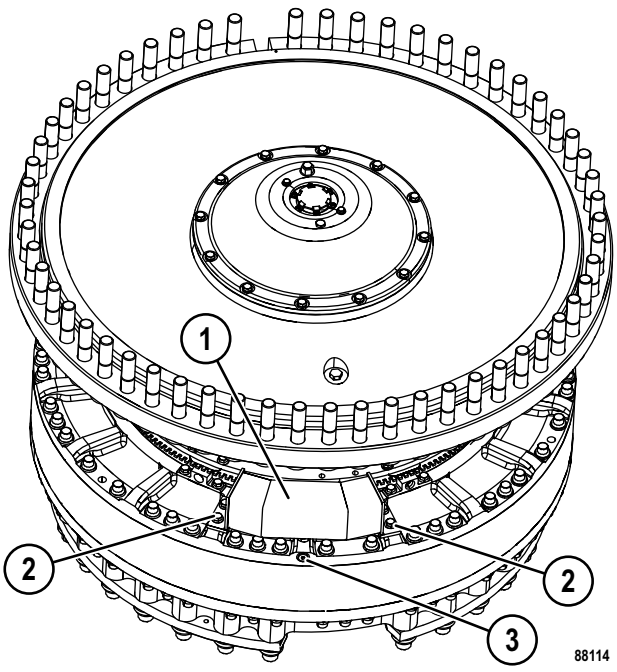

FIGURE 50-67. CATCHMENT TANK REMOVAL

1. Catchment Tank
2. Mounting Hardware
3. Catchment Tank Plug

21. Use installation tool (58F-98-40910) to install one half of floating seal assembly (5) into the seal carrier (4). Refer to the topic "Floating ring seal assembly and installation" for the proper assembly instructions for brake floating seal assembly.

NOTE: Floating seal assembly (5) is one half the brake seal assembly.

22. Place the necessary number of shims (2) that was determined in Step 18 at six locations around the wheel hub. Install speed sensor gear (3) and seal carrier (4) onto the wheel hub. Secure the components with capscrews (1).

23. Use installation tool (58F-98-40910) to install one half of seal assembly (2, Figure 50-88) into the back plate of brake assembly (1). Refer to the topic "Floating ring seal assembly and installation" for the proper assembly instructions for brake floating seal assembly.

NOTE: Floating seal assembly (2) is one half the brake seal assembly.

24. Pack the area between the lips of dust seal (3) grease, then install dust seal (3) into the back plate of brake assembly (1) with Loctite® #648.

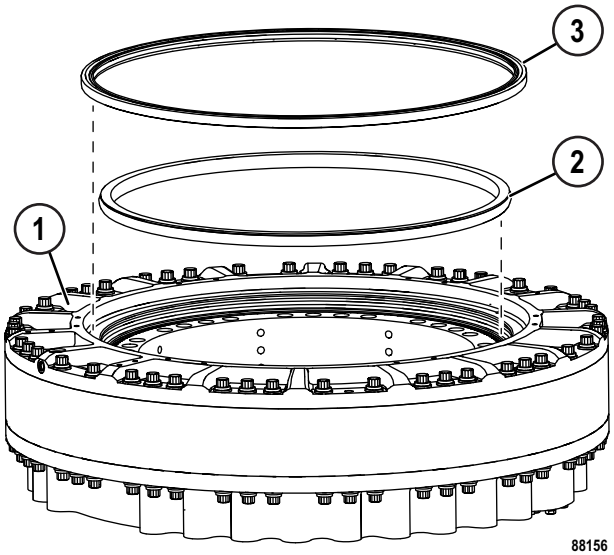

FIGURE 50-88. BRAKE SEAL INSTALLATION (ON BRAKE)

1. Brake assembly
2. Floating seal sssembly
3. Dust seal

Oil separation seal installation

25. Use Installation tool (58F-98-50000) to install one half of oil separation seal assembly (1, Figure 50-89) into wheel hub (2). Refer to the topic "Floating ring seal assembly and installation" for the proper assembly instructions for the oil separation floating seal assembly.

NOTE: Visually inspect seal for any nicks, dents, and damage to the metal ring or O-ring. Do not use damaged seal parts.

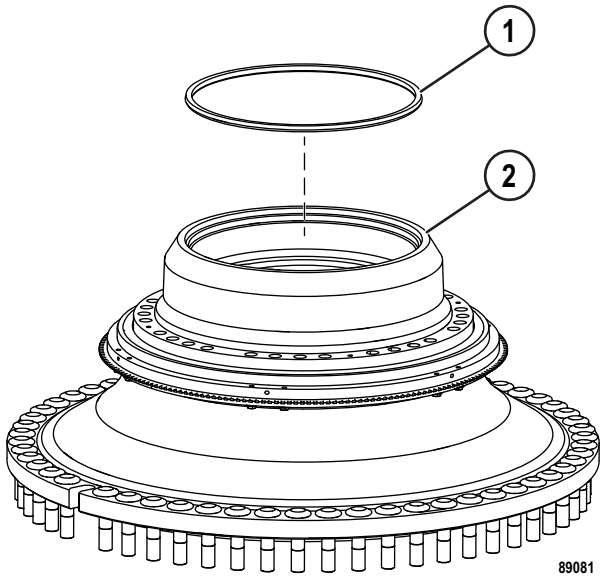

FIGURE 50-89. OIL SEPARATION SEAL INSTALLATION (ON HUB)

1. Oil Separation Seal Assembly
2. Wheel Hub

11. Once the seal is completely dry, apply light pressure to the seal ring face at multiple locations around the seal. Visually check that the O-ring rolls down the ramp and then back up the ramp as pressure is released. If the O-ring is observed sliding or slipping down the ramp, the seal is not assembled correctly. Carefully disassembly the seal and repeat steps 1 through 10.
12. Use a caliper to measure the assembled height (Figure 50-113). Check the seal height variation (marked by arrows, Figure 50-115) between seal ring (1, Figure 50-115) and wheel hub (2) or other applicable seal ring housing. Check the assembled height in four places that are 90° apart. The height variation around the assembled ring must be less than 1.0 mm (0.04 in).

    If the seal is misaligned, remove the seal and repeat steps 7 through 12. The seal rings must be level as shown in Figure 50-114.

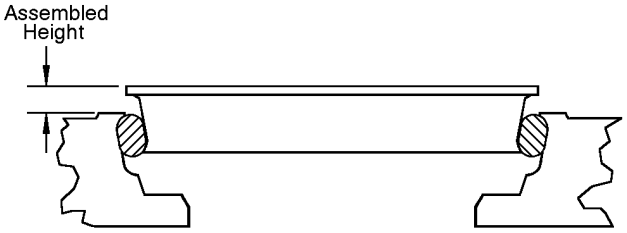

FIGURE 50-113. CHECKING SEAL RING

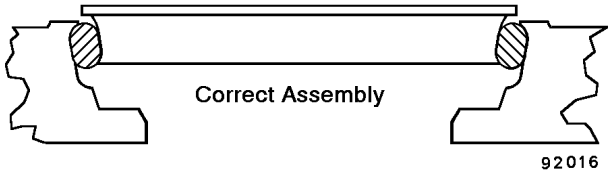

FIGURE 50-114. CORRECT ASSEMBLY

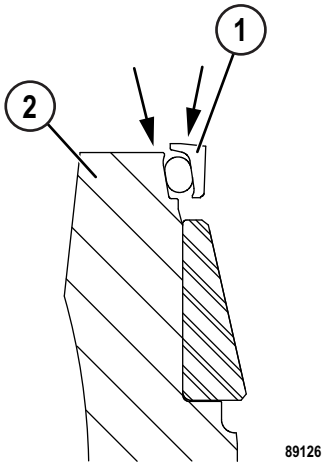

FIGURE 50-115. CHECKING SEAL HEIGHT

1. Seal Ring 2. Wheel Hub

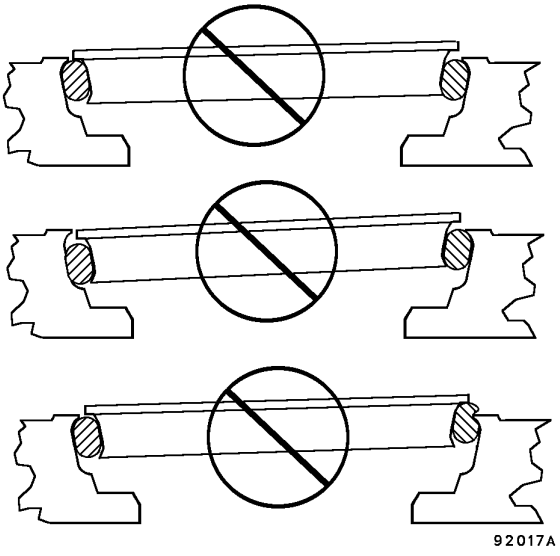

FIGURE 50-116. INCORRECT ASSEMBLY

Removal

1. Remove the pivot pin. Refer to the topic "Removal and installation of pivot pin".
2. Remove 12-point capscrews (1, Figure 50-131) and locknuts (2). There is a total of 16.
3. Remove bearing retainers (3).
4. Setup an appropriate tool to press spherical bearing (4) from pivot eye (5).

Inspection

1. Inspect all parts for excessive wear and damage. Replace parts as required.

   Spherical bearing O.D.:

   222.25 - 222.22 mm (8.7500 - 8.7488 in.)

   Spherical bearing I.D.:

   152.37 - 152.40 mm (5.9990 - 6.0000 in.)

Installation

1. Set up an appropriate tool to press spherical bearing (4) into pivot eye (5).

IMPORTANT

The lubrication groove in the outer diameter of the spherical bearing must be aligned with the lubrication fitting hole in the pivot eye.

2. Install bearing retainers (3), 12-point capscrews (1) and locknuts (2). Torque the capscrews to **420 N·m (310 ft lb).**

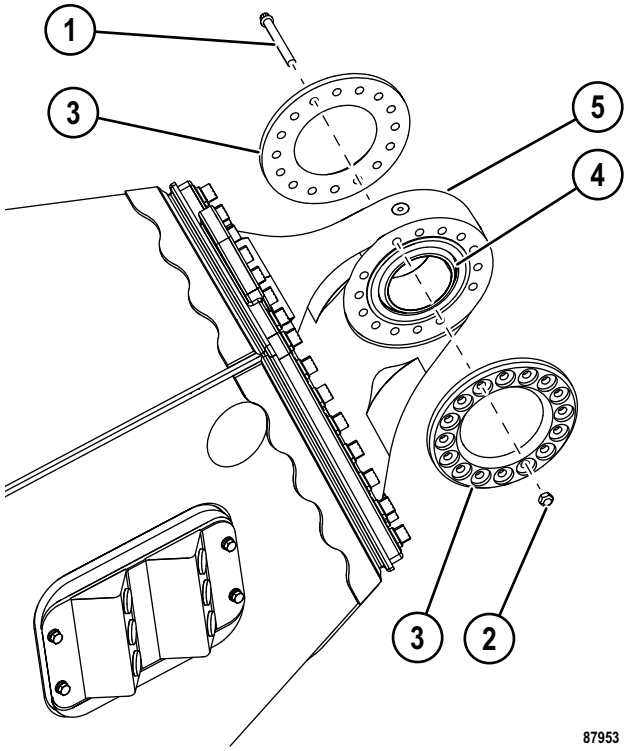

FIGURE 50-131. PIVOT EYE BEARING REMOVAL & INSTALLATION

1. 12-Point Capscrew
2. Locknut
3. Bearing Retainer
4. Spherical Bearing
5. Pivot Eye

5. Disconnect the retarder pedal harness from the truck harness.
6. Remove capscrews (1, Figure 50-3) and lockwashers (2) that secure brake valve/pedal assembly (3) to the cab.
7. Slide the brake valve/pedal assembly through the hole and remove it from the cab. Move the brake valve/pedal assembly to a clean work area for disassembly, if required.

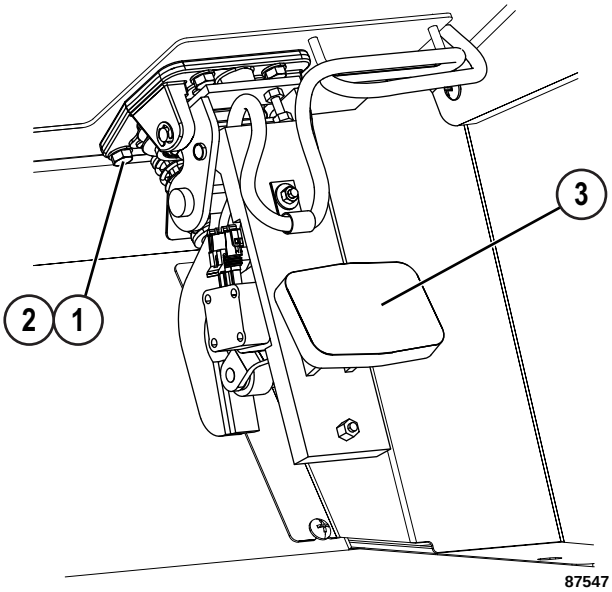

FIGURE 50-3. BRAKE VALVE REMOVAL & INSTALLATION

1. Capscrews
2. Lockwashers
3. Brake Valve/ Pedal Assembly

Installation

1. Slide brake valve/pedal assembly (3, Figure 50-3) into position in the cab and secure it with capscrews (1) and lockwashers (2). Tighten the capscrews to the standard torque.
2. Unplug and connect six hydraulic hoses (1, Figure 50-2) to their proper ports on brake valve (2). Refer to Figure 50-4.

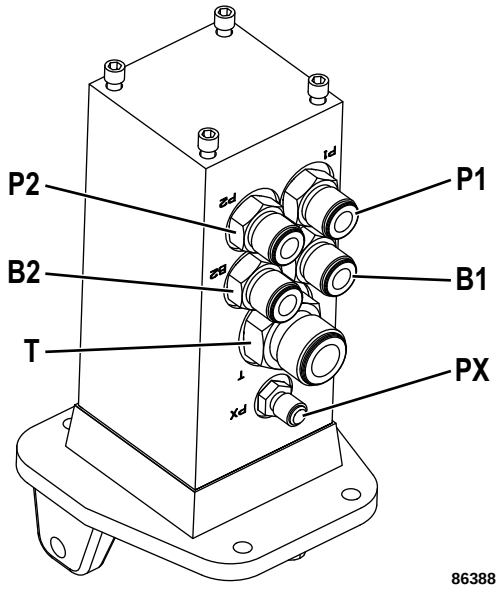

FIGURE 50-4. BRAKE VALVE PORT IDENTIFICATION

"P1" - Pressure Inlet
"P2" - Pressure Inlet
"B1" - Regulated Output
"B2" - Regulated Output
"T" - Return to Tank
"PX" - Pilot Inlet

Disassembly and assembly of piston brake accumulator

Disassembly

⚠WARNING

Wear a face mask or goggles. Make sure that only the swivel nut turns. Turning the entire charging valve assembly may result in the valve assembly being ejected from the accumulator by the gas pressure inside.

1. Before disassembly, ensure that all pressure has been discharged from the piston accumulator as follows:
   a. Remove valve cap (1, Figure 50-30) from the charging valve.
   b. Hold valve body (3) with one wrench, then turn swivel nut (2) counterclockwise three turns with a second wrench. **Do not turn the swivel nut more than three turns. Do not turn the charging valve body.**
   c. Connect the nitrogen charging kit to the charging valve. Refer to Testing and adjusting section **Accumulators and suspensions** for the charging kit installation information.
2. Loosen valve body (3) to remove the charging valve from the top of the accumulator.

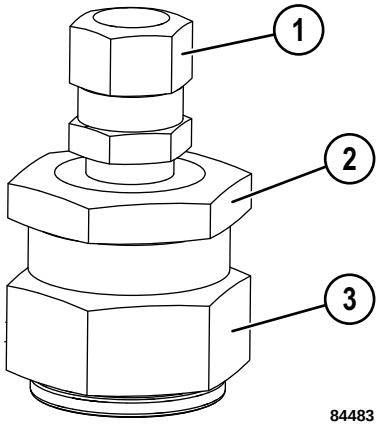

FIGURE 50-30. PISTON ACCUMULATOR CHARGING VALVE

1. Valve Cap
2. Swivel Nut (Small Hex Nut)
3. Valve Body (Large Hex Nut)

3. Remove the hose fitting, flange (1, Figure 50-31) and plugs (2) from the bottom of the piston accumulator.

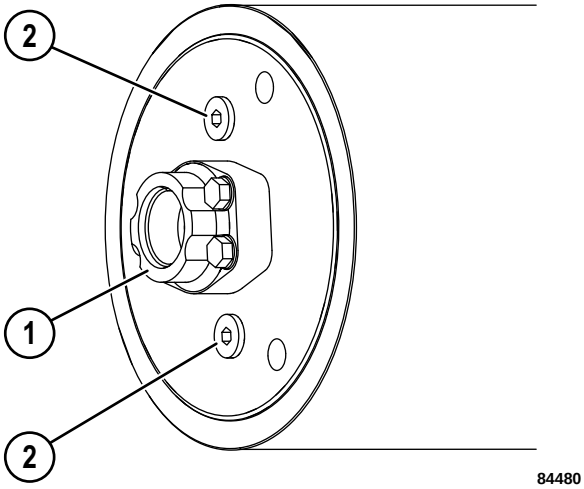

FIGURE 50-31. BOTTOM OF PISTON ACCUMULATOR

1. Flange
2. Plug

15. Remove short capscrews (1, Figure 50-49) and lockwashers (2) that attach the retainer bars to the piston housing.
16. Attach a lifting strap through ring gear retainer bars and lift inner gear (6) out of the brake assembly.
17. Remove capscrews (3) and lockwashers (2) that attach the retainer bars to inner gear (6). Remove retainer bars (4) and spacers (5).

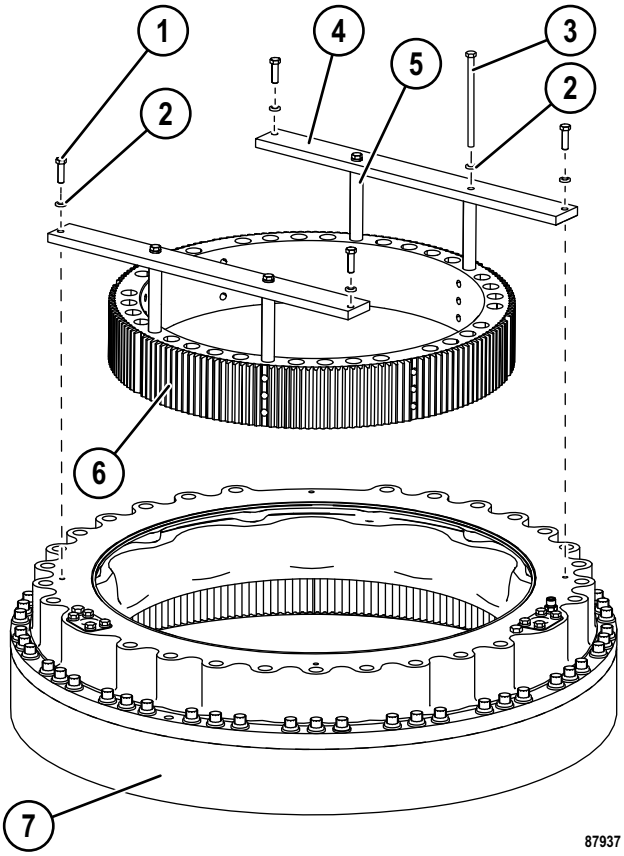

FIGURE 50-47. INNER GEAR REMOVAL & INSTALLATION

1. Capscrew
2. Lockwasher
3. Capscrew
4. Ring Gear Retainer Bars
5. Spacer
6. Inner Gear
7. Outer Ring Gear

18. Remove capscrews (1, Figure 50-48) and hardened washers (2) from piston housing.
19. Insert 3/4" - 10UNC x 2" pusher bolts (3) in each of the three tapped holes around the piston housing flange. Tighten the bolts evenly to lift the piston assembly from outer ring gear (6).
20. Remove and discard O-ring (5).

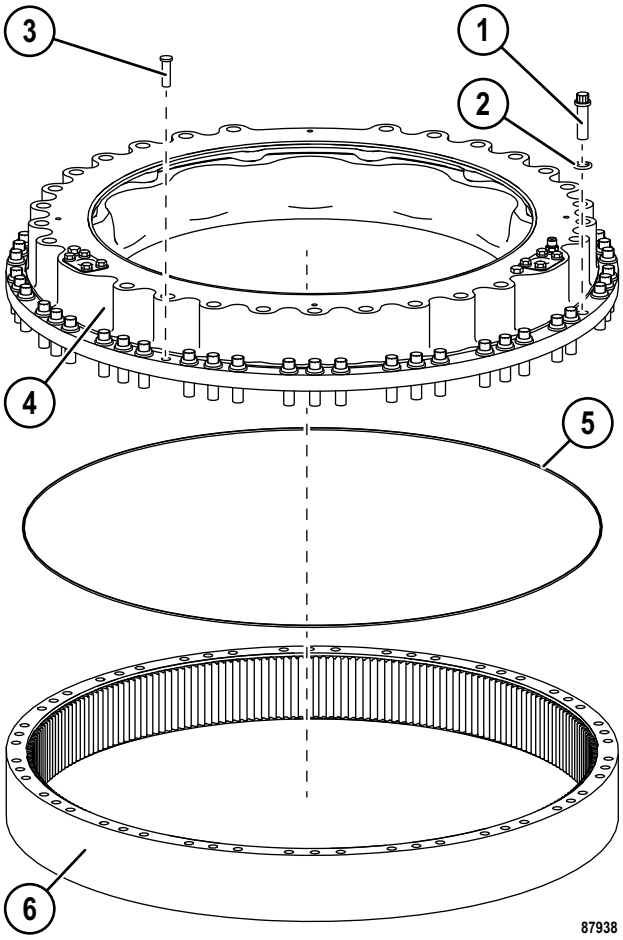

FIGURE 50-48. PISTON ASSEMBLY REMOVAL & INSTALLATION

1. Capscrew (12 Pt.)
2. Hardened Flat Washer
3. Pusher Bolt
4. Piston Assembly
5. O-ring
6. Outer Ring Gear

13. After both seal ring heights have been checked and adjusted, wipe the polished seal ring surfaces with a lint-free material and isopropyl alcohol to remove all foreign material and fingerprints.

⚠CAUTION

No foreign particles of any kind are allowed on the polished seal ring faces. Something as small as a paper towel fiber will hold the seal faces apart and could cause damage or leakage.

14. Apply a thin film of clean hydraulic oil (C-4 type SAE 10W) on the polished seal ring faces on both seal rings. Use a lint-free applicator or a clean finger to distribute the oil evenly. Ensure that no oil comes in contact with the O-rings or their mating surfaces.

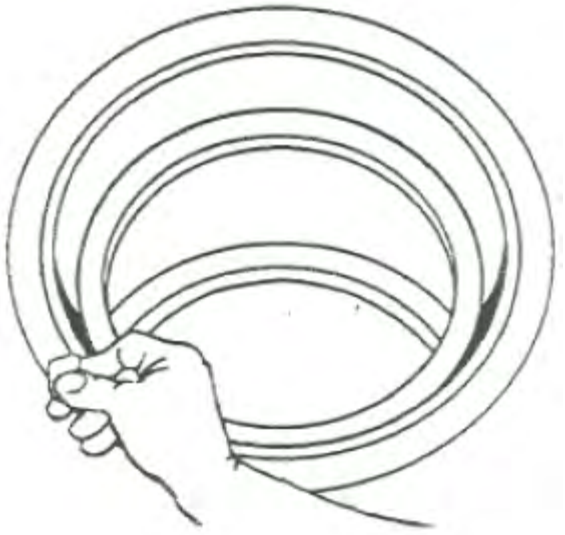

FIGURE 50-70. OILING SEAL FACE

15. During assembly, ensure that both housings are square, concentric and in correct alignment as shown in Figure 50-71. Move the parts slowly and carefully toward each other.

⚠CAUTION

Do not slam, bump or drop the seal rings together. High impact can damage the seal ring face and cause leakage.

If the seals are not square, concentric, and in correct alignment, the following failures can occur:

- ***Cocked seals cause uneven pressure on the seal face and may cause the seal to wobble.***
- ***Uneven pressure causes leakage or scoring.***
- ***Wobbling seals can cause dirt entry problems while the truck is in operation.***

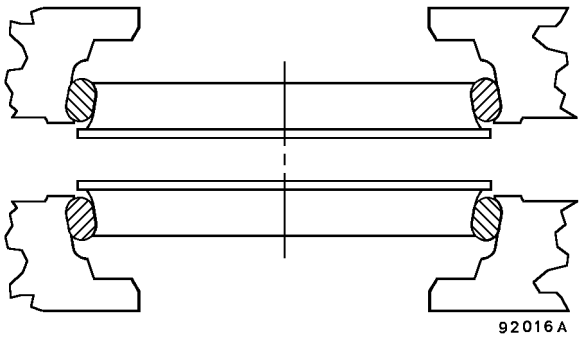

FIGURE 50-71. CORRECT ALIGNMENT

7. Remove four separator discs (1, Figure 50-88), three friction discs (2), and compression springs (3) from brake pack housing (5).

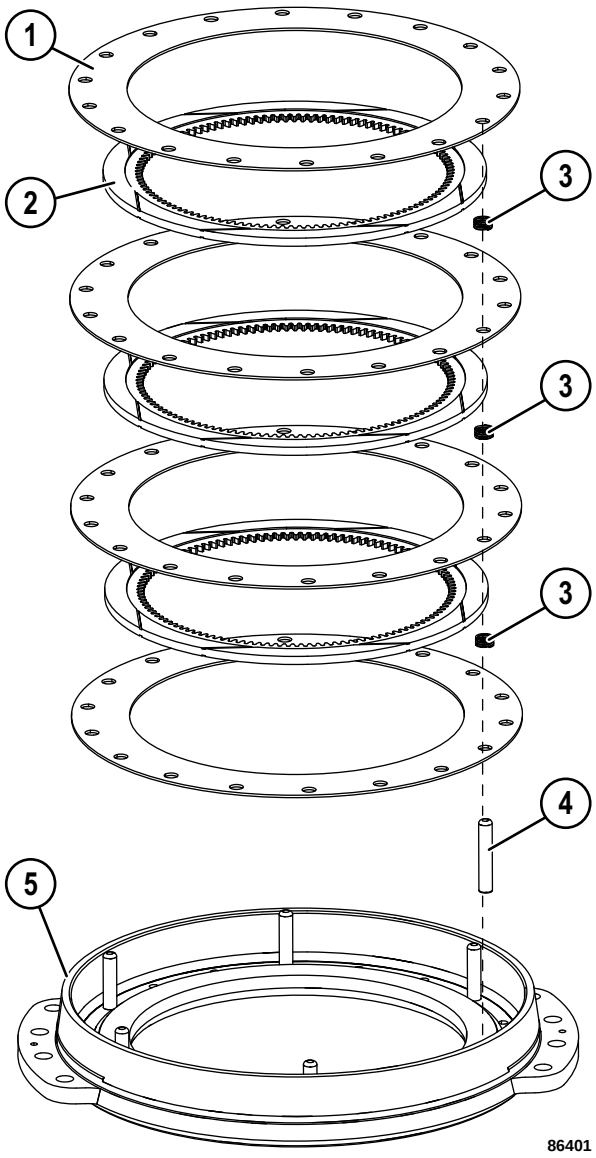

FIGURE 50-88. PARKING BRAKE DISASSEMBLY & ASSEMBLY

1. Separator Disc
2. Friction Disc
3. Compression Spring
4. Dowel Pin
5. Brake Pack Housing

Cleaning and inspection

1. Clean all parts thoroughly.
2. It is recommended that the separator discs and friction discs be replaced if the friction material on either side of the friction disc is worn to less than 1.5 mm (0.06 in.).
3. Check the piston and piston housing bore for scratches, nicks, pitting and other defects that may cause seal leakage. Slight defects may be repaired by polishing.
4. Inspect dowel pins (4, Figure 50-88). If the dowel pins are grooved from excessive wear or otherwise damaged, press the dowel pins out of brake pack housing (5).
5. Check the free height of compression springs (3) and test for height under load. Replace the springs if they are not within approximately 10% of specification.

Free Height:. . . . . 11.58 mm (0.456 in.)

Height at 162 N (36.4 lb): . . . . . .8.89 mm (0.350 in.)

6. Inspect the compression springs for cracks and damage. Replace any springs that are damaged or significantly worn.
7. Measure the unsprung total height (cone height + material thickness) of the Belleville washers. The height must be greater than or equal to 21.16 mm (0.833 in.). Discard any Belleville washers that do not meet this specification.
8. A load deflection test must now be conducted to determine whether the Belleville washers will be reused or discarded. The equipment that is needed for this test are as follows:

   • Universal Testing Machine (UTM) - capacity minimum of 18 144 kgf (40,000 lbf) in compression

   • Machined flat plate

   • Height stand and depth indicator with minimum range of 25 mm (1 in.)

   a. Place the Belleville washer on a clean, flat and leveled testing machine bed.

   b. Put the machined flat plate on top of the Belleville washer. Make sure that the plate will not slip from the Belleville washer when force is applied.

   c. Adjust the height stand so that the depth indicator is at zero.

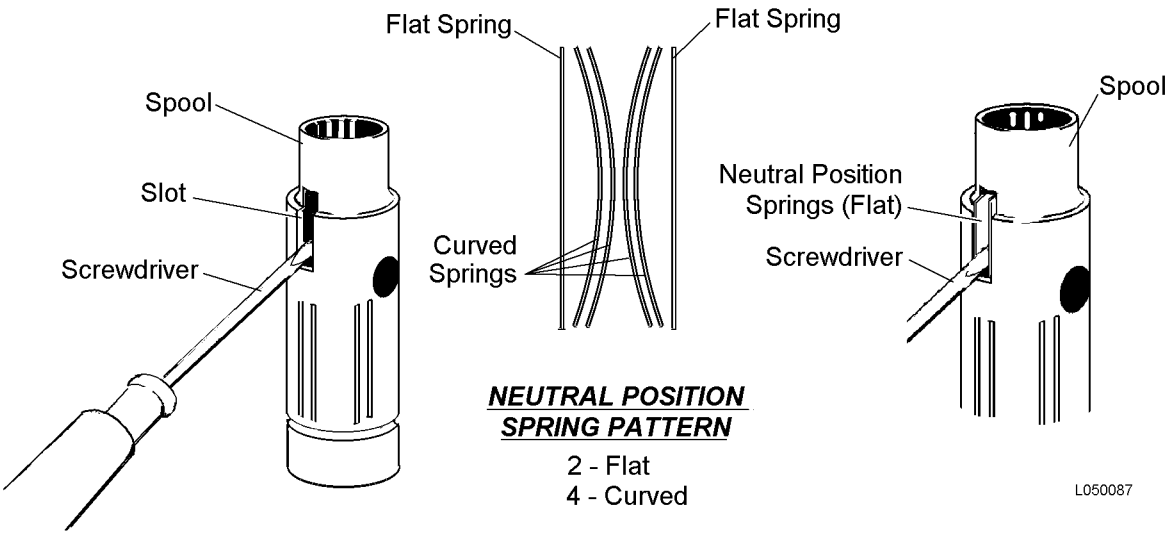

FIGURE 50-9. NEUTRAL POSITION SPRING INSTALLATION

3. To install the neutral position springs, place a screwdriver in the spool slot as shown in Figure 50-9.
4. Place one flat neutral position spring on each side of the screwdriver blade. Do not remove the screwdriver.
5. Push two curved neutral position springs in between one side of the screwdriver blade and a flat spring. Repeat for the opposite side. Remove the screwdriver.
6. Slide the inner spool in the sleeve. Compress the ends of the neutral position springs and push the neutral position springs in place in the sleeve.
7. Install cross pin (2, Figure 50-10).
8. With neutral position springs (7) centered in spool and sleeve, install ring (3), rear bearing race (4), thrust bearing (5) and front bearing race (6) in that order. The chamfer on the rear bearing must be facing away from the bearing.
9. Place dust seal (1, Figure 50-6) in position. Using a flat iron block over the seal, tap it into the housing.
10. Position O-ring (5) and kin ring (6) on the spool.

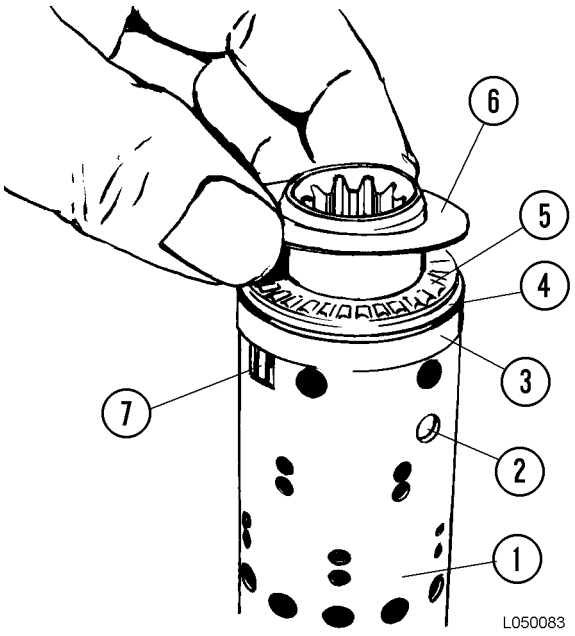

FIGURE 50-10. BEARING INSTALLATION

1. Sleeve
2. Cross Pin
3. Ring
4. Bearing Race (with chamfer)
5. Thrust Bearing
6. Bearing Race
7. Neutral Position Springs

4. Install piston (3) onto rod (1). Secure the piston to rod with locknut (4) Tighten the locknut to **3 390 N·m (2,500 ft lb)**.
5. Coat the piston and the rod with clean hydraulic oil, then carefully install the rod, piston and gland assembly into cylinder housing (7, Figure 50-23). Ensure that the backup ring and O-ring on gland (5) are not damaged during installation.
6. Install four short capscrews (1), two long capscrews (2) and flat washers (3). Tighten the capscrews evenly to standard torque.
7. If spherical bearings (2, Figure 50-22) were removed, place the steering cylinder on stands and secure it with a chain vise and install the spherical bearings. Install bearing retainer (1) with capscrews and lockwashers. Tighten capscrews to standard torque.

NOTE: Before installation, spherical bearings must be shrunk by freezing. The temperature must not be below -54°C (-65°F). A press may be necessary for installation. Do not use metal tools to strike the bearings.

8. Test the performance of the steering cylinder. Refer to "Steering cylinder leakage test" in the Testing and adjusting section **Steering, hoist, brake cooling and auxiliary hydraulic system**.

Removal and installation of steering/brake pump

Removal

WARNING

Hydraulic oil escaping under pressure can have sufficient force to enter a person's body by penetrating the skin and cause serious injury, and possibly death, if proper medical treatment by a physician familiar with this type of injury is not received immediately.

Relieve pressure before disconnecting any hydraulic lines. Tighten all connections securely before applying pressure.

1. Refer to the "Hydraulic system bleeddown procedure" in Testing and adjusting section **Steering, hoist, brake cooling and auxiliary hydraulic system**.

NOTE: Use vacuum pump kit (XB0887) to hold the oil back in the hydraulic tank. Before disconnecting hydraulic hoses, tag the hoses for proper identification during installation.

2. Clean the steering/brake pump and surrounding area carefully to help avoid contamination of hydraulic oil when the hoses are disconnected are opened.

DUMP TRUCK

930E

Machine model	Serial number
930E-5	A40004 and up
930E-5AT	A40004 and up
930E-5SE	A50001 and up

50 Disassembly and assembly
Suspensions

Cleaning and inspection

⚠WARNING

When using cleaning agents, follow the solvent manufacturer's instructions.

1. Clean all parts thoroughly in fresh cleaning solvent. Use a solvent that does not leave a film after evaporation such as trichloroethane, acetone or lacquer thinner.
2. Dry all parts completely using only dry, filtered compressed air and lint free wiping materials.
3. Inspect all parts for evidence of wear or damage. Inspect plated surfaces for scratches, nicks or other defects. Replace or repair any damaged parts.

NOTE: Contact your local Komatsu distributor for repair information and instructions not covered in this manual.

Assembly

⚠IMPORTANT⚠

Be careful not to damage the machined or plated surfaces, O-rings or seals when installing the piston assembly.

NOTE: Lubricate all interior parts and bores with clean suspension oil.

1. If piston (1, Figure 50-28) was disassembled, thoroughly lubricate and install new O-ring (2) and backup ring (3) on piston plug (4).
2. Use a rubber mallet to seat piston plug (4) in the bottom of piston (1). Install the piston plug just far enough to expose the retaining ring groove. Install retaining ring (5).
3. Install retaining plate (6), flat washer (8) and capscrew (7). Tighten the capscrew to **122 N·m (90 ft lb)**.

⚠IMPORTANT⚠

When installing backup rings with the main seal and the buffer seal, ensure that the radius is positioned toward the seal and the white dot is positioned away from the seal.

4. Install new buffer seal (6, Figure 50-27), new main seal (5) and new wiper seal (4) in the suspension housing.
5. Install new O-rings (9) and backup rings (10) in their appropriate grooves on lower bearing retainer (7).

NOTE: The backup rings must be positioned toward the bearing retainer bolt flange with the concave side toward the O-ring as shown in Figure 50-29.

6. Install new lower bearing (8, Figure 50-27) into lubricated lower bearing retainer (7). Install the lower bearing retainer into the suspension housing.
7. If equipped, install wiper retainer plate (3), hardened washers (2) and capscrews (1). Tighten the capscrews to **678 N·m (500 ft lb)**.

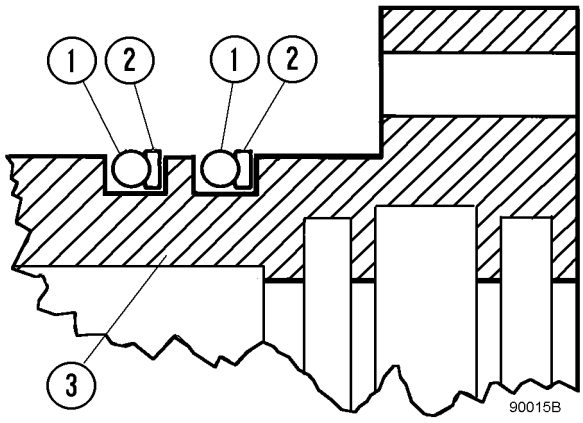

FIGURE 50-29. BACKUP RING REPLACEMENT

1. O-ring
2. Backup Ring
3. Lower Bearing Retainer

DUMP TRUCK

930E

Machine model	Serial number
930E-5	A40004 and up
930E-5SE	A50001 and up

50 Disassembly and assembly
Hoist circuit

Assembly

NOTE: A suitable seal press ring or plug and two small wood blocks should be available.

The following seal installation procedure is outlined for use with a vise, but it can be adapted for use with a press if one is available.

1. Open the vise jaws wide enough to accept the combined thickness of the flange, wood blocks and press ring.
2. Place wood blocks (2, Figure 50-17) flat against the fixed jaw of the vise. Place flange (1) against the wood blocks so that bearing projections (3) are between the wood blocks and clear of the vise jaw.

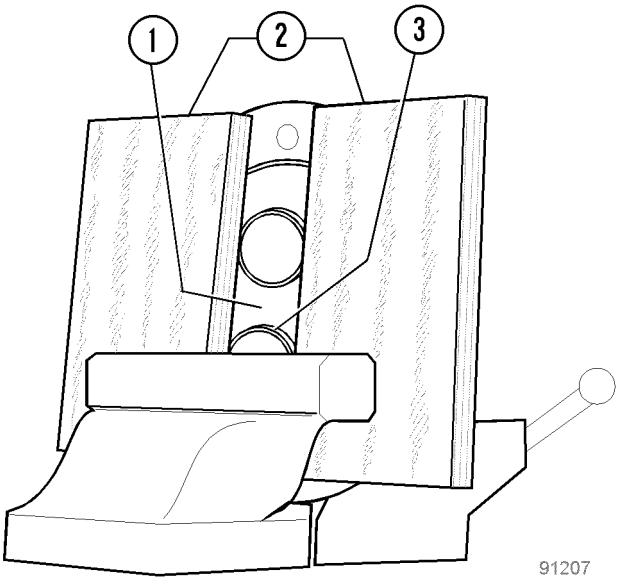

FIGURE 50-17. SHAFT SEAL INSTALLATION

1. Flange
2. Wood Blocks
3. Bearing Projection

3. Lubricate the shaft seals with clean type C-4 hydraulic oil. Position inboard shaft seal (4, Figure 50-14) so that the metal face is toward the outboard end of flange (2).
4. Position the press ring over the inboard shaft seal. Ensure that the seal stays centered and true with the bore, then start applying pressure with the vise. Continue pressing the seal until it just clears the retainer ring groove in the bore.
5. Install snap ring (5) so that the retainer ring opening is over the weep hole (7).
6. Install outboard shaft seal (6) so that the metal face is toward the outboard end of flange (2) until it just contacts snap ring (5).
7. Remove flange (2) from the vise (or press). Place the flange on wood blocks so that, when installed, the input driveshaft is facing downward. See Figure 50-7.
8. Lubricate the threads of four short studs (1, Figure 50-18) and four long studs (2) with clean type C-4 hydraulic oil. Thread the studs into flange (2) until they bottom out. Refer to Figure 50-18 for proper stud location.

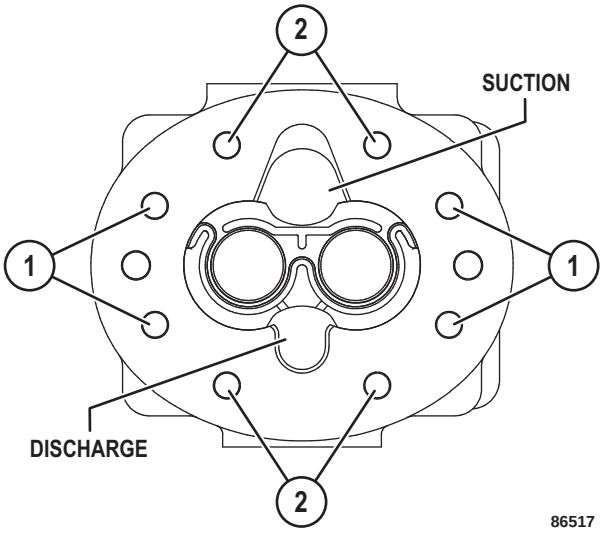

FIGURE 50-18. STUD INSTALLATION

1. Short Studs
2. Long Studs

Assembly of front spool section

1. Discard all O-rings. Clean all parts in solvent and blow dry with compressed air.
2. Inspect the springs for breaks and distortion.
3. Inspect the housing bores and surfaces of the spools for nicks, scoring and excessive wear.
4. Lubricate spools (7, Figure 50-31) with clean hydraulic oil and reinstall them in their original bores. Install springs (8).
5. Lubricate O-rings (5) and (6) with clean hydraulic oil. Install the O-rings in the bottom of the spool housing. Install bottom cover (9) and secure it in place with capscrews. Tighten the capscrews to **81 N·m (60 ft lb)**.
6. Lubricate O-rings (5) and (6) and install them in the top of the spool housing. Install top cover (4) and secure it in place with capscrews. Tighten the capscrews to **81 N·m (60 ft lb)**.
7. If removed, install plugs (2) with new O-rings (3).

Overcenter manifold service

Overcenter manifold (1, Figure 50-32) is located at the rear of the hoist valve. The O-rings and backup rings on counterbalance valve (2), needle valve (3) and check valves (4) may need to be replaced if leaking occurs.

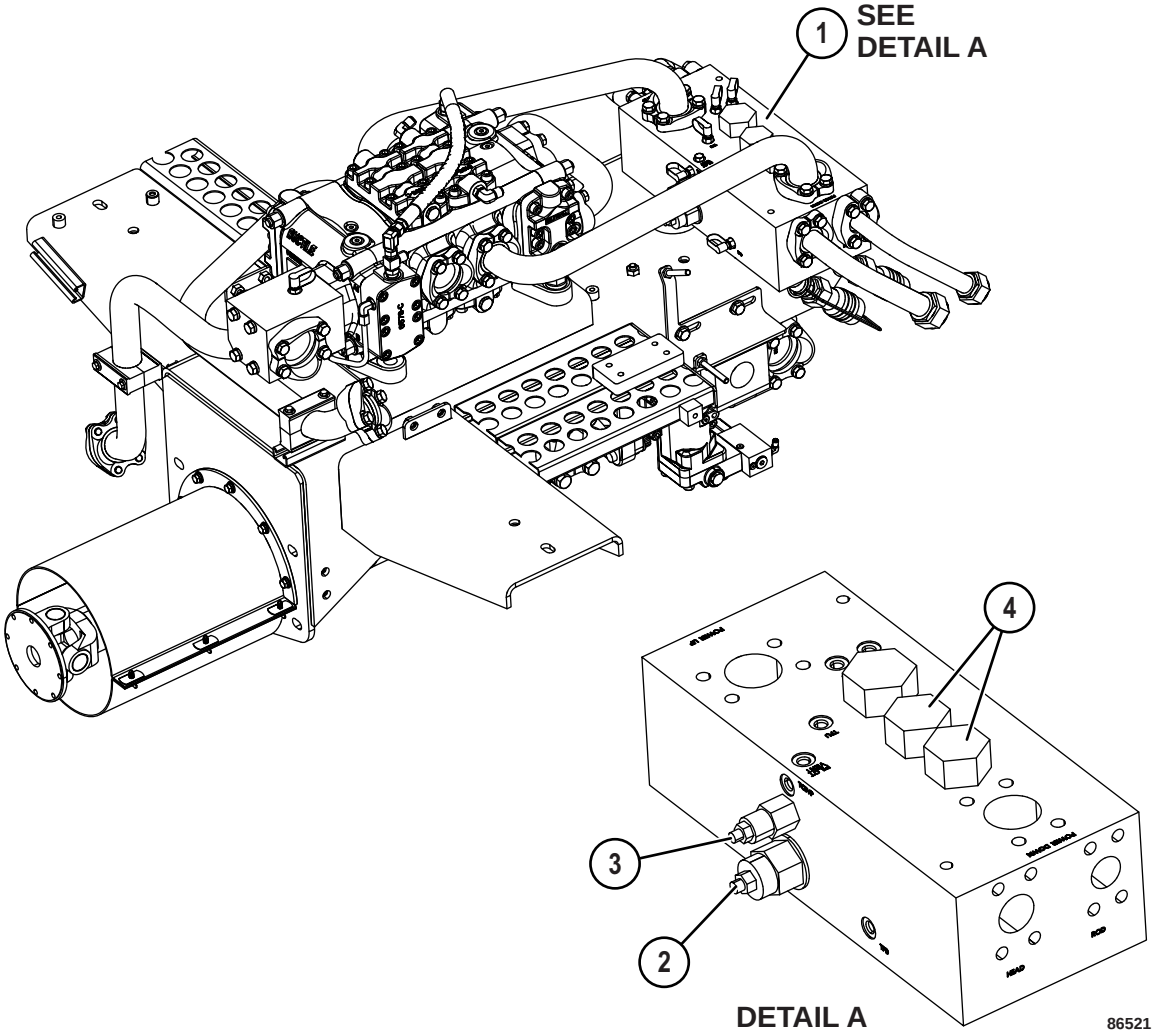

FIGURE 50-32. OVERCENTER MANIFOLD VALVES

1. Overcenter Manifold
2. Counterbalance Valve
3. Needle Valve
4. Check Valve

Installation of the quill

NOTE: Use only new seals, bearings and O-rings during reassembly. Thoroughly lubricate all parts and seals with hydraulic oil to aid in assembly and to provide lubrication during initial operation.

1. Inspect plugs (3, Figure 50-52) and check balls (4) in the quill to ensure that the plugs are tight and the ball seats are not damaged. Refer to "Installation of check balls and plugs in quill" on the next page.
2. Secure cap assembly (1) in a sturdy fixture. Ensure that the threads in the cap and the threads on the quill are clean, dry and free of oil and solvent.
3. Spray the mating threads of both cap assembly (1) and quill assembly (2) with LOCQUIC® Primer T (Komatsu part number TL8753) or equivalent. Allow the primer to dry for three to five minutes.
4. Apply Loctite® Sealant #277 (Komatsu part number VJ6863) or equivalent to the mating threads of both the cap assembly and quill assembly.
5. Install the quill. Use SS1143 tool to tighten the quill to **1 356 N·m (1,000 ft lb)**. Allow the parts to cure for two hours before exposing the threaded areas to oil.

NOTE: If LOCQUIC Primer T (TL8753) was not used, the cure time will require 24 hours instead of two hours.

6. Tack weld the quill in two places as shown in Figure 50-52.
7. Remove all slag and foreign material from the tack weld area before assembling the cylinder.

During future cylinder rebuilds, removal of the quill will not be necessary unless it has loosened or is damaged. Removal will require a break-loose force of at least **2 712 N·m (2,000 ft lb)** after the tack welds are ground off.

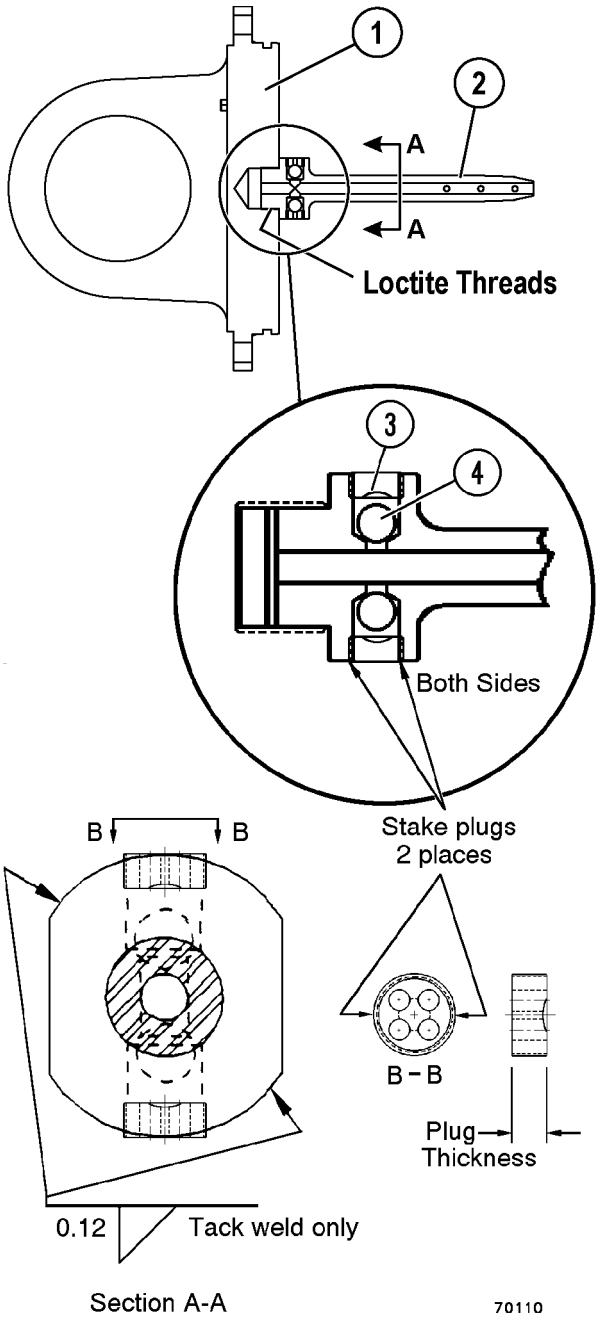

FIGURE 50-52. QUILL ASSEMBLY INSTALLATION

1. Cap Assembly
2. Quill Assembly
3. Plug
4. Check Ball

Body pad shimming procedure

NOTE: If any of the body pads are torn, cracked, or worn beyond 25% of a new body pad, Komatsu recommends replacement of all body pads at the same time. The shimming procedure must be performed at all locations.

1. Park the truck on a flat, level surface.
2. Raise the unloaded dump body to a height that is sufficient to allow access to all of the body pads.

⚠WARNING

To avoid serious personal injury or death, the body retention sling must be installed anytime personnel are required to perform maintenance on the truck with the dump body in the raised position.

3. Install the body retention sling. Refer to “Securing the dump body” in the **Foreword, safety and general information** section for the body retention sling installation procedure.
4. Remove all of the body pads and shims.
5. Bolt one spacer block (XC2293) to each side of the body. Use the pad mounting holes closest to the front of the dump body.
6. Remove the body retention sling. Lower the dump body onto the spacer blocks.
7. Check the dump body’s position and fit on the truck. If there is any interference when the body is on the spacer blocks, contact your local Komatsu distributor to resolve the issue.
8. With the body lowered, measure the distance from the frame rail to each pair of bolt holes at the dump body’s pad mounting locations. There will be a total of eight measurements “A” per side. Refer to Figure 50-6.
9. Subtract the body pad thickness of 39.7 mm (1.56 in.) from each measurement that was recorded in Step 8. There will be a total of eight measurements "B" per side. Refer to Figure 50-6.

   “A” - 39.7 mm (1.56 in.) = "B"
10. Divide each measurement “B” by the single shim thickness of 1.5 mm (0.06 in.) to determine the number of shims required for each mounting location.

    “B” / 1.5 mm (0.06 in.) = number of shims
11. Remove one shim from the calculation for the most rearward body pad on both sides.

NOTE: Using half shims is allowed if necessary. Half shims must be installed at the top of the stack.

NOTE: The frame rail and the body bolster do not have to be parallel.

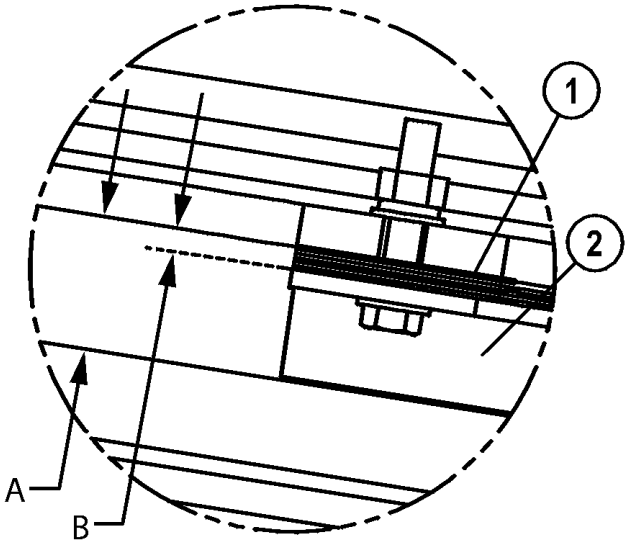

FIGURE 50-6. MEASUREMENT DETAILS

1. Shims 2. Body Pad

Cleaning and inspection

1. Inspect the strainers thoroughly for metallic particles and varnish build up (if oil has been overheated). The quantity and size of any particles may be an indication of excessive wear of components in the hydraulic system.
2. Clean the strainers from the inside out with fresh cleaning solvent.
3. Inspect the strainers for cracks and wear. Replace the strainers if necessary.
4. Clean any sediment from the bottom of the hydraulic tank.

Installation

1. Install both strainers (4, Figure 50-13). Install capscrews (5), lockwashers (6) and flat washers (7). Tighten the capscrews to standard torque.
2. Install suction cover plate (1) and a new gasket. Install capscrews (2) and lockwashers (3). Tighten the capscrews to standard torque.
3. Uncap the pump suction hoses and attach them to the proper connections on the hydraulic tank.
4. Close drain valve (1, Figure 50-12) and fill the hydraulic tank. Refer to the Operation and Maintenance Manual for the proper procedure.
5. Loosen the capscrews on the suction hoses at the pump to bleed any trapped air, then loosen the capscrews on the pressure hoses at the pump to bleed any trapped air. Tighten all capscrews securely.

NOTE: If trapped air is not bled from the steering pump, possible pump damage and no output may result.

5. Lift the door glass into the window frame so that it is near the top. While holding the glass in place, tilt the window frame outward and lift window assembly (1, Figure 50-14) out of the door.
6. Move the window assembly to a work area where the glass can be removed. Slide the glass down and out of the window channels.

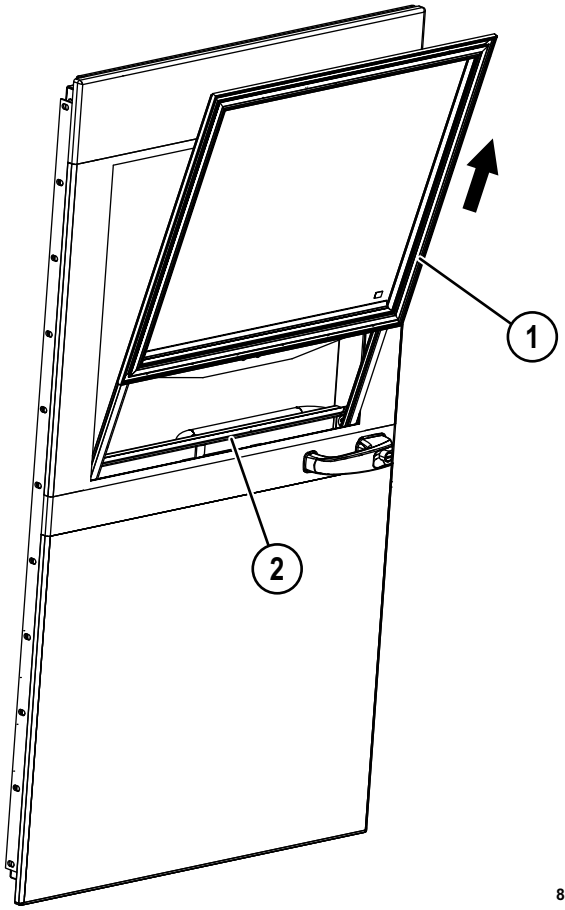

FIGURE 50-14. WINDOW ASSEMBLY REMOVAL

1. Window Assembly
2. Window Inner Seal

Installing the door glass

1. Before installing the door glass, inspect glass wipe (1, Figure 50-15) and frame filler (2) for wear and damage. Replace components if necessary.
2. Ensure that the rubber felt inserts in both window channels (3) are in good condition. Replace the inserts if necessary.

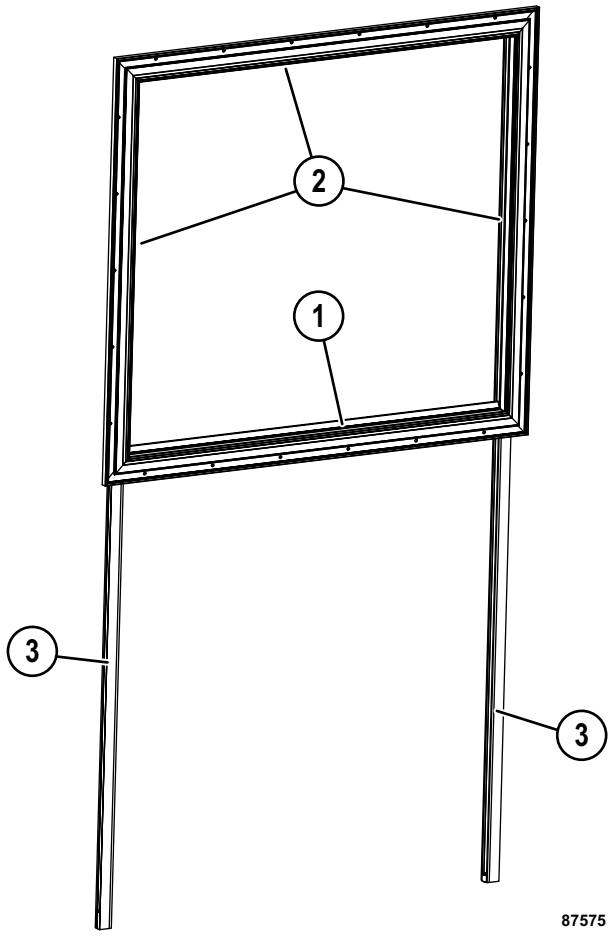

FIGURE 50-15. WINDOW ASSEMBLY

1. Glass wipe
2. Frame Filler
3. Window Channel

Removal and installation of windshield wiper components

Removing the windshield wiper motor

1. Remove front access cover (1, Figure 50-33) from the operator cab.

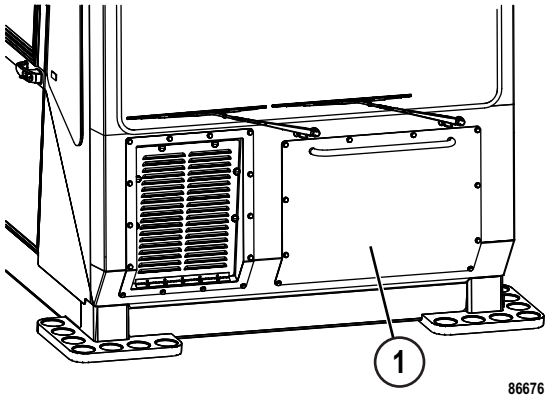

FIGURE 50-33. ACCESSING THE WIPER MOTOR

1. Front Access Cover

2. Disconnect the wiper motor harness (2, Figure 50-34).

⚠WARNING

Some wiper linkage arms may have extremely sharp edges. Wear protective gloves and long sleeves when handling wiper linkage arms.

3. While holding wiper linkage (3) stationary, loosen capscrew (4) and disconnect the wiper linkage from wiper motor (1).
4. Remove three capscrews (5), flat washers (6) and lock washers (7) that attach the wiper motor to the mounting plate. Remove the wiper motor assembly.

Installing the windshield wiper motor

1. Place wiper motor (1, Figure 50-34) into position on the mounting plate.
2. Install three capscrews (5), flat washers (6) and lockwashers (7). Tighten the capscrews to **8-9 N·m (71-79 in. lb)**.
3. Slide wiper linkage (3) onto the motor output shaft. Hold the linkage stationary and tighten capscrew (4) to **22-24 N·m (16-18 ft lb)**.
4. Reconnect wiper motor harness (2).

NOTE: In case the wiper motor operates incorrectly, lift the wiper arms off the windshield to avoid possible damage.

5. Verify that the wipers operate properly and park in the proper position (see Figure 50-33).

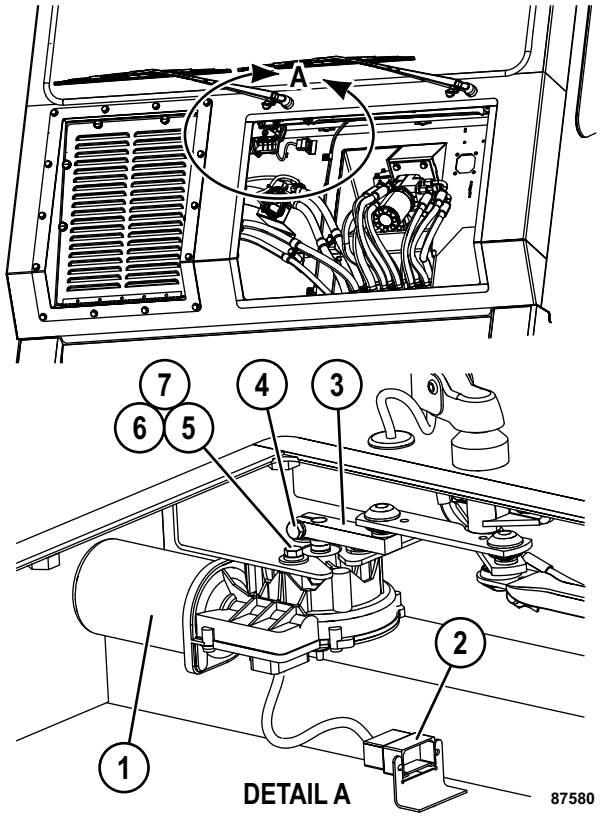

FIGURE 50-34. WIPER MOTOR REMOVAL & INSTALLATION

1. Wiper Motor
2. Wiper Motor Harness
3. Wiper Linkage
4. Capscrew
5. Capscrew
6. Flat Washer
7. Lockwasher