Shop Manual

930E-5

DUMP TRUCK

SERIAL NUMBERS **930E-5 A40216 and up**

ENGINE **16V160**

KOMATSU

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General safety

Safety records from most organizations will show that the greatest percentage of accidents are caused by unsafe acts performed by people. The remainder are caused by unsafe mechanical or physical conditions. Report all unsafe conditions to the proper authority.

The following safety rules are provided as a guide for the operator. However, local conditions and regulations may add many more to this list.

⚠WARNING

Read and follow all safety precautions. Failure to do so may result in serious injury or death.

Safety rules

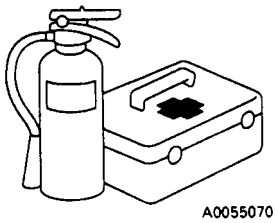
- Only trained and authorized personnel may operate and maintain the truck.
- Follow the local safety statutes and laws when working with electrical components.
- Follow all safety rules, precautions and instructions when operating or performing maintenance on the truck.
- When working with another operator or a person on work site traffic duty, make sure that all personnel understand all hand signals that are to be used.

Safety features

- Make sure that all guards and covers are in their proper position. Have any damaged guards and covers repaired.
- Learn the proper use of safety features such as safety locks, safety pins, and seat belts. Use these safety features properly.
- Never remove any safety features. Always keep them in good operating condition.
- Improper use of safety features could result in serious bodily injury or death.
- Check the seat belt fabric, buckle and hardware for damage or wear. Replace any worn or damaged parts immediately.
- The seat belts must be replaced 5 years after seat belt manufacture, or after every 3 years of use, whichever comes first.

Fire extinguisher and first aid kit

- Make sure that fire extinguishers are accessible and proper usage techniques are known.
- Provide a first aid kit at the storage point.
- Know what to do in the event of a fire.
- Keep the phone numbers of persons you should contact in case of an emergency on hand.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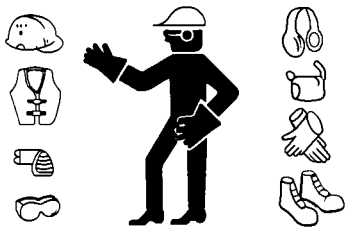
Clothing and personal items

- Avoid loose clothing, jewelry, and loose long hair. They can catch on controls or in moving parts and cause serious injury or death. Also, never wear oily clothes as they are flammable.
- Wear a hard hat, safety glasses, safety shoes, mask and gloves when operating or maintaining a truck. Always wear safety goggles, hard hat and heavy gloves if your job involves scattering metal chips or minute materials, particularly when driving pins with a hammer or when cleaning air cleaner elements with compressed air. Also, ensure that the work area is free from other personnel during such tasks.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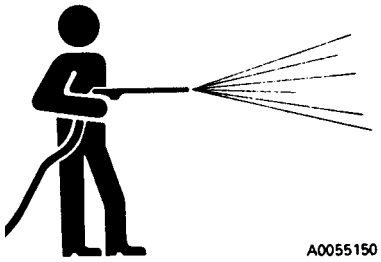
Precautions while performing service

NOTE: Only authorized personnel should service and repair the truck.

Keep the truck clean

- Spilled oil, grease, scattered tools, etc, can cause you to slip or trip. Always keep your truck clean and tidy.
- If water gets into the electrical system, there is danger that the truck may move unexpectedly and/or damage to components may occur. Do not use water or steam to clean any sensors, connectors or the inside of the operator's compartment.
- Use extreme care when washing the electrical control cabinet. Do not allow water to enter the control cabinet around the doors or vents. Do not allow any water to enter the cooling air inlet duct above the electrical control cabinet. If water enters the control cabinet through any opening or crevice, major damage to the electrical components is possible.
- Never spray water into the rear wheel electric motor covers. Damage to the wheel motor armatures may occur.
- Do not spray water into the retarding grids. Excess water in the retarding grids can cause a ground fault, which will prevent propulsion.

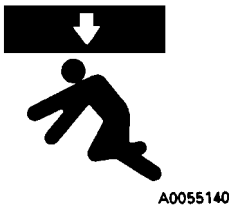


Attachments

Place attachments that have been removed from the truck in a safe place and manner to prevent them from falling.

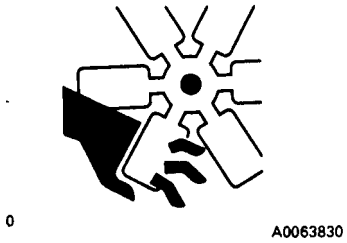
Working under the truck

- Always lower all movable work equipment to the ground or to their lowest position before performing service or repairs under the truck.
- Always block the tires of the truck securely.
- Never work under the truck if the truck is poorly supported.



Rotating fan and belts

Stay away from all rotating parts such as the radiator fan and fan belts. Serious bodily injury may result from direct or indirect contact with rotating parts and flying objects.



Adding fuel or oil

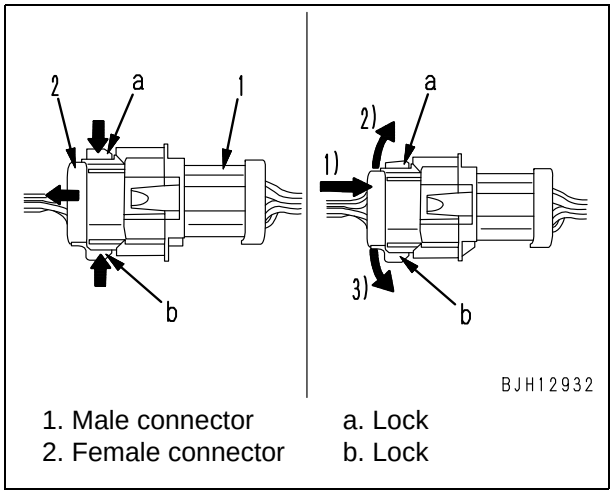
- Spilled fuel and oil may cause slipping. Always clean up spills immediately.
- Always add fuel and oil in a well-ventilated area.
- When refueling, stop the engine and do not smoke.
- Tighten the cap of the fuel and oil fillers securely.
- Never use fuel to wash parts.

Use of lighting

When checking fuel, oil, coolant or battery electrolyte, always use lighting with anti-explosion specifications. If such lighting equipment is not used, there is danger of an explosion.

- Heavy duty wire connector (DT 8-pole, 12-pole)
  a. For disconnection, press both sides of locks (a) and (b) while pulling out female connector (2).
  b. For connection, push in female connector (2) horizontally until the lock clicks.

  Since locks (a) and (b) may not be set completely, push in female connector (2) while moving it up and down until the locks are set normally.
  - Right half of figure: Lock (a) is pulled down (not set completely) and lock (b) is set completely.



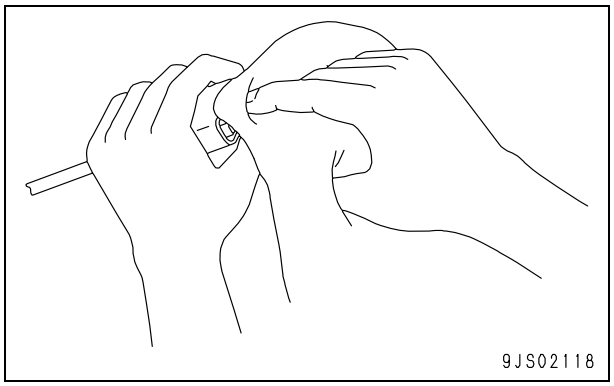
1. Male connector
2. Female connector

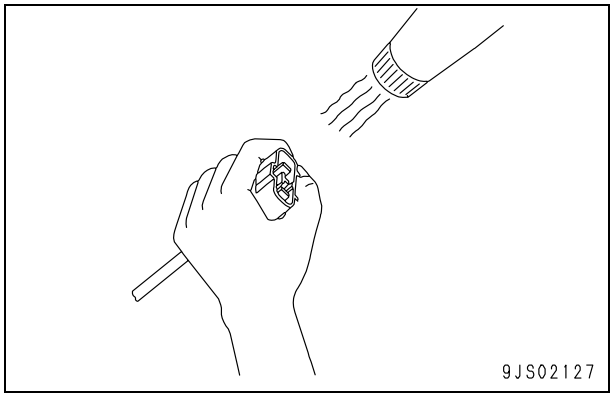
a. Lock
b. Lock

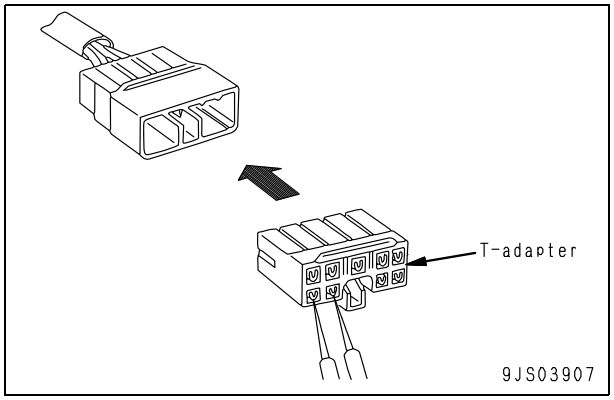
- Drying wiring harness

  If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high pressure water or steam directly on the wiring harness. If water gets directly on the connector, perform the following procedure.

  a. Disconnect the connector and wipe off the water with a dry cloth. If the connector is blown dry with compressed air, there is the risk that oil in the air may cause defective contact, so remove all oil and water from the compressed air before blowing with air.
  b. If water gets inside the connector, use a dryer to dry the inside of the connector. Hot air from the dryer can be used, but regulate the time that the hot air is used in order not to make the connector or related parts too hot, as this will cause deformation or damage to the connector.
  c. After drying, leave the wiring harness disconnected and carry out a continuity test to check for any short circuits between pins caused by water.
  d. After completely drying the connector, blow it with contact restorer and reassemble.







Conversion tables

Common conversion multipliers

Table 13: English to metric

From	To	Multiply by
inch (in.)	millimeter (mm)	25.40
inch (in.)	centimeter (cm)	2.54
foot (ft)	meter (m)	0.3048
yard (yd)	meter (m)	0.914
mile (mi)	kilometer (km)	1.61
square inch ($in.^2$)	square centimeter (cm^2)	6.45
square foot (ft^2)	square centimeter (cm^2)	929
cubic inch ($in.^3$)	cubic centimeter (cm^3)	16.39
cubic inch ($in.^3$)	liter (l)	0.016
cubic foot (ft^3)	cubic meter (m^3)	0.028
cubic foot (ft^3)	liter (l)	28.317
ounce (oz)	gram (g)	28.350
fluid ounce (fl oz)	milliliter (ml)	29.573
pound (lb) - mass	kilogram (kg)	0.454
pound (lb) - force	Newton (N)	4.448
inch pound (in lb)	Newton meter (N·m)	0.113
foot pound (ft lb)	Newton meter (N·m)	1.356
foot pound (ft lb)	kilogram meter (kgm)	0.138
pounds/square inch (psi)	kilopascal (kPa)	6.895
pounds/square inch (psi)	megapascal (MPa)	0.007
pounds/square inch (psi)	kilograms/square centimeter (kg/cm^2)	0.0704
short ton	kilogram (kg)	907.2
short ton	metric ton	0.0907
quart (qt)	liter (l)	0.946
U.S gallon (gal)	liter (l)	3.785
horsepower (HP)	kilowatt (kw)	0.745

Table 14: Metric to English

From	To	Multiply by
millimeter (mm)	inch (in.)	0.0394
centimeter (cm)	inch (in.)	0.3937
meter (m)	foot (ft)	3.2808
meter (m)	yard (yd)	1.0936
kilometer (km)	mile (mi)	0.6210
square centimeter (cm^2)	square inch ($in.^2$)	0.1550
square centimeter (cm^2)	square foot (ft^2)	0.001
cubic centimeter (cm^3)	cubic inch ($in.^3$)	0.061
liter (l)	cubic inch ($in.^3$)	61.02
cubic meter (m^3)	cubic foot (ft^3)	35.314
liter (l)	cubic foot (ft^3)	0.0353
gram (g)	ounce (oz)	0.0353
milliliter (ml)	fluid ounce (fl oz)	0.0338
kilogram (kg)	pound (lb) - mass	2.2046
Newton (N)	pound (lb) - force	0.2248
Newton meter (N·m)	inch pound (in lb)	8.85
Newton meter (N·m)	foot pound (ft lb)	0.7376
kilogram meter (kgm)	foot pound (ft lb)	7.2329
kilopascal (kPa)	pounds/square inch (psi)	0.1450
megapascal (MPa)	pounds/square inch (psi)	145.038
kilograms/square centimeter (kg/cm^2)	pounds/square inch (psi)	14.2231
kilogram (kg)	short ton	0.0011
metric ton	short ton	1.1023
liter (l)	quart (qt)	1.0567
liter (l)	U.S gallon (gal)	0.2642
kilowatt (kw)	horsepower (HP)	1.3410

NOTES

Flow amplifier operation

No steer

Refer to Figure 10-11.

High pressure oil from the steering pump and steering accumulators is available through the bleeddown manifold to the “HP” port on the flow amplifier.

Upon entering the priority valve, the oil goes past the spool to the closed amplifier valve and also out port “P” through a hose to port “P” on the steering control unit. In the steering control unit, the oil goes to a closed area in the control.

As pressure builds up in these two areas, oil passes through orifices in the end of the priority valve and builds pressure on the end of the valve and port "PP". When pressure reaches approximately 1 600 kPa (232 psi), the spool moves, compressing its spring and closing off oil supply through area “A”, resulting in high pressure at “PP” but only 1 600 kPa (232 psi) at the amplifier spool and steering control unit.

Hoist valve

Hoist valve (1, Figure 10-2) is mounted on a modular assembly containing the hoist valve, overcenter manifold, and both hydraulic pumps. This assembly is bolted to brackets attached to the frame rails behind the main alternator. The hoist valve is a split spool design. The term “split spool” describes the spool section of the valve.

The hoist valve precisely follows the differential pressure input signals generated by the hoist pilot valve when the operator moves the hoist control lever while raising and lowering the dump body.

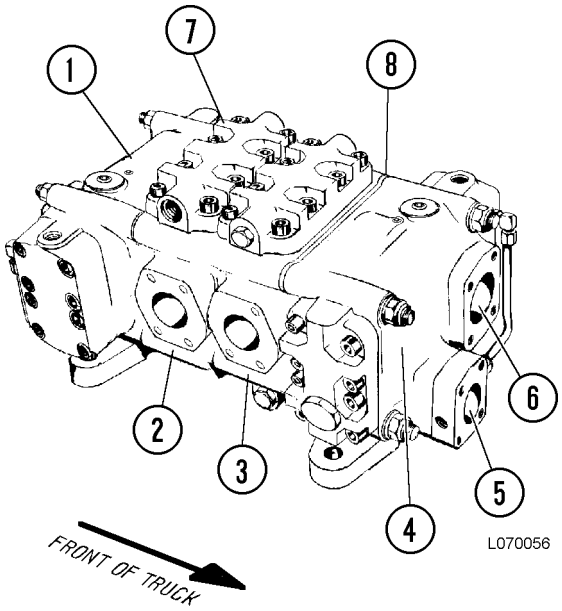


FIGURE 10-3. HOIST VALVE

1. Inlet Section
2. Work Ports Spool Section
3. Tank Ports Spool Section
4. Inlet Section
5. Inlet Port
6. Outlet Port
7. Spool Section Cover
8. Separator Plate

Inlet sections

Each of the front and rear inlet sections of the hoist valve contains of the following components:

- Flow control valve and main relief valve
- Secondary low pressure relief valve
- Anti-void check valve
- Load check valve

The flow control portion of the flow control and main relief valves allow pump flow to be diverted to the service brake cooling circuit unless the body is being raised or lowered. The relief portion of this valve is direct-acting and has the capacity to limit the maximum working pressure at full pump flow.

The secondary low pressure relief valve is located between the low pressure core and the outlet to the brake cooling circuit. It provides pressure relief if pressure spikes occur in the low pressure passage area.

The load check allows free flow from the inlet to the high pressure core and prevents flow from the high pressure core to the inlet.

The anti-void check valve allows free flow from the low pressure core to the high pressure core and prevents flow from the high pressure core to the low pressure core.

Tank ports (front) spool section

The primary low pressure valves are located in the front spool section of the hoist valve. These valves maintain back pressure on the low pressure passage and direct the hoist cylinder return oil back to the hydraulic tank.

Battery supply system

Batteries

The truck uses a 24VDC electrical system to supply power for the engine starting circuits and most non-propulsion related electrical components. The 24VDC electrical circuit is supplied by four heavy duty, type 8D, 12-volt storage batteries (1, Figure 10-1) located in the battery box on the platform in front of the radiator. The batteries are of the lead-acid type, each containing six 2-volt cells.

While the engine is off, power is supplied by the batteries. During engine cranking, power is supplied by the batteries. When the engine is running, however, power is supplied by a high capacity alternator that is driven by the engine.

During operation, the batteries function as an electrochemical device that converts chemical energy into the electrical energy that is required for operating the accessories when the engine is off.

24VDC auxiliary battery receptacles

Two auxiliary battery receptacles (5, Figure 10-1) are provided to attach battery charger leads for charging the batteries. These receptacles can also be used for connecting external batteries to aid engine starting during cold weather.

When external batteries are used, they should be of the same type (8D) as the batteries that are installed on the truck. Two pairs of batteries should be used. Each pair should be connected in series to provide 24VDC, with one pair connected to each receptacle.

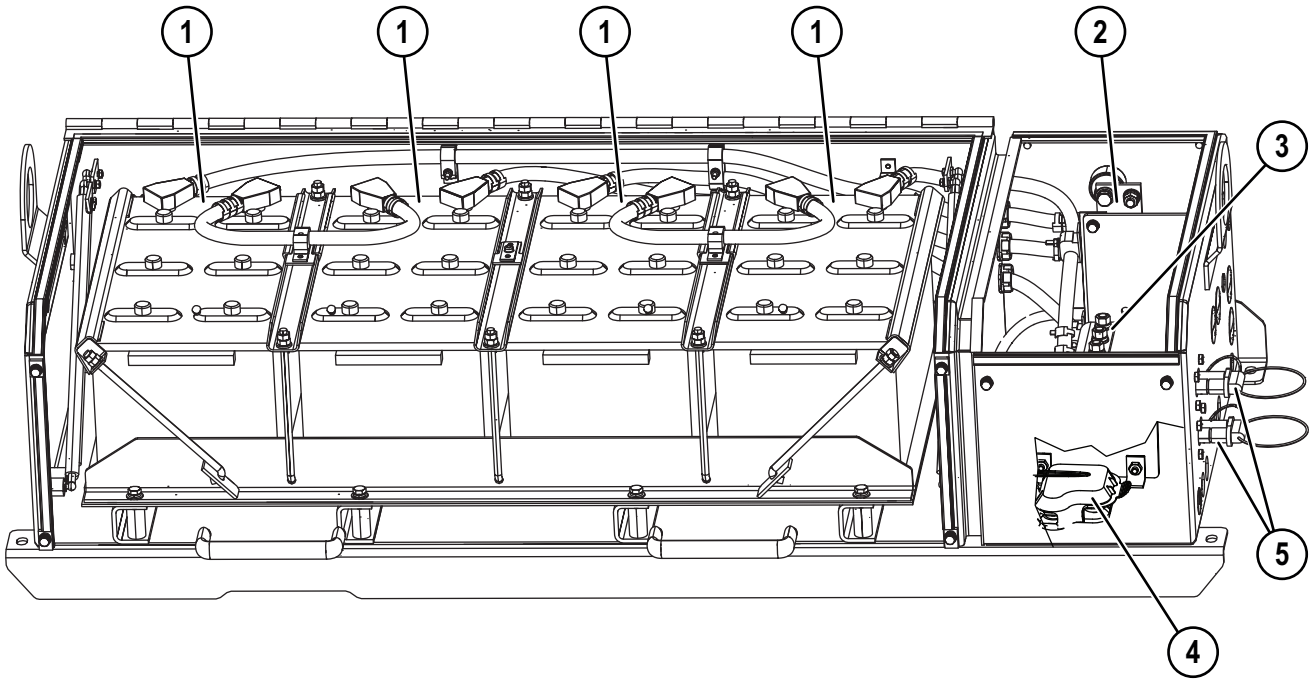


FIGURE 10-1. BATTERY BOX COMPONENTS

1. Batteries
2. 24VDC Bus Bar
3. Negative Bus Bar
4. Fuses (battery charging alternator and auxiliary control cabinet)
5. Auxiliary Battery Receptacles

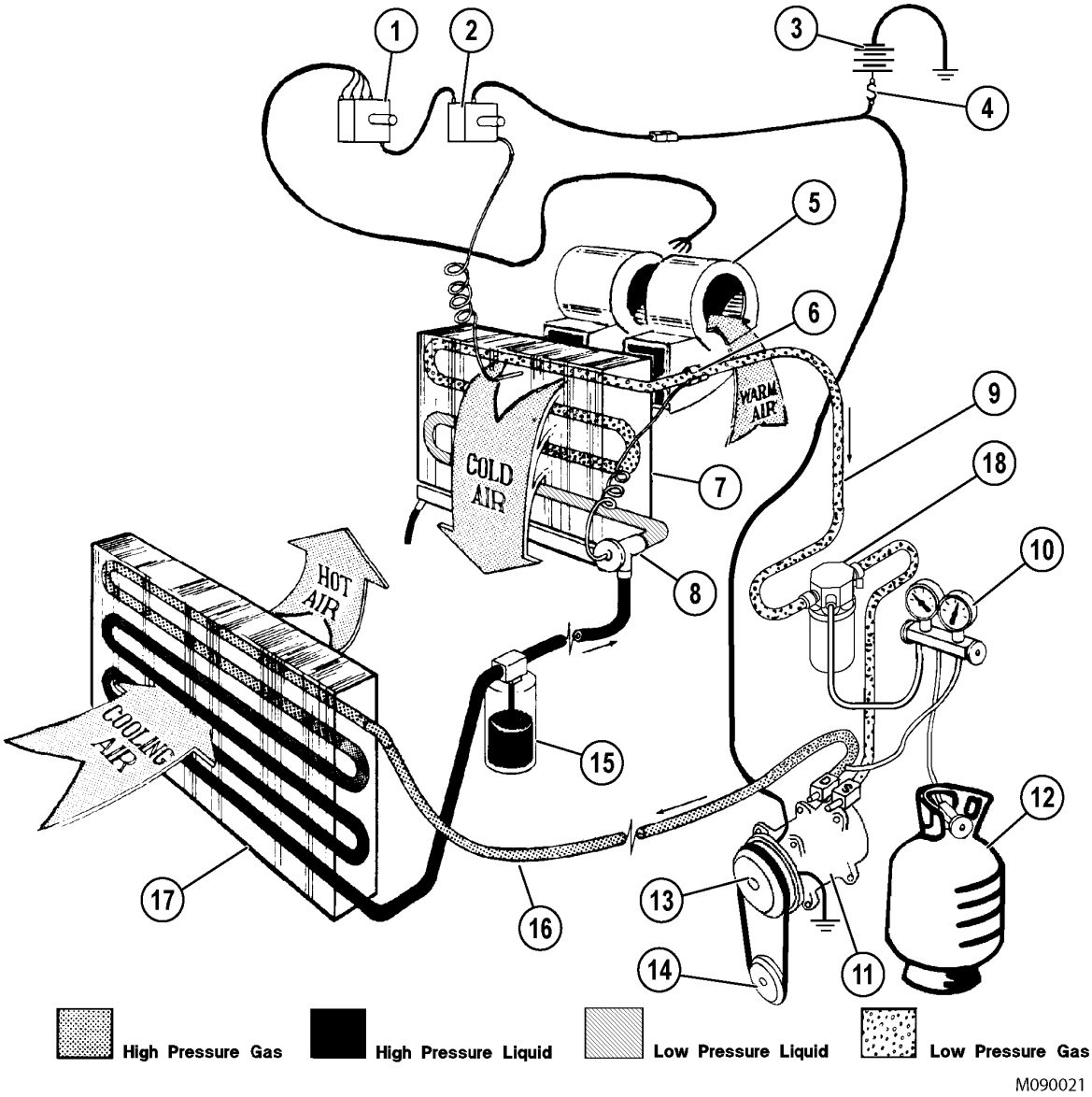


FIGURE 10-1. BASIC AIR CONDITIONING SYSTEM

1. Blower Switch
2. Thermostatic Switch
3. Battery Supply
4. Circuit Breaker
5. Blower
6. Temperature Sensor
7. Evaporator Core
8. Expansion Valve
9. Suction Line
10. Test Gauges & Manifold
11. Compressor
12. Refrigerant Container
13. Magnetic Clutch
14. Compressor Drive Pulley
15. Receiver-Drier
16. Discharge Line
17. Condenser
18. Accumulator

DUMP TRUCK

730E
830E
930E
980E

Machine model	Serial number
730E-10	A50002 and up
830E-5	A50005 - A500153
830E-5AT	A50005 and up
930E-5	A40004 and up
930E-5AT	A40004 and up
980E-5	A50005 and up
980E-5AT	A50005 and up

10 Structure and functions
Engine emissions aftertreatment system

f. With the bleed valve on the auxiliary hydraulic manifold open, verify that the pressures at test ports TP2 and TP3 remain above 16 550 kPa (2,400 psi) for at least five minutes after the auxiliary accumulator is bled down below 100 kPa (15 psi).

**** Record on Data Sheet***

g. If either of the steering accumulator pressures at test port TP2 or TP3 falls or the pressure at auxiliary hydraulic manifold test port GA rises, correct the problem and return to step 33b.

h. Close the bleed valve on the auxiliary hydraulic manifold.

System diagnostics

34. Turn the key switch OFF and wait two minutes for the steering accumulators to bleed down. Connect the Realtime monitor and observe the state of low steering pressure status bit IM2S. Status bit IM2S should be 1.

35. Start the engine and observe the pressure gauge at test port TP2. Allow the steering accumulators to charge to at least 19 000 kPa (2,750 psi). Status bit IM2S should change to 0.

36. To prevent the accumulators from bleeding down, leave the key switch ON and pull up the engine shutdown switch to stop the engine.

37. Slowly open one of the brake accumulator bleed valves (1, Figure 30-1) on the brake manifold. Note the pressure at test port T2 when the state of input IM2S changes from 0 to 1. The change should occur at a falling pressure of 15 860 ± 420 kPa (2,300 ± 61 psi).

**** Record on Data Sheet***

38. Turn the key switch OFF and wait two minutes for the steering accumulators to bleed down.

NOTE: The following step is for troubleshooting and may be skipped if no excessive leakage in the steering system is suspected.

39. To check for leakage in the steering system:

a. Disconnect the flow amplifier return hose at the steering bleeddown manifold and plug the fitting on the manifold. Disconnect the steering control unit return hose at the flow amplifier (port T) and plug the port.

b. Start the engine. Allow the steering accumulators to fully charge and the steering pump to unload. **Do not turn the steering wheel while the return hoses are disconnected.**

c. Measure the leakage from the flow amplifier and the steering control unit.

- Leakage from the flow amplifier should not exceed 820 mL (50 $in.^3$) per minute. If leakage is excessive, replace the flow amplifier.
- Leakage from the steering control unit should not exceed 164 mL (10 $in.^3$) per minute. If leakage is excessive, replace the steering control unit.

**** Record on Data Sheet***

d. Turn the key switch to OFF to stop the engine.

NOTE: The following step is for troubleshooting and may be skipped if no excessive leakage in the steering bleeddown manifold is suspected.

40. To check for leakage in the steering bleeddown manifold:

a. Disconnect the flow amplifier return hose at the bleeddown manifold and plug the fitting on the manifold. Disconnect the steering control unit return hose at the flow amplifier (port T) and plug the port.

⚠ IMPORTANT ⚠

The hydraulic tank oil level is above the level of the tank return line. It is necessary to draw a vacuum on the hydraulic tank to prevent a large amount of oil from draining from the tank with the return line disconnected from the bleeddown manifold.

NOTES

64. Verify that brake lock will activate when applied while the truck is moving, and remains activated after the truck stops, as follows:

    a. With the engine operating, low brake accumulator pressure at test port LAP1 at a minimum of 18 960 kPa (2,750 psi), move the directional control lever NEUTRAL.

    b. Use GE wPTU software to set the FWD True output ON.

    c. Pull up on the engine shutdown switch in the operator cab to shut off the engine. **Do not turn the key switch OFF.** The accumulators must not be allowed to bleed down.

    d. Provide a speed signal of 1 kph (0.6 mph) from the VID panel on the rear wall of the operator cab.

    e. Install a jumper wire between TB28-A (circuit 36) and ground to simulate a running engine.

    f. Turn the brake lock switch ON. Verify that the brake lock applies.

    - The pressure at test port PK3 should be 18 960 - 21 375 kPa (2,750 - 3,100 psi).
    - The pressures at test ports PP3 and BR should be 17 237 ± 690 kPa (2,500 ± 100 psi).
    - The pressure at test port BF should remain at 0 kPa (0 psi).

**** Record on Data Sheet***

    g. Move the directional control lever to PARK.

    h. Set the speed signal on the VID panel to 0 kph (0 mph).

    i. Verify that the brake lock remains applied. The brake lock status light and the parking brake status light should illuminate. Fault codes A272 and A274 should be activated when the speed signal is removed.

    - The pressures at test port PP3 and BR should be 10 342 ± 689 kPa (2,500 ± 100 psi).
    - The pressures at test port PK3 and BF should be 0 kPa (0 psi).

**** Record on Data Sheet***

    j. Turn the brake lock switch OFF. Verify that the brake lock releases. The brake lock status light should turn off and fault codes A272 and A274 should clear. The pressures at test ports PK3, PP3, BF and BR should be at 0 kPa (0 psi).

**** Record on Data Sheet***

    k. Remove the jumper wire from TB28-A (circuit 36).

    l. Use GE wPTU software to set the FWD True output OFF.

Brake reapplications

65. Start the engine. Allow the pressure at low accumulator pressure test port LAP1 to increase to a minimum of 18 960 kPa (2,750 psi).

66. Move the directional control lever to NEUTRAL. Pull up on the engine shutdown switch in the cab to shut off the engine. **Do not turn the key switch OFF.** The accumulators must not be allowed to bleed down.

67. Provide a speed signal greater than 1 kph (0.6 mph) from the VID panel on the rear wall of the operator cab.

68. While observing the pressure gauges, make repeated, slow brake applications until fault code A261 appears.

    Fault code A261 must not occur before the sixth pedal application. Auto apply must not occur until after fault code A261 occurs.

**** Record on Data Sheet***

69. Set the speed signal on the VID panel to 0 kph (0 mph).

70. Move the directional control lever to PARK. Turn the key switch OFF and allow steering accumulators to bleed down. Reset the engine shutdown switch.

71. Open both brake bleeddown valves and allow the brake accumulators to bleed down. Open the auxiliary accumulator bleeddown valve and allow the auxiliary system accumulator to bleed down.

72. Remove all pressure gauges, jumper wires, instrumentation and brake simulators (if used). Close all opened accumulator bleeddown valves.

Service brake disc wear inspection

Check brake disc wear by using brake wear indicators (EF9302) that are included in the tool group that is shipped with the truck. Refer to Figure 30-15.

NOTE: The brake wear indicator is inserted in a port which is open to cooling oil. Removal of the inspection port plug to insert the brake wear indicator will cause the loss of some of this oil. Advance planning will help to minimize oil loss.

The brake wear indicators may be permanently installed in the brake ports if desired. If all of the brake assemblies are equipped with brake wear indicators, future checks will not require installation and removal.

1. Place the directional control lever in PARK and turn the rest switch ON. Turn the key switch OFF to turn off the engine and wait 90 seconds to allow the steering accumulators to depressurize completely. Block the truck wheels.
2. Open bleed down valves (1, Figure 30-12) on brake manifold (2) to depressurize the brake accumulators. Close the bleed down valves after the pressure is completely released.
3. Thoroughly clean the brake assemblies, especially the area surrounding cooling oil lines.
4. Remove the plug from port (1, Figure 30-14). Quickly insert the brake wear indicator and tighten it securely. Repeat this step for each brake assembly.

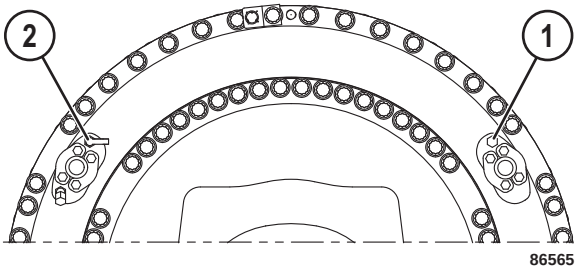


FIGURE 30-14. BRAKE WEAR INDICATOR INSTALLATION

1. Brake Wear Indicator Installation Port
2. Diagnostic Coupler

NOTE: The front brake assemblies have diagnostic coupler (2) installed for measuring brake apply pressure. The rear brake assemblies do not have a diagnostic coupler installed on the brake backplate, but instead have a plug installed. Do not attempt to install the brake wear indicator in these ports.

5. Start the engine. Allow the steering system pressure to stabilize and the brake accumulators to fill.
6. While fully applying the service brake pedal, check the wear on each brake disc as follows:
   a. Remove cover (1, Figure 30-15) from the brake wear indicator.
   b. Push pin (8) inward until it stops against the brake piston.
   c. Measure the distance from indicator pin end face (2) to housing face (3).

- ❑ If indicator pin end face (2) is even with housing face (3) or below, disc pack is worn to the maximum safe wear limits. The brakes should be scheduled for rebuild.
- ❑ If indicator pin end face (2) extends beyond housing face (3), brake disc wear is still within allowable limits.

   d. Pull pin (8) outward until it stops against tool housing (6). Install cover (1).

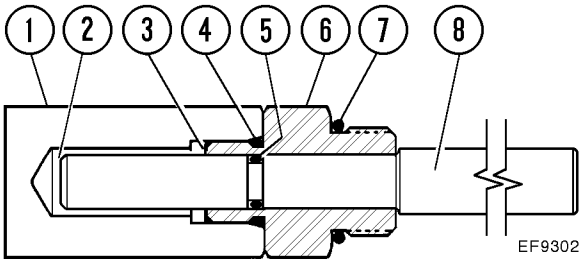


FIGURE 30-15. BRAKE WEAR INDICATOR

1. Cover
2. Indicator Pin End Face
3. Housing Face
4. O-Ring
5. O-Ring
6. Housing
7. O-Ring
8. Indicator Pin

15. After the accumulator is charged to the desired pressure, shut off the charging kit and wait 15 minutes to allow the gas temperature to stabilize. If the desired pressure is maintained, proceed to step 16. If the desired pressure is exceeded:
    a. Close the nitrogen container valve, inlet valve (4) and both outlet valves (3).
    b. Disconnect the hose that connects manifold (6) to regulator valve (5).

NOTE: A small blast of pressure will escape.

    c. Open the inlet valve (4) then slowly open each outlet valve (3) independently until the correct precharge pressure is obtained in each accumulator.

CAUTION

Do not reduce pressure by depressing the valve core with a foreign object. High pressure may rupture the rubber valve seat.

16. Tighten swivel nut (2, Figure 30-4) to **6-11 N·m (5-8 ft lb)**.
17. Use a common leak reactant to check for nitrogen leaks.
18. Install charging valve cap (1) finger tight.
19. Install valve cover (1, Figure 30-3) and tighten capscrews to **34 N·m (25 ft lb)**.
20. Operate the truck and check the steering operation.

Piston accumulator storage

WARNING

When storing a piston accumulator, do not exceed the recommended storage pressure of 172 kPa (25 psi) or less. Sudden loss of the accumulator pressure can result in a projectile hazard that can cause serious injury or death.

Only precharge the accumulators to operating pressure while installed on the truck. DO NOT handle an accumulator with a nitrogen precharge greater than 172 kPa (25 psi).

Apply a small nitrogen precharge of 172 kPa (25 psi) or less to prevent seal compression and corrosion due to condensation.

Store the accumulator in the upright position in a cool dry place away from the sun. The ideal temperature for storage is 21°C (70°F).

Cover the oil port at the bottom of the accumulator with a plastic plug (without threads) to prevent contamination. **DO NOT install a threaded plug in the oil port.**

730E Dump truck
830E Dump truck
860E Dump truck
960E Dump truck
930E Dump truck
980E Dump truck

Form No. CEN30098-12

ELECTRICAL CHECKOUT SHEET		
Function Description	**Criteria**	**Result (OK/Fail)**
Cab Seats	Driver and Passenger air seats operate	
HVAC System	HVAC System operates	
Auxiliary Control Cabinet Dome Lights	Aux Box Dome lights function	
Body Hoist Limit	Body hoist limit function	
Control Power Relay	GE I/O -Output for GE Control Power (71GE) ON/OFF	
Park Brake Input	GE I/O -Park Brake Applied Pressure Switch ON/OFF	
Service Brakes ON	GE I/O -Service Brake Applied Pressure Switch	
Wheel Brake Lock SW	GE I/O -Brake Lock Switch Dash ON/OFF (RPC CAN)	
PreShift Brake Test	GE I/O -Pre-Shift Park Brake Test Switch ON/OFF	
Axle Blower PSI SW	GE I/O -Traction Motor Pressure Switch ON/ OFF	
Control Cabinet PSI SW (RPM 950- 1150)	GE Control Cabinet Blower Pressure Switch	
Slip Slide Dis	GE I/O -Slip Slide Feature Disabled	
Forward Direction	GE I/O -Directional Shift Selector - Forward Position	
Reverse Direction	GE I/O -Directional Shift Selector - Reverse Position	
Body up Reset	GE I/O -Body up Override / Rest Reset Switch ON/OFF	
Data Store	GE I/O -Data Store Switch ON/OFF	
Generator Field Coil SW	GE I/O -Control Cabinet DC Field Cut Switch	
Propel Lockout	GE I/O -Iso Box & GE Cabinet Propel Lockout Switch ON/OFF	

5. **Steering Bleeddown Solenoid (IM1-18)** - Confirm that the steering bleeddown solenoid is de-energized. Turn key switch OFF and confirm that the steering bleeddown solenoid is energized by verifying that the coil is magnetized.
6. **Auto Lube Solenoid (IM1-5)** - Remove wire 68-006 from TB35-R2. Use the dash panel to select manual lube. Confirm that circuit 68 on TB35 is 0 volts. Reconnect wire 68-006.

NOTE: Item 7 applies only to 830E-5 trucks equipped with wet disc brakes. This check will require two persons.

7. **Brake Cooling Manifold Solenoid Valve (IM2-46)** - Start the engine. The body must be in the down position. If the truck does not have a dump body installed, make sure that pressure in the hoist circuit is less than 500 psi.

   Apply the service brakes. Have another person locate the brake cooling manifold solenoid (CMSOL) in the brake cabinet. The coil should be magnetized.

   Release the service brakes. After several seconds, the solenoid should de-energize. Turn off the engine.

- **Display Units**: This parameter can be set to display measurements in metric tons, short tons or long tons.
- **Pressure Sensor Units (Real Time Data)**: Select kg/cm^2 or psi for the values displayed on the Real Time Data web page only.
- **Drive System:** Choose between CAN BUS and Hardwired, see Figure 30-7.

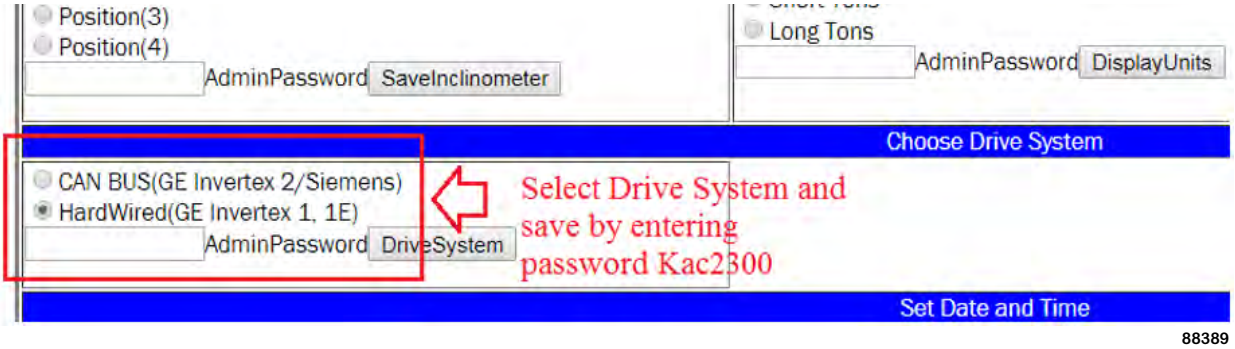


FIGURE 30-7. PLM IV DRIVE SYSTEM SELECTION

- **Date and Time**: If the truck is equipped with KOMTRAX Plus, this parameter of the will be automatically updated when the truck is powered up. If not, the date and time must be set. This parameter will be lost after approximately 30 days without truck power up.
- **Payload Load Light Test**: Proceed to step 10 to perform this test.
- **Payload Gain Factor**: The default parameter is 100%, but it is adjustable between 90% and 110%. It is recommended that this parameter not be changed. A change in this value will affect all payload calculations, which may cause errors.
- **Truck Tare Reset**: This function forces the payload meter to reset the truck tare to its default value. Do not use this function unless the payload meter state machine is locked up or has calculated an unusually low tare value. Check the system for a Sensor Low Pressure alarm.
- **Truck Tire Monitor**: The default is "No Tire Monitor". This selection must be changed if the truck is equipped with a tire pressure monitoring system.

9. To test the functionality of the payload meter load lights and wiring, turn on the brake lock. Click on the check box next to the light(s) to be tested. The lights can be set ON/OFF for five minutes from this web page. After five minutes, the lights will return to their default states.

**** Record on Data Sheet***

Test the following combinations and confirm proper light function:

- Green ON, Amber OFF, Red OFF
- Green OFF, Amber ON, Red OFF
- Green OFF, Amber OFF, Red ON
- Green OFF, Amber OFF, Red OFF

6. When the scan is complete, the available controllers will be shown. Double click the target controller. The KOMTRAX Plus configuration page will open. If no controller is found, refer to the topic "Ethernet connection to KOMTRAX Plus II controller".

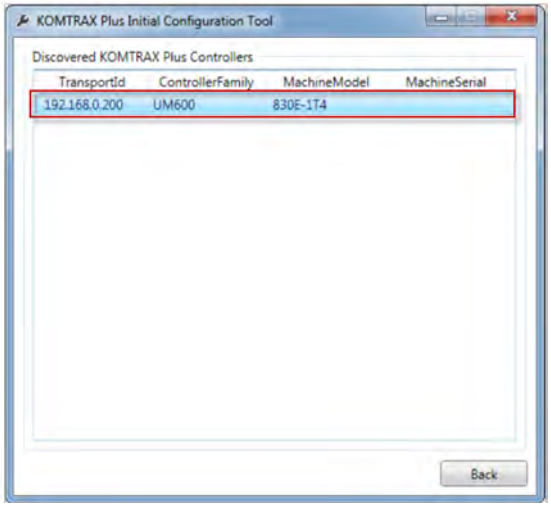


FIGURE 30-6. DISCOVERED KOMTRAX PLUS CONTROLLERS WINDOW

7. Select the **Calendar** tab.
   a. Set the time zone.
   b. Select the **Daylight Saving Time** check box if currently being observed.

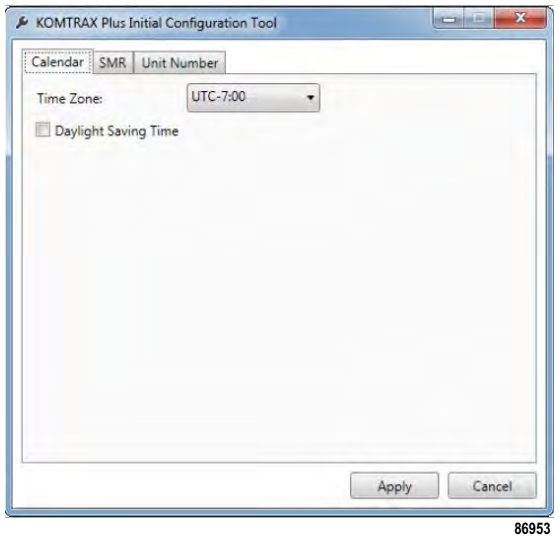


FIGURE 30-7. CALENDAR TAB

8. Select the **Unit Number** tab and enter the truck's unit number. (This is the customer assigned designation for the truck.)

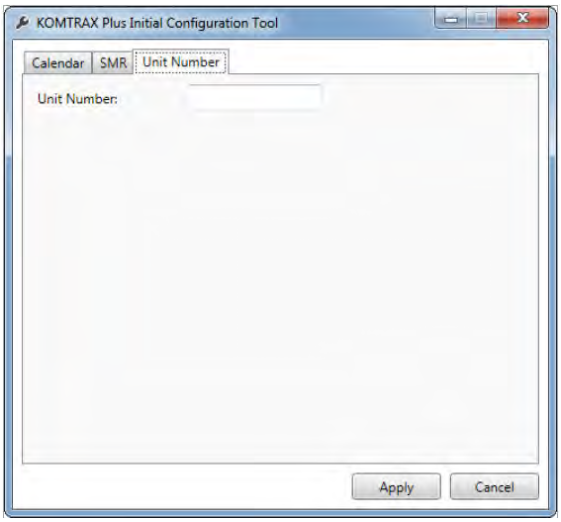


FIGURE 30-8. UNIT NUMBER TAB

9. Click **Apply**. A status window will be displayed. Changes will take approximately three minutes.
10. Click **Next** to review the changes

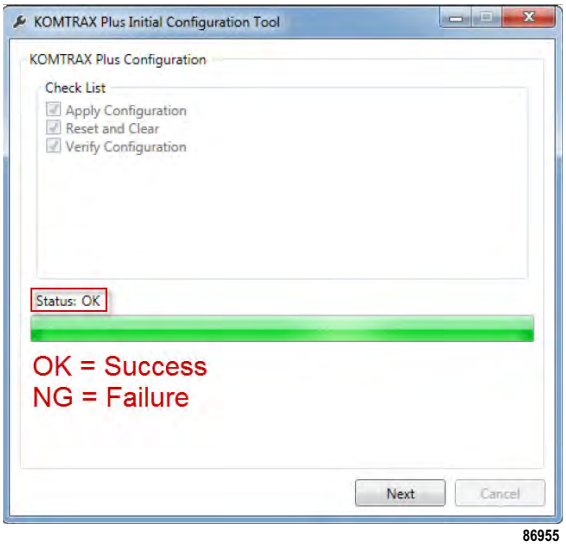


FIGURE 30-9. KOMTRAX PLUS CONFIGURATION STATUS WINDOW

7. Login using the following default settings:
   - Username: **ubnt**
   - Password: **ubnt**
8. Click the **SYSTEM** tab. See Figure 30-2.
9. Set the time zone.
10. Click the magnifying glass icon next to the administrator user name. Enter the default password and choose a new password.
11. Click **Change**, then click **Apply** on the blue ribbon that appears toward the top of the screen. Record the password in a safe place.
12. Under the **Configuration Management** heading, click **Choose File**. Select the Bullet wireless radio configuration file that was downloaded from the extranet.
13. Click **Upload**, then click **Apply** on the blue ribbon that appears toward the top of the screen.

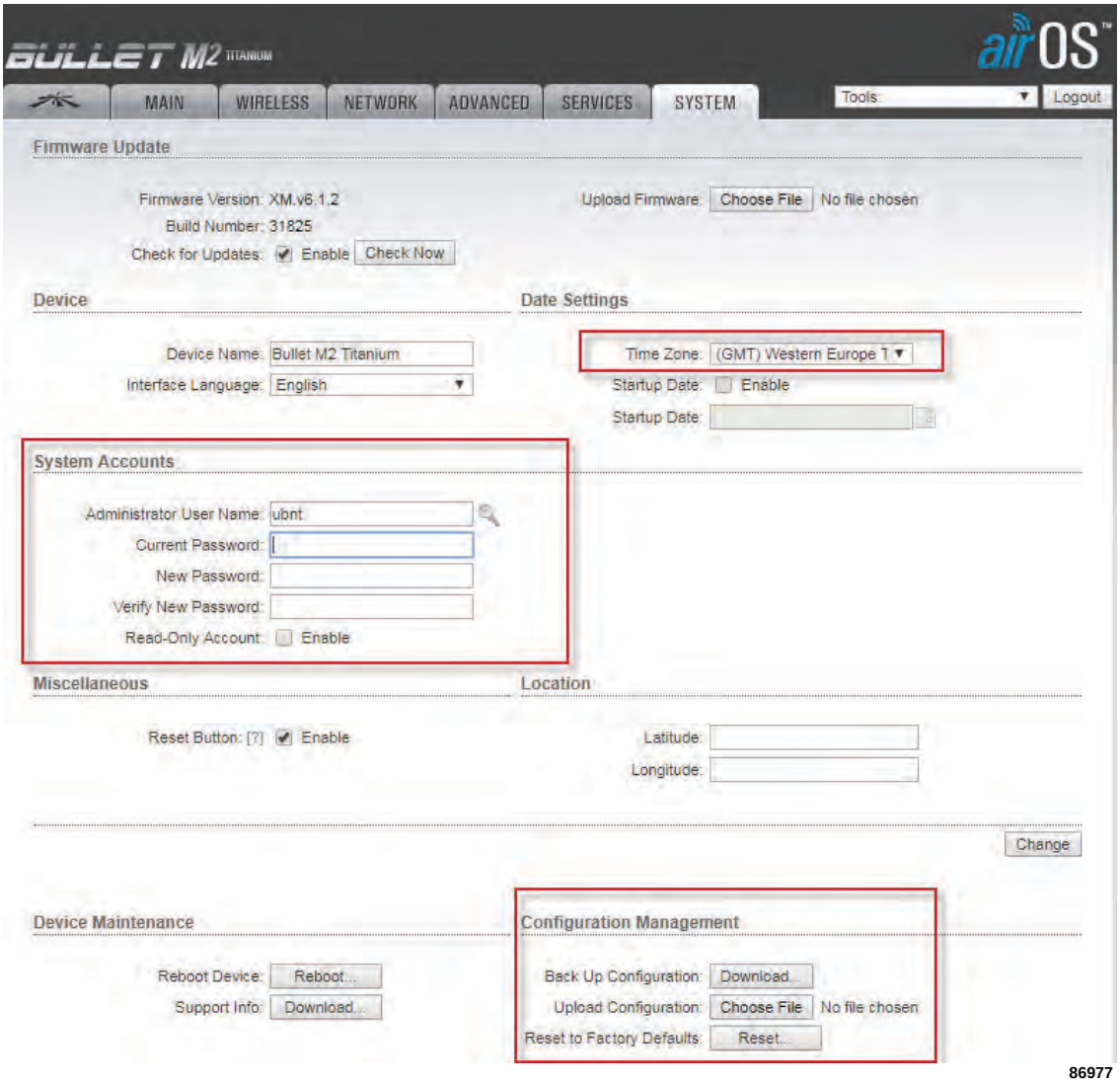


FIGURE 30-2. FIRMWARE UPDATE SCREEN

Service tools and equipment

Recovery/recycle station

Whenever refrigerant must be removed from the system, a dual purpose station (Figure 30-1) performs both recovery and recycle procedures which follows the new guidelines for handling used refrigerant. The recovered refrigerant is recycled to reduce contaminants, and can then be reused in the same machine or fleet.

To accomplish this, the recovery/recycle station separates the oil from the refrigerant and filters the refrigerant multiple times to reduce moisture, acidity, and particulate matter found in a used refrigerant.

NOTE: To be re-sold, the gas must be "reclaimed" which leaves it as pure as new, but requires equipment normally too expensive for all but the largest refrigeration shops.

Equipment is also available to just remove or extract the refrigerant. Extraction equipment does not clean the refrigerant; it is used to recover the refrigerant from an A/C system prior to servicing.

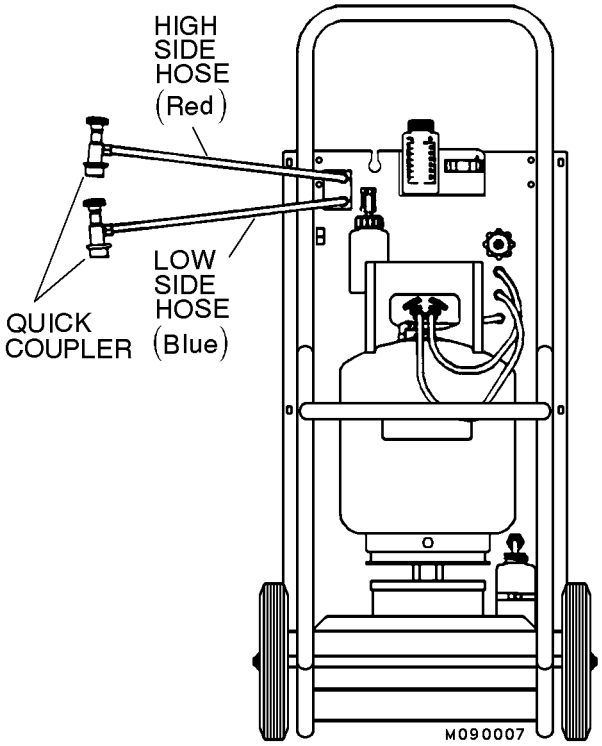


FIGURE 30-1. RECOVERY/RECYCLE STATION

CAUTION

Mixing different types of refrigerant will damage equipment. Dedicate one recovery/recycle station to each type of refrigerant processing to avoid equipment damage. DISPOSAL of the gas removed requires laboratory or manufacturing facilities.

Test equipment is available to confirm whether the refrigerant in the system is actually the type intended for the system and has not been contaminated by a mixture of refrigerant types.

Recycling equipment must meet certain standards as published by the Society of Automotive Engineers (SAE) and carry a UL approved label. The basic principals of operation remain the same for all machines, even if the details of operation differ somewhat.

Leak detector

The electronic leak detector (Figure 30-2) is very accurate and safe. It is a small hand-held device with a flexible probe used to seek refrigerant leaks. A buzzer, alarm or light will announce the presence of even the smallest leak.

Some leak detectors are only applicable to one type of refrigerant. Ensure that the leak detector being used applies to the refrigerant in the system.

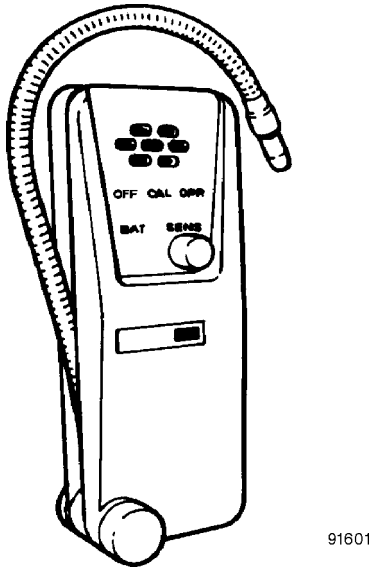


FIGURE 30-2. TYPICAL ELECTRONIC LEAK DETECTOR

DUMP TRUCK

730E
830E
860E
930E
960E
980E

Machine model	Serial number
730E-10	A50002 and up
830E-5	A50005 and up
830E-5AT	A50005 and up
860E-1K	A30031 - A30035, A30041, A30042, A30044 - A30046, A30101, A30107 - A30110, A30117, A30118
860E-1KT	A30004 - A30030, A30036 - A30040, A30043, A30047 - A30100, A30102 - A30106, A30111 - A30116

Machine model	Serial number
930E-5	A40004 and up
930E-5AT	A40004 and up
960E-2	A30027 and up
980E-5	A50005 and up
980E-5AT	A50005 and up

30 Testing and adjusting
Automatic lubrication (auto lube) system

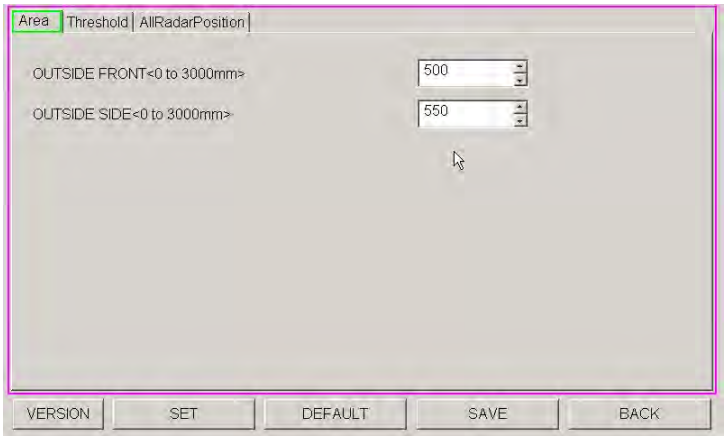


FIGURE 30-7. RADAR SETTING SCREEN - AREA TAB

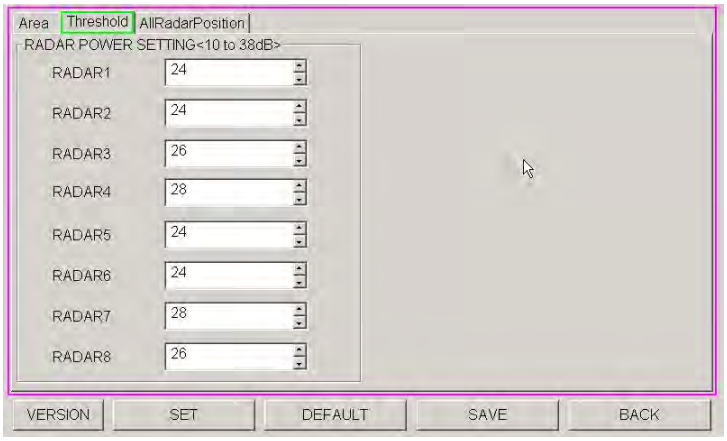


FIGURE 30-8. RADAR SETTING SCREEN - THRESHOLD TAB

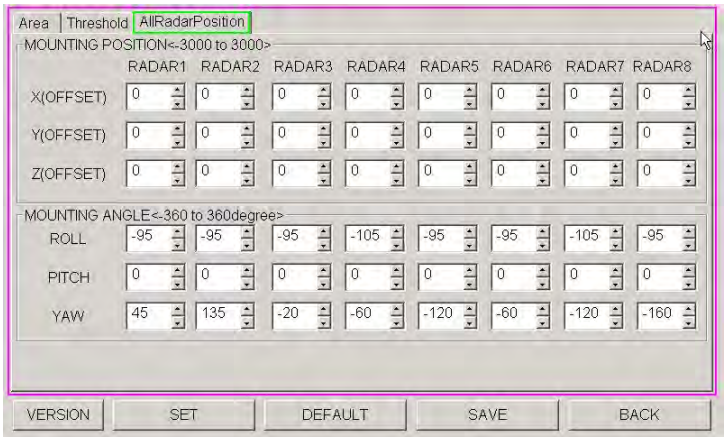
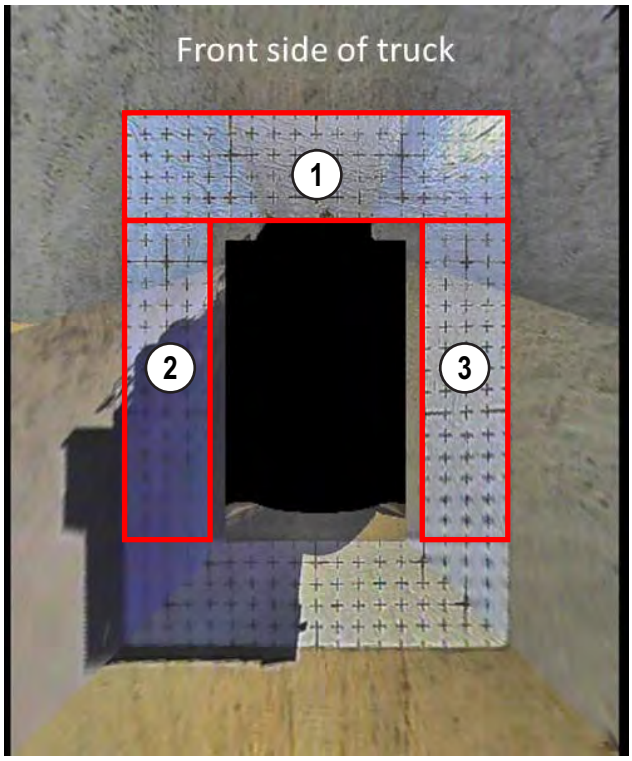


FIGURE 30-9. RADAR SETTING SCREEN - ALL RADAR POSITION TAB

The left calibration sheet and the right calibration sheet are constructed to be perpendicular to the front calibration sheet.

After each calibration sheet is in place, use stakes to secure the two corners of side which contacts the front calibration sheet to the ground.



85242

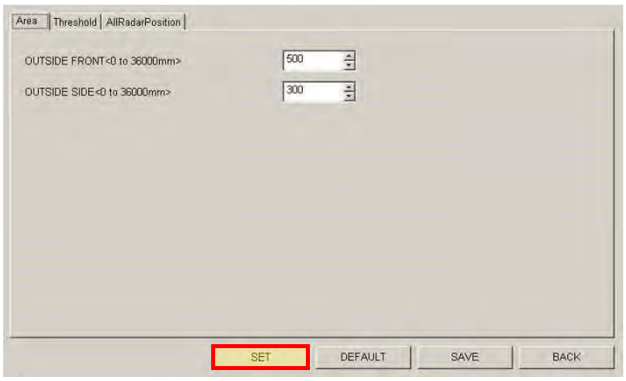
FIGURE 30-15. LEFT AND RIGHT CALIBRATION SHEET LAYOUT

Temporarily place the rear calibration sheet so that it is adjacent to the back end of left calibration sheet and the back end of the right calibration sheet (similar to the front calibration sheet).

The central line of truck is measured from the body frame. The position of the rear calibration sheet must be adjusted so that the center of rear calibration sheet is aligned with the central line of truck.

Make adjustments so that the grid lines of the rear calibration sheet and the grid lines of the left and right calibration sheets are in alignment. After the calibration sheets are in place and correctly adjusted, use stakes to secure the remaining corners to the ground.

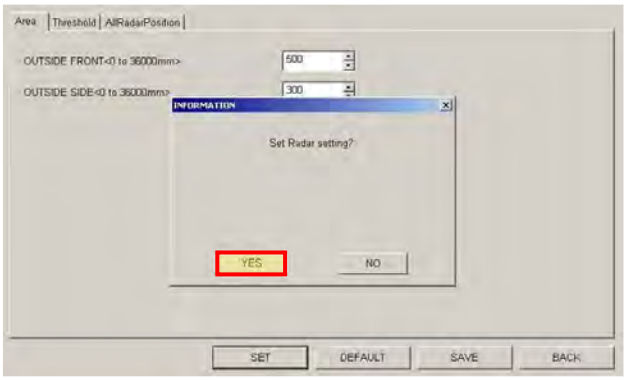
7. Select RADAR SETTING in the maintenance screen (Figure 30-42). In the Area tab, select the SET button. See Figure 30-44.



85265

FIGURE 30-44. AREA SCREEN

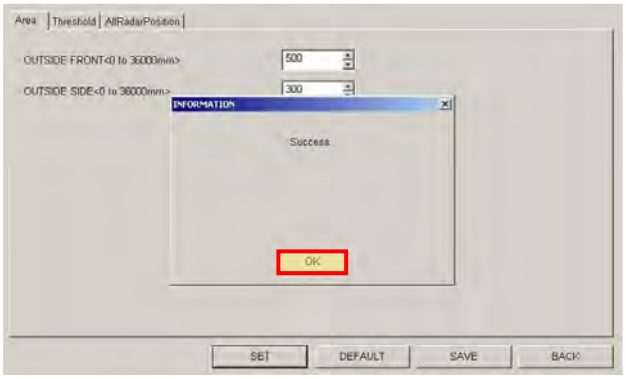
a. Select YES in the "Set Radar setting?" screen. See Figure 30-45.



85265

FIGURE 30-45. RADAR SCREEN

b. When SET is successful, select OK when the "Success" window appears. See Figure 30-46.



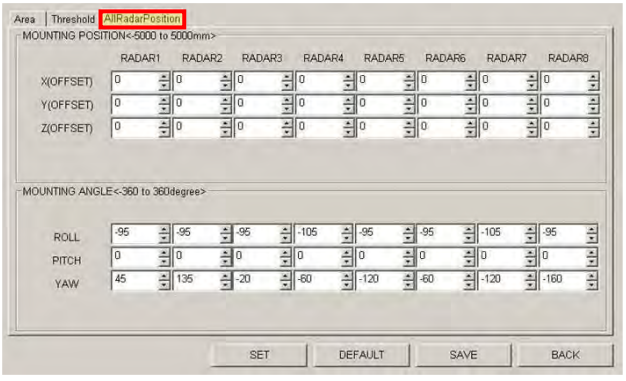
85265

FIGURE 30-46. RADAR SCREEN

8. Radar setting is complete. Select the BACK button to return to the maintenance screen.

⚠ IMPORTANT ⚠

If a radar is attached to the truck in a different position at the user's order, select the AllRadarPosition tab of the RADAR SETTING screen and input the values of for that radar's MOUNTING POSITION and MOUNTING ANGLE.



85268

FIGURE 30-47. ALLRADARPOSITION SCREEN

DUMP TRUCK

930E

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

40 Troubleshooting
Fuse, diode and relay locations

Fault Code A017

Description	A payload memory flash memory read has failed.
Fault Conditions	Sets if Payload meter reports a failure of flash memory read. Resets if the PLM has been reset or replaced.
Resulting Problem(s)	Payload and haul cycle data is bad.
Alert to Operator	**Display Fault Description**: PLM FLASH MEM READ **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 totally contained within the payload meter.
Component/Circuit Schematic Search	None
Expected State	None

Fault Code A123

Description	The drive system has generated a reduced retarding caution.
Fault Conditions	Sets if the drive system controller generates a reduced retarding event. Resets if drive system removes the reduced retarding event.
Resulting Problem(s)	Retarding will be at somewhat reduced level, but the truck can still be driven.
Alert to Operator	Alarm Buzzer **Display Fault Description**: REDUCED RETARDING **Display Operator Action**: SLOW DOWN HILL
Related Information	1. A laptop running “IM Realtime Data Monitor” or "WebPTU " software may be required to resolve this fault. 2. This fault is generated by the drive system by placing a message on CAN/RPC in response to a problem in the propel system. The CAN/RPC circuits or drive system controller may have a related fault that can be used to resolve the problem.
Component/Circuit Schematic Search	CAN/RPC connection **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: 0: fault not present. 1: fault active.

Fault Code A152

Description	Starter Failure
Fault Conditions	Sets if either starter motor is not energized for 2 seconds when cranking is attempted. Resets only when steering bleed occurs.
Resulting Problem(s)	One good starter may be destroyed or engine may not start at all.
Alert to Operator	Repair Monitor Indicator Lamp **Display Fault Description**: STARTER FAILURE **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	Motor Starter 1 (STRT1) **(730E, 830E, 930E, 980E)**
	Motor Starter 2 (STRT2) **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: IM receives input on IM3R and IM3S from each starter when energized. 0: starter motor not energized. 1: starter motor energized.
Component/Circuit Schematic Search	Crank Sense **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: IM receives input on IM3U when cranking has been enabled and attempted. 0: no cranking in process. 1: cranking in process.

Fault Code A184

Description	The J1939 data link is not connected.
Fault Conditions	Sets if no data is received from the engine for 10 seconds after an initial 11 second delay at keyswitch ON. Resets immediately when communication is established.
Resulting Problem(s)	Loss of engine data makes it impossible to operate the truck in a normal manner without risking serious damage to the engine.
Alert to Operator	Warning Monitor Indicator Lamp Alarm Buzzer **Display Fault Description**: NO ENGINE DATA **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 the IM in response to a problem on the J1939 CAN communications with the engine. The CAN circuit may have a related fault that can be used to resolve the problem.
Component/Circuit Schematic Search	CAN J1939 Data Link connection **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: The IM should be receiving messages from engine on inputs (IM1q,r,s). J1939 connected: reading of PGN 61444 is successful. J1939 not connected: no communication for 10 seconds if keyswitch has been on for 11 seconds.

Fault Code A204

Description	Steering Pressure Sensor Low
Fault Conditions	Sets if: Sensor pressure is at -2765 kPa (-401 psi) 2.4 mA for 5 seconds. Cranking state is not sensed. Engine speed is less than 600 RPM. Battery voltage is less than 18 V. Resets at -1420 kPa (-206 psi) 3.2 mA.
Resulting Problem(s)	Monitoring of steering pressure in KOMTRAX Plus 2 will be compromised.
Alert to Operator	**Display Fault Description**: STRG PRES 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 Steering Pressure (**730E**. **830E**, **930E, 980E)**
Expected State	Sensor data: Normal reading: 2.4 to 20.1 mA.

Fault Code A236

Description	The steering accumulator has not properly bled down after 90 seconds.
Fault Conditions	Sets if the steering accumulator bleed pressure switch does not indicate bleeddown complete within 90 seconds. Resets either at power down, or if keyswitch is turned back on, thereby turning off the steering bleed valve.
Resulting Problem(s)	Failure to bleed the steering accumulator can create dangerous situations under the truck.
Alert to Operator	Warning Monitor Indicator Lamp Alarm Buzzer **Display Fault Description**: STEERING BLEED FLT **Display Operator Action**: PARK: DO NOT STEER
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.
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 key off initiates steering bleed operation. **Status - Open Load:** Expected with engine start switch on. No problem. Otherwise, unexpected. Must troubleshoot. **Status - Normal:** Expected only with key off and steering bleed in process. Trouble shoot if found with key on. **Status - Shorted to Ground:** Unexpected. Troubleshoot. **Status - Overload:** Unexpected. Troubleshoot.

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 A282

Description	Excessive cranking counts or jump starts without the engine running.
Fault Conditions	Sets if: A continuous cranking cycle of 30 seconds is detected (this increases the crank count by one). Each time a jump start is attempted (engagement of either starter without start enable). A count of 7 disables further start attempts until the power is shut off. Resets when the power is shut off.
Resulting Problem(s)	Excessive cranking destroys starters.
Alert to Operator	Warning Monitor Indicator Lamp Alarm Buzzer **Display Fault Description**: EXCESS CRANKING **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. 3. The normal corrective measure for this fault is to check and correct engine and/or starting system deficiencies.
Component/Circuit Schematic Search	Crank Sense **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: IM receives input on IM3U when cranking has been attempted. 0: No cranking is in process. 1: Cranking is in process.

Fault Code A305

Description	Auto lube circuit is defective.
Fault Conditions	Sets if: Drive system control power on after 5 seconds. Solenoid sense occurs with lube output off. Pressure switch stays on. Circuit is open or short to ground. Resets at power down.
Resulting Problem(s)	Automatic lubrication may not work.
Alert to Operator	Repair Monitor Indicator Lamp **Display Fault Description**: AUTO LUBE CIRCUIT **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	Switch Auto Lube Pressure **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: The IM receives input on IM3Y from auto lube pressure switch as confirmation that lubrication has occurred. 0: Pressure switch has transferred at 2000 psi. 1: Pressure switch at low pressure or solenoid circuit not on.
Component/Circuit Schematic Search	Autolube Solenoid **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: IM provides output on IM3T to control lubrication. 0: Turns off between lubrication cycles. 1: Turns on during lubrication cycle. **Status - Open Load:** Unexpected. Troubleshoot. **Status - Normal:** Expected. No problem. **Status - Shorted to Ground:** Unexpected except momentarily at termination of a lube cycle. If detected any other time, troubleshoot. **Status - Overload:** Unexpected. Troubleshoot.

Fault Code A333

Description	The hydraulic ladder controller has declared a ladder fault.
Fault Conditions	Sets if the hydraulic ladder controller declares a fault. Resets when the hydraulic ladder controller clears the fault.
Resulting Problem(s)	Ladder may not stow properly for traveling or may not operate for ascent or descent.
Alert to Operator	Warning Monitor Indicator Lamp Alarm Buzzer **Display Fault Description**: HYD LADDER FAULT **Display Operation Action**: STOP: PARK: REPAIR
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. This fault is generated by the hydraulic ladder controller in response to problems within the controller or external switches, and limit switches that control the hydraulic ladder.
Component/Circuit Schematic Search	Hydraulic Ladder Alarm **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: The IM receives input on IM2a that there is a problem with the ladder. 0: No alarm exists. 1: Aarm exists.

Fault Code A347

Description	Operator override of drive system is active.
Fault Conditions	Sets when drive system transmits an Operator Override of Drive System Active message on CAN/RPC. Resets when drive system clears the Operator Override of Drive System Active message on CAN/RPC.
Resulting Problem(s)	Truck performance will be limited.
Alert to Operator	Alarm Buzzer **Display Fault Description**: OVERRIDE ACTIVE **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. 4. Troubleshoot the override switch and override input to drive system.
Component/Circuit Schematic Search	CAN/RPC connection **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: The IM should receive OVERRIDE ACTIVE messages from the drive system on CAN inputs (IM1i,j,k).

Fault Code A360

Description	Overload on output 1S.
Fault Conditions	Sets if driver chip detects over current or over temp on output 1S. Output is turned off when overload is detected. Resets at power down.
Resulting Problem(s)	Unused outputs with short circuits on them might damage the driver chip if not corrected.
Alert to Operator	Repair Monitor Indicator Lamp **Display Fault Description**: IM OUTPUT 1S FAULT **Display Operator Action**: None
Related Information	1. A laptop running “IM Realtime Data Monitor” software may be required to resolve this fault. 2. Any spare wires connected to this output should be removed to prevent ultimate failure of the driver chip.
Component/Circuit Schematic Search	Spare IM Output (IM1S) **(730E, 830E, 930E, 980E)**
Expected State	Sensor data: 0: Off 1: On **Status - Open Load:** Unexpected. Troubleshoot. **Status - Normal:** Expected. No problem. **Status - Shorted to Ground:** Unexpected. Troubleshoot. **Status - Overload:** Unexpected. Troubleshoot.

Fault Code A402

Description	Tire 1 (Front Left) 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 comes on.
Resulting Problem(s)	Potential tire damage.
Alert to Operator	Warning Monitor Indicator Lamp Alarm Buzzer **Display Fault Description**: #1 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 1 Data from Tire Monitor on CAN/RPC (IM1i,j,k).

Fault Code A415

Description	Tire 2 (Front Right) 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 #2 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 2 Data from Tire Monitor on CAN/RPC (IM1i,j,k).

Fault Code A428

Description	Tire 4 (Rear Left Inboard) No Data / Sensor Failure / Not Connected Fault.
Fault Conditions	Sets if Tag Time Out is on and Bad Value Sensor Error / Not Connected Fault is not on. Resets if conditions change.
Resulting Problem(s)	Loss of tire monitoring could permit tire damage.
Alert to Operator	Repair Monitor Indicator Lamp **Display Fault Description**: TIRE #4 NO DATA **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 4 Data from Tire Monitor on CAN/RPC (IM1i,j,k).

Fault Code A441

Description	Tire 6 (Rear Right Outboard) High Pressure AMBER Fault.
Fault Conditions	Sets if pressure band AMBER high 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**: #6 TIRE PRESSURE HI **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 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 6 Data from Tire Monitor on CAN/RPC (IM1i,j,k).

No.	Cause	Procedure, measuring location, criteria and remarks
6	Pin-to-Ground short circuit	Disconnect the OEM harness from the ECM connector. Disconnect the ambient air temperature sensor from the OEM harness. Measure the resistance between the signal pin and all other pins on Komatsu harness connector and engine block ground. If it is less than 100k ohms, a pin-to-pin short circuit on the signal wire has been detected. Identify and repair/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	SH6: A7
830E-5	58E-06-02310- 58E-06-02315	SH8: A7
830E-5	58E-06-02316- 58E-06-0231x	SH6: A7
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH9: A7 SH10: A7
930E-5 /5SE	58F-06-02316- 58F-06-0231x	SH7: A7 SH8: A7
980E-5	58B-06-02390- 58B-06-02392	SH8:A7
980E-5	58B-06-02393- 58B-06-0239x	SH6:A7

Fault Code CA1683

Fault Description	Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Voltage Above Normal or Shorted to High Source. High signal voltage detected at the aftertreatment diesel exhaust fluid tank heater.
Operator Action	Follow digital display instructions. DEF tank heating is disabled. Engine torque is reduced if 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 diesel exhaust fluid (DEF) tank heater keeps the DEF from freezing in the DEF tank. The tank heater consists of an electrically powered tank heater control valve which controls the flow of engine coolant to a heating coil inside the DEF. The tank heater control valve opens to allow coolant to flow to the heating coil when heating is commanded and closes when heating is no longer required. The ECM detected the aftertreatment DEF tank heater circuit is shorted to battery or open circuit.
Component Location	The DEF tank heater control valve is located under the DEF tank's lower cover. The tank heating coil is part of the head unit which mounts to the top of the DEF tank.

No.	Cause	Procedure, measuring location, criteria and remarks
1	Dirty/Damaged sensor connector pins	Disconnect the aftertreatment DEF tank heater control valve from the OEM harness. Check for dirty or damaged connector pins at the DEF tank heater control valve and at the engine ECM connections. Clean or repair connector pins, if possible.
2	Circuit Response	Disconnect the aftertreatment DEF tank heater control valve from the OEM harness. Place a jumper wire between the aftertreatment DEF tank heater control valve Signal pin and the aftertreatment DEF tank heater control valve Return pin at the aftertreatment DEF tank heater control valve of the Komatsu harness connector. Check for active fault code. Fault code CA1684 is active? - If yes, then go to step 3. - If no, then go to step 4.
3	Fault codes	Connect the aftertreatment DEF tank heater control valve to the OEM harness. Check for an appropriate circuit response after 30 seconds. Check for active fault codes. - If CA1683 is active, then the replace the aftertreatment DEF tank heater control valve. - If CA1683 is not active, then go to step 8.
4	Komatsu harness	Ensure harness is pinned correctly, no damage to connector, and run continuity check on wires.

Fault Code CA1715

Fault Description	Aftertreatment Diesel Exhaust Fluid Quality – Root Cause Not Known
Operator Action	Follow digital display instructions. Engine may be shut down.
Related Information	The aftertreatment diesel exhaust fluid (DEF) quality sensor is a smart device that communicates to the ECM via the J1939 data link. The aftertreatment DEF quality sensor performs its own internal diagnostics and reports malfunctions back to the primary engine control module via the J1939 data link. The aftertreatment DEF quality sensor is used to measure the concentration of the aftertreatment diesel exhaust fluid in the tank. The DEF quality sensor has detected a read or write error internal to the quality sensor sensing module. Possible causes of this fault code include: This fault code sets when the ECM detects an internal reset of the sensor. This internal reset is caused by an intermittent voltage supply. All wiring and connectors should be closely inspected for intermittent connections.
Component Location	The aftertreatment DEF quality sensor is part of the DEF head unit in 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 to see if fault code CA3868 is active? - If yes, then go to fault code CA3868 troubleshooting tree. - If no, then an internal malfunction has been detected in the aftertreatment DEF quality sensor. Replace the aftertreatment DEF quality sensor.
2	DEF quality sensor	Unplug Komatsu harness connector from DEF tank head unit and plug it into another DEF tank head unit to verify the fault code still exists. If fault code goes away, replace original head unit.
3	Komatsu harness	Ensure harness is pinned correctly, no damage to connector, and run continuity check on wires.
4	Cummins ECM or ECM calibration out of date	Refer to Cummins technician.

Wiring Diagram Information

	Schematic	Reference Location(s)
730E-10	58D-06-0171x	SH6: N9 SH6:N10
830E-5	58E-06-02310- 58E-06-02315	SH8: O10 SH8:O11
830E-5	58E-06-02316- 58E-06-0231x	SH6: O10 SH6:O11
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH9:M11 SH10:K8

Fault Code CA3147

Fault Description	Aftertreatment SCR Outlet Temperature Sensor Circuit - Voltage Below Normal or Shorted to Low Source. A Low 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 low. 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.

Wiring Diagram Information

	Schematic	Reference Location(s)
730E-10	58D-06-0171x	SH6: C19
830E-5	58E-06-02310- 58E-06-02315	SH8: C19
830E-5	58E-06-02316- 58E-06-0231x	SH6: C19

No.	Cause	Procedure, measuring location, criteria and remarks
6	Pin-to-Pin short circuit	Disconnect OEM harness connector from ECM. Disconnect the aftertreatment 1 DEF line heater relay from the OEM harness connector. Measure the resistance between the aftertreatment 1 DEF line heater relay signal pin at the Komatsu harness ECM connector and all other pins in the connector. - If greater than 100k ohms, then go to step 7. - If not greater than 100k ohms, then a pin-to-pin short circuit on the signal wire has been detected in the harness. Repair or replace the damaged section of the harness.
7	Cummins 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

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 CA3878

Fault Description	Aftertreatment Diesel Exhaust Fluid Quality - Data Erratic, Intermittent, or Incorrect
Operator Action	Follow digital display instructions. DEF injection is disabled. Engine torque will be reduced.
Related Information	The DEF quality sensor is a smart device and communicates with the engine ECM via the J1939 data link. The DEF quality sensor receives power and ground directly from the battery. The sensor performs its own internal diagnostics and reports malfunctions back to the primary engine ECM via the J1939 data link. The DEF quality sensor is used to measure the concentration of the DEF in the tank. Possible causes of this fault code include a damaged sensor.
Component Location	The DEF quality sensor is part of the DEF tank head unit, located inside the DEF tank.

No.	Cause	Procedure, measuring location, criteria and remarks
1	Fault Code Check	Disconnect the DEF harness from the DEF tank head unit. Connect DEF harness to another DEF tank head unit to verify Fault Code occurrence. If the fault code is then inactive, replace DEF tank head unit.
2	Check the DEF concentration	Use a DEF refractometer to measure the concentration of the DEF in the tank. - If the DEF concentration is within 32.5 +/- 1.5 percent, a malfunctioning DEF quality sensor has been detected. - If the DEF concentration is not within 32.5 +/- 1.5 percent, then drain the DEF tank and fill with new DEF.
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	SH6: N9 SH6:N10
830E-5	58E-06-02310- 58E-06-02315	SH8: O10 SH8:O11
830E-5	58E-06-02316- 58E-06-0231x	SH6: O10 SH6:O11
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH9:M11 SH10:K8 SH10:K9
930E-5 /5SE	58F-06-02316- 58F-06-0231x	SH7:M11 SH8:K8 SH8:K9
980E-5	58B-06-02390- 58B-06-02392	SH8:M8 SH8:M9
980E-5	58B-06-02393- 58B-06-0239x	SH6:M8 SH6:M9

Fault Code CA4121

Fault Description	Aftertreatment 2 SCR Catalyst Outlet Gas Temperature – Voltage Below Normal or Shorted to Low Source. Low 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 low. 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 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-Tier IV 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.

Wiring Diagram Information

	Schematic	Reference Location(s)
730E-10	58D-06-0171x	SH6: E19
830E-5	58E-06-02310- 58E-06-02315	SH8: E19
830E-5	58E-06-02316- 58E-06-0231x	SH6: E19

Fault Code CA4168

Fault Description	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit 1 Heater Circuit – Voltage Above Normal or Shorted to High Source. High signal voltage detected at the aftertreatment diesel exhaust fluid dosing unit heater circuit.
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 diesel exhaust fluid dosing unit heater is used to defrost and/or prevent freezing of the diesel exhaust fluid dosing unit. The ECM detected the aftertreatment DEF dosing unit heater circuit is shorted to battery or open circuit.
Component Location	The DEF dosing units are located on the underside of the DEF tank.

No.	Cause	Procedure, measuring location, criteria and remarks
1	Dirty/Damaged sensor connector pins	Disconnect the DEF dosing unit heater control valve from the DEF harness. Check for dirty or damaged connector pins on the DEF tank level sensor. Clean or repair connector pins, if possible.
2	Circuit Response	Disconnect the aftertreatment DEF dosing unit heater control valve from the DEF harness. Place a jumper wire between the aftertreatment DEF dosing unit heater control valve Signal pin and the aftertreatment DEF dosing unit heater control valve Return pin at the aftertreatment DEF dosing unit heater control valve of the DEF harness connector. Check for active fault code. Fault Code CA4169 is active? - If yes, then go to step 3. - If no, then go to step 4.
3	Fault codes	Connect the aftertreatment DEF dosing unit heater control valve to the DEF harness. Check for active fault codes. - If CA4168 is active, then the replace the aftertreatment DEF dosing unit heater control valve. - If CA4168 is not active, then go to step 8.
4	DEF harness	Ensure harness is pinned correctly, no damage to connector, and run continuity check on wires.
5	Open Circuit	Disconnect DEF harness from ECM. Measure the resistance between the aftertreatment DEF dosing unit heater control valve Signal pin at the dosing unit heater control valve wiring harness connector and the aftertreatment DEF dosing unit heater control valve Signal pin at the DEF harness ECM connector. - If less than 10 ohms, then go to step 6. - If not less than 10 ohms, then an open signal circuit has been detected in the harness. Repair or replace the damaged section of harness.

	Schematic	Reference Location(s)
830E-5	58E-06-02316- 58E-06-0231x	SH6: O10 SH6:O11
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH9:M11 SH10:K8 SH10:K9
930E-5 /5SE	58F-06-02316- 58F-06-0231x	SH7:M11 SH8:K8 SH8:K9
980E-5	58B-06-02390- 58B-06-02392	SH8:M8 SH8:M9
980E-5	58B-06-02393- 58B-06-0239x	SH6:M8 SH6:M9

No.	Cause	Procedure, measuring location, criteria and remarks
5	Open circuit in the harness	With the DEF harness still disconnected from the doser and the engine harness, measure the resistance between the aftertreatment 2 DEF pressure sensor Return pin of the DEF harness ECM connector and the aftertreatment 2 DEF pressure sensor Return pin in the DEF harness dosing valve connector. - If less than 10 ohms, then go to step 6 - If not less than 10 ohms an open return circuit has been detected in the harness. Repair or replace the damaged section of harness.
6	Pin-to-Pin short circuit in the harness	With the DEF harness still disconnected from the doser and the engine harness, measure the resistance between the aftertreatment DEF pressure sensor Signal pin of the DEF harness ECM connector and all other pins in the DEF harness ECM connector. - If greater than 100K ohms, then go to step 7 - If less than 100K ohms a pin-to-pin short circuit on the signal wire has been detected in the harness. Repair or replace the damaged section of harness.
7	Pin-to-Pin short circuit in the harness	With the DEF harness still disconnected from the doser and the engine harness, measure the resistance between the aftertreatment DEF pressure sensor Supply pin of the DEF harness ECM connector and all other pins in the DEF harness ECM connector. - If greater than 100K ohms, then go to step 8 - If less than 100K ohms a pin-to-pin short circuit on the supply wire 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 CA4474

Fault Description	Aftertreatment 2 Diesel Exhaust Fluid Dosing Temperature Sensor Circuit – Voltage Above Normal or Shorted to High Source. High signal voltage detected at the diesel exhaust fluid dosing temperature sensor circuit.
Operator Action	Follow digital display instructions.
Related Information	The aftertreatment diesel exhaust fluid (DEF) dosing temperature sensor is a variable resistor sensor and is used to measure the temperature of the DEF in the dosing valve. The engine control module (ECM) supplies 5 volts to the aftertreatment DEF dosing temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the aftertreatment DEF dosing temperature. The Engine Control Module (ECM) detected the aftertreatment diesel exhaust fluid dosing temperature sensor signal circuit was out of range high. Possible causes of this fault code include: Signal circuit shorted to sensor supply or battery voltage. A malfunctioning aftertreatment DEF dosing temperature sensor
Component Location	The DEF temperature sensor is 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	Dirty/Damaged sensor connector pins	Disconnect the aftertreatment 2 DEF dosing vale from the DEF harness. Check for dirty or damaged connector pins on the DEF dosing unit. Clean or repair connector pins, if possible.
2	Circuit Response	Disconnect the aftertreatment 2 DEF dosing valve from the DEF harness. Check for an appropriate circuit response after 30 seconds. Check for active fault code. Fault Code CA4475 is active and fault code CA4474 is inactive? - If yes, then go to step 3 - If no, then go to step 4
3	Fault codes	Connect the aftertreatment 2 DEF dosing valve to the DEF harness. Check for an appropriate circuit response after 30 seconds. Check for active fault codes. - If 4474 is active, then s damaged temperature sensor has been detected in the aftertreatment 2 DEF dosing valve. Replace the aftertreatment 2 DEF dosing valve. - If 4474 is not active, then go to step 6.
4	DEF harness	Ensure harness is pinned correctly, no damage to connector, and run continuity check on wires.

Fault Code CA4679

Fault Description	Aftertreatment 1 diesel exhaust fluid (DEF) tank level sensor circuit – current below normal or open circuit. Low current or an open circuit has been detected at the DEF tank level sensor.
Operator Action	Follow digital display instructions. Possible disabled DEF injection and/or reduced engine performance.
Related Information	The aftertreatment DEF tank level sensor is a smart device used to measure the level 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 tank level sensor is used to measure the level of the aftertreatment diesel exhaust fluid in the tank. Possible cause of this fault code: Malfunctioning aftertreatment DEF quality sensor
Component Location	The DEF tank level 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	Fault codes	Check for active fault codes. Is fault codes CA3868 or CA4572 active? - If yes, then go to the appropriate fault code troubleshooting tree. - If no, then a circuit malfunction has been detected in the aftertreatment diesel exhaust fluid (DEF) tank level sensor. Replace the aftertreatment DEF tank level sensor.
2	Cummins ECM or ECM calibration out of date	Refer to Cummins technician.

Wiring Diagram Information

	Schematic	Reference Location(s)
730E-10	58D-06-0171x	SH6: N9 SH6:N10
830E-5	58E-06-02310- 58E-06-02315	SH8: O10 SH8:O11
830E-5	58E-06-02316- 58E-06-0231x	SH6: O10 SH6:O11
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH9:M11 SH10:K8 SH10:K9
930E-5 /5SE	58F-06-02316- 58F-06-0231x	SH7:M11 SH8:K8 SH8:K9
980E-5	58B-06-02390- 58B-06-02392	SH8:M8 SH8:M9
980E-5	58B-06-02393- 58B-06-0239x	SH6:M8 SH6:M9

Fault Code CA4842

Fault Description	Aftertreatment 1 diesel exhaust fluid (DEF) quality – Data valid but above normal operating range – lease severe level. The DEF quality sensor has detected an in-range high condition.
Operator Action	Follow digital display instructions. Possible reduced engine performance.
Related Information	The aftertreatment diesel exhaust fluid quality sensor is a smart device that communicates to the ECM via the J1939 datalink. The aftertreatment diesel exhaust fluid quality sensor performs its own internal diagnostics and reports malfunctions back to the primary engine control module via the J1939 datalink. 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 quality 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	DEF tank contamination	Inspect the DEF tank for diesel fuel contamination. Using a DEF refractometer, measure the DEF concentration. - If the concentration is within 32.5 ± 1.5 percent, proceed to unplug Komatsu harness connector from DEF tank head unit and plug it into another DEF tank head unit to verify a malfunctioning DEF quality sensor has been detected. - If the concentration is NOT within 32.5 ± 1.5 percent, drain the DEF tank and fill with new DEF.
2	Cummins ECM calibration	Refer to Cummins technician.

Wiring Diagram Information

	Schematic	Reference Location(s)
730E-10	58D-06-0171x	SH6: N9 SH6:N10
830E-5	58E-06-02310- 58E-06-02315	SH8: O10 SH8:O11
830E-5	58E-06-02316- 58E-06-0231x	SH6: O10 SH6:O11
930E-5 /5SE	58F-06-02310- 58F-06-02315	SH9:M11 SH10:K8 SH10:K9
930E-5 /5SE	58F-06-02316- 58F-06-0231x	SH7:M11 SH8:K8 SH8:K9
980E-5	58B-06-02390- 58B-06-02392	SH8:M8 SH8:M9
980E-5	58B-06-02393- 58B-06-0239x	SH6:M8 SH6:M9

	Schematic	Reference Location(s)
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

	Schematic	Reference Location(s)
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

No.	Cause	Procedure, measuring location, criteria and remarks
6	Open 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 pressure 2 sensor Supply pin of the DEF harness ECM connector and the aftertreatment 1 DEF pressure 2 sensor Supply pin in the DEF harness aftertreatment 1 DEF dosing valve 2 connector. - If less than 10 ohms, then go to step 7 - If not less than 10 ohms an open supply circuit has been detected in the harness. Repair or replace the damaged section of harness.
7	Open 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 pressure 2 sensor Signal pin of the DEF harness ECM connector and the aftertreatment 1 DEF pressure 2 sensor Signal pin in the DEF harness aftertreatment 1 DEF dosing valve 2 connector. - If less than 10 ohms, then go to step 8 - If not less than 10 ohms an open signal circuit has been detected in the harness. Repair or replace the damaged section of harness.
8	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 pressure 2 sensor Signal pin of the DEF harness ECM connector and all other pins in the DEF harness ECM connector. - If greater than 100K ohms, then go to step 9 - If less than 100K ohms a pin-to-pin short circuit on the signal wire has been detected in the DEF harness. Repair or replace the damaged section of harness.
9	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 pressure 2 sensor Signal pin of the DEF harness ECM connector and ground. - If greater than 100K ohms, then go to step 10 - If less than 100K ohms a pin-to-ground short circuit on the signal wire has been detected in the harness. Repair or replace the damaged section of harness.
10	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

Fault Code CA5769

Fault Description	Aftertreatment 2 diesel exhaust fluid (DEF) dosing unit 2 Circuit – voltage below normal or shorted to low source. Low signal voltage detected at the DEF dosing unit.
Operator Action	Follow digital display instructions. Possible reduced engine performance. Engine torque will be reduced if the engine is operated for an extended period of time with this fault active. 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 or the aftertreatment diesel exhaust fluid dosing unit supply voltage was out of range low. Possible causes of this fault code include: Short to ground in the DEF dosing unit Supply wire shorted to ground Control signal wire shorted to ground or open
Component Location	The dosing units are mounted to the underside of the DEF tank.

No.	Cause	Procedure, measuring location, criteria and remarks
1	Dirty/Damaged sensor connector pins	Disconnect the aftertreatment 2 DEF dosing unit 2 from the DEF harness. Check for dirty or damaged connector pins on the DEF dosing unit. Clean or repair connector pins, if possible.
2	DEF dosing unit	Leave dosing unit disconnected, and disconnect the DEF harness from the engine harness. Measure the resistance between the aftertreatment 2 DEF dosing unit 2 control Signal pin at the dosing unit wiring harness connector and the aftertreatment 2 DEF dosing unit 2 control Signal pin in the Komatsu harness ECM connector. - If resistance is less 10 ohms, then go to step 3. - If resistance is not less than 10 ohms, an open signal circuit has been detected. Repair or replace the damaged section of the harness.
3	DEF dosing unit	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 at the dosing unit wiring harness connector and the aftertreatment 2 DEF dosing unit 2 Supply pin in the Komatsu harness ECM connector. - If resistance is less 10 ohms, then go to step 4. - If resistance is not less than 10 ohms, an open Supply circuit has been detected. Repair or replace the damaged section of the harness.

Fault Code CA5775

Fault Description	Aftertreatment 2 Diesel Exhaust Fluid Pressure 2 – Data Valid but Below Normal Operating Range – Moderately Severe Level. Low diesel exhaust fluid pressure has been detected in the dosing valve.
Operator Action	Follow digital display instructions. 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 Engine Control Module (ECM) provides a 5-volt supply and a ground to the aftertreatment diesel exhaust fluid 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 diesel exhaust fluid pressure supplied by the dosing unit. The ECM will detect a low signal voltage at low diesel exhaust fluid pressures, and a signal voltage at high diesel exhaust fluid pressures. The Engine Control Module (ECM) detected the aftertreatment diesel exhaust fluid pressure was less than a threshold. Possible causes of this fault code include: Low DEF tank level Blocked, restricted, or frozen DEF dosing valve or dosing unit supply line Blocked or restricted DEF tank or dosing unit filter Malfunctioning DEF dosing unit Blocked or restricted DEF dosing valve Contaminated diesel exhaust fluid Debris in the DEF tank
Component Location	The DEF temperature sensor is 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	Check for active fault code. Fault Code 5775 is active or inactive with more than one count logged in the last 25 engine hours? - If yes, then go to step 2 - If no, investigate intermittent fault code.
2	Fault codes	Check for active fault code. Fault Code 1712 is active or inactive with more than one count logged in the last 25 engine hours? - If yes, then go to fault code 1712 DEF tank is frozen. - If no, then go to step 3
3	Fault codes	Check for active fault code. Fault Code 1673, 3497, and / or 3498 active? - If yes, then fill the DEF tank. - If no, then go to step 4

Fault Code CA5889

Fault Description	Aftertreatment 1 SCR System Hydrocarbon - Data Valid but Above Normal Operating Range - Most Severe Level. Aftertreatment selective catalytic reduction (SCR) system cleaning is required.
Operator Action	Follow digital display instructions. Engine power derate
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. This fault code is an information only fault code indicating that the system was requesting an active SCR system cleaning of the aftertreatment system, but was unable to perform an active SCR system cleaning. This fault code will go inactive once the accumulation estimates are below the calibrated limits.
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	If Fault Code 5889 is active, operate engine under load with SCR intake temperature above 300° C (572° F) until hydrocarbon absorption percentage reaches 0%. Refer to Cummins Procedure 011-036.
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

	Schematic	Reference Location(s)
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 guidelines

These troubleshooting guidelines are intended to assist in diagnosing steering pump problems. However, before troubleshooting the pump, basic checks should be performed on the steering and braking systems. These checks are listed in the topic Basic Hydraulic System Checks. These checks are sequenced to determine whether the issue is due to the pump or elsewhere in the system. Failure to perform these checks may result in unnecessary component replacement or unnecessary repairs.

⚠WARNING

Various hydraulic pressure settings are referenced in this bulletin. Use only those values for the truck model being serviced. Damage or injury may result if incorrect values are used.

⚠WARNING

DO NOT loosen or disconnect hydraulic lines or components until the engine is stopped and the key switch has been OFF for at least 90 seconds.

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.

Depressurize system accumulators before opening hydraulic circuits or installing test gauges.

For the steering circuit, turn the key switch to OFF and allow 90 seconds for the accumulators to depressurize. After 90 seconds, turn the steering wheel to verify that pressure has been purged from the circuit. If the wheels do not move, the steering circuit is safe to service.

For the brake circuit, chock the wheels. Then open the shut-off valves on the brake manifold. Opening the valves allows accumulator pressure to be released.

⚠IMPORTANT⚠

Verify all pressure gauges being used are in good working condition and properly calibrated.

⚠CAUTION

To prevent hydraulic system contamination, clean system components before installing gauges or removing hoses, fittings, etc. Use caps and plugs on open hoses and fittings to keep dirt from entering the system during testing and maintenance.

DUMP TRUCK

730E
830E
860E
930E
960E
980E

Machine model	Serial number
730E-8	A40002 and up
730E-10	A50002 and up
830E-5	A50005 and up
830E-5AT	A50005 and up
860E-1K	A30031 - A30035, A30041, A30042, A30044 - A30046, A30101, A30107 - A30110, A30117, A30118
860E-1KT	A30004 - A30030, A30036 - A30040, A30043, A30047 - A30100, A30102 - A30106, A30111 - A30116
930E-5	A40004 and up
930E-5AT	A40004 and up
960E-2	A30027 and up
960E-2KT	A50074 and up
980E-4	A40003 and up
980E-4AT	A40083 and up
980E-5	A50005 and up
980E-5AT	A50005 and up

40 Troubleshooting
Automatic lubrication (auto lube) system

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

Form No. CEN40226-00

DUMP TRUCK

930E

Machine model	Serial number
930E-5	A40215 and up
930E-5AT	A40215 and up

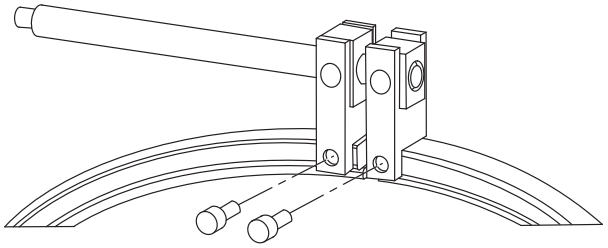
50 Disassembly and assembly
Wheels, spindles and rear axle

Installing the lock ring

⚠WARNING

Keep fingers clear of the area between the lock ring and the lock ring groove and rim base.

1. Install the lock ring onto lock ring groove at the outside position of the outer dual.
2. Adjust the expander tool jaws by hand until the holes line up with the lock ring holes.
3. Insert the capscrews through the holes of the lock ring expander tool jaws and into the lock ring holes.



84835

FIGURE 50-17.

4. Check that the capscrews are completely installed in the lock ring holes and the lock ring expander tool is seated into position.

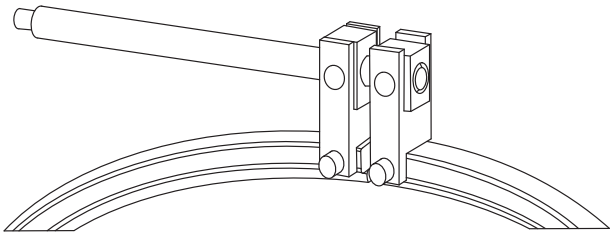
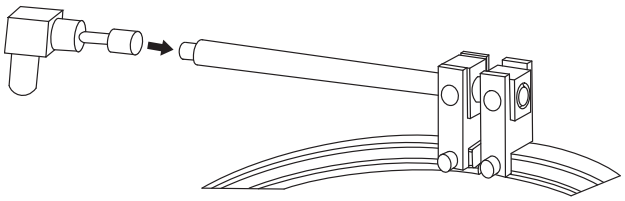


FIGURE 50-18. 84836

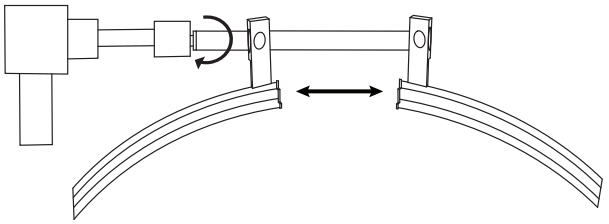
5. Place the pneumatic power tool on the end of the lock ring expander tool lead screw.



84837

FIGURE 50-19.

6. Expand the lock ring expander tool to an acceptable gap that will achieve a minimal sliding diameter for the lock ring.



84838

FIGURE 50-20.

7. **Outside position of inner dual:** Lift and slide the expanded lock ring along the rim base of the outer dual and guide it into the lock ring groove on the outside of inner dual.

   Inside position of outer dual: Lift and remove the expanded lock ring from the outside position of outer dual and rotate it so that the interface area with bead seat band is facing outward.
8. Place the lock ring expander tool at an easily accessed position.
9. Place the pneumatic power tool on the end of the lock ring expander tool lead screw. Unscrew the lead screw until the lock ring is seated in the lock ring groove.

⚠CAUTION

Be careful not to over-drive the lock ring expander tool.

10. Remove the capscrews from the lock ring and place the lock ring expander tool in a safe storage location.

7. Disconnect brake cooling lines (1, Figure 50-56) and brake apply line (2) at the inlet and outlet ports on the brake housing. Plug the lines and ports to help prevent contamination.
8. After the hydraulic lines have been disconnected, turn off the vacuum pump.

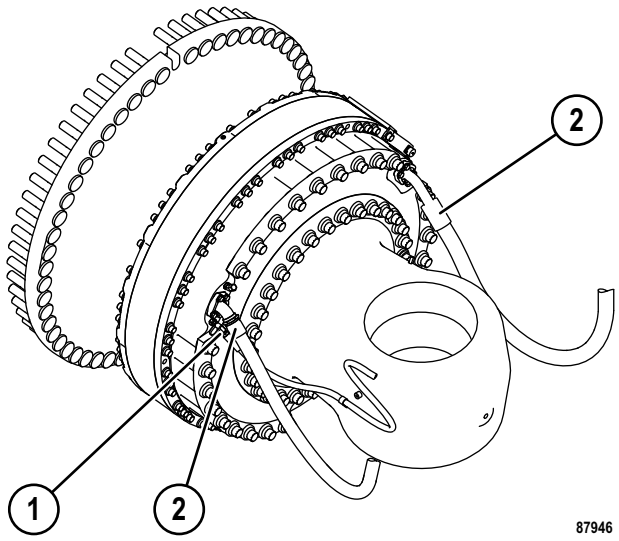


FIGURE 50-56. FRONT BRAKE LINES

1. Brake Cooling Line
2. Brake Apply Line

9. Remove drain plugs (1, Figure 50-57) and (2). Allow the oil to drain from the brake housing and catchment tank into a suitable container.

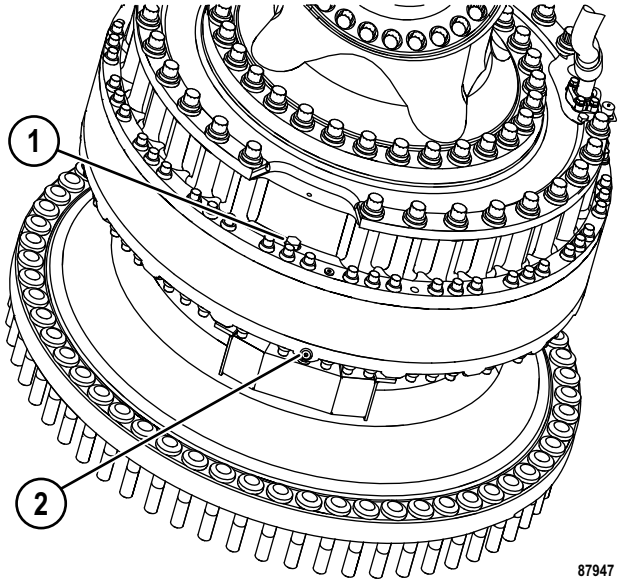


FIGURE 50-57. FRONT BRAKE DRAIN PLUGS

1. Brake Housing Drain Plug
2. Catchment Tank Drain Plug

18. Attach lifting eyes and an overhead hoist to brake assembly (1, Figure 50-76). Carefully lift the brake assembly from wheel hub (2).

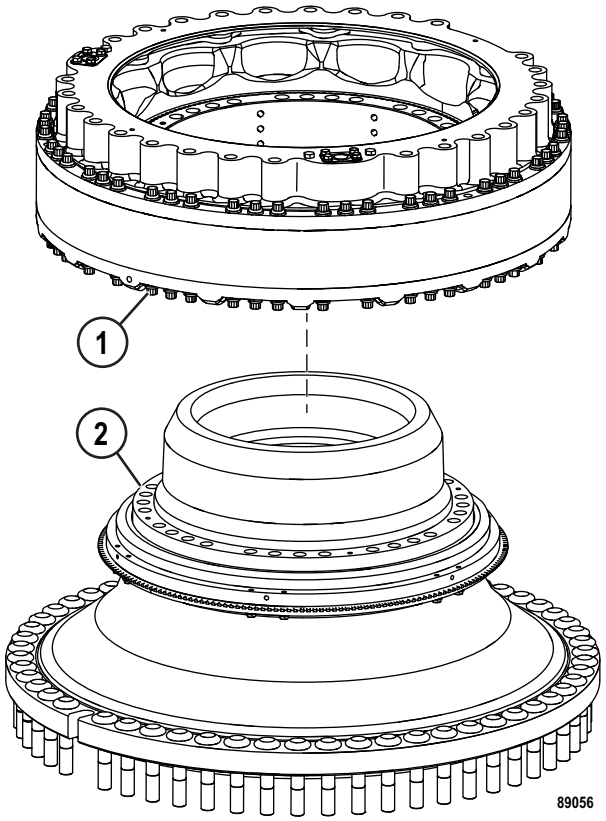


FIGURE 50-76. BRAKE ASSEMBLY REMOVAL

1. Brake Assembly
2. Wheel Hub

19. Turn over the brake assembly so that the back plate side is facing upward. Remove dust seal (3, Figure 50-77), and floating seal (2) from the brake assembly (1).

    The floating seal (2) is one half of the brake floating seal assembly.

*NOTE: For brake assembly rebuild instructions, refer to Disassembly and assembly section **Brake system**.*

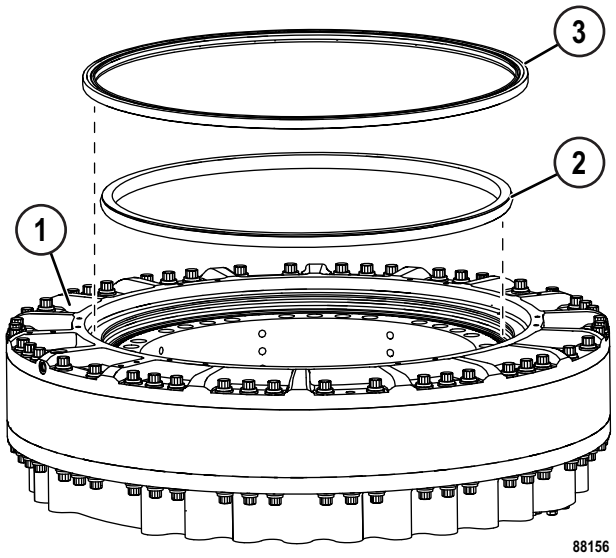


FIGURE 50-77. BRAKE SEAL ASSEMBLY REMOVAL

1. Seal Ring
2. O-ring
3. Dust seal

45. Install the catchment tank (1, Figure 50-97) and install the catchment tank plug (3) and mounting hardware (2).

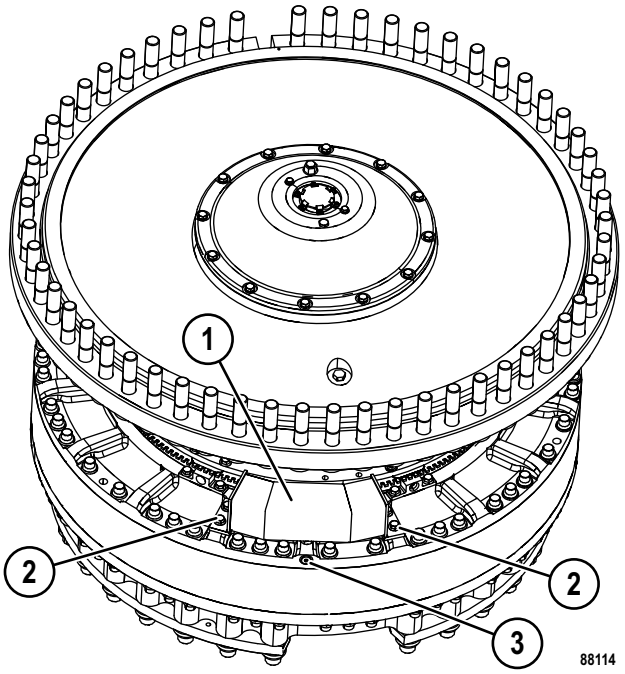


FIGURE 50-97. CATCHMENT TANK INSTALLATION

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

46. Perform a pressure test on the wheel hub to ensure the integrity of the seals. Refer to Testing and adjusting section **Brake system**.

Oil level fill and check procedure

47. Rotate wheel until sight gage and magnetic fill plug are aligned vertically, with the sight gage at the bottom. Add oil at the fill plug until floating ball is at the highest position. See section 10 for oil type and capacity.

Speed sensor installation and adjustment

48. Install wheel speed sensor (2, Figure 50-98) in sensor bracket (5). Tighten capscrews (3) and flat washers (4) to the standard torque. Connect the sensor cable to cable bracket (1).

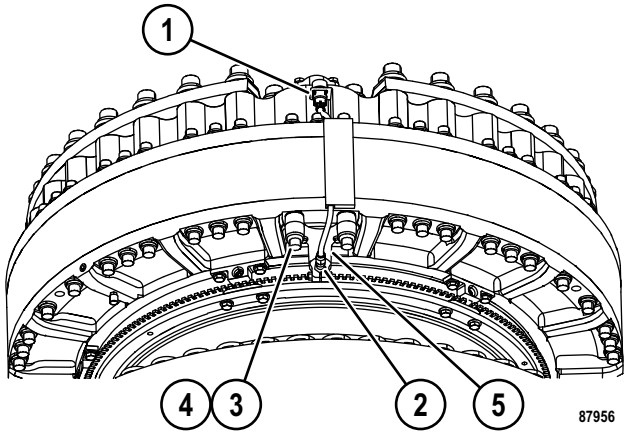


FIGURE 50-98. WHEEL SPEED SENSOR REMOVAL & INSTALLATION

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

49. Adjust the sensor as follows:

    a. Rotate the hub to position the center line of a gear tooth directly under the sensor tip.

    b. Turn in the sensor until the tip contacts the gear tooth. Then, back off 1/2 turn.

    c. Continue turning out the sensor until the flats of the sensor housing are perpendicular to the gear tooth motion (See Figure 50-99).

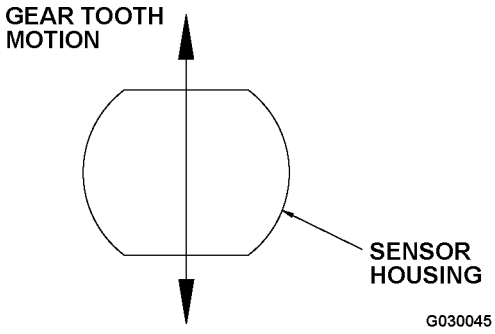


FIGURE 50-99. SPEED SENSOR ADJUSTMENT

13. Use a gauge (Figure 50-119) to check the seal height variation (marked by arrows, Figure 50-121) between seal ring (2) and back plate (1). 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 small adjustments are necessary, **do not push directly on the seal ring.** Use the installation tool to make any required adjustments. The seal rings must be level as shown in Figure 50-123.

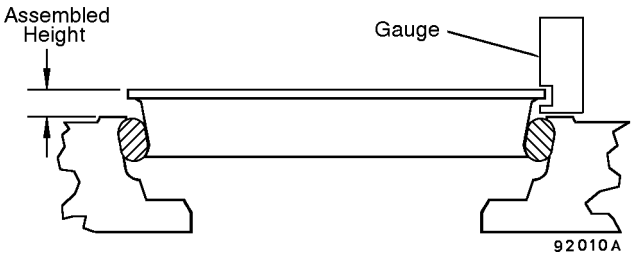


FIGURE 50-119. CHECKING SEAL RING

CAUTION

The O-rings can twist during adjustments, especially if there is a dry spot on the O-ring or if there are burrs or fins on the housing retaining lip. Verify that the O-rings are not twisted as shown in Figure 50-120. A bulging O-ring or crooked seal ring will lead to eventual failure.

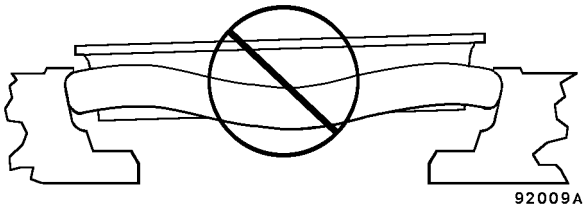


FIGURE 50-120. TWISTED O-RING

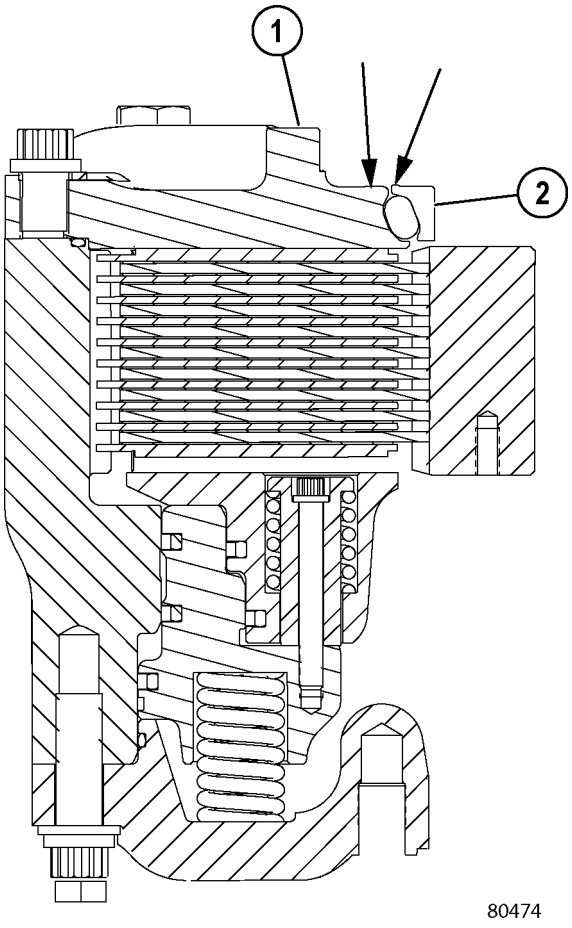


FIGURE 50-121. CHECKING SEAL HEIGHT

1. Back Plate 2. Seal Ring

4. Disconnect brake cooling hoses (1, Figure 50-138) and brake apply hoses (2) from both of the rear brakes. Plug the hoses and ports.
5. Remove the clamps that secure the brake hoses to the brake ports.

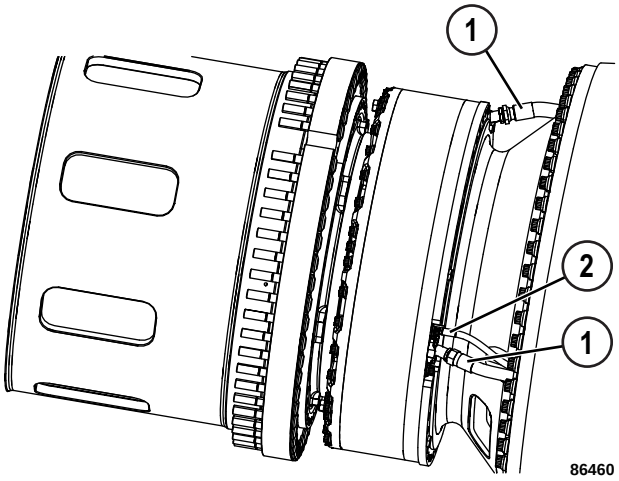


FIGURE 50-138. REAR BRAKE HOSES

1. Brake Cooling Hose 2. Brake Apply Hose

6. Open the rear axle access hatch. Disconnect and plug parking brake hoses (2, Figure 50-139) from parking brake (1) on each wheel motor.

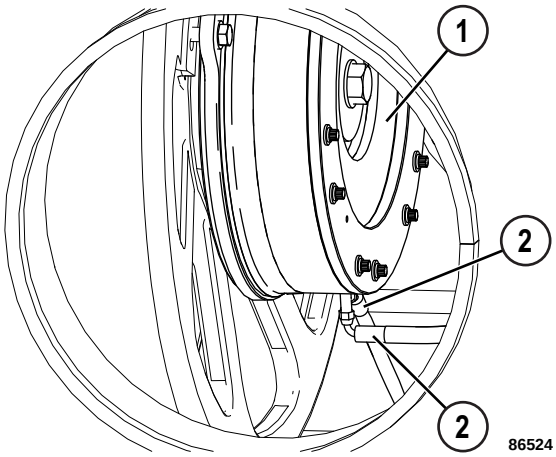


FIGURE 50-139. PARKING BRAKE HOSES

1. Parking Brake 2. Parking Brake Hose

7. After all disconnected hydraulic lines have been plugged, turn off the vacuum pump.
8. Disconnect six wheel motor power cables (1, Figure 50-140) and wheel speed sensor harnesses (2) from each wheel motor.
9. Tie up any cables and hoses as necessary to prevent damage during wheel motor removal.

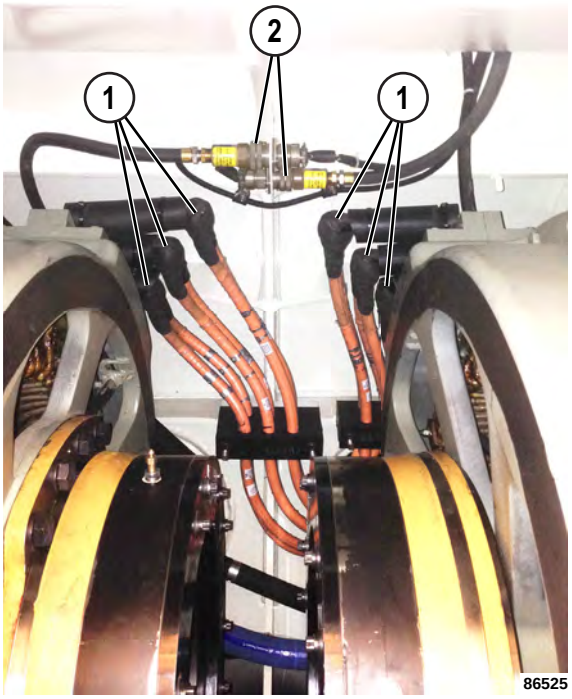


FIGURE 50-140. WHEEL MOTOR POWER CABLES

1. Wheel Motor Power Cables
2. Wheel Speed Sensor Harness

NOTE: During disassembly, precision machined parts should be ink marked or tagged to ensure proper reassembly and minimize adjustment time. All items must be placed back into the bores from which they were removed.

3. Match mark each section of the brake valve. Place the brake valve in an upright position and secure it in a vice.
4. Remove spring pivots (8) and spring (9).
5. To remove brake pedal actuator (3), remove two retainer clips (4), then use a punch and hammer to drive out pivot shaft (5).
6. Remove four button head screws (3, Figure 50-7) that secure retainer plate (4).
7. Remove retainer plate (4), boot (2) and actuator cap (1) as an assembly by grasping the boot and gently lifting it from the valve body.

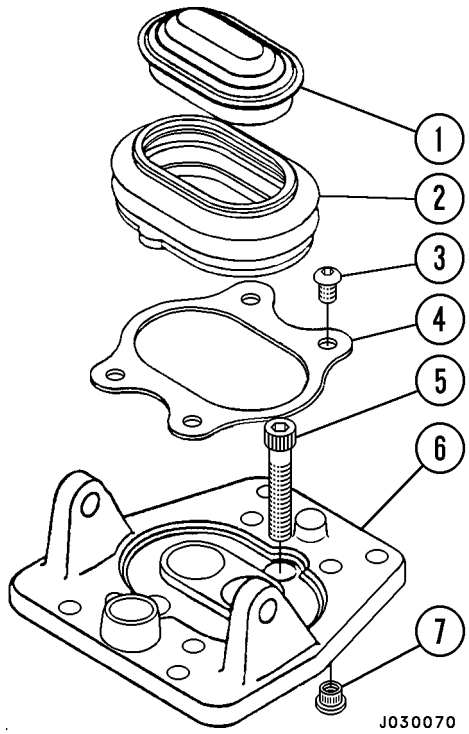


FIGURE 50-7. ACTUATOR CAP & BOOT

1. Actuator Cap
2. Boot
3. Allen Screw
4. Retainer Plate
5. Capscrew
6. Actuator Base
7. Threaded Insert

Assembly

1. Inspect threaded inserts (7, Figure 50-7) in actuator base (6). If any of the threads are damaged, the inserts must be replaced.
2. If any threaded inserts (7) were removed from actuator base (6), position the actuator base upside down on the work bench and support it directly under each of the four mounting holes.
3. Install the threaded inserts into the actuator base by tapping lightly with a small hammer until the insert flanges become flush with the actuator base. To avoid breaking the base, make sure that the base is supported.
4. Thoroughly clean the actuator base and set it aside.
5. Examine boot (2) for any cracks, tears, or other damage. If damage is evident, the boot must be replaced.
6. If damaged, remove the boot from actuator cap (1) and discard the old boot. Thoroughly clean the sides of the cap by using a knife or suitable scraper to scrape the lip where the cap contacts the boot. Clean the cap thoroughly to remove all adhesive or particles of the old boot.
7. Apply a thin bead of Loctite® Prism 410 onto the upper sides of the cap. Apply the bead to the two long sides only. Do not apply it to the rounded ends. The rounded ends must not be sealed to allow the boot to “breathe”.
8. Carefully position the cap into the new boot groove. Wipe off any excess glue.
9. Position the boot so that it conforms to the contour of the cap, then set it aside. The adhesive requires about 30 minutes to cure.
10. Once the adhesive has cured, install actuator base (6) on top of the valve body. Position the actuator base properly for correct port direction. Install and tighten two socket head capscrews (5) to **20 - 21 N·m (180 - 190 in lb)**.
11. Ensure that the jam nut (2, Figure 50-9) and set screw (1) are installed in the brake pedal actuator.

Piston seal replacement

NOTE: Replace all seals when the accumulator is completely disassembled.

1. Apply clean hydraulic oil to the seals, piston lands and grooves.
2. Assemble the seals into the appropriate piston grooves. Start with seal (5, Figure 50-26), then move outward to seals (2) to reduce the risk of seal damage. Ensure that seals (2) and (5) are not folded or twisted.
3. Insert backup rings (3) and (4) carefully so as not to stretch any more than necessary. Ensure that the backup ring gaps are on opposite sides of the piston from each other as shown.

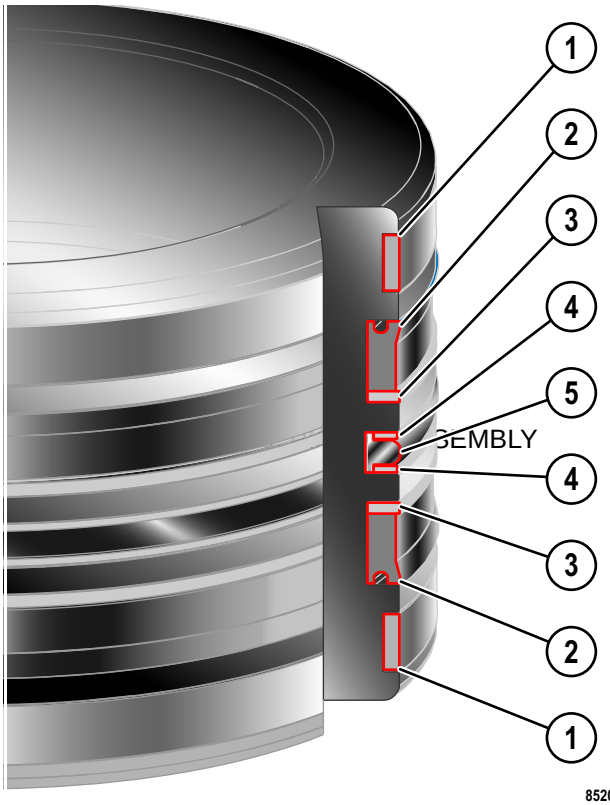


FIGURE 50-26. PISTON REPLACEMENT SEALS

1. Piston Bearing
2. Piston Seal - “U”
3. Backup Ring (thick)
4. Backup Ring (thin)
5. Piston Seal - “T”

Assembly

NOTE: Assemble the accumulator in a dust and lint free area. Maintain complete cleanliness during assembly to prevent possible contamination.

1. Secure the accumulator horizontally in a vise, preferably a chain vise.
2. Carefully insert piston assembly (2, Figure 50-27) into the accumulator housing bore. Avoid cocking to prevent damaging the piston and/or seals on the end cap threads. If necessary, tap the piston lightly with a soft hammer. Be careful not to pinch the backup rings.

NOTE: Assembly sleeve (1) may be used to help install and prevent damage to the piston assembly.

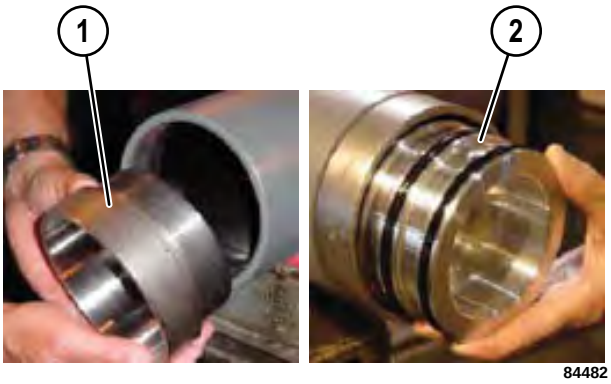


FIGURE 50-27. PISTON ASSEMBLY

1. Assembly Sleeve (XA6349)
2. Piston Assembly

Assembly

IMPORTANT

Disassemble and reassemble the brake assembly on a clean, dry work surface. The work surface should be wooden. If the work surface is metal or concrete, use padding to prevent damage to machined surfaces. Handle all parts carefully to avoid damage to polished sealing surfaces.

WARNING

Use a lifting device with adequate capacity to remove and install the components.

1. Position piston housing (7, Figure 50-42) on a clean work surface with the bore facing upward.
2. Lubricate the square O-ring portion of piston seal assemblies (5) and (6) with clean hydraulic oil and install the seals in the grooves in piston (4). Ensure that the seal assemblies are not twisted.

NOTE: It is recommended that the seals be heated to 80 - 100°C (176 - 212°F) before installation by using hot oil, hot air or hot water. This allows for easier seal installation without stretching the seals.

3. Lubricate the piston groove and outer piston seal rings. Install the seal ring portion of piston seal assemblies (5) and (6) in the grooves over the O-ring portions. Use your fingers or a smooth rounded object to push the seal ring into the groove.
4. Install two equally spaced 1/2” - 13NC x 5” guide studs in piston housing (7) in the tapped mounting holes for piston retract springs (3).
5. Lubricate the piston housing bore. Install lifting eyes and attach an overhead hoist to piston (4). Position the piston over the piston housing with the piston retract spring mounting holes aligned with the guide studs. Place spring guide (2) over each stud to aid in alignment.
6. Carefully lower the piston straight into the piston housing bore until it is seated against the housing. If necessary, seat the piston by tapping it with a soft mallet. Remove the guide studs.
7. Assemble twelve capscrews (1), spring guides (2) and retract springs (3). Apply Loctite® 271 to the capscrew threads and install the assembled parts through the piston and into the tapped holes in the piston housing. Tighten the capscrews to **122 N·m (90 ft lb)**.
8. Install any missing plugs in the piston housing, then test the piston for leakage. For instructions, refer to "Brake piston leakage test" in Testing and adjusting section **Brake system**.
9. After completing the piston leakage test, release the pressure, remove the hydraulic pressure test device, and drain the oil from the piston apply cavity. Plug the ports to prevent contamination.
10. Install O-ring (5, Figure 50-41) in the groove of outer ring gear (6).
11. Attach lifting eyes to the piston assembly and lower it into position over outer ring gear (6). Ensure that the piston assembly is oriented properly according to the match marks that were made during disassembly. Install capscrews (1) and hardened flat washers (2). Alternately tighten the capscrews to **780 N·m (575 ft lb)**.
12. Install retainer bars (1, Figure 50-40), spacers (4), capscrews and lockwashers (3) to inner gear (5). Attach a lifting strap through the retainer bars, then lift the inner gear into the piston assembly.
13. Attach the retainer bars to the piston housing by installing capscrews and flat washers (2) at the ends of the retainer bars.
14. Attach lifting eyes to the brake assembly. Turn over the assembly so that the piston housing is on the bottom.
15. Install brake pack (1, Figure 50-38) as follows:
    a. Insert one damper into the outer ring gear. The friction material must be facing the piston.
    b. Insert one friction disc (3).
    c. Install one separator plate (4).
    d. Continue installing the remaining friction discs and separator plates, alternating each type as installed.
    e. Install remaining damper (2) on top of the last friction disc. The friction material must be facing away from the top friction disc.

NOTE: The brake pack contains ten friction discs, nine separator plates, and two dampers.

5. Remove piston (1, Figure 50-63) from piston housing (4). Remove and discard piston seals (2) and (3).
6. If necessary, remove bleed valve (5).

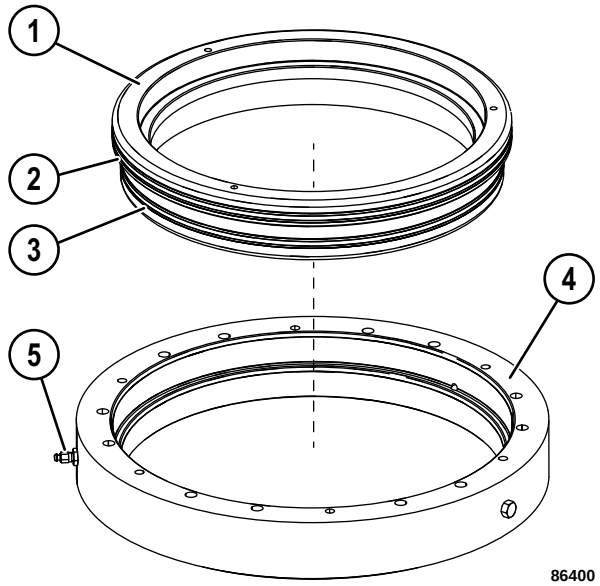


FIGURE 50-63. PARKING BRAKE DISASSEMBLY & ASSEMBLY

1. Piston
2. Piston Seal
3. Piston Seal
4. Piston Housing
5. Bleed Valve

7. Remove four separator discs (1, Figure 50-64), three friction discs (2), and compression springs (3) from brake pack housing (5).

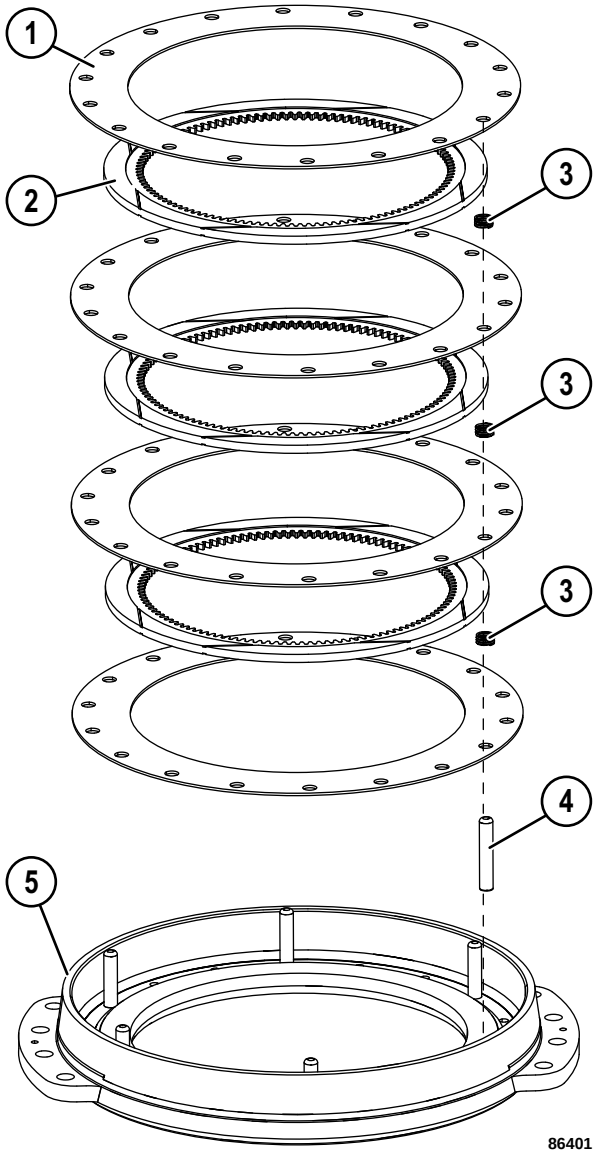


FIGURE 50-64. PARKING BRAKE DISASSEMBLY & ASSEMBLY

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

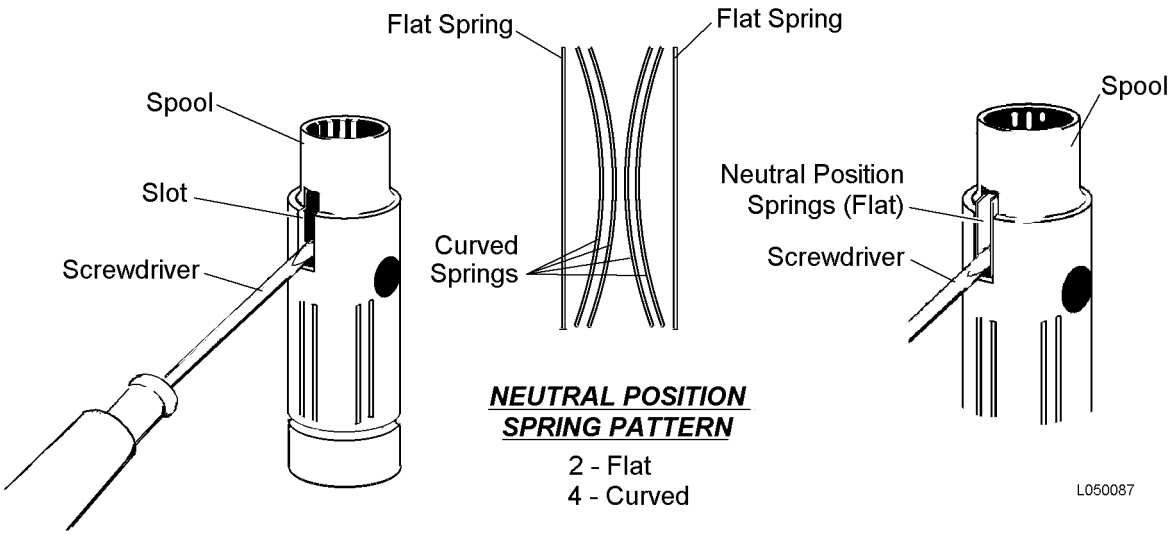


FIGURE 50-9. NEUTRAL POSITION SPRING INSTALLATION

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.

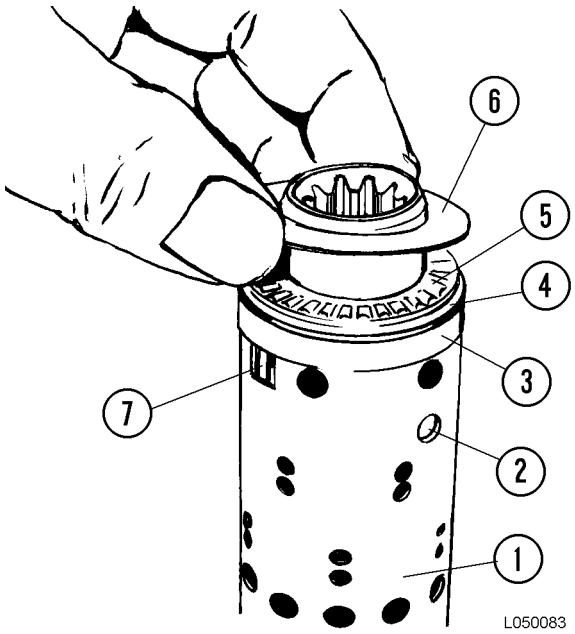


FIGURE 50-10. BEARING INSTALLATION

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 50-21). 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 50-20) 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

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.

NOTES

8. Install new O-rings (7, Figure 50-16) and backup rings (8) in the grooves of top cap (9). Backup rings must be positioned toward the flange of the end cap.
9. Install new upper bearing (6) on upper bearing retainer (5).
10. Slide upper bearing retainer (5) over the top cap rod.
11. Install key (4) and piston stop (3) on the top cap rod. Ensure that the piston stop is fully seated against the rod shoulder.
12. Install wheel nut (2) until it is snug against the piston stop. Tighten the wheel nut by an additional 1/2 turn until the hole for the spring pins is in alignment. Install spring pins (1).
13. Attach a lifting device to top of the top cap. Lower the end cap/bearing retainer assembly onto piston (4, Figure 50-15).

NOTE: Ensure that the check balls are installed in all four bosses (5) before fully seating the upper bearing retainer on top of the piston. A small amount of petroleum jelly should prevent the balls from dropping out during assembly.

14. Install new capscrews (1) and hardened washers (2) that secure piston (4) to upper bearing retainer (3). Tighten the capscrews to **678 N·m (500 ft lb)**.

⚠ IMPORTANT ⚠

Always use new capscrews during assembly. Used capscrews will be stressed and fatigued because of loads imposed on these capscrews during operation.

15. Apply a light coating of petroleum jelly to all of the seals and both bearings. With the suspension housing in a vertical position, carefully lower the top cap/upper bearing retainer/piston assembly into the bore of the suspension housing until the piston taper passes through the wiper seal and the top cap is in position on top of the suspension housing.
16. Install capscrews (1, Figure 50-14) and hardened washers (2). Tighten the capscrews to **1 017 N·m (750 ft lb)**.

NOTE: If the suspension is to be stored, put in one liter (two pints) of a rust preventive oil. This oil must be drained when the suspension is put into service.

17. Install a new O-ring onto charging valve (2, Figure 50-13). Install the charging valve onto the cylinder. Tighten charging valve body (4) to **23 N·m (17 ft lb)**.

    If a new charging valve is being used, tighten swivel nut (3) to **15 N·m (11 ft lb)**, then loosen and retighten the swivel nut to **15 N·m (11 ft lb)**. Loosen the swivel nut again, then retighten it to **6 N·m (50 in lb)**. Install the valve cap finger-tight.
18. Pressure test the suspension. Refer to the Testing and adjusting section **Accumulators and suspensions**.
19. After a successful pressure test, add approximately 151.4 liters (40 gallons) of suspension oil.
20. Apply rust preventative grease to any exposed machined surfaces.

4. Close the pump supply shutoff valves.
5. Clean the hoist pump and surrounding area carefully to help avoid contamination of hydraulic oil when the hoses are disconnected are opened.

⚠ IMPORTANT ⚠

Always maintain complete cleanliness when opening any hydraulic connection. Ensure that all system hoses and components are capped while the component is removed from the truck.

6. Loosen the capscrews that secure the outlet hoses (1, Figure 50-2) and (2) and inlet hoses (3) and (4) to the hoist pump. Allow the oil to drain from each hose into a suitable container.
7. Remove the outlet hoses and inlet hoses. Cap or cover all hoses and pump ports to prevent contamination.

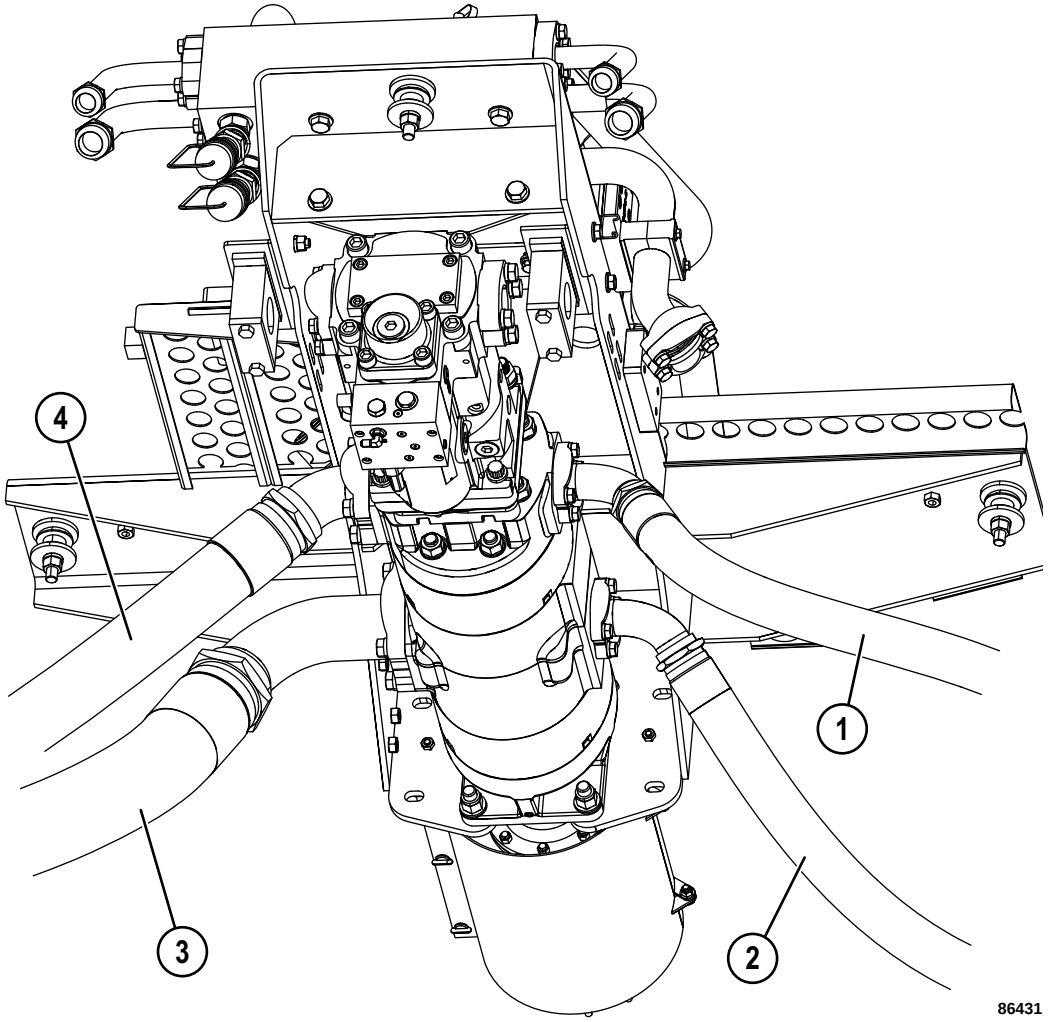


FIGURE 50-2. HOIST PUMP HOSE REMOVAL & INSTALLATION

1. Outlet Hose to Filter
2. Outlet Hose to Filter
3. Inlet Hose from Tank
4. Inlet Hose from Tank

8. Attach a suitable lifting device to hoist pump (1). Attach a support to the front end of the steering/

Removal and installation of hoist valve

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**.
2. Secure the body in the raised position with the body-up retention cable. Refer to Index and foreword section **Foreword and general information** for the procedure.

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.

3. Thoroughly clean the exterior of hoist valve (1, Figure 50-21) and surrounding area carefully to help avoid contamination of hydraulic oil when the hoses are disconnected are opened..
4. Disconnect six hydraulic tubes (2) and three hydraulic hoses (3) at the hoist valve. Disconnect three hydraulic hoses from pilot hose fittings (4).
5. Plug the hydraulic lines and valve ports to help prevent contamination. Mark each hydraulic line to aid in correct installation.

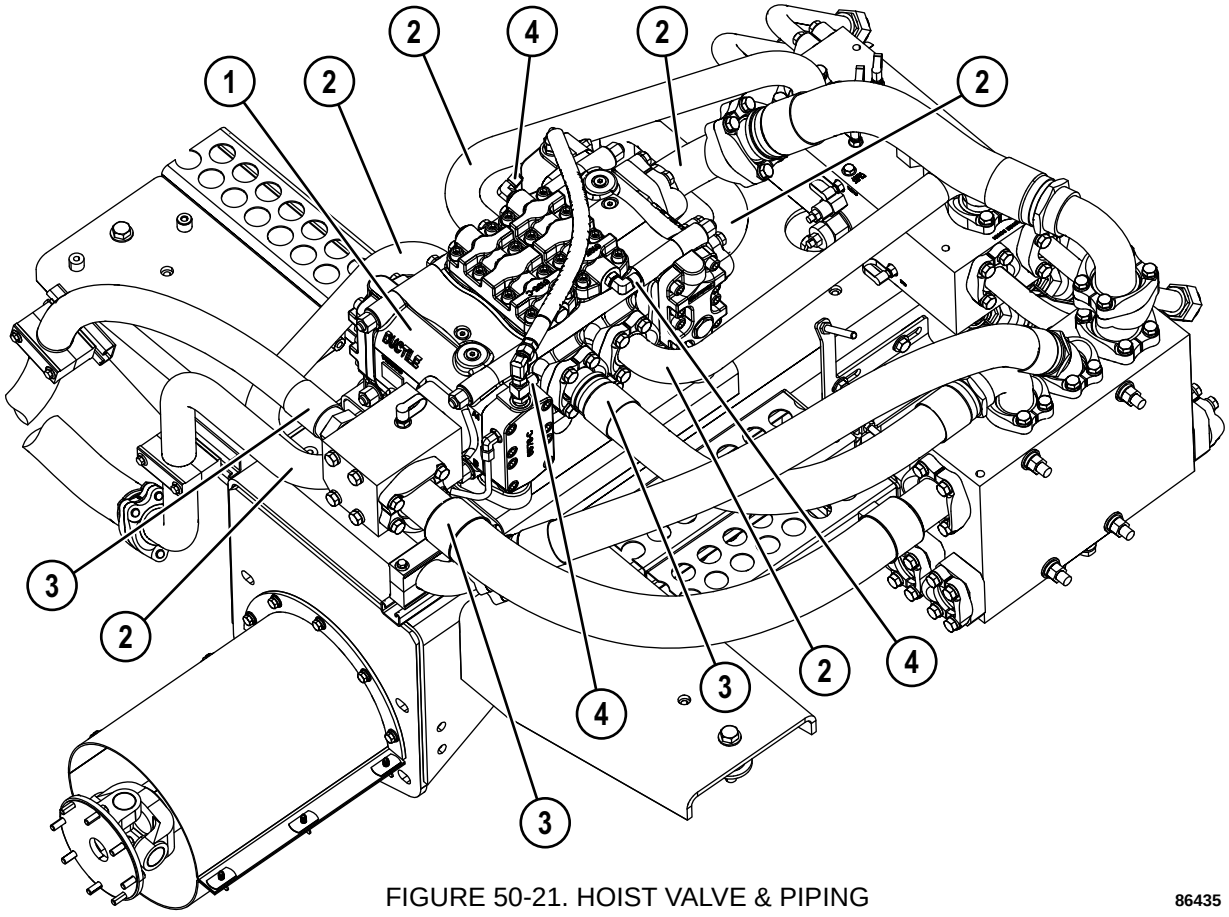


FIGURE 50-21. HOIST VALVE & PIPING 86435

1. Hoist Valve
2. Tube
3. Hose
4. Pilot Hose Fitting

Disassembly and assembly of hoist pilot valve

Disassembly

1. Thoroughly clean the exterior of the valve. Match mark inlet housing (18) and outlet housing (7) in relation to spool housing (17) to ensure proper reassembly.
2. Remove machine screws (15, Figure 50-36), seal plate (16), wiper (13) and O-ring (12).
3. Remove snap ring (1), capscrews (6), cap (24), spacer (23), and detent sleeve (22). Detent balls (2) and (21) will fall free when the cap and detent sleeve are removed. Separate cap (24), spacer (23) and detent sleeve (22).
4. Carefully slide spool (14) out of spool housing (17). Remove seal retainer (25), wiper (26) and O-ring (27) from the spool.
5. Insert a rod in the cross holes of detent pin (3) and unscrew it from spool (14). Exert slight pressure against the detent pin as it disengages and spring tension is released.
6. Remove spring seats (19), spring (4) and spacer (5).
7. Remove relief valve (2, Figure 50-35) from spool housing (1).

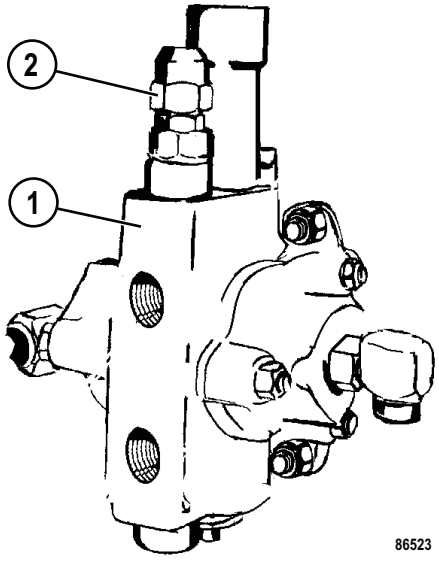


FIGURE 50-35. HOIST PILOT RELIEF VALVE

1. Spool Housing 2. Relief Valve

8. Remove nuts (8) and (10, Figure 50-36) and remove tie rods (9). Separate the valve housings. Remove O-ring (11). Remove the poppet check and spring (located on the outlet housing side of the spool housing) from the spool housing.

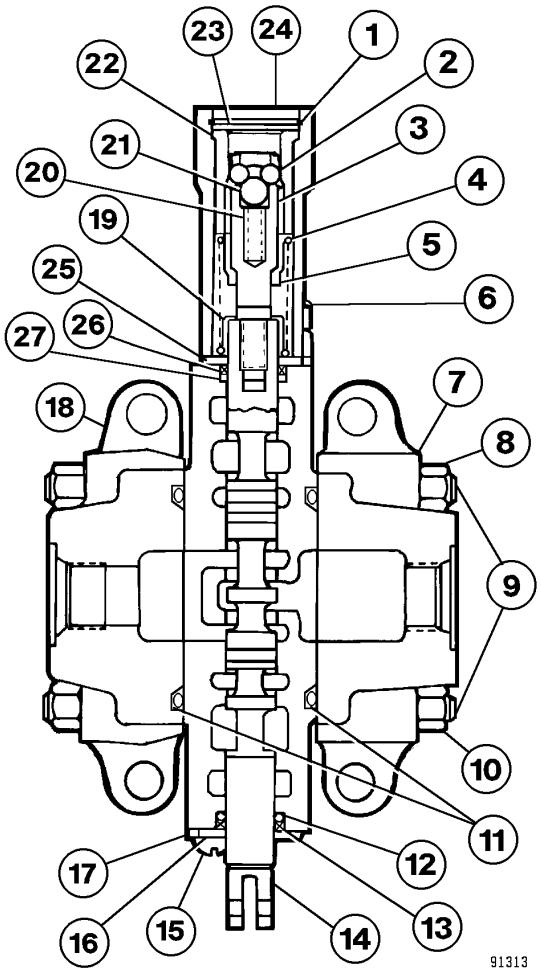


FIGURE 50-36. HOIST PILOT VALVE

1. Snap Ring
2. Ball (4)
3. Detent Pin
4. Spring
5. Spacer
6. Capscrew
7. Outlet Housing
8. Nut
9. Tie Rod
10. Nut
11. O-Ring
12. O-Ring
13. Wiper
14. Spool
15. Machine Screw
16. Seal Plate
17. Spool Housing
18. Inlet Housing
19. Spring Seat
20. Spring
21. Ball (1)
22. Detent Sleeve
23. Spacer
24. Cap
25. Seal Retainer
26. Wiper
27. O-Ring

5. Install the lifting tool (see Figure 50-48) that was used during disassembly into the first stage cylinder.
6. Align and slide the first stage cylinder into the top of the cylinder housing. See Figure 50-49.

   Allow the first stage cylinder to protrude far enough to install the nylon cap on piston seal (6, Figure 50-55), then install outer bearings (5).

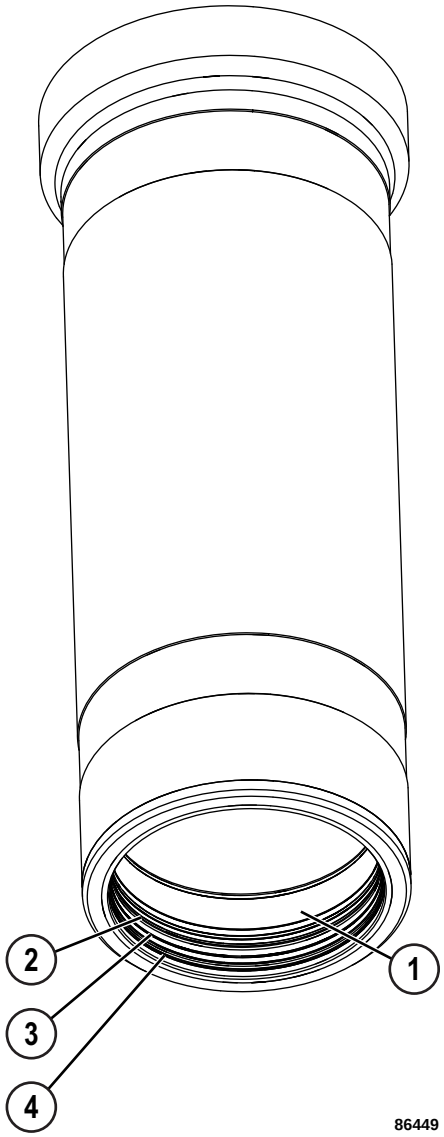


FIGURE 50-56. CYLINDER HOUSING BEARING & SEAL INSTALLATION

1. Inner Bearing
2. Buffer Seal
3. Rod Seal
4. Wiper Seal

7. Lower the first stage cylinder until it is resting on the wood block. Remove the lifting tool and install it into the second stage cylinder.

NOTE: Seal installation rings (58B-98-40020) and (58B-98-40030) will ease assembly of the first and second stage cylinders, but it is not required.

8. Lubricate the seal installation ring with clean type C-4 hydraulic oil or petroleum jelly and install it in the snap ring groove inside first stage cylinder (1, Figure 50-50). The seal installation ring allows the seals to glide over the snap ring groove without being damaged.
9. Align and slide second stage cylinder (2) inside first stage cylinder (1).

   Allow the second stage cylinder to protrude far enough to install the nylon cap on piston seal (6, Figure 50-54), then install outer bearings (5).

10. Lower the second stage cylinder past the seal installation ring. Remove the seal installation ring, then install snap ring (3, Figure 50-50) on the inside of the first stage cylinder.
11. Install two 7/8" - 9NC eye bolts in the lifting holes on the top of the rod bearing retainer. Install piston seal (2, Figure 50-57) and bearings (1) on the rod bearing retainer.

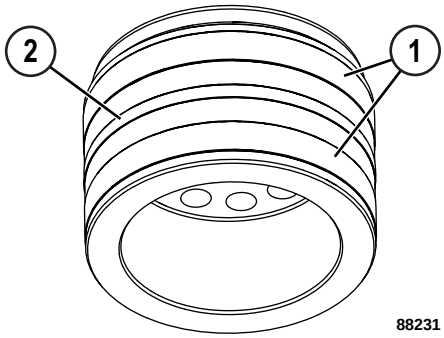


FIGURE 50-57. ROD BEARING RETAINER BEARING & SEAL INSTALLATION

1. Outer Bearing
2. Piston Seal

Removal and installation of RH deck

Removal

WARNING

Use a lifting device with adequate capacity to remove and install the components.

Do not attach lifting slings or chains to the handrails. Only use proper lifting points to attach the lifting device.

1. Disconnect all retarding grid cables from the control cabinet.

NOTE: It is recommended that the retarding grid and deck be removed separately. If removing the deck and grid together, the sling must be connected to the deck, as the grid lifting eyes are not rated to lift the weight of both items.

2. Remove retarding grid mounting hardware (2, Figure 50-8) at six locations.
3. Attach an appropriate lifting device to the lifting eyes on the retarding grid. Lift the retarding grid clear of deck structure (4).

NOTE: If repairs to the retarding grid or cooling blower are required, refer to the applicable GE publication for service and maintenance procedures.

4. Disconnect deck lighting harness (6). Inspect the underside of the deck. If necessary, remove any hoses or cables that remain connected to the deck.

NOTE: The lighting harness and clamps do not require removal.

5. Remove the egress gate from the handrail at the front of the deck.
6. Install an appropriate lifting device to the lifting eyes at each corner of the deck and take up any slack. **Do not attach the lifting device to the handrails.**
7. Remove deck mounting hardware (5) and any shims at the deck support and the front upright.
8. Loosen radiator bumpers (3) on both decks.
9. Ensure that all wiring harnesses, cables and hoses have been removed. Carefully lift the deck from the deck supports.

Installation

WARNING

Use a lifting device with adequate capacity to remove and install the components.

Do not attach lifting slings or chains to the handrails. Only use proper lifting points to attach the lifting device.

1. Clean all deck mount mating surfaces.
2. Install an appropriate lifting device to the lifting eyes at each corner of the deck and take up any slack. **Do not attach the lifting device to the handrails.**
3. Carefully lift and position the deck on the deck supports. Ensure that any wiring harnesses, cables and hoses that may still be attached to the deck are moved out of the way.

NOTE: Shimming may be necessary at the deck mounting hardware locations to level the RH deck with the center deck.

4. Install deck mounting hardware (5, Figure 50-8) and any necessary shims on the deck support and the front upright. Tighten the capscrews to the standard torque.
5. Connect deck lighting harness (6) and any hoses or cables that were disconnected from the deck. Ensure that all electrical wiring and clamps are undamaged and installed securely. Replace any components as necessary.
6. Attach an appropriate lifting device to the lifting eyes on the retarding grid. Lift retarding grid (1) onto deck structure (4).
7. Install retarding grid mounting hardware (2) at six locations. Tighten the capscrews to the standard torque.
8. Connect the retarding grid cables to the control cabinet. Make sure the cables are installed in the correct locations.
9. Tighten radiator bumpers (3) on both decks.

DUMP TRUCK

730E
830E
930E

Machine model	Serial number
730E-10	A50002 and up
830E-5	A50005 and up
830E-5AT	A50005 and up
930E-5	A40004 and up
930E-5AT	A40004 and up

50 Disassembly and assembly
Operator cab

Removing the interior door handle and door latch

1. Remove 10 door panel screws and inner door panel (1, Figure 50-17).

NOTE: There should be enough slack in the window regulator harness so that disconnection of the harness is not required.

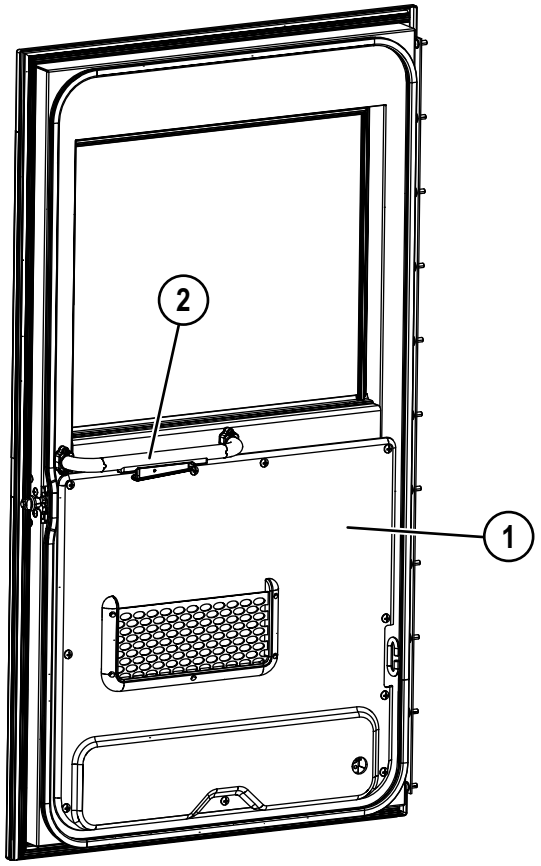


FIGURE 50-17. INNER DOOR PANEL

1. Inner Door Panel
2. Interior Door Handle

2. Remove two screws (1, Figure 50-18) and detach push lever (2) to access the end of the latch cable.
3. Detach latch cable (3) from lever cam (4). Push and hold door latch lever (5) to loosen the cable as needed.

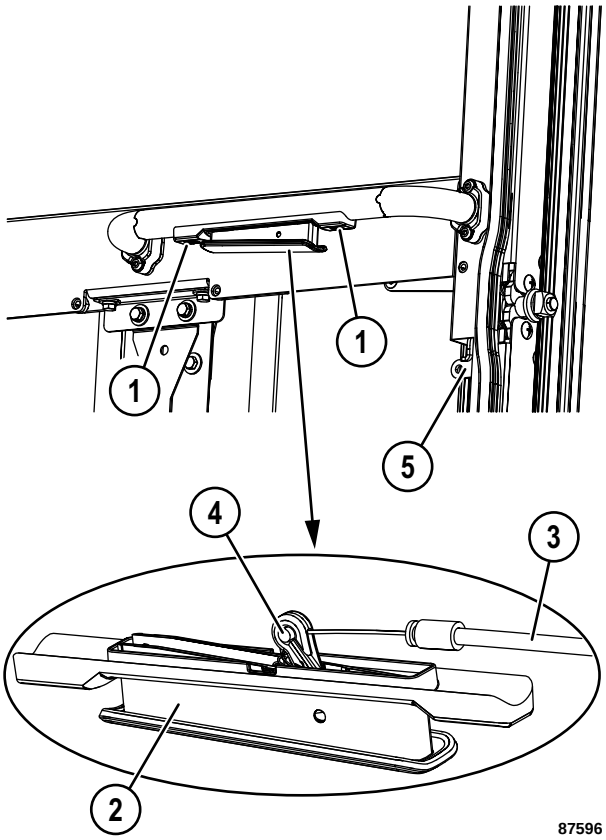


FIGURE 50-18. REMOVING THE PUSH LEVER

1. Screw
2. Push Lever
3. Latch Cable
4. Cam Lever
5. Door Latch Lever

Removal and installation of seat belts

⚠ IMPORTANT ⚠

Inspect the date of manufacture on the seat belt. If the seat belt is over five years old, or if the seat belt has been in service for more than three years, replace the seat belt.

Removal

1. Remove capscrew (1, Figure 50-34) that secures lap belt retractor (2) and seat tether (3) to the seat.
2. Remove carriage bolt (4) that secures shoulder belt retractor (5) to the mounting bracket.

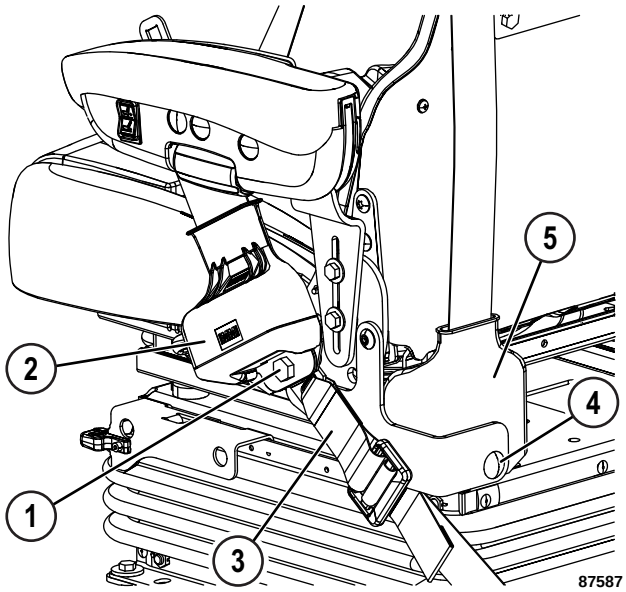


FIGURE 50-34. LOWER SEAT BELT MOUNT

1. Capscrew
2. Lap Belt Retractor
3. Seat Tether
4. Carriage Bolt
5. Shoulder Belt Retractor

3. Disconnect seat belt minder harness (1, Figure 50-35).
4. Remove capscrew (2) that secures seat belt latch (3) and seat tether (4) to the seat.

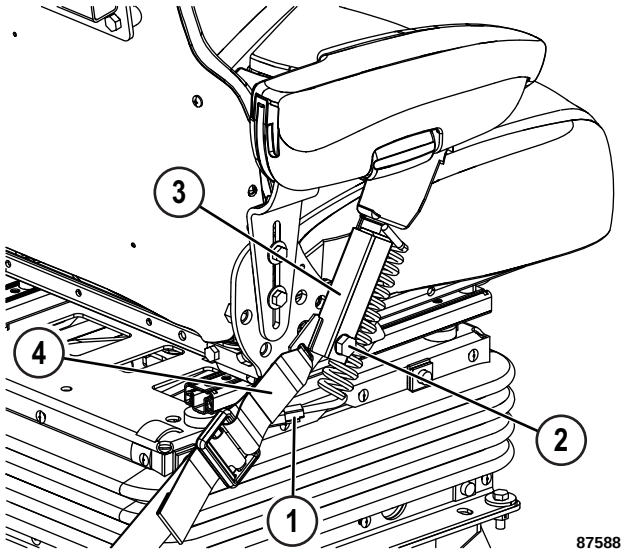


FIGURE 50-35. RH SEAT BELT MOUNT

1. Seat Belt Minder Harness
2. Capscrew
3. Seat Belt Latch
4. Seat Tether

5. Remove nut (3, Figure 50-36), the capscrew and foam pad (2). Slide upper seat belt mount (1) off the mounting bracket.

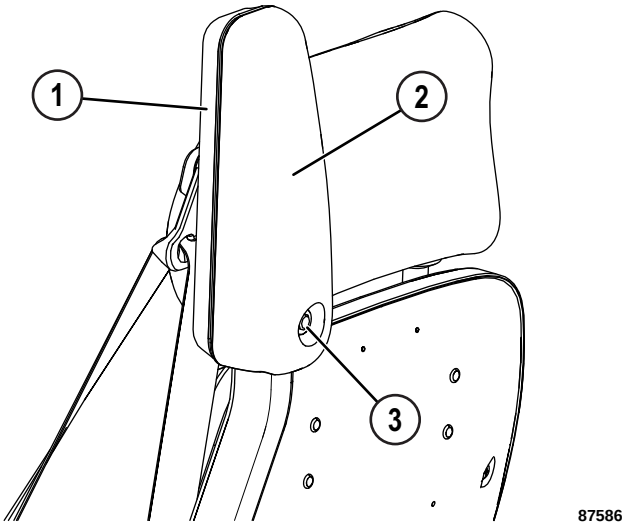


FIGURE 50-36. UPPER SEAT BELT MOUNT

1. Upper Seat Belt Mount
2. Foam Pad
2. Nut

27. Remove the mounting hardware and subframe rubber mounts (3, Figure 50-14) on both sides of the subframe.
28. Install a safety chain around the engine subframe cross member and the main frame to prevent the power module from rolling when the subframe rollers are installed.

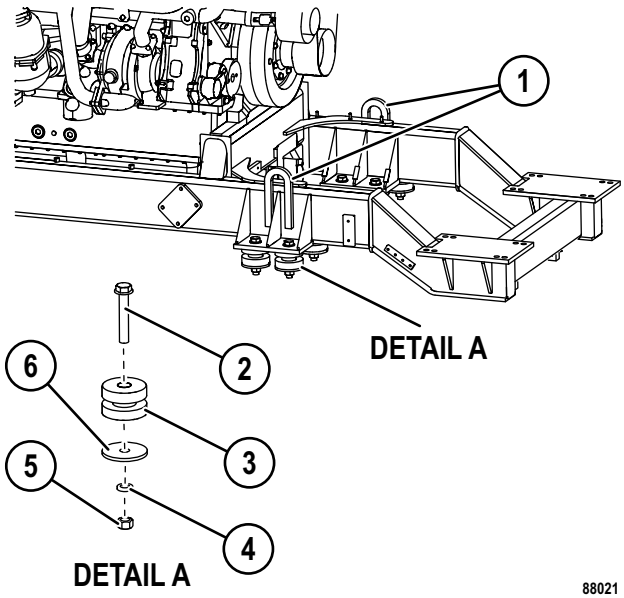


FIGURE 50-14. FRONT SUBFRAME MOUNTS

1. Front Subframe Lifting Points
2. Capscrew & Hardened Washer
3. Rubber Mount
4. Lockwasher
5. Nut
6. Large Washer

29. Remove capscrews (5, Figure 50-15), and caps (3) that secure the subframe to mounting bushings (2) on both sides of the rear of the engine subframe.
30. Check the engine and the alternator to ensure that all cables, wires, hoses, tubing and linkages have been disconnected.

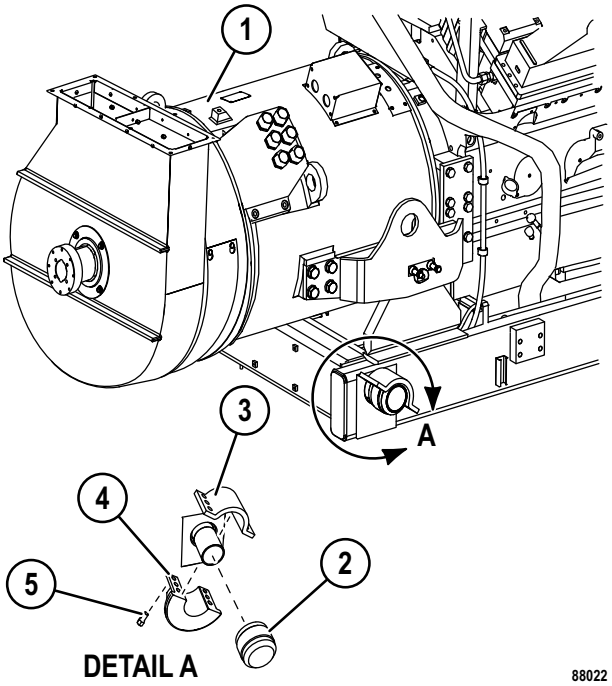


FIGURE 50-15. REAR SUBFRAME MOUNTING BUSHINGS

1. Alternator
2. Mounting Bushing
3. Cap
4. Subframe Mount
5. Capscrew

22. To move the alternator rotor rearward, bolt a push bar across the center of the alternator rotor.

    Install two 5/8” - 11NC capscrews through both ends of the bar and fasten the bar to the alternator housing. See Figure 50-34.

    Alternately tighten each capscrew until the rotor reaches the end of travel. **Do not exceed 16 N·m (12 ft lb)**.

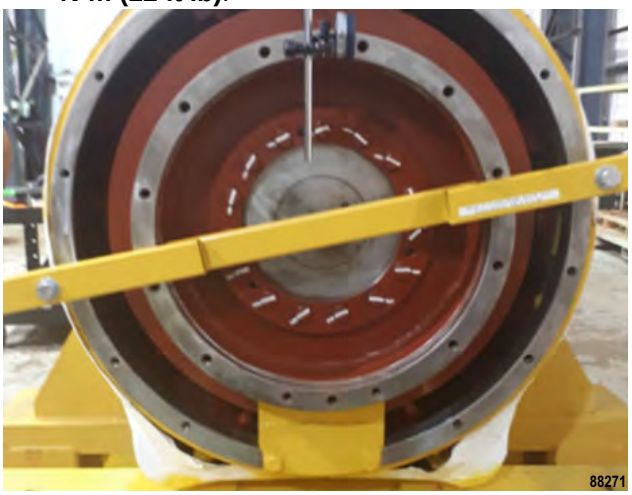


FIGURE 50-34. MOVING THE ALTERNATOR ROTOR

23. Push bar is to remain in position to hold the rotor in rearward position. Bolt a calibrated flat steel bar to the rotor. Make sure the bars are not contacting each other affecting the readings. See Figure 50-35.

FIGURE 50-35. ALTERNATOR HOUSING TO ROTOR MEASUREMENT

24. Measure the distance between the alternator housing and rotor at 45º. See Figure 50-36. This will be measurement A_1.

NOTE: When taking the measurements, ensure that the readings are taken from the mating surfaces.

FIGURE 50-36. ALTERNATOR HOUSING TO ROTOR MEASUREMENT

25. Repeat the same procedure in three more locations, 90 degrees apart from each other in the perimeter, to find the values A_2, A_3 A_4.

1st measurement - 45º (A_1): _____

2nd measurement - 135º (A_2): _____

3rd measurement - 225º (A_3): _____

4th measurement - 315º (A_4): _____

A_{avg} : $(A_1+A_2+A_3+A_4) / 4$ =_____

⚠WARNING

Use lifting equipment with adequate capacity to remove and install the components.

16. Attach a hoist to the radiator and take up any slack.
17. Remove stabilizer bars (1, Figure 50-51) from both sides of the radiator.

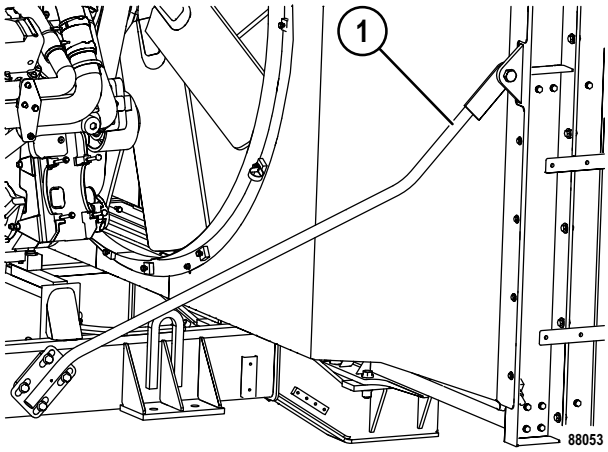


FIGURE 50-51. STABILIZER BAR REMOVAL

1. Stabilizer Bar

18. Remove upper support rods (1, Figure 50-52) from both sides of the radiator.

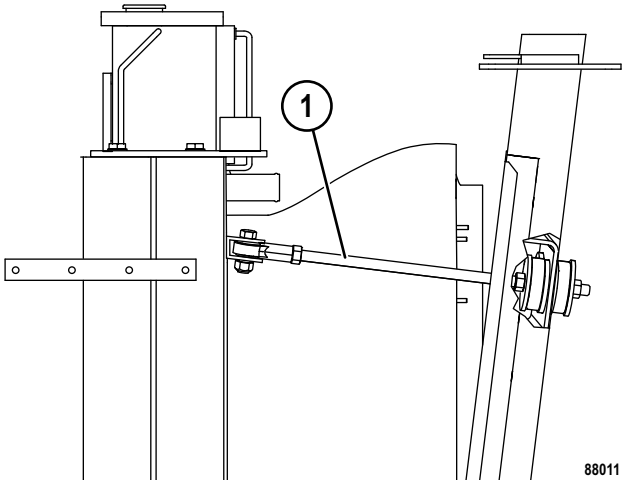


FIGURE 50-52. UPPER SUPPORT ROD REMOVAL

1. Upper Support Rod

19. Remove capscrews (1, Figure 50-53), hardened flat washers (2), lockwashers (3) and nuts (4) that secure the radiator and to the power module subframe.

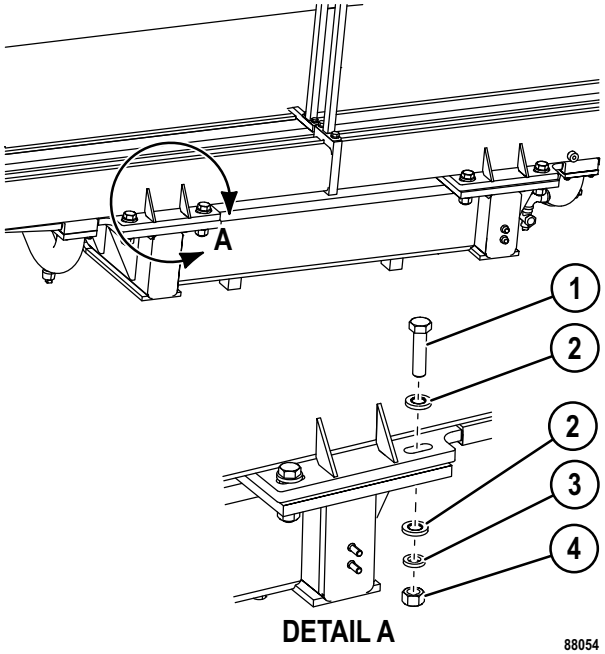


FIGURE 50-53. RADIATOR MOUNTING HARDWARE REMOVAL

1. Capscrew
2. Flat Washer
3. Lockwasher
4. Nut