CEBM027402

Shop Manual

830E-1AC

DUMP TRUCK

SERIAL NUMBERS **830E-1AC A40851 – A40938**
A40995

ENGINE **16V160**

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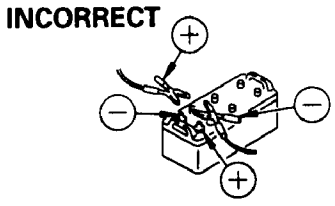
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Jump Starting With Jumper Cables

- Always wear safety glasses or goggles when starting the machine with jumper cables.
- While jump starting with another machine, DO NOT allow the two machines to touch.
- Ensure the parking brake is applied on both machines. The engine on the good machine is to be operating.
- Ensure the size of the jumper cables and clips are suitable for the battery size. Inspect the cables and clips for any damage or corrosion.
- Ensure the key switch and master battery disconnect switch (3, Figure 3-2) on the disabled machine is in the OFF position.
- Connect the batteries in parallel: positive to positive and negative to negative.
- Connect the positive (24VDC +) cable from the good machine to the (24VDC +) on the disabled machine first.
- Then connect the ground cable from the negative (-) battery terminal on the good machine to the frame of the disabled machine, as far away as possible from the batteries. This will prevent a spark from possibly starting a battery fire.
- Move the master battery disconnect switch (3, Figure 3-2) to the ON position. Allow time for the batteries to charge.
- If starting with a jumper cable, perform the operation with two people. One person in the cab of the disabled machine, the other person working with the jumper cables.
- If the batteries are low, DO NOT attempt starting the machine with only one set of jumper cables installed. Install the second set of jumper cables in the same way as already described.
- Attempt starting the disabled machine.
- For jumper cable removal, disconnect the ground or negative (-) cable first, then the (24VDC +) cable last.



- If any tool touches between the positive (+) terminal and the chassis, it will cause sparks. Always use caution when using tools near the batteries.

Jump Starting With Receptacles

- Always wear safety glasses or goggles when starting the machine with jumper cables.
- While jump starting with another machine, DO NOT allow the two machines to touch.
- Ensure the parking brake is applied on both machines. The engine on the good machine is to be operating.
- Inspect the cables and connectors for any damage or corrosion.
- Ensure the key switch and master battery disconnect switch (3, Figure 3-2) on the disabled machine is in the OFF position.
- Connect the jumper cable to the receptacle on the good machine to the receptacle on the disabled machine.
- Allow time for the batteries to charge.

NOTE: The batteries will charge even with the master battery disconnect switch is in the OFF position.

- If starting with a jumper cable, perform the operation with two people. One person in the cab of the disabled machine, the other person working with the jumper cables.
- If the batteries are low, DO NOT attempt starting the machine with only one set of jumper cables installed. Install the second set of jumper cables in the same way as already described.
- Turn the master battery disconnect switch (3, Figure 3-2) to the ON position and attempt starting.
- For jumper cable removal, disconnect the cables from each machine.
- If any tool touches between the positive (+) terminal and the chassis, it will cause sparks. Always use caution when using tools near the batteries.

SPECIAL PRECAUTIONS FOR WORKING ON AN 830E-1AC TRUCK

Preliminary Procedures before Welding or Performing Maintenance

Prior to welding and/or repairing an 830E-1AC dump truck, maintenance personnel must attempt to notify a Komatsu service representative. Only qualified personnel, specifically trained for servicing the AC drive system, must perform this service.

If it is necessary to perform welding or repair to the truck without the field engineer present, the following procedures must be followed to ensure that the truck is safe for maintenance personnel to work on and to reduce the chance for damage to equipment.



Anytime the engine is operating:

- ***DO NOT open any of the cabinet doors or remove any covers.***
- ***DO NOT use any of the power cables for hand holds or foot steps.***
- ***DO NOT touch the retarding grid elements.***



Before opening any cabinets or touching a grid element or a power cable, the engine must be shutdown and the red drive system warning lights must not be illuminated.

Engine Shutdown Procedure before Welding or Performing Maintenance

Normal operation of the drive system at shutdown leaves the system safe to maintain. However, in the event of a system failure, performing the following procedure prior to any maintenance activities will ensure that no hazardous voltages are present in the AC drive system.

1. Before shutting down the engine, verify the status of all the drive system warning lights on the overhead display panel. Use the lamp test switch to verify that all lamps are functioning properly.

   If any of the red drive system warning lights remain on, DO NOT attempt to open any cabinets, disconnect any cables, or reach inside the retarder grid cabinet without a trained drive system technician present - even if engine is off.

   Only qualified personnel, specifically trained for servicing the AC drive system, must perform this service.
2. If all red drive system warning lights are off, follow all of the instructions for “Parking The Machine.”
3. After the engine has been off for at least five minutes, inspect the link voltage lights on the exterior of the main control cabinet and rear of the center console. If all lights are off, the retard grids, wheel motors, alternator, and related power cables are safe to work on.
4. Locate the GF cut-out switch in the front access panel on the left side of the main control cabinet. Place the switch in the CUTOUT position. This will prevent the alternator from re-energizing and creating system voltage until the switch is returned to the previous position.
5. Ensure both battery disconnect switches are in the OFF position. Verify that the battery disconnects are functioning.
6. Before doing any welding on the truck, always disconnect the battery charging alternator lead wire.

6. Inspect air conditioner belts for correct tension, obvious wear, and tracking. Inspect fan guard security and condition. When leaving this point, ensure the service light is off, if used.
7. Move outboard of the front wheel. Inspect attaching lugs/wedges to ensure all are tight and complete. Inspect the tires for cuts, damage or bubbles. Check tire inflation pressure. Check sight glass for front wheel oil level.
8. Move behind the front wheel and inspect the steering cylinder. Check for proper greasing and inspect the mounting hardware to ensure it is all in place. Inspect all steering linkage joints (10, Figure 3-16) for proper greasing. Inspect the suspension mounting hardware to ensure it is all in place. Ensure the suspension protective boot is in good condition. Inspect the hub and brakes for any unusual conditions. Check the entire area for leaks.
9. Inspect the sight glass on hydraulic tank (21). With the engine stopped and body down, hydraulic fluid must be visible in the upper sight glass.
10. Verify all hydraulic tank shut off valves are locked in their fully open positions.
11. Move around the hydraulic tank and in front of the rear dual tires. Inspect hoist cylinder (15) for any damage and leaks. Inspect both upper and lower hoist cylinder pins for integrity and for proper greasing.
12. Before leaving this position, look under the lower edge of the chassis to ensure the flexible duct that carries the air from the blower to the final drive housing is in good condition with no holes or breakage. Also, look up at the main hydraulic pumps (22) to see that there is no leakage or any other unusual condition with the pumps or the pump drive shafts.
13. Move around the dual tires, and check to see that all lugs/wedges are in place and tight. Inspect latches on the wheel cover to be sure they are properly latched. Inspect the wheel for any oil that would indicate brake leakage or wheel motor leakage.

    Check the dual tires (18) for cuts, damage or bubbles. Verify that inflation appears to be correct. If the truck has been operating on a flat tire, the tire must be cool before moving the truck inside a building. Check for any rocks that might be lodged between the dual tires. Inspect the rock ejector condition and straightness so that it can not damage a tire.
14. Inspect the left rear suspension (19) for damage and for correct rod extension. Check for leaks. Ensure that the covers over the chrome piston rod are in good condition. Inspect for proper greasing.
15. Open the rear hatch cover (20), turn on the work light if necessary. Inspect for leaks around wheel motor mounting to rear housing, and also brake hoses and fittings. Ensure that covers on wheel motor sump are in place, and that there are no rags or tools left behind. Inspect condition of hatch cover gasket, report any bad gasket to maintenance. Turn off work light if used, close and latch hatch.
16. While standing in front of the rear hatch, look up to see that rear lights are in good condition, along with the back-up horns. Look up at the panhard rod to see that it is getting proper greasing. Also look at both body hinge pins for greasing and any abnormal condition. Check hoist limit switch and clear any mud/debris from contacts.
17. Perform the same inspection on the right rear suspension (19) as done on the left.

Parking Brake Test

1. Place the directional control lever in the PARK position.
2. Press the brake test switch and wait for the brake check light to be on solid.
3. The DID panel will display:

   Parking Brake or Retard Test READY
   Press Accel or Retard Pedal to Start

4. Fully depress the accelerator pedal. The drive system controller will enter propel mode and generate torque up to the park brake limit.
5. The DID panel will display:

   Park Brake Test ACTIVE
   Check Truck Movement when Light Flashes

6. Once the torque has reached the limit for the parking brake test, the brake check light will begin to flash. This is the indication for the operator to make a determination as to the status of the parking brake system.

   - **If the truck did not move:**
     The park brake system passed the test.
   - **If the truck moved during the test:**
     The park brake test has failed. Release the accelerator pedal. If the truck starts to roll, apply the service brakes to hold the truck stationary. Notify maintenance personnel immediately.

⚠CAUTION

If the truck moves at all during the parking brake test, immediately release the accelerator pedal to avoid serious damage to the parking brake.

⚠WARNING

If the truck fails the parking brake test, notify maintenance personnel immediately. Do not resume operation unless the truck passes all brake tests.

7. When the operator releases the accelerator pedal, torque will be reduced, the test will stop and the brake check light will turn off.

Retard System Test:

1. Place the directional control lever in the PARK position.
2. Press the brake test switch and wait for the brake check light to be on solid.
3. The DID panel will display:

   Parking Brake or Retard Test READY
   Press Accel or Retard Pedal to Start

4. Fully depress the retard pedal. The drive system controller will ramp up the engine speed, close CM1, close CM2, close CM3 close CM4, turn on the choppers, and test the retarding system. The system will verify current flow through each grid leg and the grid blower motor.
5. The DID panel will display the current status of the test.

   Retard System Test ACTIVE
   CM1 CM2 CM3 CM4 CHOP
   (Elements are added as the test progresses.)

6. Upon successful completion of the test, the light will flash for 10 seconds indicating a successful test. The DID panel will display:

   Retard System Test PASSED

   or

   Retard System Test FAILED or Incomplete

NOTE: If the brake check light never flashes, but turns off, the test has failed.

⚠WARNING

If the truck fails the retard system test, notify maintenance personnel immediately. Do not resume operation unless the truck passes all brake tests.

7. When the operator releases the retard pedal, the test will stop and the brake check light will turn off.
8. If the retard system failed the test, notify maintenance personnel immediately. Do not resume operation unless the truck passes all brake tests.

8. The parking brakes must be released before towing. To release the parking brake, follow the steps below to install a special wiring harness to release the parking brakes.
   a. Ensure switch (1, Figure 3-26) is in the OFF position.
   b. Connect one lead of the special wiring harness to the 24VDC bus bar terminal on the side wall in the auxiliary control cabinet for the 24V supply.
   c. Disconnect the truck wiring harness from parking brake solenoid (2, Figure 3-27). Connect special wiring harness (3, Figure Figure 3-26) to the parking brake solenoid. Attach the short lead (2) to ground.
   d. WIth the window lowered, place the end of the special wiring harness inside the cab so the operator can control the parking brake with switch (1).

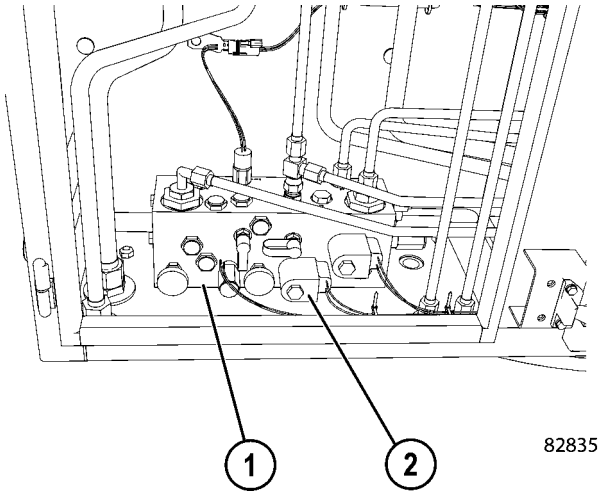


FIGURE 3-27. BRAKE CABINET

1. Brake Manifold
2. Park Brake Solenoid

9. Ensure the operator in the towing vehicle has 2-way radio communications with the driver in the disabled truck.
10. When ready to tow the disabled truck, remove blocking from the wheels.
11. The operator in the disabled truck should now move switch (1, Figure 3-26) to the ON position. This will release the parking brakes.
12. Tow the disabled truck. Sudden movement may cause tow bar failure. Smooth, gradual truck movement is preferred. Do not tow the truck any faster than 8 kph (5 mph).
13. Minimize the tow angle at all times. **Never exceed 30 degrees.** The towed truck must be steered in the direction of the tow bar.
14. When the desired location has been reached, the operator in the towed vehicle is to apply the service brakes, then turn switch (1) to the OFF position. This will apply the parking brakes.
15. Block the wheels on the towing vehicle and the disabled truck to prevent roll-away.
16. Shut down the engine in the towing vehicle. Disconnect the hydraulic hoses.
17. Disconnect special wiring harness (3) from the truck. Connect the truck wiring harness back to the parking brake solenoid.
18. Disconnect the tow bar.

A caution decal is also attached to the door of the rear hatch cover to alert personnel that hot exhaust air is present and may cause injury.

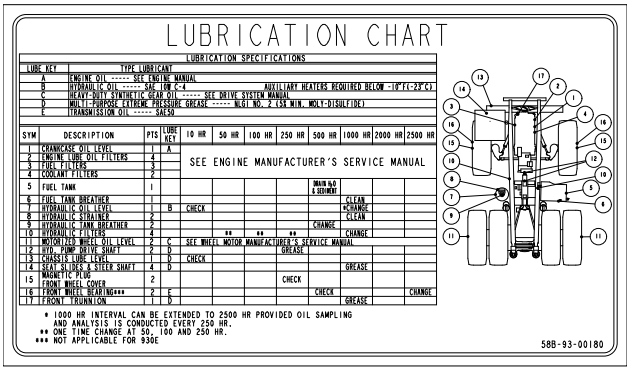
This caution decal is also placed around the retarding grid cabinet.



This decal is placed on both front wheel hubs to warn about hot oil inside the wheel hubs. Remove the oil level plug carefully to avoid injury.



The lubrication chart is mounted on the right hand side of the radiator grille structure. Refer to Section P, Lubrication and Service, in this manual for more complete lubrication instructions.



STORAGE AND IDLE MACHINE PREPARATION

There may be periods when it is necessary for a machine to be idle for an extended period of time. Properly prepared, a stored machine may promptly and safely be put back into operational service. Improper preparation, or complete lack of preparation, can make the job of getting the vehicle back to operating status difficult.

The following information outlines the essential proper steps for preparing a unit for extended storage, and the necessary steps to bring it back to operational status. Additional information is given to help restore those machines which were not put into storage, merely shut down and left idle for a long period of time.

Much of this material is of a general nature since the environment, where the machine has been standing idle, will play a big part in its overall condition. Hot, humid climate will affect vehicle components much differently than the dry desert atmosphere or a cold arctic environment. These climatic aspects must be considered, and appropriate actions taken when restoring a long term idle vehicle.

These instructions are not intended to be all inclusive, but are furnished to provide the minimum guide lines. The final aim should always be to provide the operator with a safe, fully productive vehicle, that he can rely on.

SHORT TERM IDLE PERIODS

There will be periods when a vehicle may be idle from 30-60 days, but must be ready for use at all times.

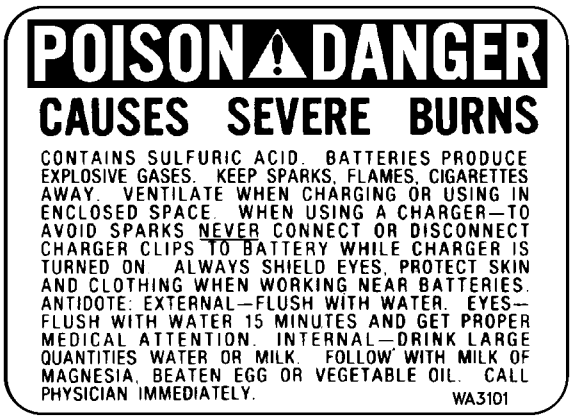
The most effective handling of this type situation is to follow the procedure given below to prevent any deterioration from beginning.



1. Keep the vehicle fully serviced.
2. On a weekly schedule, perform a visual check of the vehicle, start and run the engine until both the engine and transmission are up to operating temperature. Move the vehicle around the yard for a few minutes to insure that all internal gears and bearings are freshly lubricated.
3. Operate all hydraulic functions through complete range to insure that cylinder rams and all seals are fully lubricated.



4. Check and operate all systems.
5. Once a month, perform the 10 hour service items shown in the Operation and Maintenance Manuals. Keep batteries properly serviced.



TRANSMISSION PRESERVATION AND STORAGE

Storage, New Transmission

(Prior to installation). New transmissions are tested with preservative oil and drained prior to shipment. The residual oil remaining in the transmission provides adequate protection to safely store the transmission for up to one year (stored inside the conditions of normal climate and with all shipping plugs installed) without further treatment.

Preservation Methods. When the transmission is to be stored or remain inactive for an extended period (one or more years), specific preservation methods are recommended to prevent damage due to rust, corrosion, and organic growth in the oil. Preservation methods are presented for storage with and without transmission fluid.

Storage, One Year -- Without Oil

1. Drain the oil.
2. Spray two ounces (60 milliliters) of VCI #10 through the fill tube.
3. Seal all openings and the breather with moisture-proof tape.
4. Coat all exposed, unpainted surfaces with preservative grease such as petroleum (MIL-C-11796, Class 2).
5. If additional storage time is required, repeat steps (2), (3) and (4) at yearly intervals.

Storage, One Year With Oil (normally in a vehicle chassis)

1. Drain the oil and replace the oil filter element(s).
2. Fill the transmission to operating level with a mixture of one part VCI #10 (or equivalent) to 30 parts C-3 transmission fluid. Add 1/4 teaspoon of Biobor JF (or equivalent) for each 3 gallons (11 liters) of fluid in the system.

NOTE: When calculating the amount of Biobor JF required, use the total volume of the system, not just the quantity required to fill the transmission. Include external lines, filters, and the cooler.

3. Run the engine for approx. five minutes at 1500 rpm with the transmission in neutral.
4. Drive the vehicle. Make sure the transmission shifts through all ranges. Make sure the lockup clutch is working.
5. Continue running the engine at 1500 rpm with the transmission in neutral until normal operating temperature is reached.

⚠WARNING

If the unit does not have a converter-out temperature gage, do not stall the converter.

6. If normal operating temperature is less than 225° F (107° C), shift the transmission to the highest forward range and stall the converter.When the converter-out temperature reaches 225° F (107° C), stop the engine. Do not exceed 225° F (107° C).
7. As soon as the transmission is cool enough to touch, seal all openings and the breather with moisture-proof tape.
8. Coat all exposed, unpainted surfaces with preservative grease such as petrolatum (MIL-C-11796, Class 2).
9. If additional storage time is required, repeat steps (2) through (8) at yearly intervals; except, it is not necessary to drain the transmission each year. Just add Motorstor and Biobor Jf (or equivalents).

Restoring Transmission to Service

1. Remove all tape from openings and the breather.
2. Wash off all external grease with mineral spirits.
3. If the transmission is new, drain the residual preservative oil. Refill the transmission to the proper level with C-4 transmission fluid.
4. If the transmission was prepared for storage without oil, drain the residual oil and replace the oil filter elements. Refill the transmission to the proper level with C-4 transmission fluid.
5. If the transmission was prepared for storage with oil, it is not necessary to drain and refill the transmission with new transmission fluid. Check for proper fluid level. Add or drain transmission fluid as required to obtain to proper level.

DUMP BODY

Removal

⚠WARNING

Inspect all lifting devices. Slings, chains, and/or cables used for lifting components must be inspected daily for serviceable condition. Refer to the manufacturer's manual for correct capacities and safety procedures when lifting components. Replace any questionable items.
Slings, chains, and/or cables used for lifting components must be rated to supply a safety factor of approx. 2X the weight being lifted.
When in doubt as to the weight of components or any assembly procedure, contact the Komatsu area representative for further information.
Lifting eyes and hooks should be fabricated from the proper materials and rated to lift the load being placed on them.
Never stand beneath a suspended load. Use of guy ropes are recommended for guiding and positioning a suspended load.
Before raising or lifting the body, be sure there is adequate clearance between the body and overhead structures or electric power lines.
Be sure that the lifting device is rated for at least a 45 ton capacity.

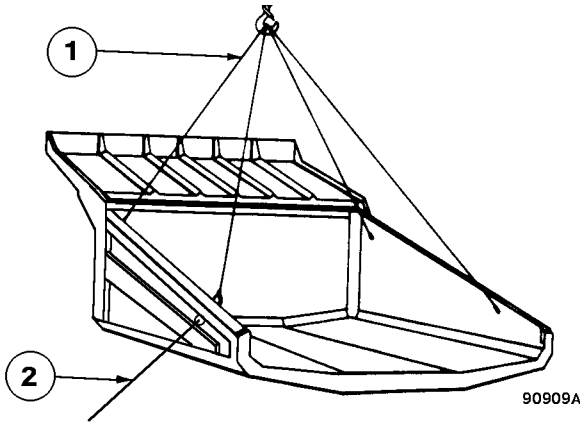


FIGURE 3-1. DUMP BODY REMOVAL

1. Lifting Cables
2. Guide Rope

1. Park truck on a hard, level surface and block all the wheels. Connect cables and lifting device to the dump body and take up the slack as shown in Figure 3-1.
2. Remove mud flaps and rock ejectors from both sides of the body. Remove electrical cables, lubrication hoses, etc, attached to the body.
3. Attach chains around upper end of hoist cylinders to support them after the mounting pins are removed.
4. At each of the upper hoist cylinder mounting eyes, remove shoulder bolt (4, Figure 3-2), flat washer (5) and nut (6). With adequate means of supporting the hoist cylinders in place, remove both pins (2).

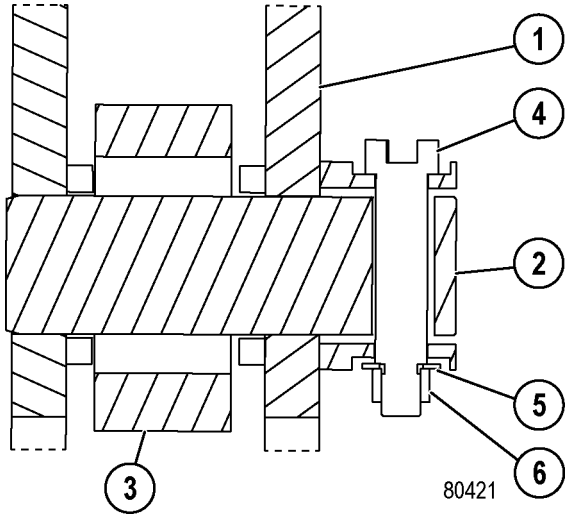


FIGURE 3-2. HOIST CYLINDER MOUNTING (UPPER)

1. Dump Body
2. Pin
3. Hoist Cylinder
4. Shoulder Bolt
5. Flat Washer
6. Locknut

QUICK FILL FUEL RECEIVERS

Fuel receiver assembly (4, Figure 4-6) is mounted on the front of the fuel tank. An optional left hand fuel receiver assembly (6) is mounted to the bottom of the hydraulic tank. It is connected to the rear of the fuel tank by a hose (2).

The quick fill fuel system is a pressurized system that is rated at a maximum of 568 l/m (150 gpm). When filling the tank, vent assembly (1) allows air to escape to prevent the tank from over-pressurizing. When the fuel level reaches the float balls in the vent, the balls rise with the fuel. When the fuel level reaches its maximum level, the float balls block air flow out of the vent, causing pressure to rise in the fuel tank. When pressure reaches 55 - 70 kPa (8 - 10 psi), the fuel nozzle should turn off.

If the nozzle fails to turn off and fuel continues to fill the tank, a relief valve in the vent will open at 79 kPa (11.5 psi) to prevent over-pressurization of the tank. If filling persists and the fuel reaches the top of the tank, fuel will flow out of the vent until the nozzle is turned off.

If fuel spills from the vent, or if the tank does not completely fill, check the vent to see whether the float balls are in place and overflow tube is clean. If the vent is operating properly, the problem will most likely be in the fuel supply system.

NOTE: Keep the cap on each fuel receiver to prevent dirt buildup in valve area and nozzle grooves.

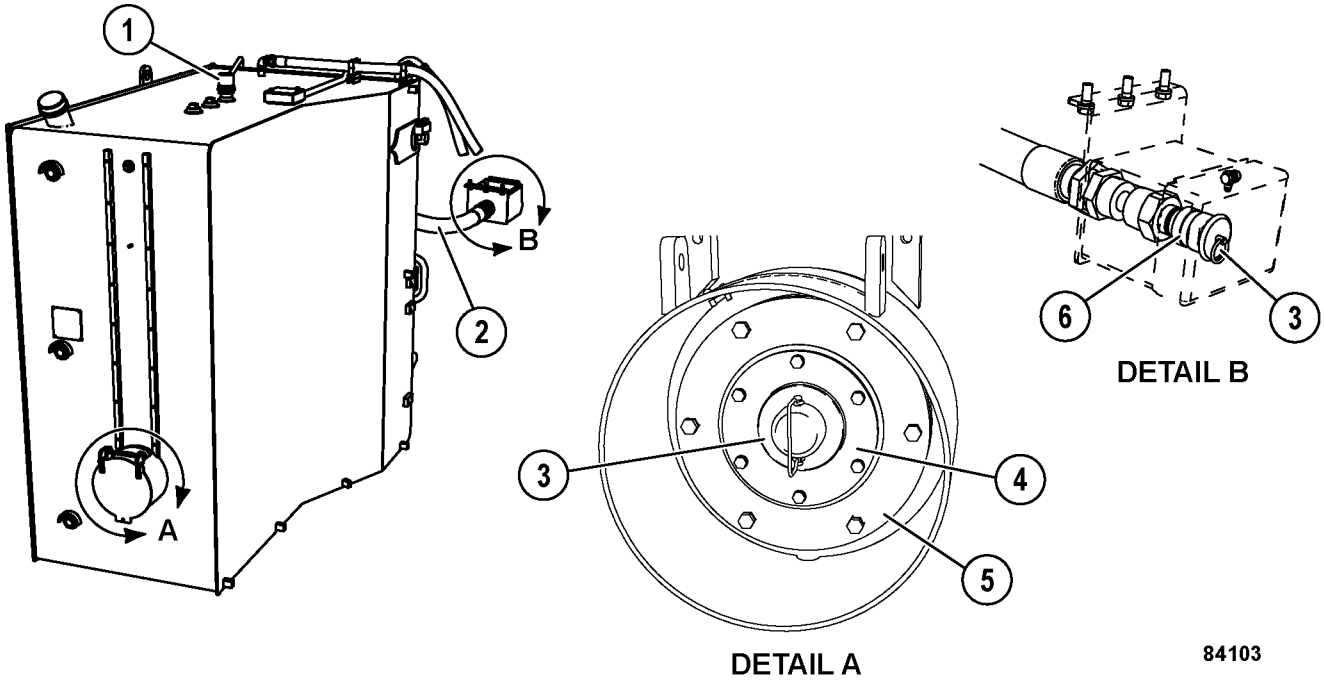


FIGURE 4-6. QUICK FILL FUEL RECEIVERS

1. Vent Assembly
2. Quick Fill Hose
3. Fuel Receiver Cap
4. RH Fuel Receiver Assembly
5. Adapter Plate
6. LH Fuel Receiver Assembly

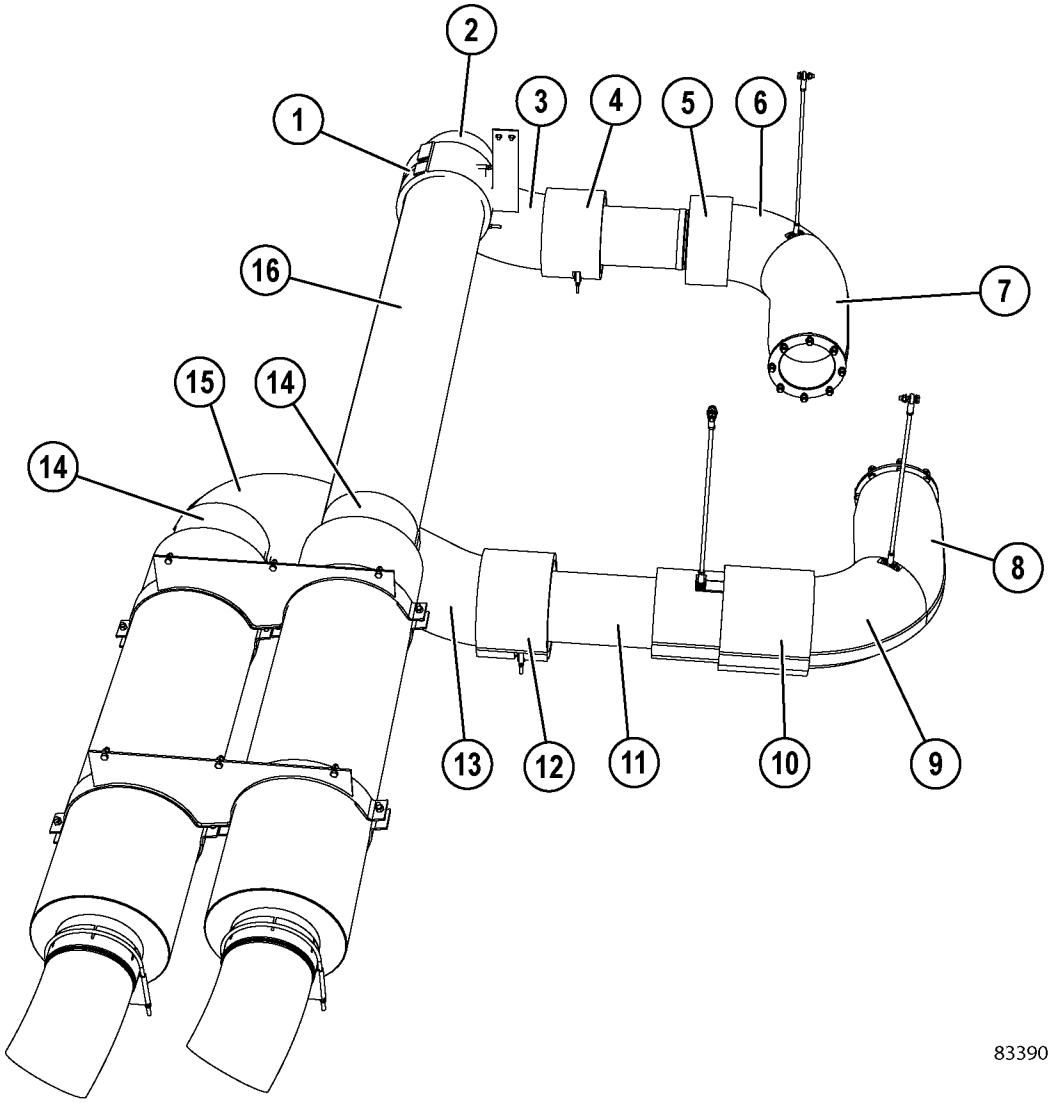


FIGURE 2-8. EXHAUST BLANKETS

1. Exhaust Blanket, Mid RH Pipe
2. Exhaust Blanket, Mid RH Pipe
3. Exhaust Blanket, Rear RH Pipe
4. Exhaust Blanket, Rear RH Pipe
5. Exhaust Blanket, Rear RH Pipe
6. Exhaust Blanket, Rear RH Pipe
7. Exhaust Blanket, Rear RH Pipe
8. Exhaust Blanket, Rear LH Pipe
9. Exhaust Blanket, Rear LH Pipe
10. Exhaust Blanket, Rear LH Pipe
11. Exhaust Blanket, Rear LH Pipe
12. Exhaust Blanket, Rear LH Pipe
13. Exhaust Blanket, Rear LH Pipe
14. Exhaust Blanket, Front LH and RH Pipe
15. Exhaust Blanket, Front LH Pipe
16. Exhaust Blanket, Mid RH Pipe

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IMPORTANT

Have a new safety (secondary) filter element on hand before removing the used filter element. Do not keep the intake system open to the atmosphere any longer than necessary.

4. If the safety element must be replaced, remove and discard the safety element. **Do not** clean the damaged or dirty safety element.
5. Install the new safety element.
6. Install primary element (2) into the air cleaner. If the original element is being reused, ensure the sealing gasket is not damaged. The gasket must seal completely.
7. If open, close and latch dust cup valves (11) on the bottom of dust cups (10).

AIR CLEANER ASSEMBLY CLEANING

Primary Element Cleaning

IMPORTANT

Only the primary elements may be cleaned, and then only if they are structurally intact. Do not reuse an element that is damaged. Do not clean and reuse the safety elements. Replace them with new parts if necessary.

After inspection, determine the condition of the primary element. Choose either the washing method or compressed air method for cleaning the element. If the element is clogged with carbon, soot, oil and/or dust, the complete washing procedure will produce the best results.

Wash elements with water and detergent as follows:

1. Soak the element in a solution of detergent and water for at least 15 minutes. Rotate the element back and forth in the solution to loosen dirt deposits. **Do not soak elements for more than 24 hours.**
2. Rinse the element with a stream of fresh water in the opposite direction of normal air flow until rinse water runs clear. Maximum permissible water pressure is 276 kPa (40 psi). A complete and thorough rinse is essential.
3. Dry the element thoroughly. If drying is done with heated air, the maximum temperature must not exceed 60°C (140°F) and must be circulated continually. Do not use a light bulb to dry elements.

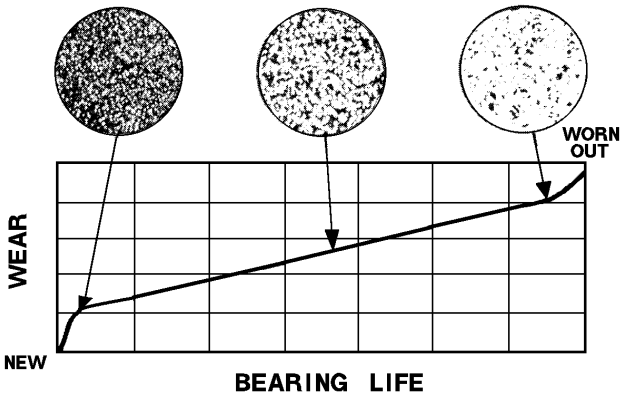


FIGURE 7-14.

13. Inspect sleeve bearing (44) and sleeve bearing (41). Compare the color of each bearing to the chart above. The lighter the appearance of the bearing, the more worn it is. If either bearing needs replacing, proceed to the next step. If the bearings are in good condition, skip the next step.

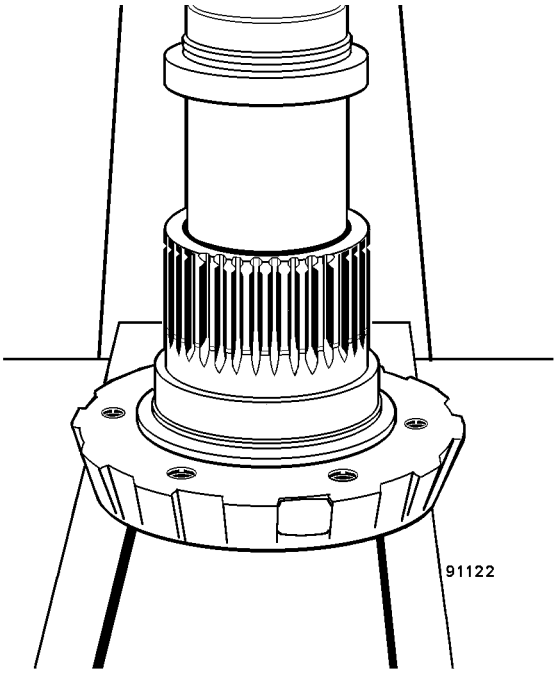


FIGURE 7-15.

14. Position tooling (C) against sleeve bearing (41). Press the front sleeve bearing downward to press it out of the fan mounting hub. Rear sleeve bearing (44) will be pressed out simultaneously.

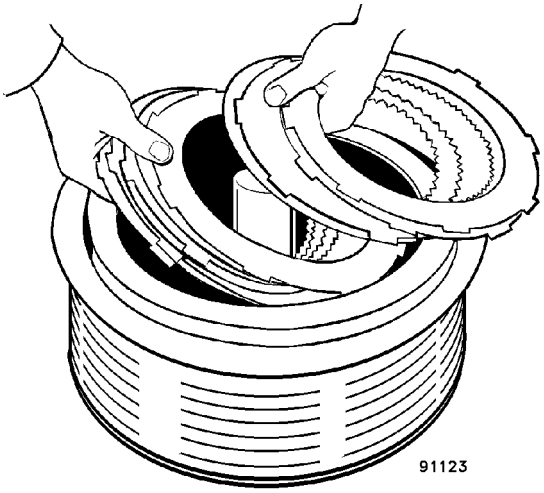


FIGURE 7-16.

15. Remove the stack of facing plates (30) and steel clutch plates (31) from inside the pulley.

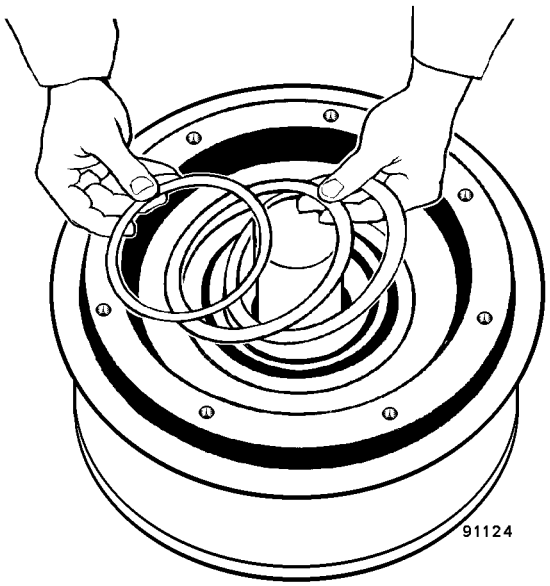


FIGURE 7-17.

16. Remove external snap ring (27), shim (26), and spring washer (25).

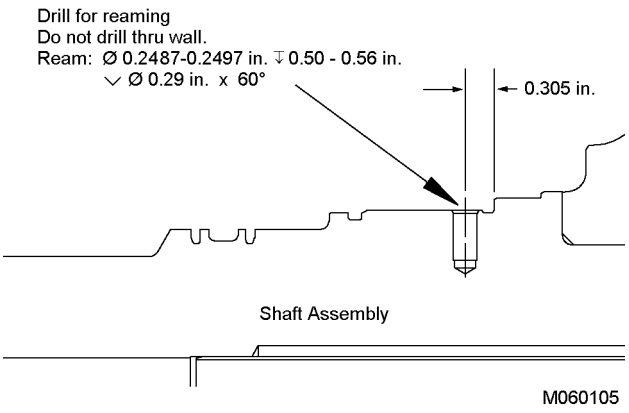


FIGURE 7-53.

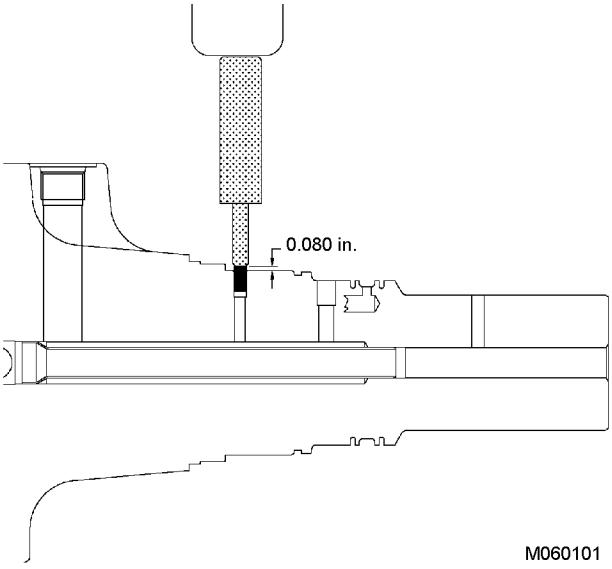


FIGURE 7-54.

14. If removed, install rear dowel pin (2) in shaft assembly (6). Press the pin until 2.0 mm (0.080 in.) is left exposed above the surface.

    If the shaft did not originally come with pinned bearings, install the dowel per instructions in Figures 7-53 &7-54.

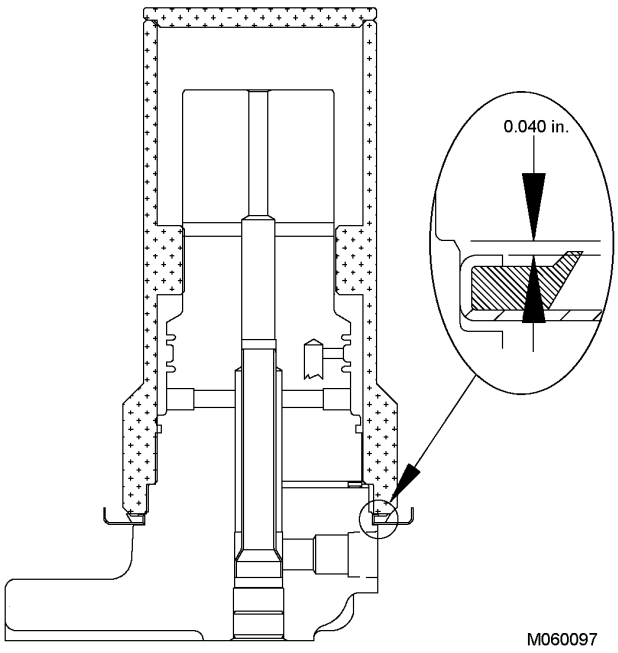


FIGURE 7-55.

15. Use tooling (D) to press rear retainer/seal assembly (5) onto shaft (6). The inner race of the retainer should be recessed 1.0 mm (0.040 in.) below the shoulder.

    Check carefully to ensure that the retainer/seal assembly is installed straight and not bent or damaged in any way which will cause interference between it and the bearing retainer after assembly.

SECTION D2
24VDC ELECTRIC SUPPLY SYSTEM
INDEX

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Cleaning and Inspection

1. Drive (71), armature (45) and fields (46) must not be cleaned in any degreasing tank, or with grease dissolving solvents, since these will dissolve the lubricant in the drive and damage the insulation in the armature and field coils.
2. All parts except the drive must be cleaned with mineral spirits and a clean cloth.
3. If the commutator is dirty, it may be cleaned with No. 00 sandpaper.

NOTE: DO NOT use emery cloth to clean the commutator.

4. Inspect brushes (13, Figure 2-6) for wear.
   a. If worn excessively when compared with a new brush, they must be replaced.
   b. Ensure the brush holders (10) are clean and the brushes are not binding in the holders.
   c. The full brush surface must ride on the commutator. Check by hand to insure that brush springs (16) are giving firm contact between brushes (13) and commutator.
   d. If springs (16) are distorted or discolored, they must be replaced.

FIGURE 2-6 CRANKING MOTOR ASSEMBLY

1. C.E. Frame
2. Washers
3. O-Rings
4. Insulator
5. Support Plate
6. Brush Plate Insulator
7. Washers
8. Plate & Stud
9. Plate
10. Brush Holder
11. Lockwasher
12. Screw
13. Brush (12 required)
14. Lockwasher
15. Screw
16. Brush Spring
17. Screw
18. Screw
19. Screw
20. Lockwashers
21. Plate
22. Brush Holder Insulator
23. Screw
24. Lockwasher
25. Washer
26. O-Ring
27. Bushing
28. Insulator
29. Washer
30. Lockwasher
31. Nut
32. Nut
33. Lockwasher
34. Screw
35. Field Frame
36. Stud Terminal
37. Bushing
38. Gasket
39. Washers
40. Washers
41. Nut
42. Connector
43. Lockwasher
44. Nut
45. Armature
46. Field Coil
47. Shoe
48. Insulator
49. Screw
50. Washer
51. O-ring
52. Inspection Plug
53. Solenoid Housing
54. Lockwasher
55. Screw
56. Plunger
57. Washer
58. Boot
59. Washer
60. Spring
61. Retainer
62. Snap Ring
63. Shift Lever
64. Nut
65. O-Ring
66. O-Ring
67. Snap Ring
68. Lever Shaft
69. Drive Housing
70. Screw
71. Drive Assembly
72. Gasket
73. Plug
74. Gasket
75. Brake Washer
76. Screw
77. Lockwasher
78. Lever Housing
79. Washer
80. O-Ring

RTMR1 - VEC Block

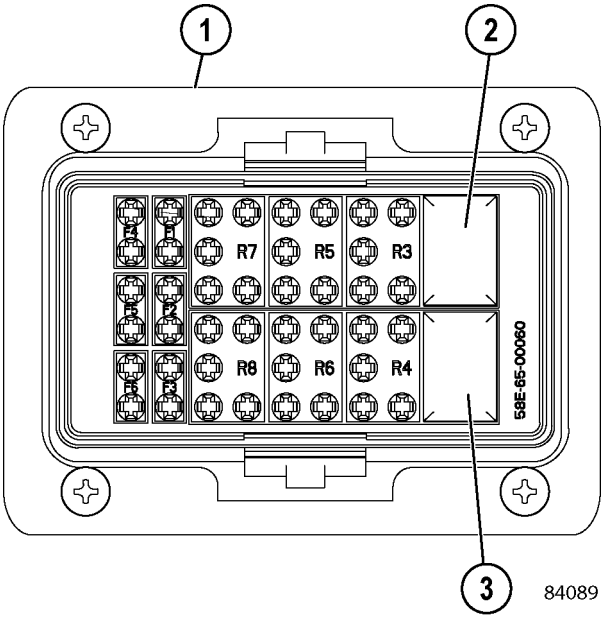


FIGURE 3-4. RTMR - VEC BLOCK

1. RTMR-VEC Block
2. Relay R1 (A/C Shutter Control)
3. Relay R2 (930E Park Brake Protection)

Vehicle Electrical Centers (VEC)

There are three VECs (1, 2 & 4, Figure 3-2) located inside the auxiliary control cabinet. VECs contain replaceable relays, diodes and fuses that are mounted on a plug-in connector for easy replacement.

All diodes are used to control the flow of current in a circuit as required.

The fuses protect various circuits on the truck. Spare fuses are provided in the VECs.

NOTE: Before replacing a fuse, determine the cause of failure. Repair as necessary. Always replace a fuse with one of the same specified amperage. Never replace with one of greater amperage.

The relays switch on/off circuits that require control logic on the truck. The relays in the VEC are replaceable.

The following briefly describes each component and its function. Refer to Section R, Schematics, for the following circuit components.

KOMTRAX PLUS COMPONENTS

KOMTRAX PLUS BASIC FEATURES

The center of the KOMTRAX Plus (previously called VHMS) system is the controller which gathers data about the operation of the truck from sensors and other controllers installed on the truck. Refer to Figure 11-1 for an overview of the KOMTRAX Plus system components.

For instructions on how to use KOMTRAX Plus software programs, refer to KOMTRAX Plus Software elsewhere in this section. For error codes and troubleshooting procedures, refer to KOMTRAX Plus & Interface Module Error Codes and Troubleshooting elsewhere in this section.

Gather Data

The KOMTRAX Plus controller gathers data from four sources. Real-time and alarm data from each controller is gathered continually. In addition, haul cycle summary data from the PLM is requested by the KOMTRAX Plus controller one time per day.

The KOMTRAX Plus system performs three primary functions:

1. Gathers data from on-board sources:
   a. PLM Controller
   b. Interface Module (IM)
   c. Engine Controllers
   d. Drive System Controller
2. Converts data into usable formats and record into permanent memory.
3. Communicates data to off-board systems:
   a. Satellite (ORBCOMM)
   b. Laptop Personal Computer (PC) Download

NOTE: The ORBCOMM controller may not be approved for use in certain countries of the world. Local regulation may prohibit the use of the ORBCOMM controller/satellite communicator. If equipped, the controller and antenna may be disconnected and/or removed from the truck..

Convert and Record Data

KOMTRAX Plus controller (2, Figure 11-1) processes data received from external controllers and stores the following data in internal memory:

- Fault codes from the engine, Interface Module, and PLM.
- Snapshots of data when specific fault codes occur
- Trends of specific engine and chassis parameters
- Load map and other measures of engine and chassis usage
- Haul cycle summary information, including payload, distance traveled, and travel times

In addition to data gathered from external controllers, KOMTRAX Plus records information about the vehicle and KOMTRAX usage, including:

- Key ON and engine ON record
- KOMTRAX Plus configuration changes

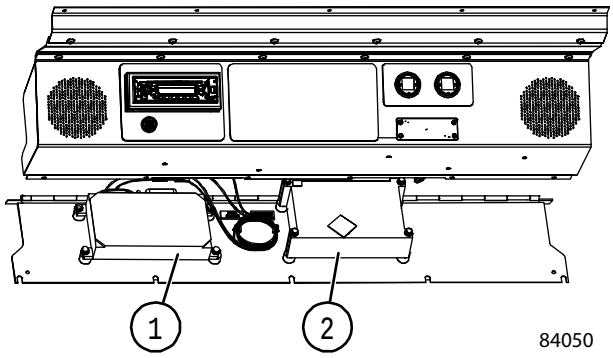


FIGURE 11-1. KOMTRAX Plus SYSTEM COMPONENTS

1. ORBCOMM Controller 2. KOMTRAX Plus Controller

KOMTRAX PLUS SOFTWARE

To work with the KOMTRAX Plus system, several special tools and software programs are required. Refer to Table 7 and Table 8 for detailed information on KOMTRAX Plus software and tools.

Refer to the following pages for detailed information on how to perform certain procedures using KOMTRAX Plus specific software.

The data files, application code and flashburn software are only required if the interface module is being replaced. Replacement interface modules from Komatsu do not have any software installed in them.

NOTE: Be aware that the software and data files are updated periodically. Check with the local Komatsu distributor for the latest software versions.

NECESSARY SOFTWARE

Table 7: KOMTRAX Plus Software

Part Number	Name	Description	Source
Version 3.04.03.01	VHMS Technical Analysis Tool Box	To maintain KOMTRAX Plus system	Komatsu Distributor
Version 3.06.00.00	VHMS Setting Tool	To initialize KOMTRAX Plus system	Komatsu Distributor
1.4.7.39	PDM	Payload Meter Data Manager	Komatsu Distributor
EJ0575-5	PLM	PLM Controller Software to work with KOMTRAX Plus	Komatsu Distributor

NECESSARY TOOLS

Table 8: KOMTRAX Plus Tools

Name	Description	Source
Laptop PC	200 MHz or higher 64 MB RAM or more Serial or USB Port CD/DVD -Rom drive Floppy Drive Windows 95/98/2000/ME/XP	Purchased Locally
Serial cable	(RS232) Purchase locally Male DB9 connector at one end Female DB9 connector at other end	Purchased Locally
Adaptor	USB port to RS232 (serial) port adapter (If laptop PC does not have an RS232 port, this adaptor is required)	Purchased Locally

KOMTRAX PLUS CONTROLLER CHECKOUT

KOMTRAX Plus Controller

The KOMTRAX Plus controller (1, Figure 11-6) collects and stores signals from sensors and data from other controllers. It also gives commands for transmitting the accumulated data through the communications system. The controller operates on 20VDC - 30VDC.

Necessary Equipment:

- Checkout procedure
- System schematic
- Laptop personal computer (PC)
- *VHMS Technical Analysis Toolbox* software
- *VHMS Setting Tool* software
- Tera Term Pro software
- Serial cable (RS232)
  (male DB9 connector on one end, female connector on the other end)

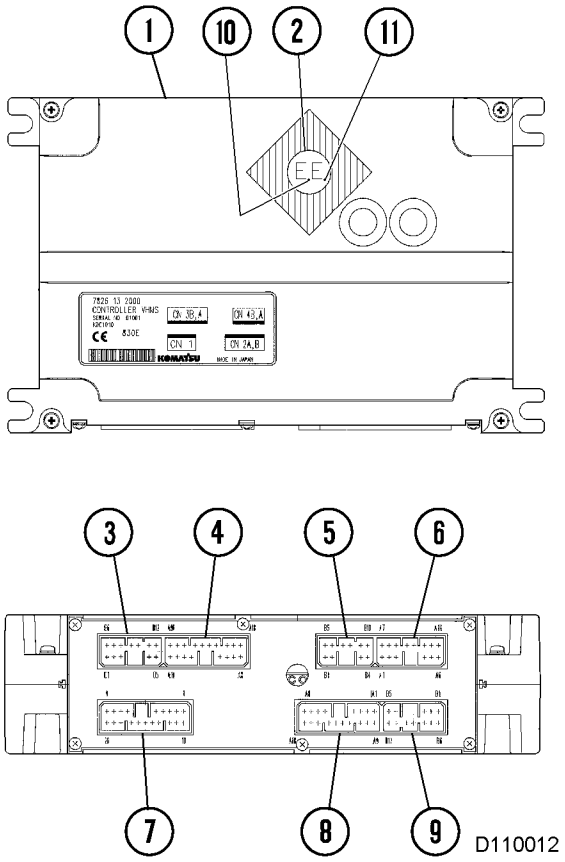


FIGURE 11-6. KOMTRAX Plus CONTROLLER

1. KOMTRAX Plus Controller
2. LED Display
3. Connector CN3B
4. Connector CN3A
5. Connector CN4B
6. Connector CN4A
7. Connector CN1
8. Connector CN2A
9. Connector CN2B
10. PLM Light
11. OrbComm Light

7. Check for fault codes associated with the interface module.
   a. Perform a KOMTRAX Plus download with the *VHMS Technical Analysis Toolbox* program. Refer to KOMTRAX Plus Download for detailed instructions on performing a download.
   b. In the download data, view the fault history and confirm that there are no fault codes associated with the interface module. If any are found, these circuits should be analyzed to determine the cause of the fault and repaired.
   c. Confirm that there are no fault codes associated with the communications between PLM, engine controller, interface module, drive system controller or the ORBCOMM controller. If any are found, these circuits should be analyzed to determine the cause of the fault and repaired.

Checking Inputs And Outputs From The Interface Module

1. Attach the KOMTRAX Plus serial cable to the machine's IM diagnostic port (2, Figure 12-5), and the other end to the laptop PC's serial port.
2. Start the *Interface Module Real Time Data Monitor* program by double-clicking on the shortcut. The program begins with a blank window. On the menu bar, there are five items: Select Serial Port, Start/Stop, Logging, Screenshot, and Units.
3. Click on [Select Serial Port] in the menu bar. Select the correct communication port. It will usually be Com1.
4. Click on [Start/Stop] in the menu bar and select Start.
5. The program should display data as shown in Figures 12-6 and 12-7.

NOTE: If any fault codes associated with the interface module are found, these circuits should be analyzed to determine the cause of the fault, and they should be repaired.

Table 3: Chassis Fault Codes (continued)				
KOMTRAX Plus Fault Code	**KOMTRAX PLUS Fault Description**	**Source**	**Sent via ORBCOMM**	**Snapshot Trigger**
#A216	Brake Auto Apply Circuit Fail	IM/GE	X	
#A230	Park Brake Request While Moving	IM		
#A231	Body Is Up While Traveling Or Intending To Travel	IM		
#A235	Steering Accumulator Being Bled Down	IM		
#A236	Steering Bleed Fault	IM		
#A237	The CAN/RPC Connection To The Display Is Open	IM		
#A240	IM Key Switch Power Lost	IM		
#A242	Defective Fuel Gauge Within Display Panel	IM		
#A243	Defective Engine Coolant Temp Gauge In Display Panel	IM		
#A244	Defective Drive System Temp Gauge Within Display Panel	IM		
#A245	Defective Hydraulic Oil Temp Gauge Within Display Panel	IM		
#A246	PLM Reports Truck Overload	IM		
#A247	Low Steering Pressure Warning Displayed	IM		
#A248	Defective Status Module Within Display Panel	IM		
#A249	Red Warning Lamp Short	IM		
#A250	Low Battery Voltage - Engine Off	IM		
#A251	Sonalert Is Open Or Shorted To Ground	IM		
#A252	Start Enable Circuit Fault	IM		
#A253	Steering Bleed Circuit Not Open While Running	IM		
#A255	Fault On IM Output 1n	IM		
#A256	Red Warning Lamp Open	IM		
#A257	Payload CAN/RPC Not Connected	IM		
#A258	Steering Accumulator Bleed Pressure Switch Fault	IM		
#A260	Park Brake Failure - On While Moving	IM		
#A261	Low Brake Accumulator Pressure Warning Display	IM		
#A262	Steering Bleed Circuit Open During Shutdown	IM		
#A264	Park Brake Relay Circuit Defective	IM		
#A265	Service Brake Failure	IM		
#A266	Selector Switch Not In Park While Cranking Engine			
#A267	Park Brake Not Set While Attempting To Crank Engine			
#A268	Secondary Engine Shutdown While Cranking			
#A270	Brake Lock Switch Power Supply Not On When Required	IM		
#A271	Shifter Not In Gear	IM		
#A272	Brake Lock Switch Power Supply Not Off When Required	IM		
#A273	Pump Filter Circuit Fault	IM		

SECTION D14
KOMTRAX PLUS FORMS
INDEX

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KOMTRAX PLUS DATA DOWNLOAD D14-4
KOMTRAX PLUS INITIALIZATION CHECK LIST D14-5
KOMTRAX PLUS INITIALIZATION FORM D14-7

SYSTEM COMPONENTS

Drive System Controller (DSC)

The DSC is the main controller for the AC drive system. The DSC panel receives input signals from speed sensors mounted on the alternator and traction motors, as well as voltage and current feedback signals from various control devices. Using these inputs, the DSC controls the two inverters, retarding circuits, relays, contactors, and other external devices to provide the following functions:

- Propulsion and wheel slip control
- Retarding and wheel slide control
- Engine speed control
- Event detection
- Initialization of the necessary operating restrictions, including the shut down of the truck if a serious system fault (event) is detected. If the fault is not serious, an indicator lamp alerting the operator to the problem will illuminate. All event data is recorded for future review by maintenance personnel.
- Log event data
- Store statistical data of the history of various component and system function operations.
- Communicate directly with the Portable Test Unit (PTU) to test and monitor propulsion system status, upload system data, and to receive system software updates.
- Drive the operator cab status and warnings.

The DSC contains the following internal, removable printed circuit boards and two fiber optic boards:

System CPU Card: Provides serial communications and control functions, RS232 communications to PTU, and microprocessor controls for internal panel circuits.

Digital I/O Cards: Receives digital inputs and feedback information from various propulsion and control system components. Digital outputs drive propulsion system contactors, relays and provide equipment enable commands.

System Analog I/O Card: Receives engine, voltage and current signals for the main alternator, link voltage and current, retard pedal input, and retard lever input. Controls retard effort, engine speed request, and AFSE firing pulses.

Inverter 1 & 2 CPU and I/O Cards (2 ea.): Receives motor speed signals, link voltage, phase voltages, and phase currents for microprocessor control for inverters 1 and 2. Controls IGBT phase modules through the fiber optic assembly. Phase module status is returned via a separate fiber optic assembly.

Ethernet Switch Card:

Fiber Optic Assembly: Provides electrical isolation for control and feedback signals for phase modules and chopper modules.

Table 3: DID PANEL FAULT CODES
(Codes received from Inverters 1 & 2)

EVENT NUMBER		EVENT DESCRIPTION	RESTRICTION	CAUSE OR DEFINITION	AUTO RESET
113/ 213	:01, 02, 07, 08, 13, 85	Inverter 1 General Fault Inverter 2 General Fault	Inverter 1 Disable Inverter 2 Disable	Problem detected with Inverter 11 and 12 (or 21 and 22) Phase A current during VI test	Yes
	:03, 04, 09, 10, 15, 86			Problem detected with Inverter 11 and 12 (or 21 and 22) Phase B current during VI test	Yes
	:05, 06, 11, 12, 84, 87			Problem detected with Inverter 11 and 12 (or 21 and 22) Phase C current during VI test	Yes
	:17-22, 48, 49			Problem detected with Inverter 1 or 2, Phase A voltage during VI test	Yes
	:23-28, 50, 51			Problem detected with Inverter 1 or 2, Phase B voltage during VI test	Yes
	:29-34, 52, 53			Problem detected with Inverter 1 or 2, Phase C voltage during VI test	Yes
	:35, 36			Problem detected with Inverter 11 and 12 (or 21 and 22), Phase A overcurrent during VI test	Yes
	:37, 38			Problem detected with Inverter 11 and 12 (or 21 and 22), Phase B overcurrent during VI test	Yes
	:39, 40			Problem detected with Inverter 11 and 12 (or 21 and 22), Phase C overcurrent during VI test	Yes
	:54			Inverter 1 or 2 DC Link positive to Phase short detected during VI test	Yes
	:55			Inverter 1 or 2 DC Link negative to Phase short detected during VI test	Yes
	:60			Inverter 1 or 2 DC Link voltage excessive	Yes
	:70			Inverter 11 or 12 (or 21 and 22), Phase A negative current unbalanced, low current detected	Yes
	:71			Inverter 11 or 12 (or 21 and 22), Phase B negative current unbalanced, low current detected	Yes
	:72			Inverter 11 or 12 (or 21 and 22), Phase C negative current unbalanced, low current detected	Yes

Table 4: DID PANEL FAULT CODES
(Codes received from DSC - truck control)

EVENT NUMBER		EVENT DESCRIPTION	RESTRICTION	CAUSE OR DEFINITION	AUTO RESET
644	:01	Control Cabinet Heater Event	System event	Relay HCR commanded closed (ON) and feedback indicates HCR is open (OFF)	No
	:02			Relay HCR commanded open (OFF and feedback indicates HCR is closed (ON)	No
	:03			Relay HCR commanded closed (ON) and HR1 feedback indicates open (OFF)	No
	:04			Relay HCR commanded open (OFF) and HR1 feedback indicates closed (ON)	No
	:05			Relay HCR commanded closed (ON) and HR2 feedback indicates open (OFF)	No
	:06			Relay HCR commanded open (OFF) and HR2 feedback indicates closed (ON)	No
	:07			Relay HCR commanded closed (ON) and HR3 (if equipped) feedback indicates open (OFF)	No
	:08			Relay HCR commanded open (OFF) and HR3 (if equipped) feedback indicates closed (ON)	No
645	:01	Pre-Shift Brake Test Event (if equipped)	System event	Pre-shift Service Brake test active and specified torque achieved for test	No
	:02			Pre-shift Parking Brake test active and specified torque achieved for test	No
	:03			Pre-shift retarder test active and retarder circuit passed test	No
	:04			Pre-shift retarder test active and retarder circuit failed test	No
	:05			Pre-shift test activation button input remains ON for more than 60 seconds, brake is stuck	No
646	:01	Retard Request (if equipped)	No propel	Dash Full Retard Request button pressed and truck speed is more than 1 mph (1.6 kph)	No
647	:01	Service Brake Event	System event	Service Brake applied higher than preset truck speed	No
650	:01	Pedal Calibration Required	System event	Accel Pedal values are outside the preset numbers	Yes
	:02			Retard Pedal values are outside the preset numbers	Yes
	:03			Accel Pedal does not register 100% over an extended period of time	Yes
	:04			Pedals (Accel/Retard) must be calibrated after replacement of any CPU card or software load	Yes
651	:01	Truck ID Event	System event	Truck Identification (ID) has not been set or programmed	Yes
652	:01	DID Panel Configuration Error	System event	DID Panel configuration incorrect for DID Panel hardware	No
696	:01	Unexpected CPU Reset Event	System event	The DSC or TCI CPU card reset while truck was in an operational mode	No
	:10			The DSC or TCI CPU card reset while truck was in an operational mode	No
698	:01	PTU Data Store Event	System event	A data store process was manually initiated	Yes

Table 5: PROPULSION SYSTEM COMPONENTS DESCRIPTION			
	FIG. NO.	**COMPONENT**	**FUNCTION**
GFS		Suppression Module	Suppresses voltage spikes in coil circuit when GF contactor is de-energized.
GRR	2-6	Ground Resistor Panel	Detects power circuit grounds.
GRR9, 10	2-4	Resistors	Used with GRR to detect power circuit grounds.
INV1 TMC CARD		Inverter 1 Central Processing Unit Card and Input/Output Card	Generates Phase Module turn-on/turn-off commands for the Inverter 1. Monitors voltages and currents from various areas for Inverter 1. Monitors Traction Motor 1 speed.
INV2 TMC CARD		Inverter 2 Central Processing Unit Card and Input/Output Card	Generates Phase Module turn-on/turn-off commands for the Inverter 2. Monitors voltages and currents from various areas for Inverter 2. Monitors Traction Motor 2 speed.
KEYSW		Key Switch	Connects battery voltage to CPR and control circuits when closed. (Located on instrument panel.)
LINK1		Link Current Sensing Module	Detects amount of current flow through the DC link.
L1, 2		Cabinet Lights	Provide interior cabinet illumination.
M1, 2		Motorized Wheels	Each Motorized Wheel consists of a Traction Motor and a Transmission Assembly. The 3-phase asynchronous Traction Motors convert electrical energy into mechanical energy. This mechanical energy is transmitted to the wheel hub through a double reduction gear train (Transmission).
P11A+, 11B+, 11C+ P12A+, 12B+, 12C+	2-3	IGBT Phase Modules	Provide positive driving voltages (PWM or square wave, depending on truck speed) for each of the three windings of Traction Motor 1.
P11A-, 11B-, 11C- P12A-, 12B-, 12C-	2-3	IGBT Phase Modules	Provide negative driving voltages (PWM or square wave, depending on truck speed) for each of the three windings of Traction Motor 1.
P21A+, 21B+, 21C+ P22A+, 22B+, 22C+	2-3	IGBT Phase Modules	Provide positive driving voltages (PWM or square wave, depending on truck speed) for each of the three windings of Traction Motor 2.
P21A-, 21B-, 21C- P22A-, 22B-, 22C-	2-3	IGBT Phase Modules	Provide negative driving voltages (PWM or square wave, depending on truck speed) for each of the three windings of Traction Motor 2.
PS	2-4	Power Supply	A DC to DC converter which provides regulated ± 24 VDC outputs from the unfiltered battery supply. Supplies power to DSC & LEMS.
RD	2-6	Rectifier Diode Panel	Converts Alternator 3-phase, AC voltage to DC voltage to power the two Inverters.
RG1A - 5C		Retard Grid Resistors	Dissipate power from the DC link during retarding, load box testing, and Inverter Filter Capacitor discharge operations.
RP1, 2	2-5	Retard Contactors 1and 2	When closed, connects Grid Resistors to the DC link during retarding, load box testing, and Inverter Filter discharge operations. *Note: Some trucks do not have RP3 installed.*
RP1S, RP2S		Suppression Modules	Suppresses voltage spikes in coil circuit when RP contactors are de-energized.
RP1BR \ RP2BR	2-4	Resistor	Provides a small load across the contactor feedbacks to help keep the contactors clean.
R1	2-5	Battery Boost Resistor	Limits surge current in the Alternator field circuit when GFR contacts first close.

⚠CAUTION

Check the polarity of the suppression modules across all coils: relays, contactors and reverser. If any are reversed, output channels on the digital input/output cards can be damaged during attempts to energize.

Do not use a bell ringer wiring tester. Use an ohmmeter or light continuity tester.

Before removing any of the cards in the electronics panels, turn battery power to the control system OFF.

Do not put a shorting wire on the terminal boards.

Preparation for Megger Test

Perform the following procedure to prepare for a megger test by either removing wiring connections, insulating, jumping, or preparations indicated by the instructions. Use shorting wire for jumping procedures. However, be careful not to short devices to ground or to the wrong devices.

The truck must be grounded. Ensure that all earth ground connections and ground blocks are connected and grounded.

Insulating gloves must be worn by personnel performing the megger test.

1. Ensure that the truck directional control lever is in PARK and the rest switch is in the REST position.
2. Shut down the engine.
3. Disable the 24VDC electrical system by moving the master disconnect switch to the OFF position.
4. To ensure that the link will not be energized during test and repair procedures, move generator field contractor (GF) switch (2, Figure 3-1) in the control cabinet to the CUTOUT position by pulling the switch out and moving the switch downward.
5. For first commissioning, disconnect all DSC connectors.
6. Remove CN1 connector from the power supply.
7. Disconnect the round connector from the top of the gate driver power converters (GDPC1 and GDPC2).
10. Disconnect the CCLR1 and CCLR2 connectors.
11. Disconnect the round output connectors from all VAMs (VAM1, VAM2, VAM3, and VAM4).
12. Remove the wires from ground block located near the DSC panel. Ensure that all removed ground wires are insulated from ground and from other wires. A wire that makes contact with ground or any other wire may affect the megger test results.
13. Remove the arc chute from GF contactor (1, Figure 3-2) and install a jumper between main contactor tips (2).

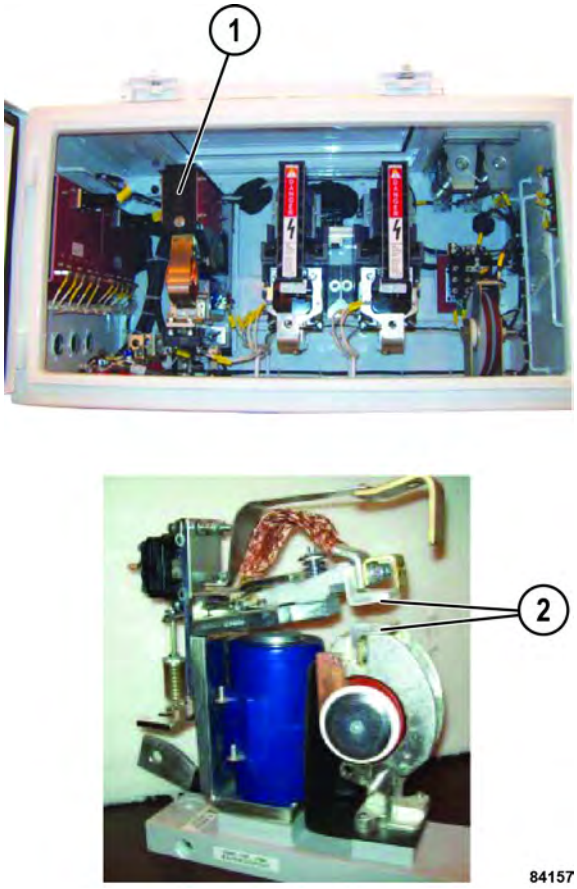


FIGURE 3-2. JUMPERING GF CONTACTOR TIPS

1. GF Contactor 2. Contactor Tips

Control Cabinet Pressure Switch Check

⚠WARNING

Hazardous voltages may be present in this equipment even if the engine and capacitor charge lights are off. Use measurement and protective equipment rated for 2000VDC minimum to verify that no voltage is present before touching any terminal. Verify functionality of the measurement equipment using site-approved procedures both before and after performing control group measurements. Failure to observe these precautions may result in death or serious personal injury.

⚠WARNING

Before opening the cover to adjust the switch, the system must be de-energized. Ensure that the control power switch (CPS) is in the OFF position and that the generator field contactor (GF) switch is in the CUTOUT position before attempting any work.

The control cabinet pressure switch provides protection from the loss of coolIng air in the control group.The control cabinet pressure switch is located in the motor cable connection area at the rear of the control cabinet. See Figure 3-14.

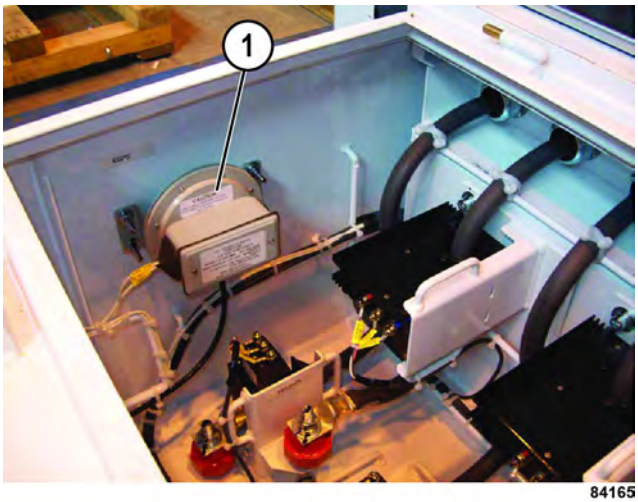


FIGURE 3-14. PRESSURE SWITCH LOCATION

1. Control Cabinet Pressure Switch

Checking the Software Setting

1. Start and login to a console window. Refer to "Preparation for Software Installation" for instructions on opening a console window.
2. Select the screen “View OEM Options (2)”. View the heading “Hardware Configuration Options” and verify that “Control Group Pressure Sensor Present” is set to 1.

Checking the Pressure Switch Setting

1. Ensure that the truck directional control lever is in PARK and the rest switch is in the REST position.
2. Shut down the engine.
3. Connect an RS232 serial cable or ethernet cable to the DSC.
4. Move control power switch (1, Figure 3-4) upward to the ON position.
5. Start the wPTU Toolbox program on the PTU or laptop computer. At the login screen, select Normal mode, enter a password, and click on **LOGIN to wPTU Toolbox**. See Figure 3-15. A truck model will be automatically selected. The PTU screens window will appear on the screen.

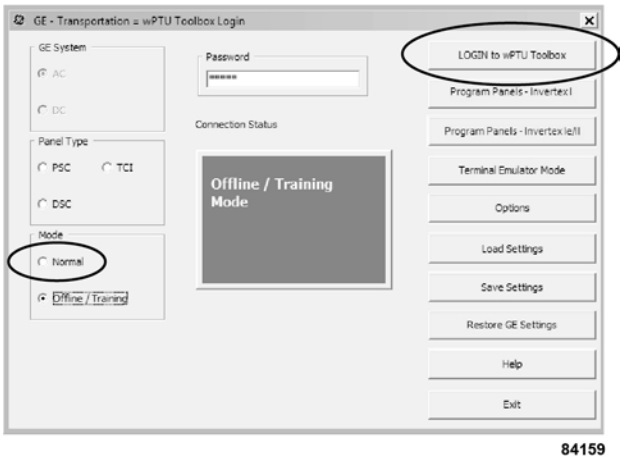


FIGURE 3-15. wPTU TOOLBOX LOGIN SCREEN

DIAGNOSTIC INFORMATION DISPLAY (DID) PANEL

The Diagnostic Information Display (DID) panel indicates the operating condition of the truck and is a primary troubleshooting aid for maintenance and service personnel.

The propulsion system utilizes the message lines and the function keys on the DID panel. Message lines (1, Figure 3-29) provide propulsion system operating information, test status information, and function key label information depending on the DID panel mode of the display. Function keys (2) assume different functionality depending on the DID panel's mode of display.

DID Panel Display Selection

Pressing Menu (F4) from the Normal or Faults display accesses the first layer of menu selections for Test, Info, and Inv cutout. Then pressing the desired function key (F1 through F5) accesses the menu for that function key. Test, Info, or Inv cutout selection is made by pressing the desired function key from this menu layer. Display selection function keys (soft keys) are shown in Figure 3-29. Refer to Figure 3-30 for an overview of the hierarchy of the displays that are available.

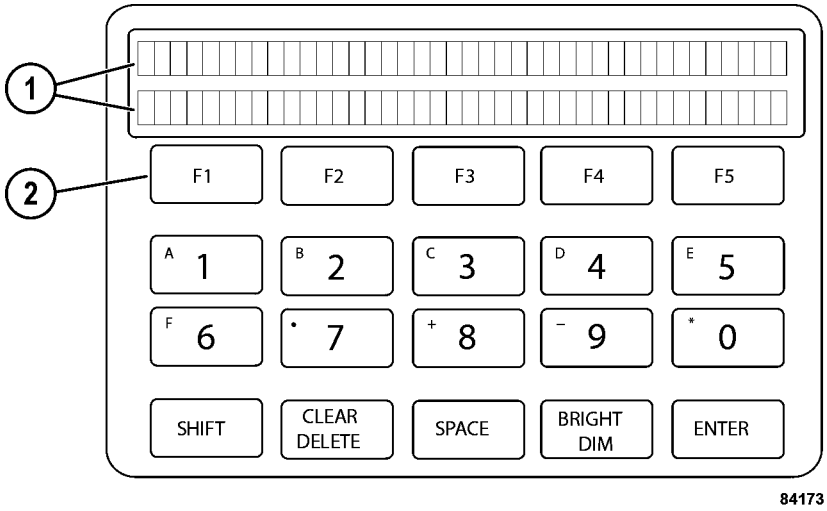


FIGURE 3-29. DID PANEL ARRANGEMENT

Press F2 (Data Dump) to transfer data to a USB drive.

1. Press function key F2 (All) to copy all data onto USB drive or press function key F3 (Quick) to copy everything but the data packs to the USB drive. See Figure 3-46.
   a. If a USB drive is not attached, an error message appears on the screen.
   b. If a USB drive is attached, the generating files status will appear on the screen.
   c. After the files are generated, a message indicating that the files are being transferred will appear on the screen.
   d. When the file transfer is successful, the message “Data Transfer Complete” will appear on the screen.
2. Press function key F5 (Exit) to exit the data dump mode and return to the DID panel Info Menu mode.

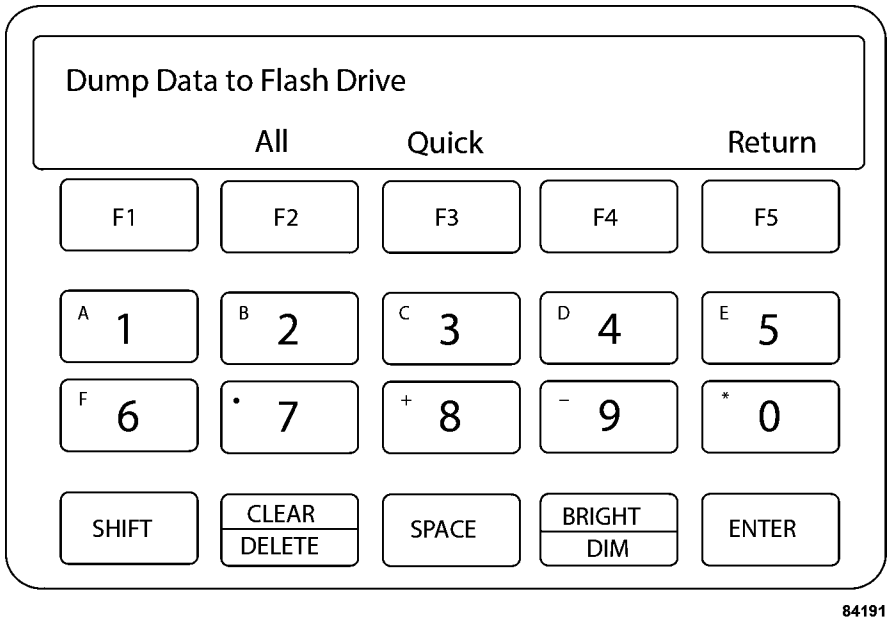
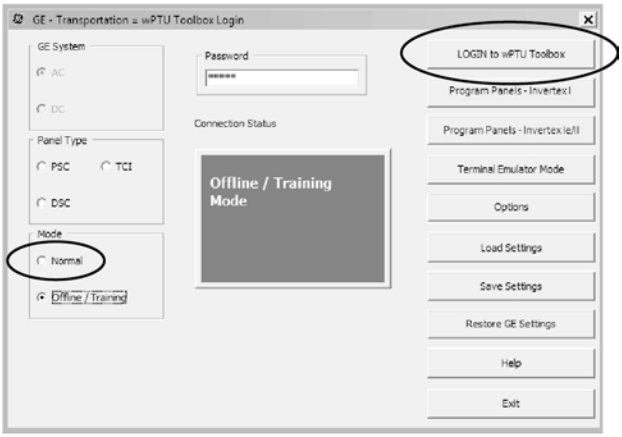


FIGURE 3-46. DID PANEL DATA DUMP DISPLAY

LOGIC SCREENS

To aid in troubleshooting, logic screens are provided to determine issues when operation modes are inhibited.

1. Connect an RS232 serial cable or ethernet cable to the DSC.
2. Start the wPTU Toolbox program on the PTU or laptop computer. At the login screen, select Normal mode, enter a password, and click on **LOGIN to wPTU Toolbox**. See Figure 3-70. A truck model will be automatically selected. The PTU screens window will appear on the screen.

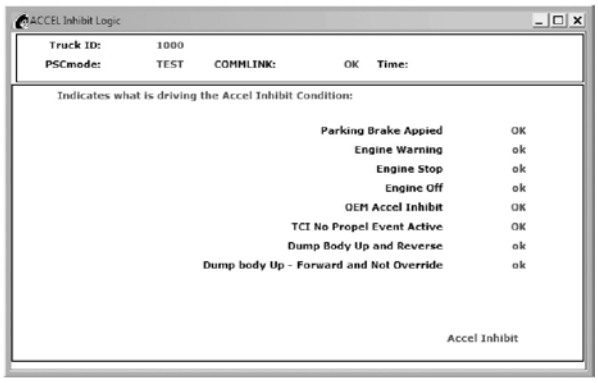


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FIGURE 3-70. wPTU TOOLBOX LOGIN SCREEN

3. To view the ACCEL Inhibit Logic:
   a. In the PTU screens window, go to Ptu_Screens -> Inverters -> Normal_Operation -> Logic -> ACCEL Inhibit Logic.
   b. After clicking on ACCEL Inhibit Logic, the ACCEL Inhibit Logic window will be displayed in the activity portion of the wPTU program screen. See Figure 3-64.

   This screen shows conditions from the engine that prevent truck propulsion but allow dynamic retarding.

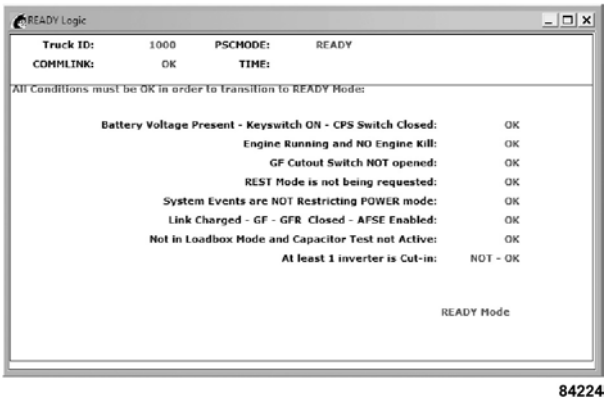


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FIGURE 3-71. ACCEL INHIBIT LOGIC WINDOW

4. To view the READY Logic:
   a. In the PTU screens window, go to Ptu_Screens -> Inverters -> Normal_Operation -> Logic -> READY Logic.
   b. After clicking on READY Logic, the READY Logic window will be displayed in the activity portion of the wPTU program screen. See Figure 3-64.

   This screen shows conditions that prevent the control from entering the READY mode.



84224

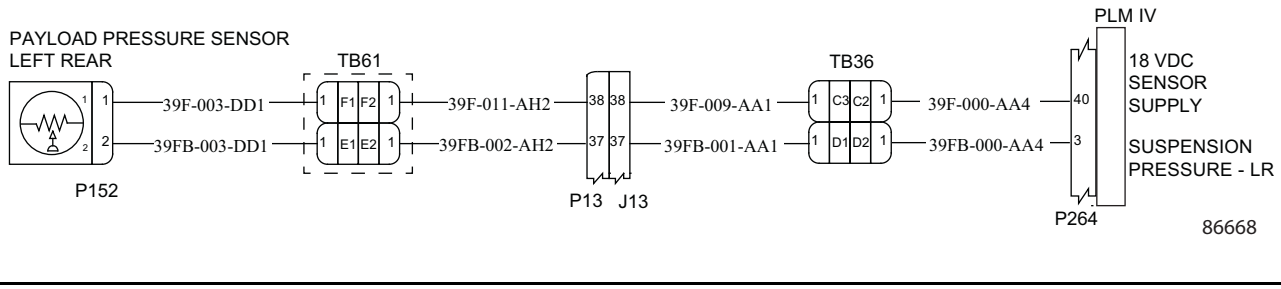
FIGURE 3-72. READY LOGIC WINDOW

Fault Code A005: Left rear suspension pressure sensor signal is high

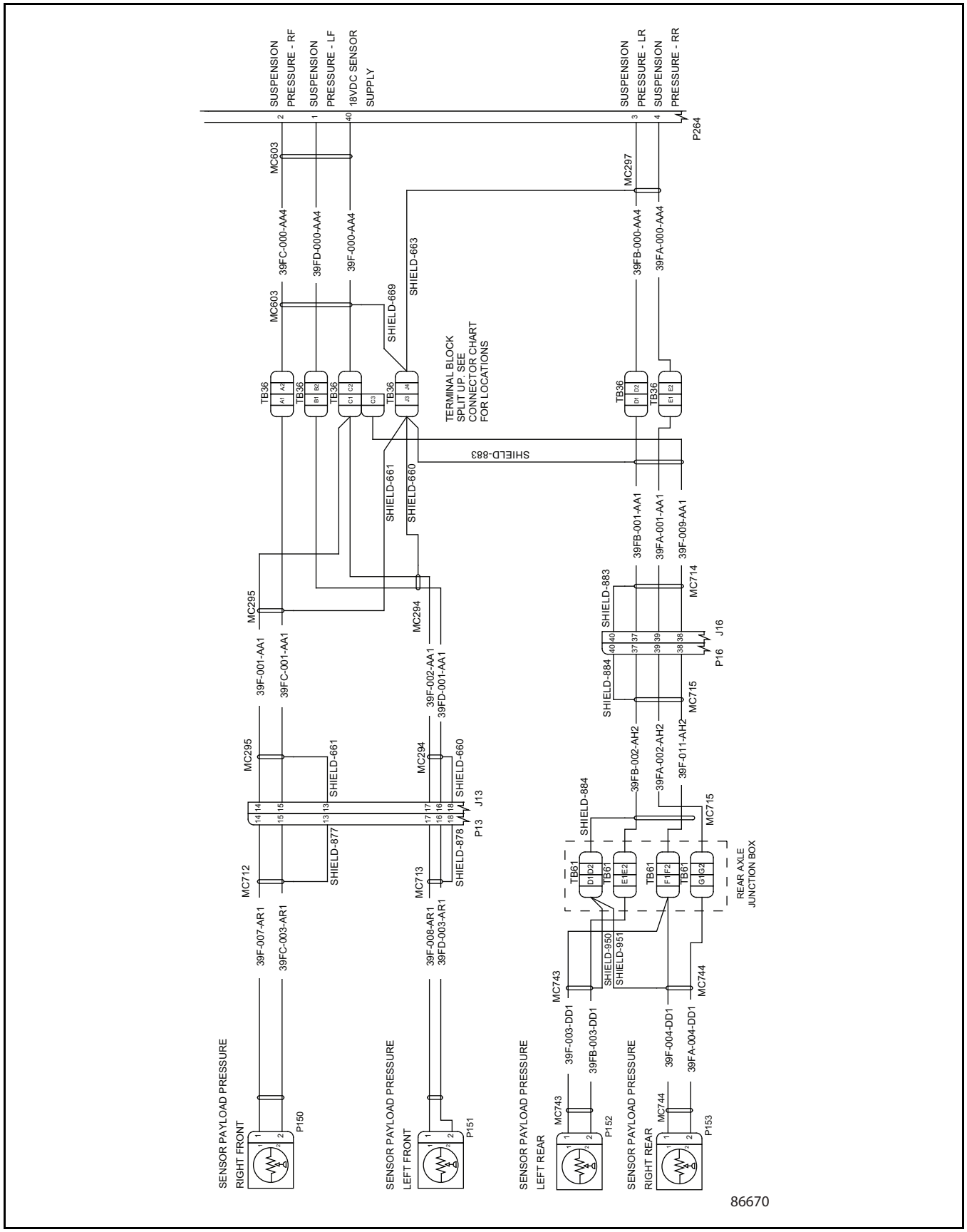
Operator Action	None
Fault Code	A005
Description	Left rear suspension pressure sensor signal is high.
Fault Conditions	Sets if pressure signal is out of range high (sensor current over 22 ma). Resets if reading returns to normal.
Operator Alerting System Response	Repair Lamp Display Operator Action: None Display Fault Description: PLM LR PRESS SENS HI Display Fault Code: A005
Resulting Problem(s)	Bad payload computation.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table	
1. This fault is generated by PLM3 in response to a problem in the sensor circuit. This sensor circuit may have a related fault that can be used to resolve the problem. Refer to the Troubleshooting Instructions for the active parameter fault(s). 2. If there are no active parameter fault codes then based on the truck's setup while this fault is active, determine which of the parameters in the Table is not shown in its expected state on the IM Realtime Data Monitor program. Refer to the schematic to identify which item(s) may be causing the parameter(s) to be in the unexpected state. Troubleshoot these items. 3. If this fault is not currently active or if no parameters are currently in the unexpected state and the malfunction is still unresolved then check each of the parameters in the Table for proper functionality. Troubleshoot all item(s) related to the parameter(s) which are found to be malfunctioning.	
Parameter	**Expected State and/or Related Fault(s)**
Left Rear Pressure Sensor (PLM3 36,30)	Sensor current > 22 ma: Failed high Sensor current < 2 ma: Failed low Sensor current > 2 ma but < 22 ma: Valid readings Fault(s): A006

Related circuit diagram

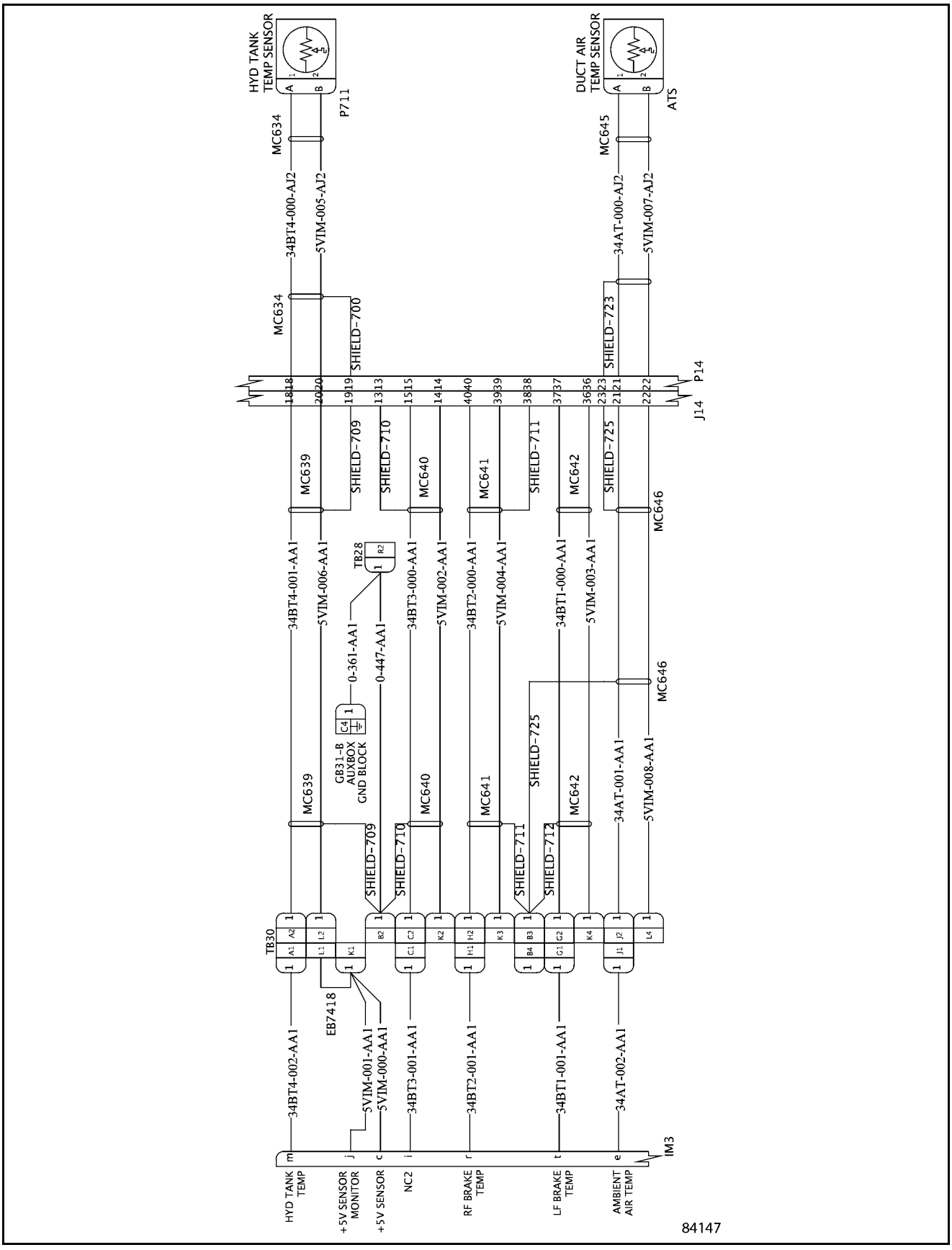


Related circuit diagram



Related Circuit Diagram	
Circuit Description	**Circuit Reference**
Low Steering Pressure Switch	Refer to 58E-06-02002-03, Sheet 13, zones N2 through N7
CAN/J1939 at Engine	Refer to 58E-06-02002-03, Sheet 6, zone H9 and Sheet 15, zone B2
CAN/J1939 at IM	Refer to 58E-06-02002-03, Sheet 13, zone E4 and Sheet 15, zone B9
CAN/RPC connection at GE Control	Refer to 58E-06-02002-03, Sheet 15, zone E9
CAN/RPC connection at IM	Refer to 58E-06-02002-03, Sheet 15, zone E6 and Sheet 13, zone H11

Related circuit diagram



Fault Code A184: J1939 data link is not connected

Operator Action	Stop; Park; Power Down
Fault Code	A184
Description	J1939 data link is not connected.
Fault Conditions	Sets if no data received from the engine for 10 seconds after an initial 11 second delay at key on. Resets immediately when communication is established.
Operator Alerting System Response	Sound Buzzer Flash IM Warning Indicator Display Operator Action: STOP: PARK: PWR ↓ Display Fault Description: NO ENGINE DATA Display Fault Code: A184
Resulting Problem(s)	Loss of engine data makes it impossible to operate truck in a normal manner without risking serious damage to the engine.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table	
1. This fault's logic contains more than one parameter, each of which may have its own related fault code(s). This fault may be resolved by resolving the parameter(s) active fault code(s). Refer to the Troubleshooting Instructions for the active parameter fault(s). 2. If there are no active parameter fault codes, then based on the truck's setup while this fault is active, determine which of the parameters in the Table is not shown in its expected state on the IM Realtime Data Monitor program. Refer to the schematic to identify which item(s) may be causing the parameter(s) to be in the unexpected state. Troubleshoot these items. 3. If this fault is not currently active or if no parameters are currently in the unexpected state and the malfunction is still unresolved, then check each of the parameters in the Table for proper functionality. Troubleshoot all item(s) related to the parameter(s) which are found to be malfunctioning.	
Parameter	**Expected State and/or Related Fault(s)**
CAN J1939 Data Link (IM1q,r,s)	No communication for 10 seconds if keyswitch has been on for 11 seconds: J1939 not connected. Successful read of PGN 61444: J1939 is connected.
Keyswitch (IM3G)	0: Keyswitch is off and the truck is not moving and the engine is not running 1: Keyswitch is on or the truck is moving or the engine is running *NOTE: For this fault, the keyswitch function is delayed for 11 seconds internally after initial turn on.* Fault(s): A240

Related Circuit Diagram	
Circuit Description	**Circuit Reference**
CAN/J1939 at Engine	Refer to 58E-06-02002-03, Sheet 6, zone H9 and Sheet 15, zone B2
CAN/J1939 at IM	Refer to 58E-06-02002-03, Sheet 13, zone E4 and Sheet 15, zone B9
Keyswitch, OR connection at IM	Refer to 58E-06-02002-03, Sheet 13, zones D9 through C19

Fault Code A212: Bad truck speed signal

Operator Action	Go To Shop Now
Fault Code	A212
Description	Bad truck speed signal
Fault Conditions	Sets if truck speed timeout (frequency input does not produce 5 periods within 1 second) persists for 12 seconds with GE powered up and engine not being cranked. Resets if timeouts clear for 3 seconds.
Operator Alerting System Response	Sound Buzzer Flash IM Warning Indicator Display Operator Action: GO TO SHOP NOW Display Fault Description: NO TRUCK SPEED DATA Display Fault Code: A212
Resulting Problem(s)	Loss of truck speed signal caused loss of protection from mis-application of the parking brake and loss of speedometer for the driver.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table

1. The primary correction for this fault is to correct any external wiring or replace the GE signal source.
2. This fault's logic contains more than one parameter.
3. Since there are no active parameter fault codes, then based on the truck's setup while this fault is active, determine which of the parameters in the Table is not shown in its expected state on the IM Realtime Data Monitor program. Refer to the schematic to identify which item(s) may be causing the parameter(s) to be in the unexpected state. Troubleshoot these items.
4. If this fault is not currently active or if no parameters are currently in the unexpected state and the malfunction is still unresolved then check each of the parameters in the Table for proper functionality. Troubleshoot all item(s) related to the parameter(s) which are found to be malfunctioning.

Parameter	Expected State and/or Related Fault(s)
Truck Speed [kph] (IM1g,h)	0: Truck is not moving > 0: Truck is moving
Drive System Control Power (IM3M)	0: Power to GE control is off 1: Power to GE control is on
Crank Sense (IM3U)	0: Engine not being cranked 1: Engine is being cranked

Related Circuit Diagram	
Circuit Description	**Circuit Reference**
Selector Switch connections	Refer to 58E-06-02002-03, Sheet 7, zone G18
Interface Module connections	Refer to 58E-06-02002-03, Sheet 7, zone I20
VEC connections	Refer to 58E-06-02002-03, Sheet 7, zone H10
CAN/RPC connection at GE Control	Refer to 58E-06-02002-03, Sheet 15, zone E9
CAN/RPC connection at IM	Refer to 58E-06-02002-03, Sheet 15, zone E6 and Sheet 13, zone H11
Park Brake Release connection	Refer to 58E-06-02002-03, Sheet 4, zones H7 through H21
Park Brake Set connection	Refer to 58E-06-02002-03, Sheet 13, zones F9 through F4

Fault Code A243: The engine coolant temp gauge within the display panel is defective

Operator Action	Go To Shop Now
Fault Code	A243
Description	The engine coolant temp gauge within the display panel is defective.
Fault Conditions	Sets if the display panel detects an engine coolant temp gauge fault. Resets if the display panel clears the fault.
Operator Alerting System Response	Sound Buzzer Flash IM Warning Indicator Display Operator Action: GO TO SHOP NOW Display Fault Description: ENG COOL TEMP GAUGE Display Fault Code: A243
Resulting Problem(s)	Engine could overheat without warning.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table

1. Except for being masked by the steering bleed process, this fault is entirely contained within the display panel. The panel and communication to it must be working in order for interface module to be aware of the fault. Therefore, the only diagnostic effort is to check the gauge and wiring within the panel and replace if necessary.

Parameter	**Expected State and/or Related Fault(s)**
Steering Bleed Valve	0: Steering bleed valve is off 1: Steering bleed valve is on

Related Circuit Diagram	
Circuit Description	**Circuit Reference**
Sonalert to IM connection	Refer to 58E-06-02002-03, Sheet 8, zones E10 through E17
Keyswitch to Sonalert connection	Refer to 58E-06-02002-03, Sheet 8, zone F13
IM Protected Power connection	Refer to 58E-06-02002-03, Sheet 4, zones J7 through J10

Related Circuit Diagram	
Circuit Description	**Circuit Reference**
Steering Bleed Circuit	Refer to 58E-06-02002-03, Sheet 13, zones C11 through C19
Bleed Power Relay Coil Circuit	Refer to 58E-06-02002-03, Sheet 13, zone B18
Battery & Keyswitch OR Power to VEC-89	Refer to 58E-06-02002-03, Sheet 5, zones C10 through B/C14

Related Circuit Diagram	
Circuit Description	**Circuit Reference**
Selector Switch	Refer to 58E-06-02002-03, Sheet 7, zone G18
Selector Switch (Park) connection to IM	Refer to 58E-06-02002-03, Sheet 7, zone H20
Selector Switch (FNR) connection to IM	Refer to 58E-06-02002-03, Sheet 7, zone I20
Keyswitch connection to IM	Refer to 58E-06-02002-03, Sheet 13, zone C9

Fault Code A279: Low steering pressure switch is defective

Operator Action	Stop; Park; Power Down; Check
Fault Code	A279
Description	Low steering pressure switch is defective.
Fault Conditions	Sets if low steering pressure switch fails to turn on by the time the steering accumulator Bleed Down pressure switch indicates that Bleed Down is complete. Resets if low steering pressure switch actuates (reports low pressure).
Operator Alerting System Response	Sound Buzzer Flash IM Warning Indicator Display Operator Action: STOP: PRK: PWR↓: CHK Display Fault Description: BAD STRG PRESS SW Display Fault Code: A279
Resulting Problem(s)	Loss of steering may not be reported.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table

1. This fault's logic contains more than one parameter, each of which may have its own related fault code(s). This fault may be resolved by resolving the parameter(s) active fault code(s). Refer to the Troubleshooting Instructions for the active parameter fault(s).
2. If there are no active parameter fault codes, then based on the truck's setup while this fault is active, determine which of the parameters in the Table is not shown in its expected state on the IM Realtime Data Monitor program. Refer to the schematic to identify which item(s) may be causing the parameter(s) to be in the unexpected state. Troubleshoot these items.
3. If this fault is not currently active or if no parameters are currently in the unexpected state and the malfunction is still unresolved, then check each of the parameters in the Table for proper functionality. Troubleshoot all item(s) related to the parameter(s) which are found to be malfunctioning.

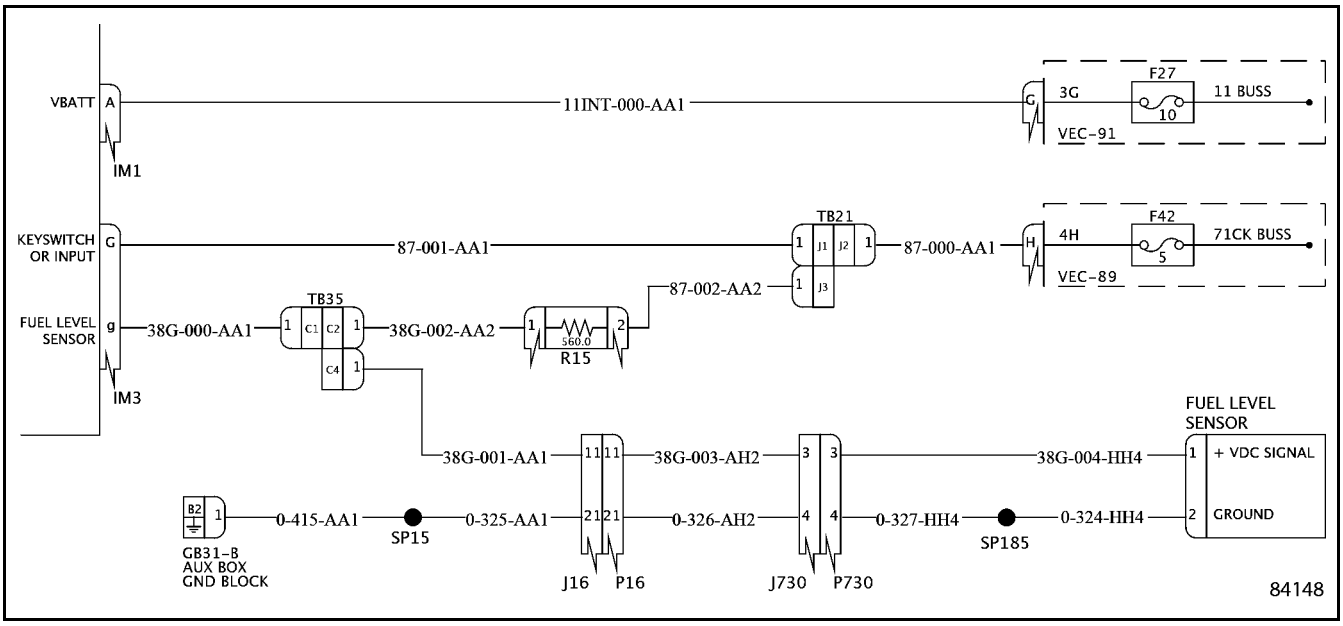
Parameter	Expected State and/or Related Fault(s)
Low Steering Pressure Switch (IM2S)	0: Steering pressure normal 1: Low steering pressure
Steering Accumulator Bleed Pressure Switch (IM2Z)	0: Accumulator is completely bled down 1: Accumulator is not completely bled down Fault(s): A280
Steering Bleed Valve	0: Steering bleed valve is off 1: Steering bleed valve is on

Related Circuit Diagram

Circuit Description	Circuit Reference
Low Steering Pressure Switch and Steering Accum Bled Pressure Switch connection to IM	Refer to 58E-06-02002-03, Sheet 13, zones N2 through N7

Related Circuit Diagram	
Circuit Description	**Circuit Reference**
Delayed Shutdown Relay	Refer to 58E-06-02002-03, Sheet 4, zone D10
Delayed Shutdown Relay IM connection	Refer to 58E-06-02002-03, Sheet 4, zone I7
Keyswitch Direct circuit at Keyswitch	Refer to 58E-06-02002-03, Sheet 4, zone F8
Keyswitch Direct circuit at IM	Refer to 58E-06-02002-03, Sheet 4, zone I7

Related circuit diagram



Fault Code A324: GE link voltage wire input not same as serial input

Operator Action	Go To Shop Now
Fault Code	A324
Description	GE link voltage wire input not same as serial input.
Fault Conditions	Sets if serial RS232 input shows GE link voltage on when wired input does not for 8 seconds with GE power on and drive system data OK. Resets if conditions change for 8 seconds.
Operator Alerting System Response	Sound Buzzer Flash IM Warning Indicator Display Operator Action: GO TO SHOP NOW Display Fault Description: NO DC LINK VOLT CKT Display Fault Code: A324
Resulting Problem(s)	Malfunctioning wired input could cause loss of warning for GE link voltage.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table

1. This fault's logic contains more than one parameter, each of which may have its own related fault code(s). This fault may be resolved by resolving the parameter(s) active fault code(s). Refer to the Troubleshooting Instructions for the active parameter fault(s).
2. If there are no active parameter fault codes, then based on the truck's setup while this fault is active, determine which of the parameters in the Table is not shown in its expected state on the IM Realtime Data Monitor program. Refer to the schematic to identify which item(s) may be causing the parameter(s) to be in the unexpected state. Troubleshoot these items.
3. If this fault is not currently active or if no parameters are currently in the unexpected state and the malfunction is still unresolved, then check each of the parameters in the Table for proper functionality. Troubleshoot all item(s) related to the parameter(s) which are found to be malfunctioning.

Parameter	**Expected State and/or Related Fault(s)**
GE Link Voltge (IM2b)	0: GE link voltage is on 1: GE link voltage is off
GE Link Voltage - RS232 Input (IM2D,E,F)	0: GE link voltage is off 1: GE link voltage is on Fault(s): A276
Drive System Control Power (IM3M)	0: Control power is off 1: Control power is on
Drive System Data Link OK (IM2D,E,F)	0: RS232 Data Link not OK 1: RS232 Data Link OK Fault(s): A276

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Fault Code A352: Overload on output 1H

Operator Action	None
Fault Code	A352
Description	Overload on output 1H.
Fault Conditions	Sets if driver chip detects over-current or over temp on output 1H. Output is turned off when overload is detected. Resets at power down.
Operator Alerting System Response	Repair Lamp Display Fault Description: SHUTDOWN DELAY CKT Display Fault Code: A352
Resulting Problem(s)	Shutdown delay circuit is disabled.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table

1. This fault's logic contains just one parameter, which may have additional fault code(s). This fault may be resolved by resolving the parameter(s) active fault code(s). Refer to the Troubleshooting Instructions for the active parameter fault(s).
2. If there are no active parameter fault codes, then based on the truck's setup while this fault is active, determine which of the parameters in the Table is not shown in its expected state on the IM Realtime Data Monitor program. Refer to the schematic to identify which item(s) may be causing the parameter(s) to be in the unexpected state. Troubleshoot these items.
3. If this fault is not currently active or if no parameters are currently in the unexpected state and the malfunction is still unresolved, then check each of the parameters in the Table for proper functionality. Troubleshoot all item(s) related to the parameter(s) which are found to be malfunctioning.

Parameter	**Expected State and/or Related Fault(s)**
Shutdown Delay Relay (IM1H)	Status - Open Load: Unexpected. Troubleshoot Status - Normal: Expected. No problem Status - Shorted to Ground: Unexpected. Troubleshoot Status - Overload: Unexpected. Troubleshoot 0: Turns off when conditions clear or engine speed drops to zero 1: Turns on when Keyswitch, Direct is off, Engine Shutdown Delay is on, Park Brake is set, Selector Lever is in park, but not J1939 Not Connected, not High Batt Charge Voltage, not Starter Stuck On, not Active Engine Red Light, and engine speed above 300 Fault(s): A286, A292

Related Circuit Diagram

Circuit Description	**Circuit Reference**
Shutdown Delay Relay coil circuit	Refer to 58E-06-02002-03, Sheet 4, zone D9
Shutdown Delay Relay coil circuit at IM connection	Refer to 58E-06-02002-03, Sheet 4, zone I7

NOTES

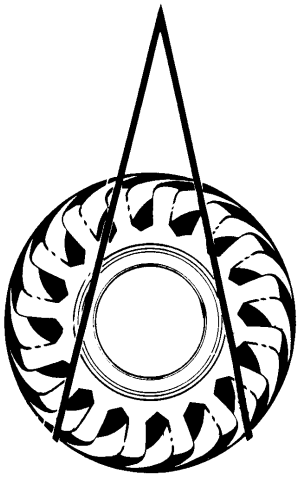


FIGURE 2-10. TIRE LIFTING SLING (BODY REMOVED)

⚠WARNING

Due to its size and weight, always keep personnel away from a wheel assembly when it is being removed and installed.

NOTE: Be sure to position outer dual wheel so that tire valve bracket aligns with inner wheel inflation line.

3. Install wedges onto studs and secure in place with lubricated wheel nuts. Evenly tighten each nut in an alternating (criss-cross) pattern as shown in Figure 2-7) to **407 N·m (300 ft lbs)** torque.
4. Spin the wheel and check rim run-out. Maximum run-out is 5mm (0.20 in.). If run-out exceeds specifications, then loosen all the nuts and re-tighten them evenly as shown in Figure 2-7.
5. If run-out is OK, then tighten each nut as shown in Figure 2-7 to **746 N·m (550 ft lbs)** torque.

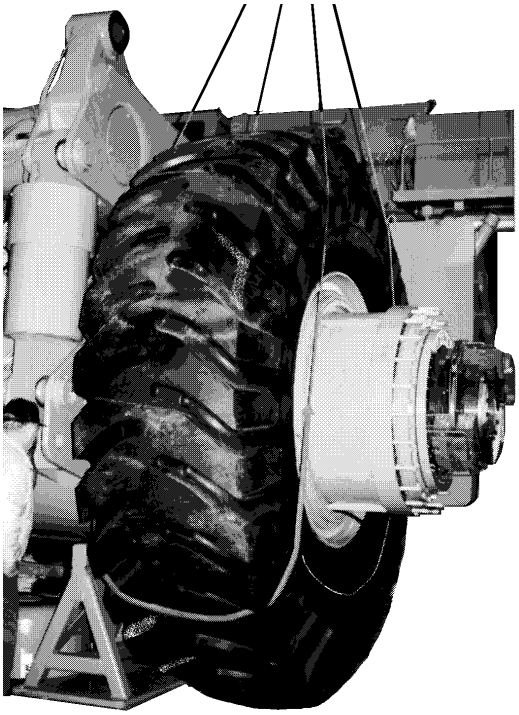
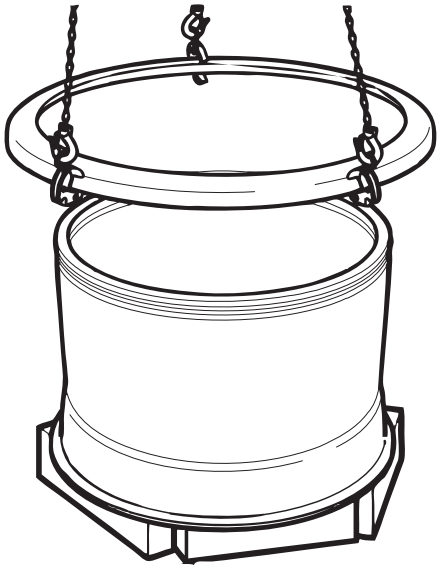


FIGURE 2-11. INNER TIRE REMOVAL AND INSTALLATION

6. Secure inner and outer dual tire inflation lines to bracket on outer rim. Tighten capscrews to standard torque.
7. Install wheel cover. Remove blocks from under truck and lower truck to the ground.
8. Operate truck for one load and retighten wheel nuts as specified in Step 5. Recheck nut torque daily (each 24 hours of operation) to insure proper torque is maintained on each nut. Once torque is maintained, daily checking is no longer required. Check intermittently to insure torque is maintained.

Installation (5-Piece Standard Rim)

1. Place the rim base on a rim base stand with the gutter side up.
2. Install the side ring.



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FIGURE 2-48.

3. Install the valve.
4. Apply lubricant to both tire bead seats. Refer to Figure , “Lubricants,” on page 15for details.

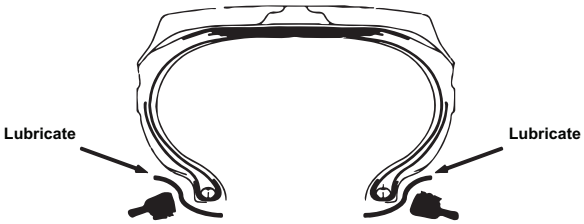
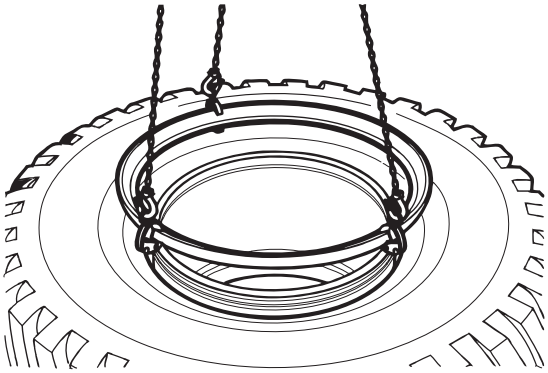


FIGURE 2-49.

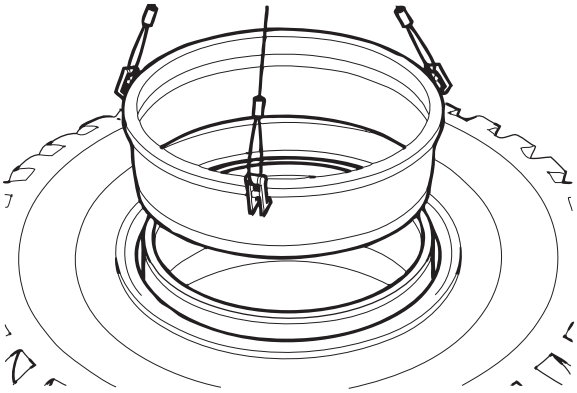
5. Place the tire on the rim base and assemble the rim.
6. Install the side ring on the tire rim.



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FIGURE 2-50.

7. Insert the bead seat band into the side ring and rim base.



85029

FIGURE 2-51.

7. If removed, install steering arm (4, Figure 3-8). Before installing steering arm, clean and check the tapped holes in bottom of spindle for damaged threads. Retap holes, if necessary.

   Steering arm threads. . . . . 1.25 in. - 12NF tap

8. Lubricate capscrews (5, Figure 3-8) on the threads and seats with lithium based chassis grease (multi-purpose, EP, NLGI #2, with a maximum molybdenum content of 5%).
9. Install capscrews (5) and tighten to **2 705 ± 135 N·m (1,995 ± 200 ft lb)**.
10. Install steering cylinder and tie rod in their respective mounting holes on the spindle. Tighten retaining nuts to **712 ± 71 N·m (525 ± 52 ft lb)**. Connect lubrication lines.
11. Tighten the tie rod clamp capscrews and locknuts to **420 N·m (310 ft lb)**. Reapply torque to each capscrew and locknut until the specified torque is maintained.
12. Apply an upwards force to each end of the tie rod assembly near the rod end threads. Look for lateral movement between the tie rod ends and tie rod structure.

- If lateral movement is detected, visually inspect the internal and external threads on both ends. Replace parts that have damaged threads. Use new capscrews and locknuts where thread damage to the tie rod end and tie rod structure is observed.

13. Apply an upwards force to each end of the tie rod assembly near the rod end threads.

- Look for lateral movement between the tie rod ends and tie rod structure. Replace parts that have damaged threads. Use new capscrews and locknuts where thread damage to the tie rod end and tie rod structure is observed.

14. Rotate the wheel hub to position the fill plug at the 12 o'clock position. Remove the fill plug and level plug. Fill wheel hub assembly at fill hole with the appropriate oil. When properly filled, oil should be present at the level (lower) hole. The wheel hub holds approximately 36 liters (9.5 gal) of oil. Replace fill and level plugs.

NOTE: SAE 80W-90 transmission oil is recommended. However, SAE 50W transmission oil may also be used.

15. Install wheel speed sensor (4, Figure 3-9). Adjust sensor to obtain an air gap of 2.0 ± 0.1 mm (0.079 ± 0.004 in.) between tip of the sensor and gear.
16. Install sensor harness (3) securely with mounting clamps. Connect sensor harness to chassis harness.
17. Install junction block (2) with the spacer, capscrews, and flat washers.
18. Attach supply lines to brake calipers and connect main supply lines to connection on frame.
19. Bleed brakes according to “Bleeding Brakes” in Section J.
20. Install wheel and tires as described in "Front Wheel and Tire Installation".

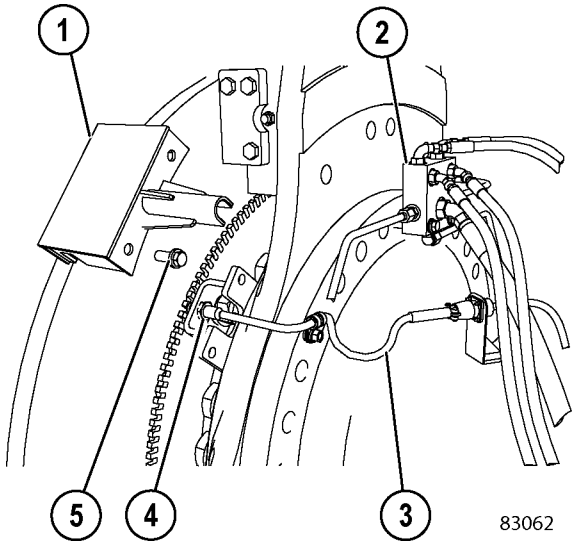


FIGURE 3-9. SPEED SENSOR

1. Cover
2. Junction Block
3. Harness
4. Speed Sensor
5. Capscrew

TOE-IN ADJUSTMENT

1. The steering system must first be centered in the straight ahead position. Shut down the engine and turn the key switch to the OFF position. Allow at least 90 seconds for the accumulator to bleed down. DO NOT turn the steering wheel.
2. Block the front and back of the rear wheels.
3. Check toe-in by measuring the distance between the centers of the front tires. These measurements must be taken on a horizontal center line at the front and rear of tires. Refer to Figure 3-21.

   The front measurement should be 19 ± 0.6 mm (0.75 ± 0.25 in.) less than rear measurement for bias-ply tires. Radial tires and undesignated tires should have equal measurements (zero toe-in).

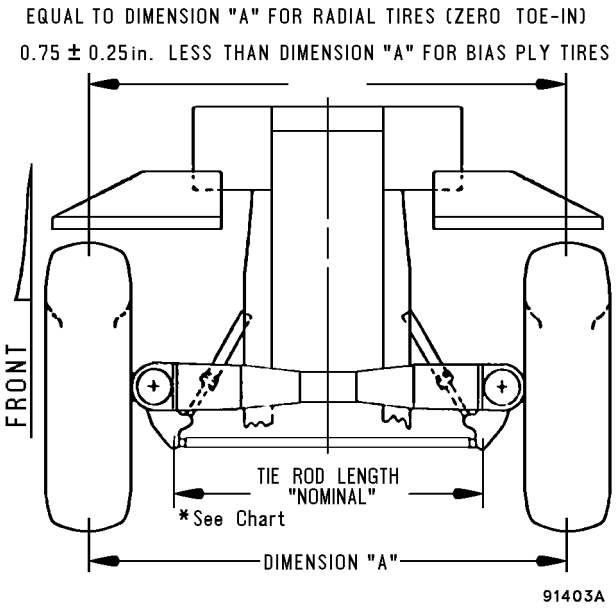


FIGURE 3-21.MEASURING TOE-IN

4. To adjust an old style tie rod:
   a. Loosen clamp locknuts (5, Figure 3-22) on the tie rod. Rotate the tie rod as necessary to obtain the correct toe-in setting. See the chart under Figure 3-21 for "Toe-in Data".
   b. When the adjustment is complete, tighten the clamp locknuts on the tie rod to **420 ± 42 N·m (310 ± 31 ft lb)**.
5. To adjust a new style tie rod:
   a. Loosen clamp locknuts (4, Figure 3-23) on the tie rod. Rotate the tie rod structure as necessary to obtain the correct toe-in setting. See the chart under Figure 3-21 for "Toe-in Data".
   b. Make sure that capscrews (5) are parallel to the ground as shown, and the gap between clamps (3) is aligned with the slot in the tie rod structure.
   c. When the adjustment is complete, tighten the clamp locknuts on the tie rod to **1017 ± 102 N·m (750 ± 75 ft lb)**.
6. Reapply torque to each capscrew until the specified torque is maintained.
7. Install the lubrication line(s) to the pin ends.
8. Remove the blocks from the rear wheels.

830E Toe-In Data	cm (in.)
Nominal Tie-rod Length, Radial Tires, 0 mm (0 in.) Toe-in Loaded	365.76 (144.00)
Nominal Tie-rod Length, Bias Ply Tires, 19 mm (0.75 in.) Toe-in Loaded	366.50 (144.29)
Change In Toe-in From Loaded to Empty	0
Change In Toe-in Length with: One Full Turn Of One Rod-end	0.833 (0.328)
Change In Toe-in Length with: One Full Turn Of Double End Tie Rod	1.666 (0.656)

REAR AXLE HOUSING

Removal

1. Remove the dump body as outlined in Section B.

NOTE: It is not necessary to remove the rear axle assembly to service the anti-sway bar or pivot pin.

2. Loosen hose clamps and disconnect wheel motor cooling flexible air duct from connection on front center of housing.
3. Mark and disconnect lube and brake lines from center case.
4. Mark electrical cables for identification and disconnect at wheel motors. Loosen cable grips and pull cables free.
5. Remove rear tires as covered in this section.
6. Remove wheel motors as covered in this section.
7. Block up truck frame and remove rear HYDRAIR® suspensions as outlined in Section H.
8. Remove pivot pin as outlined previously in this Section.
9. Remove anti-sway bar as outlined earlier in this Section.
10. Move housing from under truck for repair or replacement.

Installation

1. Position axle housing under frame.
2. Align pivot pin bores and install pivot pin.
3. Install anti-sway bar.
4. Install rear suspensions, as covered in Section H, Suspensions.
5. Install wheel motors.
6. Hook up lube lines on wheel motors.
7. Route electrical cables through cable grips on right hand end of axle.
8. Connect electrical cables to motorized wheels inside axle housing using identifications made at removal.
9. Reconnect all brake lines and remaining lube lines. Bleed brake and lube lines.
10. Reconnect wheel motor cooling air duct and clamp securely.
11. Install wheels and tires.

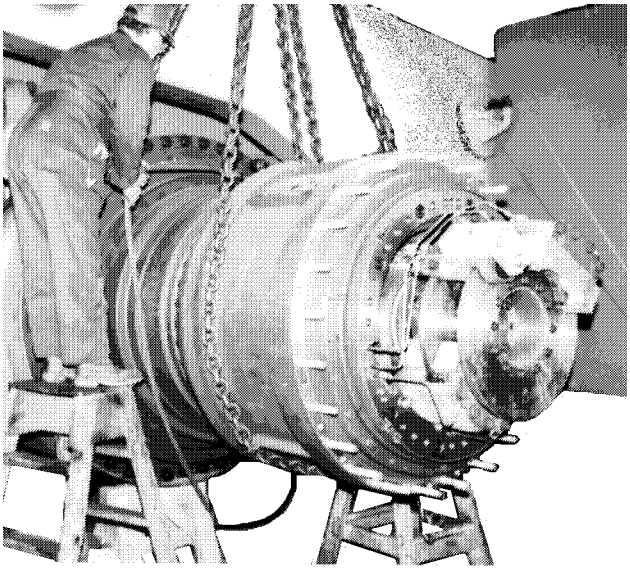


FIGURE 5-1. WHEEL MOTOR REMOVAL AND INSTALLATION

(Shown with the body removed.)

4. Mark a corner of the capscrew head with a paint marker as shown in Figure 2-6. Draw a reference line on the suspension surface next to the marked corner on the capscrew. Draw a reference line on the suspension 60 degrees in advance of the marked corner on the capscrew.
5. Hold the nut at the rear of the joint stationary while tightening. Advance the capscrew to the 60° advance mark.
6. Make new reference lines along the capscrew, nut and frame at the rear of the joint as shown in Figure 2-7. These reference lines will be used to verify the capscrews have maintained their torque.
7. Repeat this process in sequence for the remaining five capscrews in the upper mounting joint.

NOTE: If for any reason these fasteners need to be checked for tightness after completing this procedure, replace all the hardware and repeat the entire process.

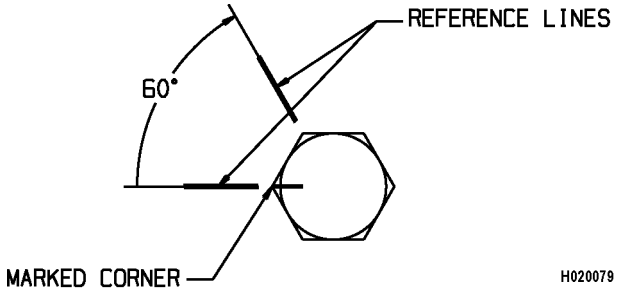


FIGURE 2-6. 60 DEGREE ADVANCE

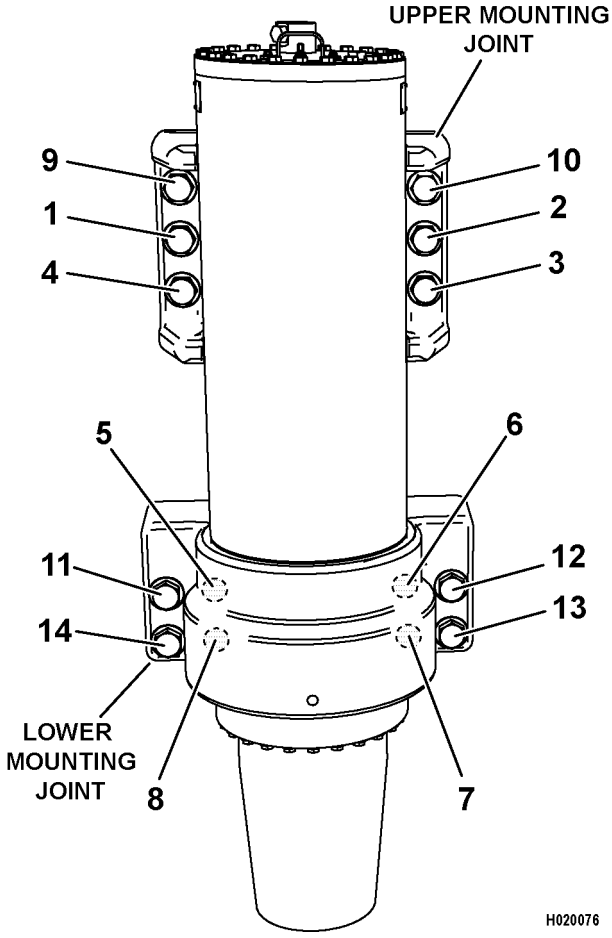


FIGURE 2-5. TIGHTENING SEQUENCE MAP

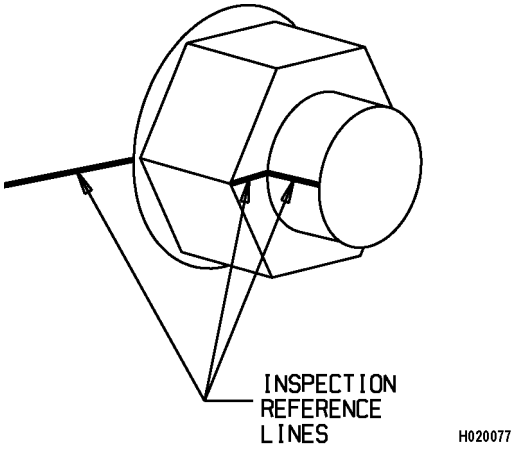


FIGURE 2-7. MAKING REFERENCE LINES

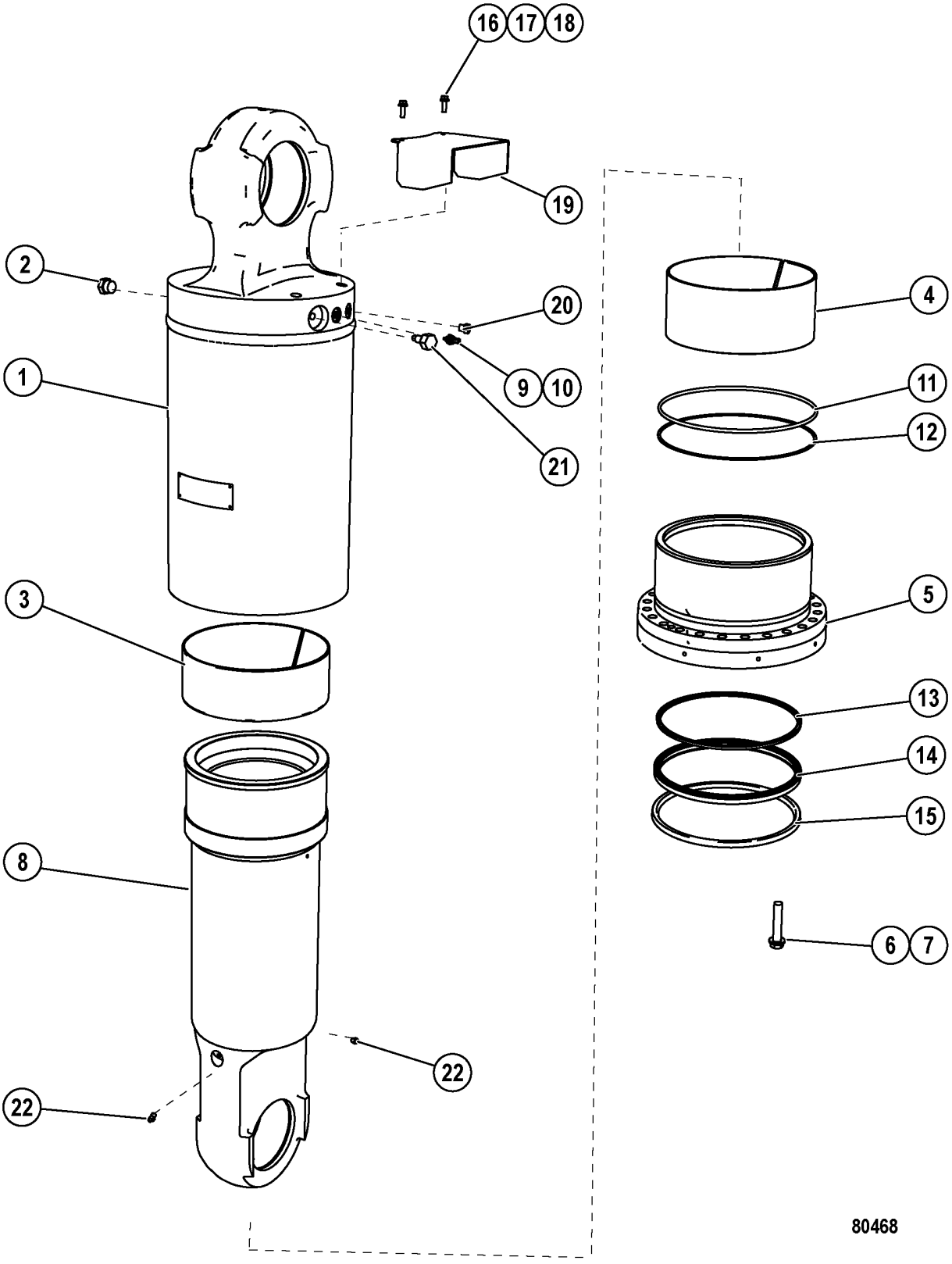


FIGURE 3-6. REAR SUSPENSION ASSEMBLY (ROD DOWN)

⚠WARNING

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

5. Discharge the nitrogen pressure from the suspension as follows:
   a. Remove valve cap (1, Figure 4-7) from the charging valve on top of the rear suspension.
   b. Connect the nitrogen charging kit to the charging valve. Refer to "Installation of Charging Kit".
   c. Turn swivel nut (2) counterclockwise three full turns to unseat the valve seal. **Do not turn the swivel nut more than three turns. Do not turn charging valve body (3).**
   d. As the nitrogen pressure is released, the suspension should lower slowly and seat solidly on the support blocks. Remove the nitrogen charging kit. Refer to "Removal of Charging Kit".

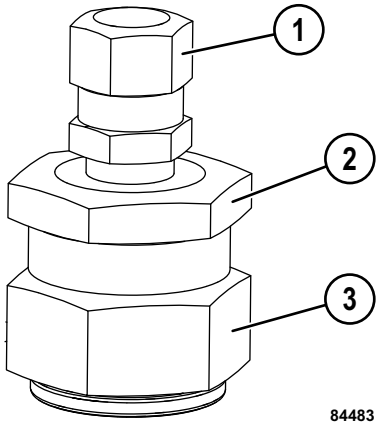


FIGURE 4-7. CHARGING VALVE

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

NOTE: A plastic tube can be used to help bleed off trapped air inside the piston.

6. Remove vent plug (1, Figure 4-8), pressure sensor (2) and charging valve (3).
7. Use one of the open ports to fill the suspension cylinder with a clean suspension oil mixture (with 6% friction modifier) until oil weeps from the open ports. Use drip pans and clean all spillage from the outside of the suspension.

NOTE: As an alternative method, the suspension can be pressure filled from the rod drain port at the bottom of the cylinder. This would eliminate the 15 minute wait in the following step.

8. Allow the suspension to settle for at least 15 minutes. Add more suspension oil mixture if necessary.
9. Install vent plug (1) and pressure sensor (2) into the suspension cylinder.
10. Install a new O-ring onto charging valve (3) and install it into the suspension cylinder.

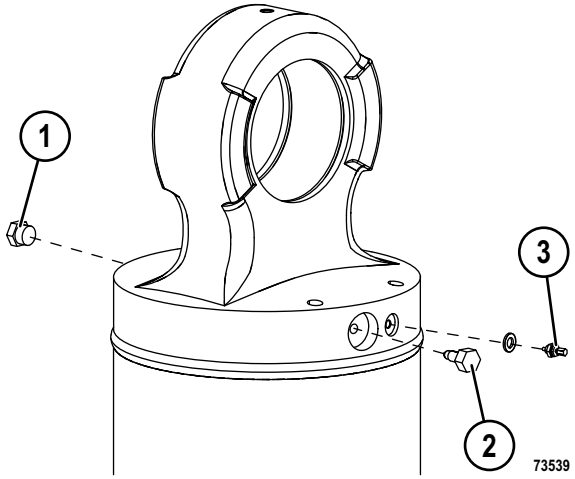


FIGURE 4-8. REAR SUPENSION PORTS

1. Vent Plug
2. Pressure Sensor
3. Charging Valve

11. Connect the nitrogen charging kit to the charging valve. Refer to "Installation of Charging Kit".
12. Charge the suspensions with nitrogen gas to a charging height of approximately 305 mm (12 in.). Close inlet valve (4, Figure 4-2).

SECTION J3
BRAKE CIRCUIT COMPONENT SERVICE
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INTEGRAL MOUNTED ELECTRONIC RETARD PEDAL BRAKE ASSEMBLY (Dual Function)

Installation of Retard Pedal To Brake Pedal

Follow Installation Of Brake Pedal Actuator Assembly to Brake Valve instructions on previous page. Although the brake pedal actuator structure (7, Figure 3-10 & 17, Figure 3-11) is different on each valve, the assembly procedure is identical.

1. Install nylon bearings (7, Figure 3-11) in retard pedal.
2. Install retard pedal (16) to brake pedal actuator (17) with pivot shaft (8). Install two retainer clips (6).
3. With jam nut (10) loose, adjust capscrew (11) until roller on retard pedal just contacts the brake pedal actuator. Tighten jam nut (10).
4. Connect wiring harness to retard pedal.

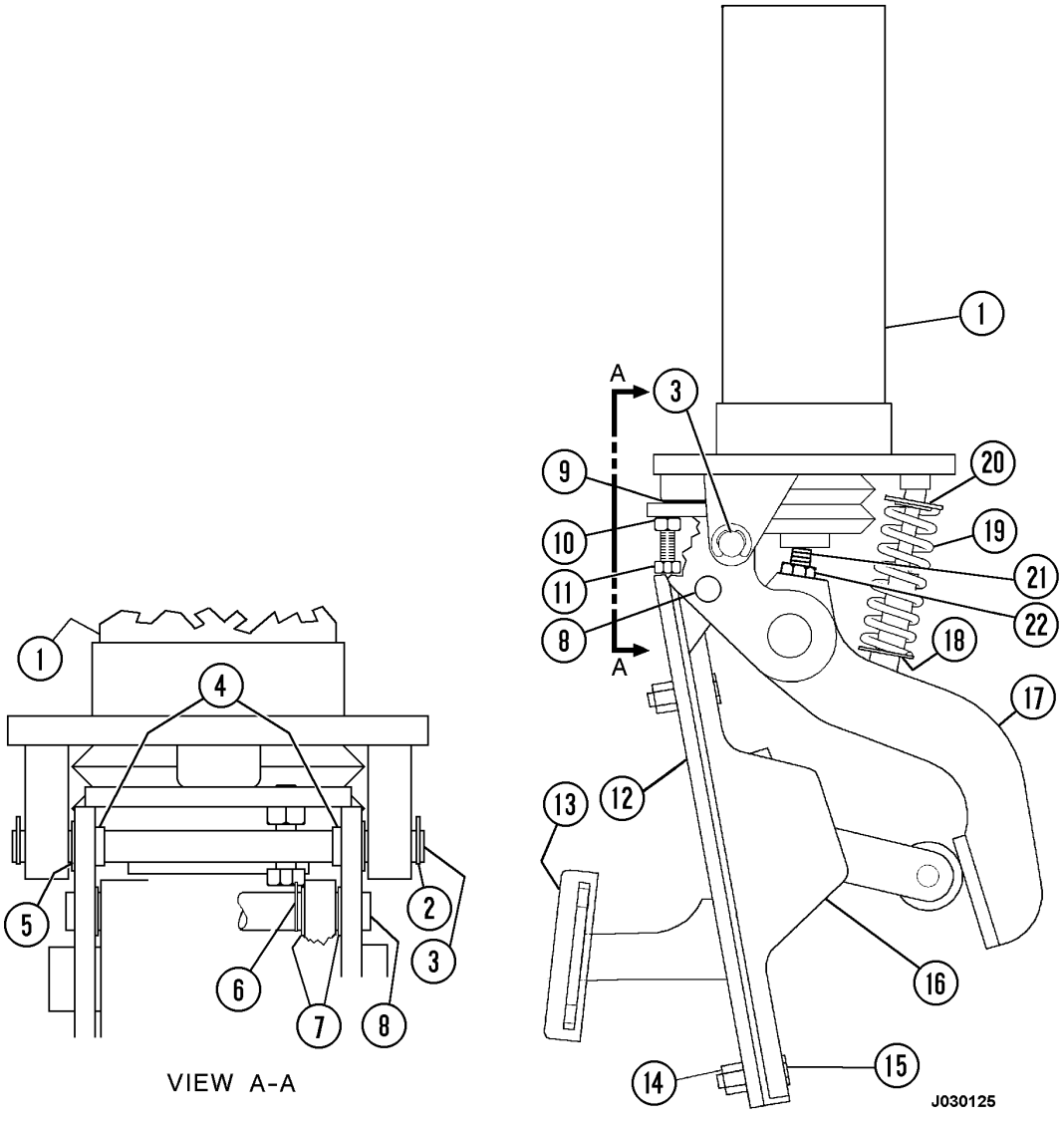


FIGURE 3-9. BRAKE VALVE WITH RETARD PEDAL

1. Brake Valve
2. Retainer Clip
3. Pivot Shaft
4. Bushings
5. Shims
6. Retainer Clip
7. Nylon Bearing
8. Pivot Shaft
9. Insert 0.025 in. Shim
10. Jam Nut
11. Capscrew
12. Pedal Structure
13. Pad
14. Nut
15. Capscrew
16. Electronic Retard Pedal Assembly
17. Brake Pedal Actuator
18. Spring Pivot (Lower)
19. Spring
20. Spring Pivot (Top)
21. Set Screw
22. Jam Nut

BRAKE CIRCUIT ABBREVIATIONS	
AA	Automatic Apply Pressure
AF2	Accumulator, Front Brake
AF1	Supply Pressure to Dual Controller for Front Brakes
AR2	Accumulator, Rear Brake
AR1	Supply Pressure to Dual Controller for Rear Brakes
BF	Brake Pressure, Front (11, Figure 4-1)
BL	Brake Lock Apply Pressure
BR	Brake Pressure, Rear (11, Figure 4-1)
CV1	Check Valve, Rear
CV2	Check Valve, Front
CV3	Check Valve, Park Brake
LS1	Shuttle Valve
HS1	Low Pressure Emergency Apply Shuttle Apply Valve
LAP1	Pressure Tap Test Port Low Accumulator Pressure
LAP2	Low Brake Pressure Switch N.C., 15 858 ± 517 kPa (2300 ± 75 psi)
NV1	Rear Accumulator Manual Drain Valve
NV2	Front Accumulator Manual Drain Valve
ORF1	Orifice 1.57 mm (0.062 in.)
ORF2	Orifice 2.54 mm (0.100 in.)
PK1 & 2	Park Brake Release Pressure
PP3	Pressure Tap Test Port Brake Lock Pressure
PR1	Pressure Reducing Valve
PR2	Park Brake Pressure Regulator (To Release)
PS1	Automatic Apply Valve
SP1	Supply Oil Inlet
SP3	Pressure Tap Test Port Brake Circuit Supply Oil Pressure
SV1	Brake Lock Solenoid
SV2	Park Brake Solenoid
T1 & T3	Return to Tank

EQUIPMENT REQUIRED

Included on the last page of this module is a data sheet to record the information observed during the hydraulic brake system check-out procedure. The data sheet can be removed, copied, and used during the check-out procedure.

- Steps indicated in this manner **should be recorded on the data sheet** for reference.

The following equipment will be necessary to properly check-out the hydraulic brake circuit.

a. Hydraulic brake schematic, refer to Section R this manual.

b. Calibrated pressure gauges:

-Three 0-34,475 kPa (0-5000 psi) range.

-Three 0-20,685 kPa (0-3000 psi) range.

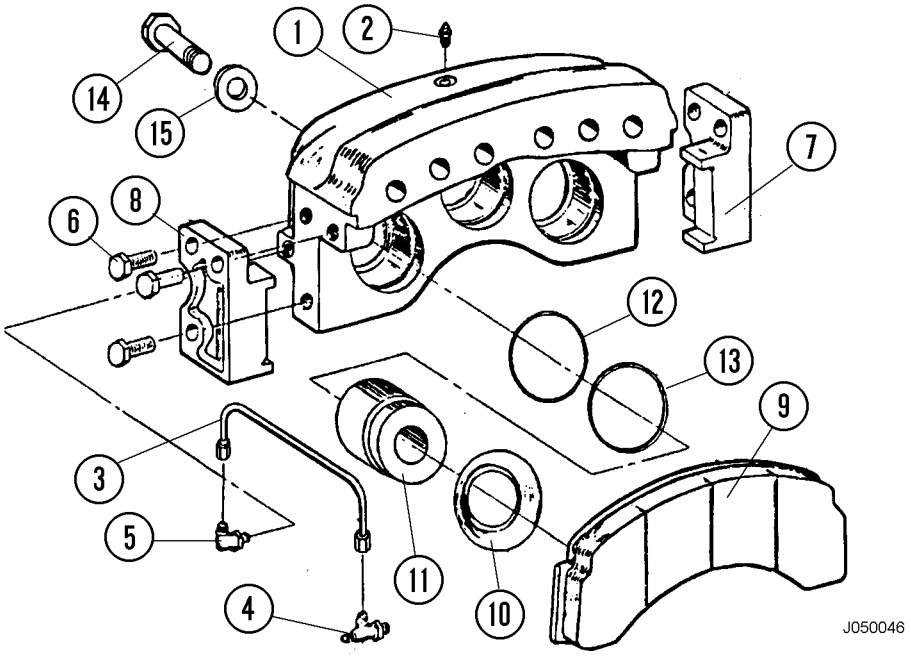
c. One PB6039 female quick disconnect and hose long enough to reach from brake cabinet to the inside of the operator's cab for each gauge.

d. Accumulator charging kit (EB1759 or equivalent) with gauges and dry nitrogen.

NOTE: A gas intensifier pump will be required, if using "T type" nitrogen bottles.

e. Clear plastic hose and bucket for bleeding brakes.

f. Volt/ohm meter with leads and two 61 mm (24 inch) leads with alligator clips.



1. Housing
2. Bleeder
3. Crossover Tube
4. T-Fitting
5. Elbow Fitting
6. Retainer Bolt
7. End Cap
8. End Cap
9. Brake Lining
10. Piston Dust Shield
11. Piston
12. Piston O-Ring Seal
13. Backup Ring
14. Brake Mounting Bolt
15. Washer

FIGURE 5-3. BRAKE CALIPER (HALF)

Disassembly

1. Remove bleeders (2, Figure 5-3) and end caps (7 and 8) from each end of each brake caliper housing (1).
2. Remove linings from the caliper assembly.

NOTE: A shallow container may be necessary to receive any remaining fluid that will drain from cavities. Do not reuse fluid.

3. Carefully remove the piston dust shields (10) from behind the groove lip in the housing and from the grooved lips on the piston.
4. Mark each piston and corresponding brake caliper housing position and pull piston out of the housing. Do not interchange parts.
5. Remove O-ring seals (12) and backup ring (13) from the piston cavity using small flat non-metallic tool having smooth round edges.
6. Refer to Caliper Cleaning and Inspection on the following page for detailed instructions regarding condition and usability of parts.

Assembly

When assembling pistons (11, Figure 5-3) into the housings (1), lubricate all cylinder walls, threads, seals, piston seal surfaces, etc., with clean C-4 hydraulic oil.

1. Install new piston seals (12) and backup rings (13) in housings.
2. With housing lying on mounting face, gently push each piston past piston seal until seated in bottom of cavities.
3. Install new or reusable dust shields (10).

NOTE: Do not allow lubricant to contact dust shields.

4. Install all fittings (4 & 5) and bleeder (2) in correct position in housings.
5. Apply Loctite® 271 to threads of capscrew (6). Install linings (9) and end caps (7 & 8) with bolts (6) and tighten to **546 N·m (403 ft lbs)** torque.
6. Refer to Rear Disc Brakes in this Section and perform Bench Test before installing caliper.
7. After bench test is performed, refer to Installation for procedures for installing calipers on brake adapter.

PARK BRAKE ADJUSTMENT PROCEDURE

CAUTION

Do not apply the service brakes or bleed the service brakes until after the adjustment procedure is complete. It may result in reduced parking brake performance.

1. Connect each hydraulic pump to the parking and service brake system on the wheel motor.
2. Bleed the air from the parking brake hydraulic lines.
3. Close the service brake pressure release valve.

CAUTION

No pressure should be applied to the service brake when the parking brake is pressurized to release.

4. Use a hydraulic pump to apply 17,250-20,700 kPa (2500-3000 psi) to the parking brake.
5. Wait five minutes to verify that there are no leaks or pressure drops. Repair leaks as needed.
6. Close the parking brake valve.
7. Bleed the air for the service brake. Refer to “Hydraulic System Bleeddown Procedure”. in section 30.
8. Use a hydraulic pump to apply 11,000-17,250 kPa (1600-2500 psi) to the service brake.
9. Wait five minutes to verify that there are no leaks or pressure drops. Repair leaks as needed.
10. Release the pressure on the service brake.
11. After the service brake pressure has been released, ensure that the parking brake has maintained the required pressure of 17,250-20,700 kPa (2500-3000 psi).
12. To verify the clearance between the rotors and brake linings:
    a. Push on the outboard disc and verify the gap between the rotors and all four linings.
    b. Pull on the outboard disc and verify the gap between the rotors and all four linings.
    c. Linings should not contact the inboard or outboard discs. It may be necessary to push the linings back into the calipers to check the gap. If contact is observed, it is necessary to remove the brakes and perform verification of installation measurements.

NOTE: If a gap exists but is less than 0.254 mm (0.010in.), turn the rotor one revolution while checking that there is always a gap.

CAUTION

Lining/disc contact will cause brake drag, excessive wear, possible lining damage and high brake temperatures.

13. Release the pressure on the parking brake.

Piston Return Spring

1. Inspect the return spring for a free height dimension of 22.15 mm (0.872 in.). A measured height of less than 21.59 mm (0.850 in.) is an indication that the brake assembly has been subjected to high temperature operation, resulting in permanent set of the spring. This causes loss of spring force at working height.
2. Measure the spring force at maximum service deflection of a spring tester as shown in Figure 6-26. Use an outer spring guide for test setup purposes.

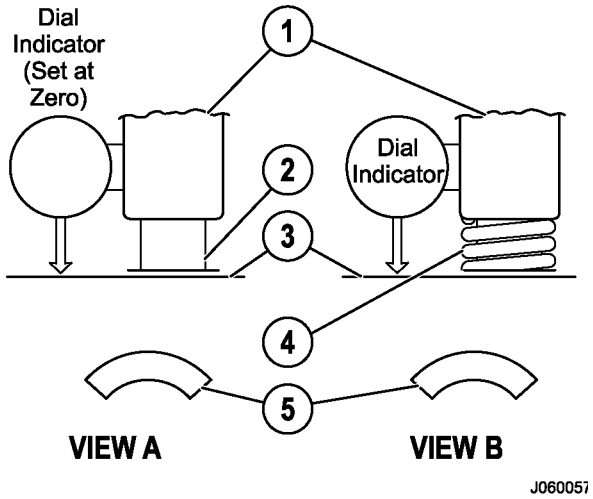


FIGURE 6-26. INSPECTING PISTON RETURN SPRINGS

1. Tester Arbor
2. Outer Spring Guide
3. Tester Table
4. Return Spring
5. Tester Force Scale

Setup for inspecting piston return springs at maximum operating deflection. Set up tester as at (A), disregarding any force scale reading; install return spring over outer spring guide, compress slowly until dial indicator again reads zero, read spring force on tester force scale.

3. Set up the dial indicator between the tester arbor and the table. Place the outer spring guide under the tester arbor. Lower the arbor firmly onto the spring guide. Disregard any tester reading. Hold the arbor in this position and set the indicator dial to ZERO, as shown in View A. Figure 6-26.
4. Raise the arbor. Place the return spring over the spring guide and lower the arbor slowly until the dial indicator again reads ZERO. Read the spring force on the tester scale, as shown in View B, Figure 6-26.

This value is the spring return force exerted under maximum deflection installed in the piston subassembly. Because of the manufacturing tolerances, this can be as low as 113 kg (250 lbs), but will usually measure greater than 136 kg (300 lbs). It is recommended that springs measuring a lower force than 113 kg (250 lbs) under these test conditions be replaced.

SECTION L
HYDRAULIC SYSTEMS
INDEX

HYDRAULIC SYSTEM OPERATION L2

HYDRAULIC COMPONENT REPAIR L3

STEERING SYSTEM L4

STEERING SYSTEM COMPONENT REPAIR L5

HOIST SYSTEM L7

HOIST SYSTEM COMPONENT REPAIR L8

HYDRAULIC CHECKOUT PROCEDURES L10

4. Attach front support bracket to the “T” bracket and to the pump with capscrews, lockwashers and nuts. Tighten capscrews to standard torque.
5. Connect hoist pump drive flange to drive shaft with capscrews, lockwashers and nuts. Tighten to standard torque.
6. Tighten support bracket capscrew (on rear of steering pump) to standard torque.
7. Uncap inlet and outlet hoses and install to pumps using new O-rings. Tighten capscrews securely.
8. Service the hydraulic tank with C-4 type hydraulic fluid. Refer to *Hydraulic Tank*, this section for filling instructions.
9. Open the three suction line shut-off valves. Loosen capscrews (at the pump) on suction hoses (12 & 16) to bleed trapped air. Then loosen capscrews (at the pump) on pressure hoses to bleed any trapped air. Tighten all capscrews securely.

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

10. Remove fitting (12) and fill the steering pump case with clean type C-4 hydraulic oil through the case drain port. It may require 1.9 - 2.9 liters (2-3 quarts) of oil. Reinstall fitting (12) and connect the hose.
11. Reconnect blower tube and install blower tube support strap.

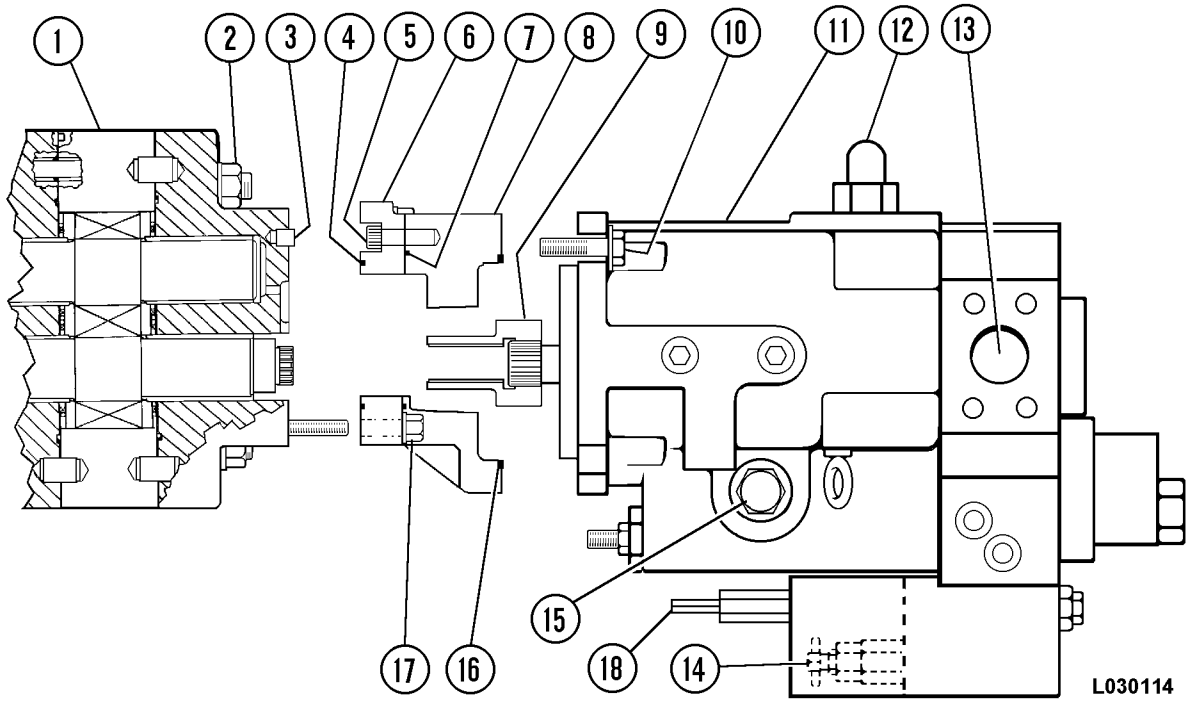


FIGURE 3-2. STEERING PUMP REMOVAL

1. Hoist Pump
2. Nut & Washer
3. Dowel
4. O-Ring
5. Capscrew
6. Bearing Plate
7. O-Ring
8. Transition Plate
9. Coupling
10. Capscrew
11. Steering & Brake Pump
12. Pump Case Drain
13. Inlet Port
14. Compensator Adjuster
15. Plug
16. O-Ring
17. Nut
18. Unloader Adjuster

Installation

1. Install suction strainers (4, Figure 3-18) into hydraulic tank and secure in place with capscrews (5), flat washers and lockwashers. Tighten capscrews to standard torque.
2. Install cover (7) using new gasket (6). Secure in place using capscrews (8), flat washers and lockwashers. Tighten capscrews to standard torque.
3. Attach all hydraulic hoses to the hydraulic tank.
4. Fill the hydraulic tank, refer to Hydraulic Tank Filling Instructions. Open the three suction line shut-off valves.
5. Loosen suction line connections at both pumps to bleed any trapped air. Tighten hose connections.
6. Bleed trapped air inside steering pump. Refer to Pump Pressure Setting, Section L for air bleeding procedure

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

HYDRAULIC TANK BREATHERS

There are two breather filters (3, Figure 3-16) located on top of the hydraulic tank to allow air in and out of the tank. The filters should be replaced at the interval specified on the lubrication chart.

Keep the area around the breather filters clean and free of debris build up. If there is any sign that the breather filters are oil soaked, replace the filters as soon as possible and check for proper oil level. Once the breather filters become oil soaked, they will plug very quickly.

NOTE: Plugged breather filters can cause pressure build up inside the hydraulic tank and can cause the service brakes to drag.

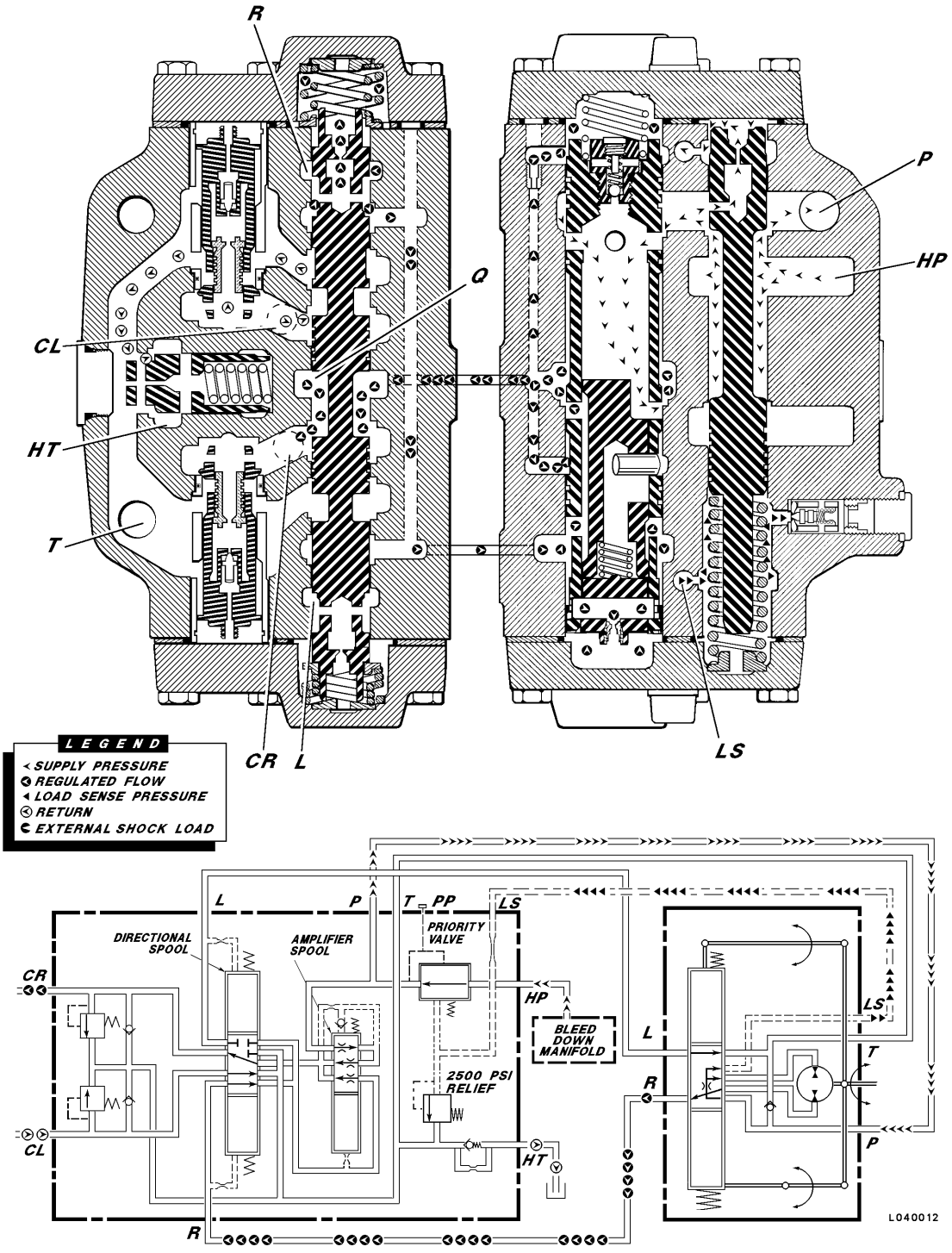


FIGURE 4-6. FLOW AMPLIFIER (Steering Right)

Pump Fails to Develop Pressure L5-50
Pump Slow in Developing Pressure L5-51
Pump Control Valve Inspection and Troubleshooting L5-52
Pump Case Drain Check L5-52
Setting Pump Pressure Controls L5-54
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STEERING CONTROL UNIT

Removal

⚠WARNING

Relieve pressure before disconnecting hydraulic and other lines. Tighten all connections before applying pressure. Hydraulic fluid 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 injury is not received immediately.

1. Turn the key switch OFF and allow 90 seconds for the accumulators to bleed down. Turn steering wheel to ensure no oil remains under pressure.
2. Remove cap screws and lockwashers securing the steering control unit access cover in place (Access cover is located on the front side of the operator's cab.) Remove access cover.

NOTE: Clean the steering control unit and surrounding area carefully to help avoid contamination of hydraulic oil when lines are opened.

3. Tag all hydraulic lines for proper identification during installation. Disconnect hydraulic lines (3, 4, 5, 6, & 7, Figure 5-11) at steering control unit (2) ports and plug. Move lines clear of valve.
4. Remove the four mounting cap screws, flatwashers and lockwashers securing the steering control unit to the mounting bracket. Remove the steering control unit.
5. Place the steering control unit in a clean work area for disassembly.

Spline Inspection

Whenever the steering control unit is removed for service, the steering column shaft should be inspected for excessive wear.

1. Thoroughly clean splines on steering column shaft and inspect for damage or excessive wear.
2. Using an outside micrometer or dial caliper, measure the outside diameter of the male splines on the steering column shaft.
   - **Minimum diameter:** 24.13 mm (0.950 in.)

If splines are worn more than the minimum diameter specification, replace steering column. (Refer to Section N.)

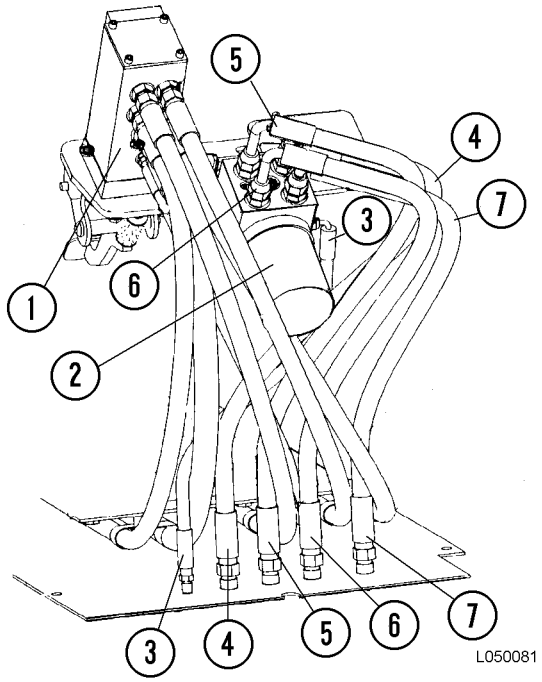


FIGURE 5-9. STEERING CONTROL UNIT

1. Brake valve
2. Steering Control Unit
3. “LS” Port Hose
4. “L” Port Hose
5. “T” Port Hose
6. “P” Port Hose
7. “R” Port Hose

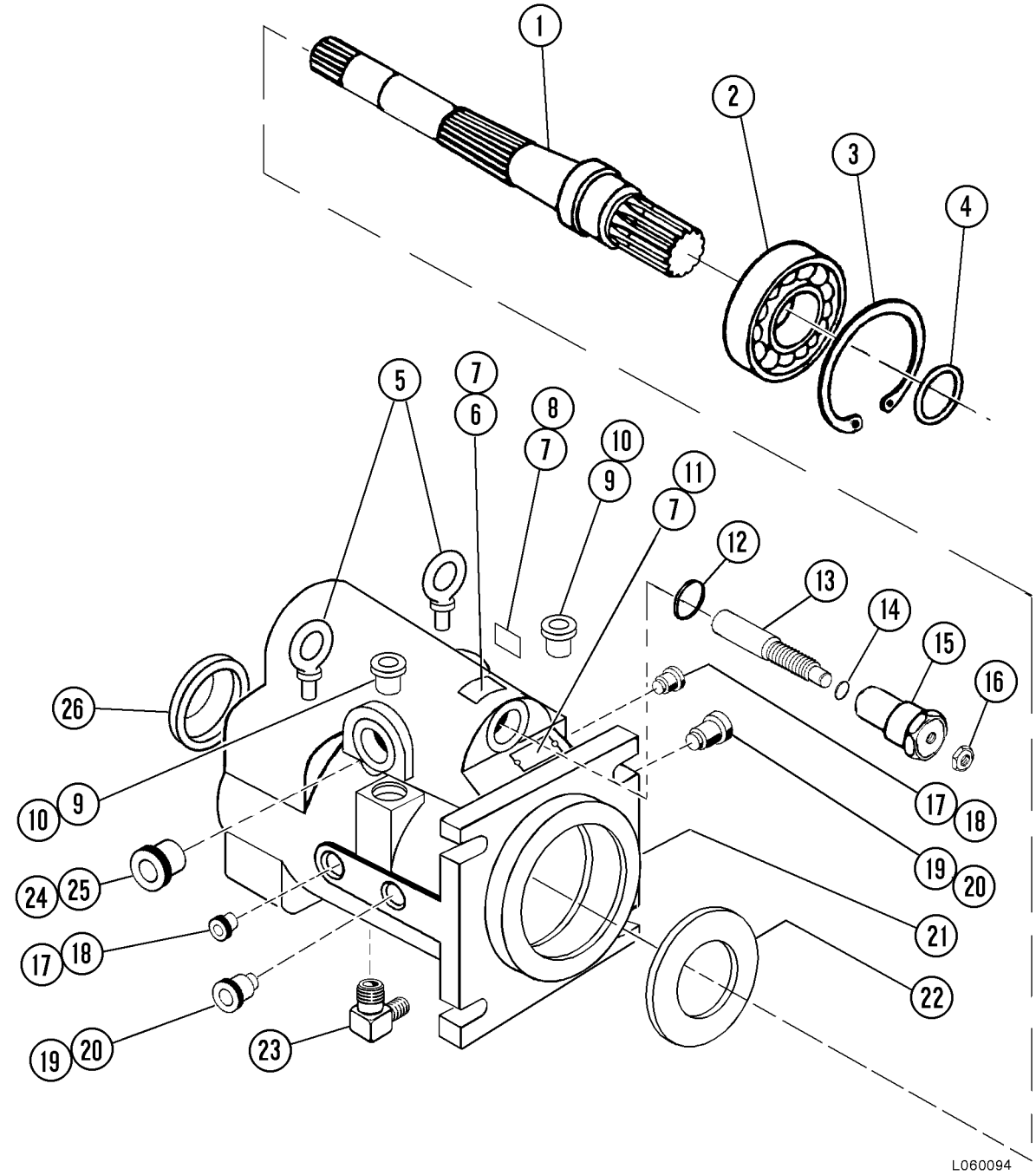


FIGURE 6-22. PUMP, FRONT HOUSING

1. Shaft
2. Bearing
3. Snap Ring
4. Retainer Ring
5. Lifting Eyes
6. Name Plate
7. Drive Screw
8. Name Plate
9. Plug
10. O-ring
11. Plate
12. O-ring
13. Stem
14. O-ring
15. Gland
16. Jam Nut
17. Pin
18. O-ring
19. Pin
20. O-ring
21. Housing
22. Seal Retainer
23. Elbow Fitting
24. Plug
25. O-ring
26. Seal

6. Allow the system pressure to stabilize for a minimum of three minutes after the manifold gauge has reached its maximum pressure. The GPA pressure gauge (7, Figure 6-30) should also rise to within 172 kPa (25 psi) of the manifold pressure gauge (T2, Figure 6-31). For the purposes of this test, the manifold pressure is permitted to be less than the specified reload/ unload pressure range. If it is greater, adjust the pressure controls as outlined in the topic Setting Pressure Controls.

NOTE: Incorrect pressure readings could occur if the system is not allowed to stabilize for at least three minutes.

   a. If both gauges are at or near 0 kPa (0 psi), a pump problem is indicated. Refer to Steering Pump Troubleshooting Guide - Pump Case Drain Check.
   b. If the pump gauge indicates pressure and the manifold gauge is at or near 0 kPa (0 psi), confirm the manifold gauge is connected to the correct port. If the gauge is on the correct port, inspect the system for blockage. Blockage may be caused by a defective hose, a stuck inlet check valve or other obstruction, or a hose installed on the wrong port.

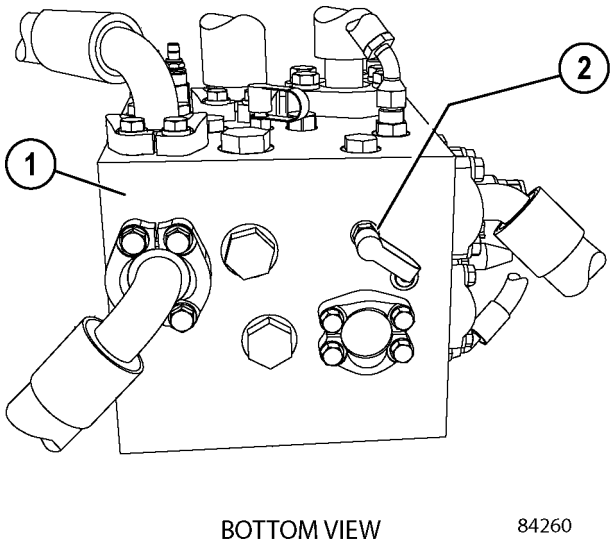


FIGURE 6-31. BLEED-DOWN MANIFOLD

1. Bleed-down Manifold 2. Test Port T2

7. Turn the engine off by pulling up on the engine shutdown switch on the center console, but leave the key switch in the ON position. This will stop the engine without bleeding down the steering accumulators.

NOTE: The key switch must remain ON. The steering accumulator bleed down cycle will initiate if the key switch is turned to the OFF position.

8. Observe the gauges as the engine stops. The pump pressure gauge will drop to zero.

   a. Slow pressure drop - If the manifold pressure gauge remains near the original (engine on) pressure or drops slowly (less than 1 034 kPa (150 psi) per minute), minimal leakage is present. Pump functions may be confirmed using the Steering Pump Troubleshooting Guide.
   b. Gradual pressure drop - If the manifold pressure gauge exhibits a gradual drop in pressure (between 1 042 kPa (151 psi) and 4 137 kPa (600 psi) per minute), leakage is present, but does not require repair prior to confirming pump functions using the Steering Pump Troubleshooting Guide. Hydraulic pump controls settings may require minor re-adjustment after the leaks are repaired.
   c. Excessive pressure drop - If both pressure gauges drop rapidly to zero (greater than 4 137 kPa (600 psi) per minute), excessive leakage is present. The system downstream of the pump is leaking excessively. Locate and repair the leakage before proceeding to the Steering Pump Troubleshooting Guide.

HOIST CIRCUIT

HOIST CIRCUIT OPERATION

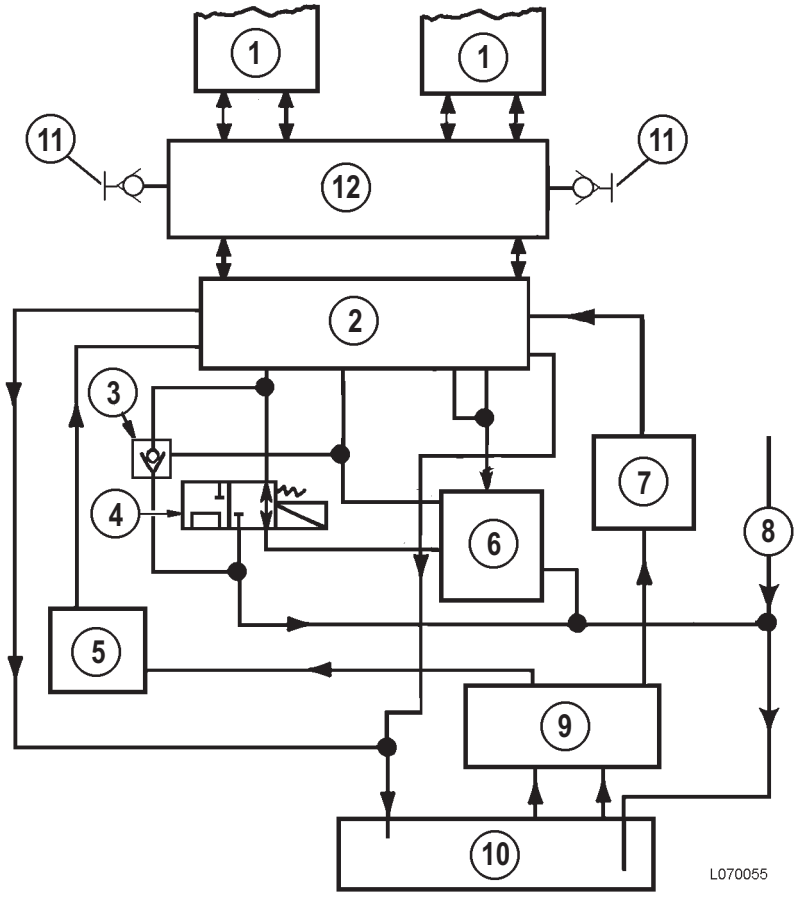
The following hoist circuit operation description describes the basic hoist circuit. Details of individual component operation is outlined under the individual component descriptions.

Hydraulic fluid is supplied by a tank (10, Figure 7-1) located on the left frame rail. Hydraulic oil is routed to a tandem gear type pump (9), driven by a driveshaft on the traction alternator.

Pump output is directed to two, high pressure filters (5 & 7) mounted on the side of the fuel tank. Hydraulic oil from the filters is directed to the hoist valve (2), mounted on a modular assembly containing the hoist pump, steering/brake pump, hoist valve and counterbalance valve manifold.

The hoist valve directs oil to the body hoist cylinders (1) for raising and lowering the dump body. Hoist valve functions are controlled by the operator through a flexible cable to the hoist pilot valve (6) in the hydraulic component cabinet located behind the operator's cab. Also in the hydraulic cabinet is the hoist-up limit solenoid (4). The hoist-up limit solenoid prevents the hoist cylinders from extending to maximum physical limit. A counterbalance valve in the overcenter manifold (12) prevents abrupt cylinder extension due to material buildup on the tail of the body.

Quick disconnect fittings (11) allow the use of another truck's hydraulic system to dump a load in the body if the hoist pump, hoist valve or related components are inoperable.



1. Hoist Cylinders
2. Hoist Valve
3. Pilot Operated Check Valve
4. Hoist-Up Limit Solenoid
5. Filter
6. Hoist Pilot Valve
7. Filter
8. Return from Flow Amplifier Valve
9. Hoist Pump
10. Hydraulic Tank
11. Quick Disconnects
12. Overcenter Manifold

⚠WARNING

Hydraulic hoses deteriorate with age and use. Prevent possible malfunctions by inspecting all hoses periodically. Replace any hose showing wear, damage, or deterioration.

FIGURE 7-1. HOIST CIRCUIT SCHEMATIC

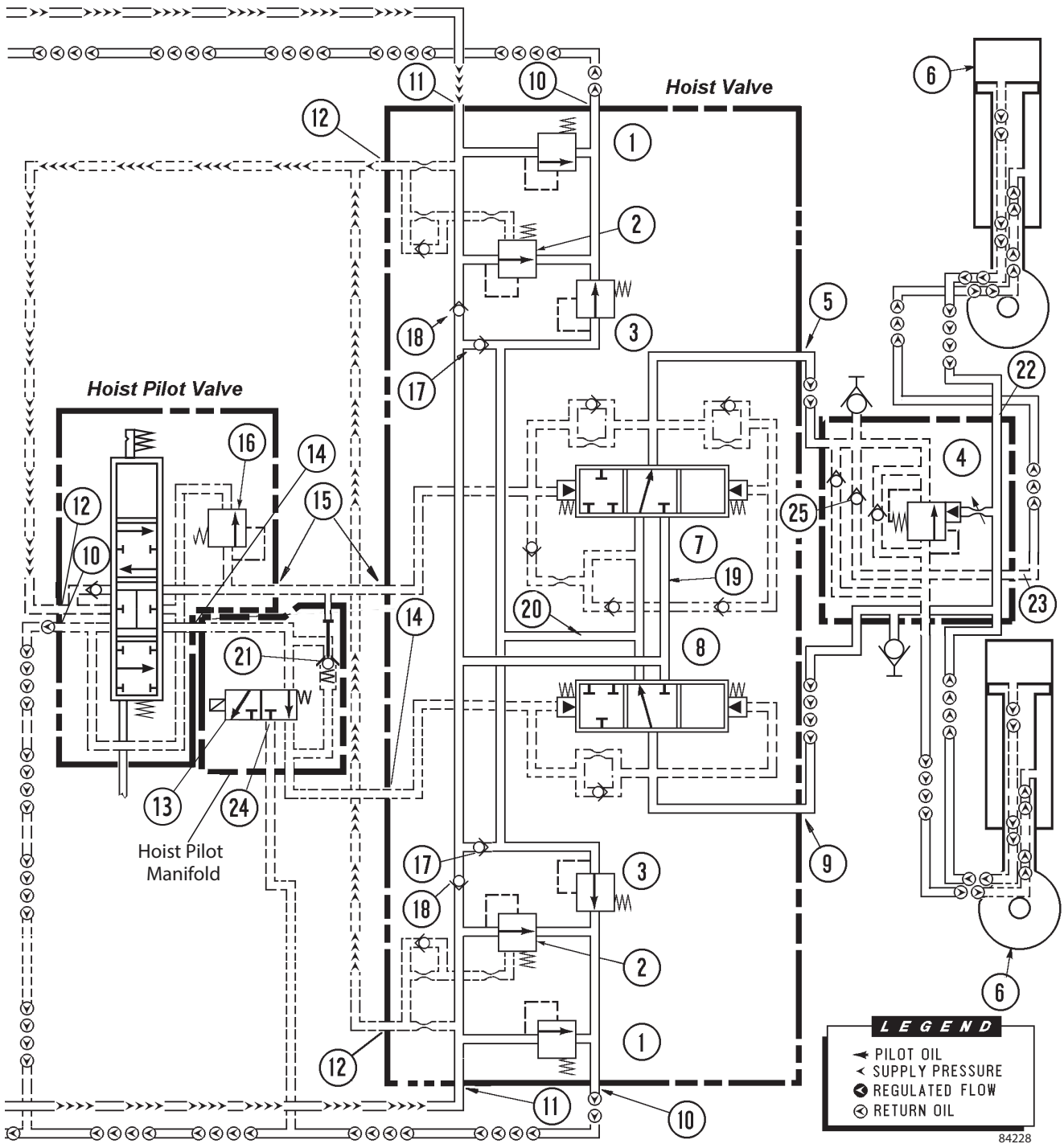


FIGURE 7-10. FLOAT POSITION

Assembly

1. Thoroughly coat all parts including housing bores with clean type C-4 hydraulic oil.
2. If the inlet and outlet housings were removed follow steps 3 through 5 for reassembly.
3. Install check poppet (2, Figure 8-14) and spring (3) in spool housing (1).
4. Install new O-ring (4) in spool housing. Move the inlet and outlet housings into position.
5. Install tie rods. Install tie rod nuts. Tighten tie rod nuts to the torques shown in Figure 8-15.
6. Install a new O-ring (27, Figure 8-12) and wiper (26). Install seal retainer (25).
7. Install spacer (5), spring seats (19), and spring (4). Thread detent pin (3) into spool (14). Slight pressure will be required to compress the detent spring. Tighten detent pin **9-11 N·m (84-96 in. lbs)**. Install spring (20). Carefully install spool into spool housing.
8. Apply grease to the cross holes of the detent pin (3) to hold balls (21) and (2).
9. Slide detent sleeve (22) into cap (24) and place over a punch. Using this punch, depress ball (21) and insert balls (2) in detent pin cross holes.
10. While holding down on ball (21), slide detent sleeve (22) and cap (24) as an assembly over the detent pin (3). Continue to insert detent sleeve (22) until it contacts spring seat (19).
11. Secure cap (24) in place with capscrews (6). Tighten capscrews (6) to **7 N·m (5 ft lbs)**. Install spacer (23) and snap ring (1).
12. Install a new O-ring (12) and wiper (13). Install seal plate (16). Install machine screws (15).
13. Using new O-rings, install relief valve (2, Figure 8-13) in spool housing.

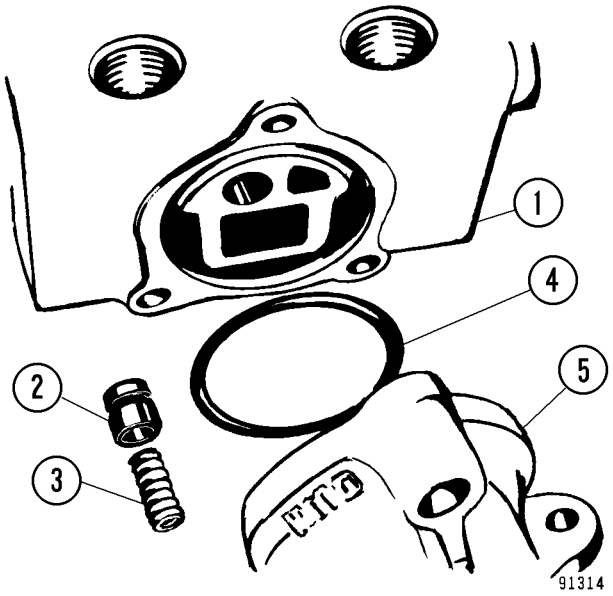


FIGURE 8-14. HOIST PILOT VALVE ASSEMBLY

1. Spool Housing
2. Check Poppet
3. Spring
4. O-ring
5. Outlet Housing

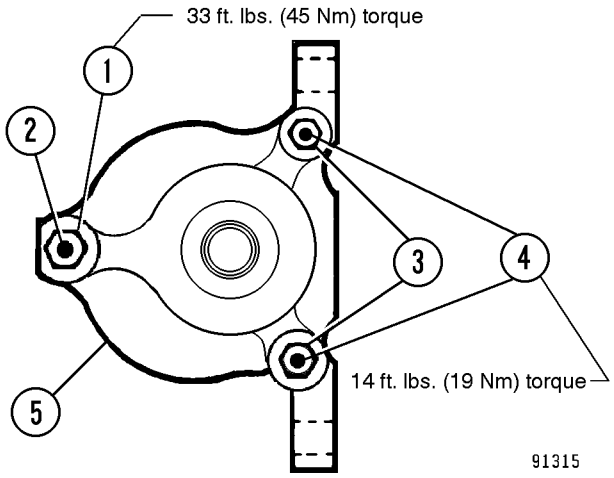


FIGURE 8-15. TIE ROD NUT TORQUE

1. Nut
2. Tie Rod
3. Nut
4. Tie Rod
5. Outlet Housing

HYDRAULIC SYSTEM CHECKOUT PROCEDURE

The following instructions outline the procedure for flushing the hydraulic system.

Hoist system bypass blocks (PC3074) and steering system flushing hose (XB5776) are required so the hydraulic system can be flushed and any debris can be removed from the hydraulic system.

All flushing hoses must be rated to withstand 27 580 kPa (4,000 psi) pressure. The hoses must be 1 inch inside diameter and meet SAE 100R12 specifications.

PRE-CHECKOUT ITEMS

The following checkout items must be reviewed and understood before performing the Hydraulic Check-out Procedure:

1. Interface Module Checkout Procedure must be successfully completed before engine is started. Failure to do so may prevent detection of improper/incomplete steering accumulator bleed down function if problems existing with wiring, switches, etc. in accumulator bleed down circuit.
2. Steering Accumulator Bleed Down Function Description:
   a. The steering accumulator bleed down solenoid is energized, which allows bleed down of the accumulators, two seconds after all the following conditions are met:
      - The key switch is turned off.
      - The truck is stopped.
      - The engine is not running.
   b. The solenoid will remain energized until the Interface Module shuts down. Battery disconnect switch must be in ON position during entire steering accumulator bleed down operation.
   c. If steering bleeddown successfully reduces pressure below 1 930 ± 275 kPa (280 ± 40 psi) within 90 seconds and the parking brake has applied, as indicated by the park brake pressure switch, then the Interface Module will shut down. Steering pressure at bleeddown manifold test port “T3” (9, Figure 10-2) will be 103 kPa (15 psi) or less after successful bleed down.
   d. If 90 seconds elapse before the steering bleed pressure switch indicates a successful bleed down, then Fault A236 will be generated (requires Interface Module Realtime Data Monitor to see fault). Fault A236 is the “Steering Bleed Fault”. The Interface Module will keep the steering bleed down solenoid energized and will not shut down while this fault is active. The Interface Module Warning indicator will illuminate, the buzzer will sound, and the steering pressure indicator will flash on and off while fault A236 is active.

⚠WARNING

If Interface Module Warning Indicator is illuminated, buzzer sounding and steering pressure indicator flashing, do not attempt to remove any hydraulic hose, fitting, plug, switch, etc. as hydraulic pressure may be trapped.

   e. Refer to Section D12 for additional information about Fault A236. Battery disconnect switch must be in ON position during entire steering accumulator bleed down operation and remain in ON position until no fault is active or until active faults are diagnosed.
3. Brake accumulators are **not** bled down through the steering accumulator bleeddown circuit. Brake accumulators are bled down by means of needle valves located in the hydraulic brake cabinet.
4. Use the HYDRAULIC BRAKE AND STEERING ACCUMULATOR BLEED DOWN PROCEDUREtL4 for bleeding down the hydraulic accumulators for the brake and steering systems.

TROUBLESHOOTING

TROUBLESHOOTING CHART (Hoist Pump)		
Trouble	**Possible Cause**	**Suggested Corrective Action**
Visible damage in the following areas: **• Sandblasted band around pressure plate bores** **• Angle groove on face of pressure plate** **• Lube groove enlarged and edges rounded** **• Dull area on shaft at root of tooth** **• Dull finish on shaft in bearing area** **• Sandblasted gear bore in housing**	Abrasive wear caused by fine particles in oil supply — Dirt (fine contaminants, not visible to the eye).	Change hydraulic oil. Hydraulic filters may need changing. Verify correct filter elements are being used. Check hoist and steering cylinders for dents, scoring, or seal damage. Entire hydraulic system may require complete cleaning (See Flushing Procedure in the following pages).
Visible damage in the following areas: **• Scored pressure plates** **• Scored shafts** **• Scored gear bore**	Abrasive wear caused by metal particles — Metal (coarse contaminants, visible to the eye).	Entire hydraulic system may require complete cleaning (See Flushing Procedure in the following pages). Check other hydraulic system components for possible source of contaminants.
External damage to pump	Incorrect installation.	Remove and repair as required.
Damage on rear of drive gear and rear pressure plate only	Defective pump driveshaft.	Check pump driveshaft. Check cross and bearings for smooth operation. Check for adequate joint lubrication.
Eroded pump housing or pressure plate	Aeration - cavitation • Restricted oil flow to pump • Aerated oil	Check hydraulic tank oil level. Verify correct oil viscosity. Check for restriction or air leak at pump inlet line. Check for loose fittings, clamps etc.
Excessive wear on pressure plate and/or end of gear	Lack of oil.	Check hydraulic oil level. Check pump inlet hoses for obstructions or leaks.

HYDRAULIC OIL HEATERS

GENERAL INFORMATION

Operation of the optional hydraulic oil heaters is controlled by the coolant system heater thermostats. This system utilizes two 240 Volt, 500 watt heaters in the hydraulic oil tank. Not all trucks are equipped with this option.

TROUBLESHOOTING

Operation of a hydraulic oil heater can be tested by touching mounting boss (3, Figure 7-6) on the hydraulic tank. After allowing time for the heater to warm up, it will be warm to the touch.

1. If the oil heater is not warm to the touch, check for a voltage of 230 to 240 volts to the power cord.
2. If the oil heater is not warm to the touch, check the thermostat circuit. Also check the circuits between the heater and the external power source.
3. If the oil heater is not warm to the touch and the voltage is correct, the heater element must be replaced.

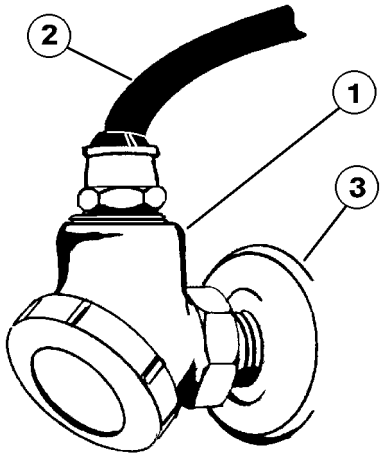


FIGURE 7-6. HYDRAULIC OIL HEATER

1. Oil Heater
2. Power Cord
3. Mounting Boss

SECTION M19
RADIATOR SHUTTERS
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PAYLOAD METER IV SOFTWARE AND TOOLS

Several software programs and tools are required for Payload Meter IV (PLM IV) setup and checkout procedures.

- PLM IV application code (latest version)
- Service computer with Windows® operating system (200 MHz processor, 64 MB RAM minimum)
- Cat5e ethernet cable
- USB drive with 1 - 4GB of memory
- Four 3 kohm, 1W resistors (58B-06-03100)
- Voltmeter

NOTE: Be aware that the software and data files are updated periodically. Download the latest versions from the Komatsu extranet at:

https://www.komatsuamerica.net/northamerica



FIGURE 20-3. PLM IV COMMUNICATION MODULE

1. USB 2.0 Ports
2. LED Indicators
3. RJ45 Ethernet Port

PAYLOAD METER IV SYSTEM CONFIGURATION

Connecting to the payload meter IV web server

The PLM IV web server allows users to download data and configure the payload meter system. PLM IV can be connected to a service computer via a Cat5e cable connection from RJ45 ethernet port (3, Figure 20-3) on the payload meter communication module, or it can be connected to a wireless radio on the truck if a wireless connection is desired.

Once connected, use a web browser such as Internet Explorer® or Google Chrome™ to access the web server.

NOTE: The service computer static IP address must be configured within the same network range as the payload meter.

Configuring a static IP address

FIGURE 20-4. For a wired or wireless connection, a static IP address of the service computer is required to allow connectivity. Refer to Figure 20-5.

1. Right click on the Wired Connection icon in the bottom right corner of the window.
2. Click on “Open Network and Sharing Center.”
3. In the Network and Sharing Center window, click on “Change adapter settings” on the left hand bar.
4. Right click on the computer's "Wired Connection Device". If using wireless access, right click on the "Wireless Connection Device".
5. Click on "Properties".
6. Click on "Internet Protocol Version 4 (TCP/IPv4)" to highlight the option.
7. Click on "Properties."
8. Select "Use the following IP address".
9. Fill in the following IP Settings:
   - Set the service computer’s IP address within the same IP address range of the PLM IV controller. The default factory programmed static IP address of the PLM IV controller is **192.168.3.128**.

     For example, set the IP address of the service computer to **192.168.3.<u>123</u>**. The last three numbers can be any number between 1 and 254 except for **<u>128</u>** since that number is already assigned to the PLM IV controller.
   - Subnet Mask: **255.255.255.0**
10. Click "OK."

RESERVE ENGINE OIL SYSTEM

The reserve engine oil system is designed to add more oil capacity to the engine sump and to reduce frequent servicing of the engine oil. The constant circulation of oil between the engine sump and reserve tank (9, Figure 31-1) increases the total volume of working oil. This dilutes the effects of contamination and loss of additives and maintains the oil quality over longer periods. The system adds or removes oil from the engine as required to maintain a constant level which prevents over fills or under fills.

The normal reserve system capacity of oil carried in the tank can be one half or nearly the same (depending on tank size) volume inside the engine. In the process of continuous adjustment of the engine oil level, there is a constant circulation of oil between the engine and the reserve tank. The volume of oil in the tank becomes part of the working oil for the engine. Oil change intervals may usually be extended in proportion to the increased working oil volume. Extension beyond a proportional increase is often possible, but should be undertaken only as determined by oil sampling and analysis. Local conditions such as engine application, climate, and fuel quality should be taken into consideration before determining permissible oil life.

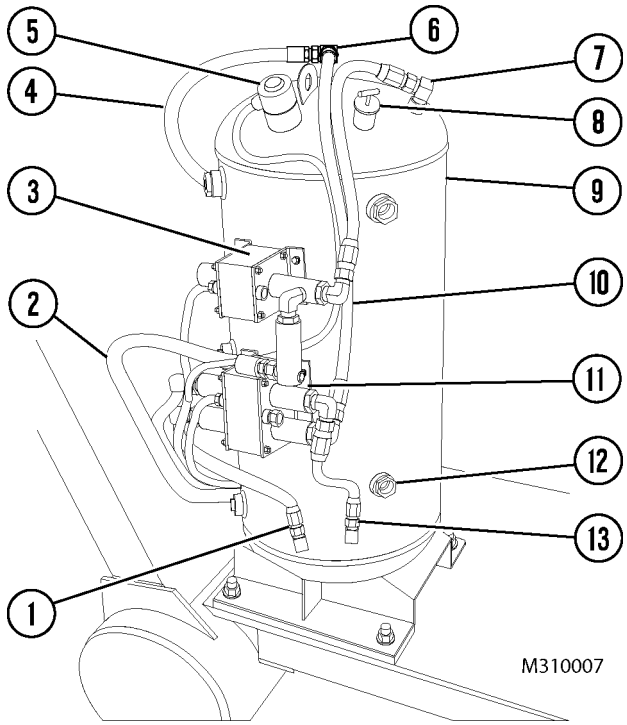


FIGURE 31-1. OIL RESERVE TANK

1. Suction Line
2. Remote Fill Line
3. Fill Valve
4. Engine Add Line
5. Fill Switch
6. Air Relief Valve
7. Tank Fill Line
8. Tank Fill Cap
9. Reserve Tank
10. Engine Add Line
11. Pumping Unit
12. Sight Gauge
13. Tank Add Line

IN-CAB CONTROL PANEL FEATURES

The in-cab control panel features a digital display screen, command buttons ([UP], [DOWN], [ENTER], [EXIT], [LEFT], [RIGHT]) for operating the ladder and navigating through the various menu display screens, a USB key port and RS 232 port for downloading ladder system operational data to a laptop computer for troubleshooting. The control panel is connected to an electrical harness with a 15-pin harness plug. Refer to Figure 32-5.

In-cab control panel display screen (1) provides the user with system status, error/fault messages and a visual indicator of the ladder's position (lowered, raised, in motion).

[UP] button (2) is a dual function control that is used to raise the ladder during normal operation and scroll through the menu displays. Pressing this button and holding it briefly will cause the ladder to raise. Pressing and releasing this button one time will scroll up one line of menu display, and holding it will result in continuous menu scrolling.

[DOWN] button (3) is a dual function control that is used to lower the ladder during normal operation and scroll through the menu displays. Pressing this button and holding it briefly will cause the ladder to lower. Pressing and releasing this button one time will scroll down one line of menu display, and holding it will result in continuous menu scrolling.

[LEFT] button (4) is for scrolling left when entering a password.

[RIGHT] button (5) is for scrolling right when entering a password.

[ENTER] button (6) is a multi-function button used for ladder system alarm acknowledgment and menu access when in Display Mode. This button is also used to confirm or accept changes shown on the display screen. Press this button to confirm or accept changes listed on the display screen.

[EXIT] button (7) is a multi-function button used for ladder system alarm acknowledgment and menu access when in Display Mode. This button is also used to exit from the menu screens. Press this button to exit from menu screens.

USB Port (8) is located on the side of the control panel and allows the user to access and download ladder operational data onto a USB key or flash drive for analysis.

The control panel is connected to the electrical system with 15-pin harness plug (9).

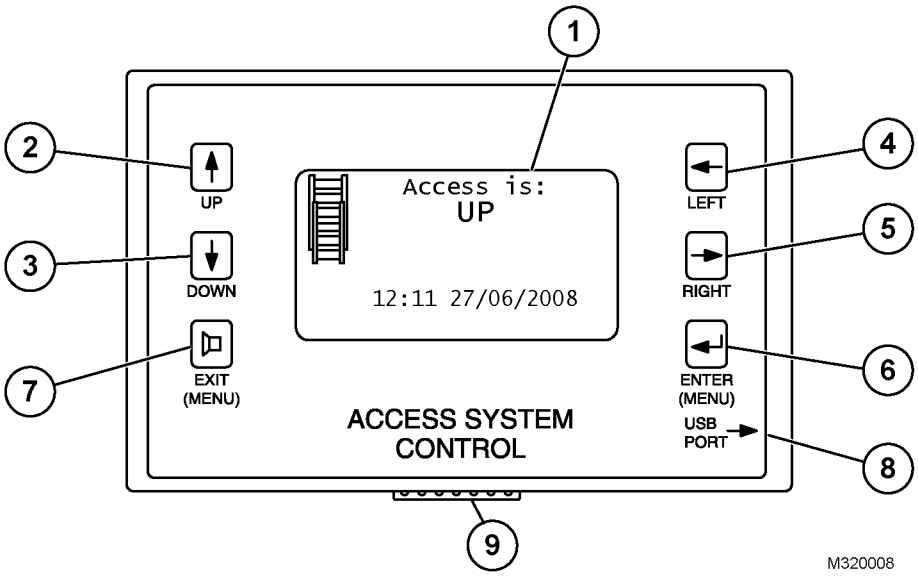


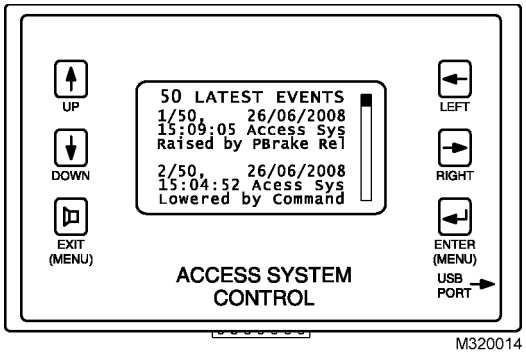
FIGURE 32-5. IN-CAB CONTROL PANEL (FRONT VIEW)

1. Display Screen
2. [UP] Button
3. [DOWN] Button
4. [LEFT] Button
5. [RIGHT] Button
6. [ENTER] Button
7. [EXIT] Button
8. USB Port
9. 15-Pin Harness Plug

Historic System Data Review

To view up to 50 of the last logged events:

1. Press the [ENTER] or [EXIT] buttons on the in-cab control panel.
2. From the CONTROLLER MENU screen, use the [DOWN] button to scroll to “Show Recent Logs” and press the [ENTER] button.
3. To view each entry, use the [DOWN] button to scroll.



NOTE: The events are listed from the last time and date stamped event (1/50) through to the first in the series (50/50). Pressing and holding the DOWN or UP button will continuously scroll through the list until the button is released.

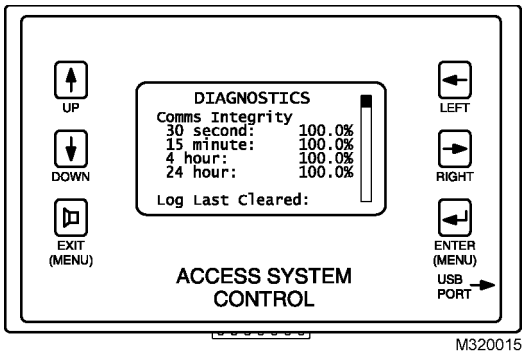
NOTE: The In-Cab Control Node contains a rechargeable battery to maintain the clock. If the Date and Time set screens appear on start up the internal battery will require charging. Charge times are as follows:
Standby Time (Fully Charged) – 3 Weeks
Time to fully Charge – 5 Hours
Minimum Charge Time – 1.5 Hours

NOTE: This battery status only affects Time and Date settings. IT DOES NOT AFFECT NORMAL LADDER, STAIRWAY OR STEP OPERATION.

Comms Integrity Monitoring

The Comms Integrity interface provides a simple health check for the communications between the in-cab control panel and the main controller in the power pack. To access this screen:

1. From the CONTROLLER MENU screen, use the [DOWN] button on the in-cab control panel to scroll down to Diagnostics and press the [ENTER] button.
2. Use the [DOWN] button to scroll to DIAGNOSTICS and press the [ENTER] button. A comprehensive list of system events are tagged as either ‘active’ or ‘inactive’ for quick identification of system faults that are currently active and need immediate attention. Comms Integrity is listed as a percent value. These percent values indicate communications integrity for the last 30 seconds, 15 minutes, 4 hours and 24 hours.



If intermittent, unreliable operation of the ladder, stairway or step access system is experienced, a check of the Comms Integrity entries is recommended. For a healthy system, the percentages should be no lower than 80%.

If the percentages fall below this prescribed value, the possible symptoms will be:

- Intermittent communications errors shown on the controller
- Unreliable/unpredictable ladder operation
- No ladder operation

The possible causes are:

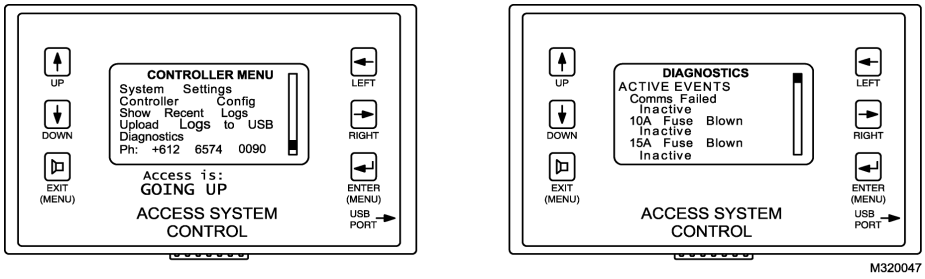
- Poor/degraded wiring
- Substantial electrical interference
- An internal fault with the controller hardware

Fault Types 23, 24: Levels 1 and 2 service overdue

Fault Types	23, 24
Priority	Low
Description	When the first, second and overdue service intervals have been exceeded by the operations count an error is logged and a user acknowledgement is requested.
Possible Cause(s)	Ladder, stairway or step has not been serviced within the acceptable number of operations. If the service has been completed then the service request has not been cleared from the system.
Operator Alerting System Response	The in-cab control panel will display a fault message and list all of the faults in order of priority. The in-cab control panel will sound a buzzer spaced at regular intervals.
Resulting Problem(s)	None.
Operator Acknowledgment Required?	Yes.

Fault Type 25: Levels 1 and 2 service complete

Fault Type	25
Priority	Low
Description	Once the ladder, stairway or step has been serviced a user with the Master User ID must clear the service request. When the service request is cleared a Level 1 and/or 2 Service Complete entry will be logged.
Possible Cause(s)	
Operator Alerting System Response	The in-cab control panel will display a fault message and list all of the faults in order of priority. The in-cab control panel will sound a buzzer spaced at regular intervals.
Resulting Problem(s)	None.
Operator Acknowledgment Required?	Yes.



MAIN ACCESS DISPLAY
Displays current ladder/stairway status

To access the **CONTROLLER MENU** press the **[ENTER]** or **[EXIT]** buttons

CONTROLLER MENU
Displays Main Root Menu Options

System Settings
Displays Currently Programmed System Settings

To view the current **System Settings** press the **[UP]** or **[DOWN]** buttons to scroll through the options

Controller Config
Password access to change the System Settings

Show Recent Logs
Displays the 50 latest events time & date stamped

Upload Logs to USB
Allows the download of the data log via USB Key

Use the **[DOWN]** button to scroll to **Diagnostics** then press **[ENTER]**.

Diagnostics
Displays a summary of Events and Comms Integrity

DIAGNOSTICS RECORDS OPTIONS

- **Active Events** (A comprehensive list of system events indicated whether currently active or inactive). Comms Failed, 10A Fuse Blown, 15A Fuse Blown, Up Coil Failed, Down Coil Failed, In Coil Failed *[Swing Ladder only]*, Out Coil Failed *[Swing Ladder only]*, Pump Coil Failed, Power Pack Failed, Inhibit Relay Failed, Ladder Off Limit, Did Not Reach Limit, Stay on Limit, Low Oil Level *[Future Inclusion]*, Under Voltage at Command, Under Volts, Over Volts, Top Remote UP Held, Top Remote DOWN Held, Low Remote UP Held, Low Remote DOWN Held, Pressure Recharge > 1 Hour, Raised by Park Brake, L1 Service Overdue, L2 Service Overdue.
- **Comms Integrity** (Monitors system communications integrity between the In-Cab Control Panel and the Main Control Board in the Power Pack. The results are displayed as a percent value for various time periods up to 24 hours. For a healthy system, the percentages should be no lower than 80%). Time intervals displayed are 30 seconds, 15 minutes, 4 hours and 24 hours.
- **Log Last Cleared** (Displays the date when the log was last cleared)
- **Total Log Space** (Displays the log storage space remaining as a percent)
- **Code Versions** (Displays the current software code versions for the In-Cab and Hydraulic Control Nodes)
- **Operations Until L1 Service Due** (Displays the remaining access system operations before Service Level 1 Indicator is activated)
- **Operations Until L2 Service Due** (Displays the remaining access system operations before Service Level 2 Indicator is activated)

To return to **MAIN ACCESS DISPLAY** press the **[EXIT]** button.

Ph: +555-555-1212
Displays Komatsu Contact Details

FIGURE 32-18. Control Panel Menu Structure - Diagnostics

There are markers showing the status for each option of the camera. Enabled is a check mark symbol located on a square box. Non-enabled is a simply a blank square box.

NOTE: The default setting done in Step 1 of this procedure puts camera 1 (forward camera), into a mirror mode function, but it must be placed into normal mode.

3. Using the plus or minus buttons, navigate the highlight bar to the "C1" column as shown in Figure 33-20. Press the enter button. This will cause the highlight bar to move down a line in the column to the desired setting place for the mirror.

NOTE: Now the plus or minus buttons will navigate the highlight upward and downward within the settings of the column for this camera.

4. Navigate to the setting "Mirror" for C1. Press the enter button to select the mirror function as disabled, which should be a blank box symbol. C1 needs to be set as mirror disabled.
5. Navigate to the setting "switch delay" for C1. Press the enter button to select the function as disabled, which should be a blank box symbol. C1 needs to be set as switch delay disabled.
6. When completed, press the return button to return to the previous menu state as shown in Figure 33-20. The setting should remain in the disabled state.
7. Using the plus or minus buttons, navigate the highlight bar to the "C2" column as shown in Figure 33-20. Press the enter button. This will cause the highlight bar to move down a line in the column to the desired setting place for the mirror.
8. Navigate to the setting "switch delay" for C2. Press the enter button to select the function as disabled, which should be a blank box symbol. C2 needs to be set as switch delay disabled.
9. When completed, press the return button to return to the previous menu state as shown in Figure 33-20. The setting should remain as set.
10. Using the plus or minus buttons, navigate the highlight bar to the "C3" column. Press the enter button. This will cause the highlight bar to move down a line in the column to the desired setting place for the mirror.
11. Navigate to the setting "switch delay" for C3. Press the enter button to select the function as disabled, which should be a blank box symbol. C3 needs to be set as switch delay disabled.
12. When completed, press the return button to return to the previous menu state as shown in Figure 33-20. The setting should remain in the disabled state.
13. Using the plus or minus buttons, navigate the highlight bar to the "C4" column. Press the enter button. This will cause the highlight bar to move down a line in the column to the desired setting place for the mirror.
14. Navigate to the setting "Mirror" for C4. Press the enter button to select the mirror function as enabled, which should be a check mark symbol. C4 needs to be set as mirror enabled.
15. Navigate to the setting "switch delay" for C4. Press the enter button to select the function as disabled, which should be an empty square box symbol. C4 needs to be set as switch delay disabled.
16. When completed, press the return button to return to the previous menu state as shown in Figure 33-20. The settings should remain as set.

TABLE 1: CAMERA SETTINGS

Setting	C1	C2	C3	C4
Mirror	❑	❑	❑	☑
Switch Delay	❑	❑	❑	❑

2. Transfer the center of this opening onto the skin of the cab nearest where the door jamb bolt is located. Use a T-square or other measuring equipment and mark on the cab with a pencil.

NOTE: Release the door catch before trying to close the door.

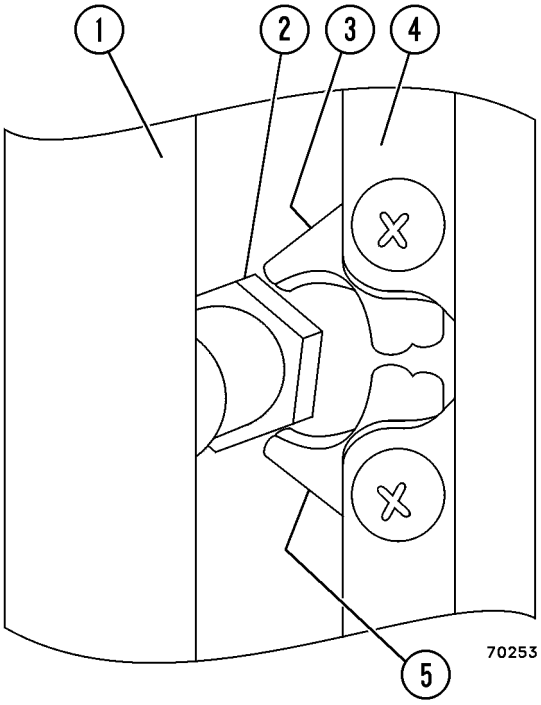


FIGURE 2-4. DOOR JAMB BOLT ADJUSTMENT

1. Washer
2. Striker Bolt
3. Frame
4. Seal

3. Loosen and vertically align (center) the door jamb bolt with this mark and tighten it firmly enough to hold it in place but still allow some slippage.
4. Carefully try to close door (4) and determine whether this adjustment has helped the “springing” problem. If the door latches but not firmly enough, follow the procedure in Step 1. If the door latch does not catch, move the bolt outward and try again. When corrected, follow the adjustment procedures in Step 1 to ensure a good seal.

   By design, if both seals are in good condition, proper adjustment of the outside seal will ensure good contact on the inside seal to prevent dust and moisture from entering the cab.

Door Handle Plunger Adjustment

If the door handle becomes inoperative, it can either be adjusted or replaced. The following is a procedure for adjusting the exterior door handle plunger.

1. Determine the amount of free play in the door release plunger by pushing in on the plunger until it just contacts the door release mechanism. Measure the distance that the plunger travels (Figure 2-5) from this position to where the plunger is fully released.

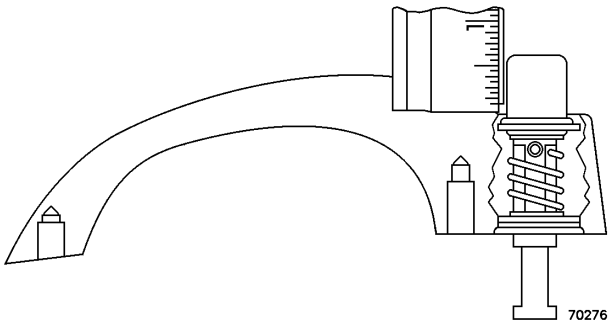


FIGURE 2-5. MEASURING TRAVEL DISTANCE OF PLUNGER

2. Remove the door panel as follows:
   a. Remove hair pin clip (1, Figure 2-6) and bolt (2) from the door check strap closest to the door.
   b. Remove two capscrews (3), which hold the door strap bracket to the door.
   c. Disconnect wiring harness (4) to the window regulator.
   d. Open the door as far as possible in and remove the internal door panel.
   e. Before removing all door panel mounting screws, support the panel to prevent the assembly from dropping. Remove 15 mounting screws (5).

SECTION N3
OPERATOR AND PASSENGER SEATS
INDEX

OPERATOR AND PASSENGER SEATS N3-2

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PASSENGER SEAT (OPTIONAL SEAT)

The passenger seat provides a fully adjustable cushioned ride for passenger comfort and easy operation.

Seat Belts

- On both driver and passenger seats, check the seat belt fabric, buckle, all belt retractors and hardware for damage or wear. Replace any worn or damaged parts immediately.
- Even if there are no signs of damage, replace both driver and passenger seat belts 5 years after seat belt manufacture, or every 3 years after start of use, whichever comes first. The passenger seat belt date of manufacture label is sewn into the seat belt near the buckle.
- Always use the new mounting hardware included in the seat belt kit. Do not reuse any of the existing seat belt mounting hardware.

Adjustment

The following adjustments must be made while sitting in the seat.

1. **Headrest:** (1, Figure 3-26) will move up, down, fore, or aft by moving headrest to desired position.
2. **Seat Height:** Press rocker switch (7) on top to increase ride height. Press on lower part of rocker switch to decrease ride height.
3. **Fore/Aft Location of Seat Cushion -** Lift and hold lever (8) and move the seat cushion to a comfortable position. Release the lever to lock the position adjustment.
4. **Seat Tilt:** Lift seat slope lever (9) and hold to adjust the slope of the seat. Release the lever to lock the adjustment.
5. **Fore/Aft Location of Seat:** Lift fore and aft lever (6) and hold. Bend knees to move seat to a comfortable position. Release the control lever to lock the adjustment.
6. **Suspension Dampener:** Press rocker switch (5) on top to increase ride firmness. Press on lower part of rocker switch to decrease ride firmness.
7. **Air Lumbar Support:** Each rocker switch controls an air pillow. One switch controls the lower air pillow and the other switch controls the upper air pillow. To inflate, press on top of the rocker switch and hold for desired support, then release. To deflate, press on the bottom of the rocker switch and hold for desired support, then release. Adjust each pillow for desired support.
8. **Seat Belt:** The operator must have seat belt (3) buckled in place and properly adjusted whenever vehicle is in motion.
9. **Backrest Angle:** Lift backrest adjustment handle (2) to release and select the backrest angle. Release the control handle to set.

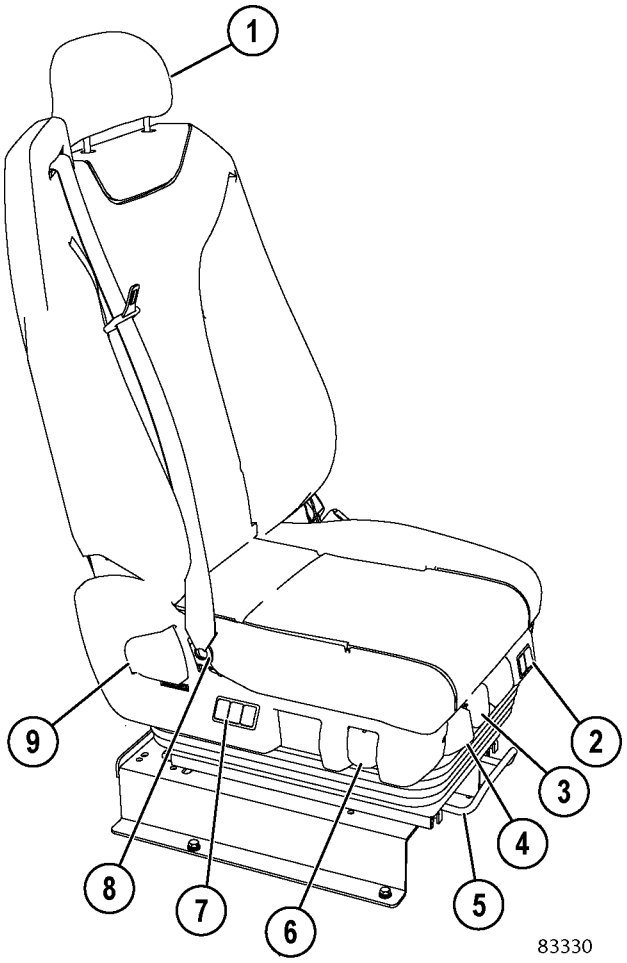


FIGURE 3-26. PASSENGER'S SEAT CONTROLS

1. Headrest
2. Seat Height
3. Seat Cushion Fore and Aft
4. Seat Tilt
5. Fore and Aft
6. Suspension Dampener
7. Lumbar Support
8. Seat Belt
9. Backrest Angle

Refrigeration - The Act Of Cooling

- There is no process for producing cold; there is only heat removal.
- Heat always travels toward cooler temperatures. This principle is the basis for the operation of a cooling unit. As long as one object has a temperature lower than another, this heat transfer will occur.
- Temperature is the measurement of the intensity of heat in degrees. The most common measuring device is the thermometer.
- All liquids have a point at which they will turn to vapor. Water boiling is the most common example of heating until vapor is formed. Boiling is a rapid form of evaporation. Steam is a great deal hotter than boiling water. The water will not increase in temperature once brought to a boil. The heat energy is used in the vaporization process. The boiling point of a liquid is directly affected by pressure. By changing pressure, we can control the boiling point and temperature at which a vapor will condense. When a liquid is heated and vaporizes, the gas will absorb heat without changing pressure.
- Reversing the process, when heat is removed from water vapor, it will return to the liquid state. Heat from air moves to a cooler object. Usually the moisture in the cooled air will condense on the cooler object.
- Refrigerant - Only R-134a should be used in the new mobile systems which are designed for this refrigerant.

The Refrigeration Cycle

In an air conditioning system, the refrigerant is circulated under pressure through the five major components in a closed circuit. At these points in the system, the refrigerant undergoes predetermined pressure and temperature changes.

The compressor (refrigerant pump) takes in low pressure heat laden refrigerant gas through the suction valve (low side), and as its name indicates, pressurizes the heat laden refrigerant and forces it through the discharge valve (high side) on to the condenser.

Ambient air, passing through the condenser removes heat from the circulating refrigerant resulting in the conversion of the refrigerant from gas to liquid.

The liquid refrigerant moves on to the receiver drier where impurities are filtered out, and moisture removed. This component also serves as the temporary storage unit for some liquid refrigerant.

The liquid refrigerant, still under high pressure, then flows to the expansion valve. This valve meters the amount of refrigerant entering the evaporator. As the refrigerant passes through the valve, it becomes a low temperature, low pressure liquid and saturated vapor. This causes the refrigerant to become cold.

The remaining low pressure liquid immediately starts to boil and vaporize as it approaches the evaporator, adding to the cooling. The hot, humid air of the cab is pulled through the evaporator by the evaporator blower. Since the refrigerant is colder than the air, it absorbs the heat from the air producing cool air which is pushed back into the cab. The moisture in the air condenses upon movement into the evaporator and drops into the drain pan from which it drains out of the cab.

Refrigerant leaving the evaporator enters the accumulator. The accumulator functions as a sump for liquid refrigerant in the system. Because of its design, the accumulator only allows vaporized refrigerant to return to the compressor, preventing compressor slugging from occurring. Desiccant is located at the bottom of the accumulators to remove moisture that is trapped in the system.

The cycle is completed when the heated low pressure gas is again drawn into the compressor through the suction side.

This simplified explanation of the principles of refrigeration does not call attention to the fine points of refrigeration technology. Some of these will be covered in the following discussions of the components, controls, and techniques involved in preparing the unit for efficient operation.

SYSTEM LEAK TESTING

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

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

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

⚠WARNING

Use extreme caution when leak testing a system while the engine is running.

In its natural state, refrigerant is a harmless, colorless gas, but when combined with an open flame, it will generate toxic fumes (phosgene gas), which can cause serious injuries or death.

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

Electronic Leak Detector

(Refer to Figure 4-7). As the test probe is moved into an area where traces of refrigerant are present, a visual or audible announcement indicates a leak. Audible units usually change tone or speed as intensity changes.

Tracer Dyes

Tracer dyes are available that can be added to the system as refrigerant is added. The system is then operated to thoroughly circulate the dye. As refrigerant escapes, it leaves a trace of the dye at the point of leakage, which is then detected using an ultraviolet light (black light), revealing a bright fluorescent glow.

Soap and Water

Soap and water can be mixed together and applied to system components. Bubbles will appear to pinpoint the specific location of leaks.

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

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

⚠CAUTION

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

PROBLEM: Condenser Malfunction or System Overcharge

Indications:

Low Side High
High Side High
Discharge air may be warm.
High pressure hoses and lines are very hot.

Possible Causes	Suggested Corrective Actions
- Lack of air flow through the condenser fins	**Repair Procedure:** Check the engine cooling system components, fan and drive belt, fan clutch operation, and the radiator shutter. Inspect condenser for dirt, bugs, or other debris, and clean if necessary. Be sure the condenser is securely mounted and there is adequate clearance (about 38 mm) between it and the radiator. Check the radiator pressure cap and cooling system, including the fan, fan clutch, drive belts and radiator shutter assembly. Replace any defective parts and then recheck A/C system operation, gauge readings, and performance. If the problem continues, the system may be over-charged. Recover the system refrigerant. Use a scale to recharge the system using the correct amount. Recheck A/C system operation, gauge readings and performance. If the gauge readings do not change, all of the refrigerant should be recovered and the system flushed. The condenser may be partially blocked -replace condenser. The receiver-drier must also be replaced. Evacuate the system, recharge, and check operation and performance.

CENTER CONSOLE

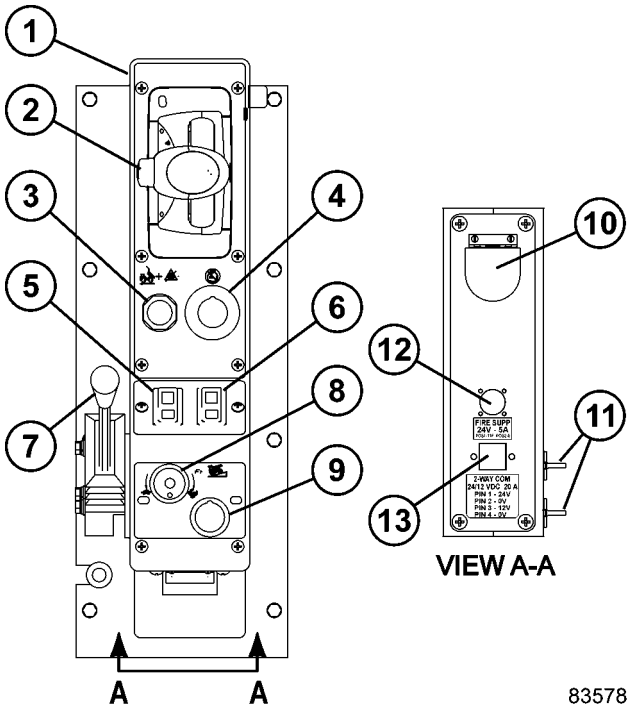


FIGURE 5-7. CENTER CONSOLE

1. Center Console
2. Directional Control Lever
3. Override/Fault Reset Switch
4. Engine Stop Switch
5. L.H. Window Control Switch
6. R.H. Window Control Switch
7. Hoist Control Lever
8. Retard Speed Control Dial
9. RSC Switch
10. Data Store Button
11. 12V Auxiliary Power Outlets
12. Fire Suppression Control Outlet
13. Communication Radio Outlet

Directional Control Lever

Directional Control Lever (2, Figure 5-7) is mounted on a console to the right of the operator's seat. It is a four position lever that controls the park, reverse, neutral, and forward motion of the truck. Before moving the directional control lever, apply the service brakes to completely stop the truck. Depress the button on the side to release the detent lock, then move the control lever to the desired position. When the control lever is in the center N position, it is in NEUTRAL. When the control lever is in the P position, it is in PARK, and the parking brake will be applied. The parking brake is spring applied and hydraulically released. It is designed to hold the truck stationary when the engine is off and the key switch is turned OFF. The truck must be completely stopped before moving the control lever to PARK, or damage may occur to the park brake. When the key switch is ON, and the control lever is in PARK, the parking brake indicator light will be illuminated.

⚠ IMPORTANT ⚠

The directional control lever must be in PARK to start the engine.

NOTE: DO NOT move the directional control lever to the PARK position at the shovel or dump.

The operator can select FORWARD drive by moving the control lever to the F position.

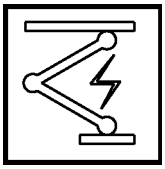
The operator can select REVERSE drive by moving the control lever to the R position. DO NOT allow the control lever to travel too far and go into the PARK position when REVERSE is desired.

NOTE: The truck must be completely stopped before the control lever is moved to a drive position or into PARK. A GE fault will be recorded if the control lever is placed into the PARK position while the truck is still moving.

NOTE: The center console contains an access hole for a wiring harness resistor. This resistor is to reduce the current flow to the directional control lever contacts, increasing their service life.

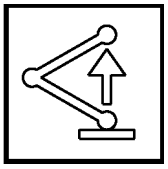
Not Used

This indicator (12) light is not used in this application.



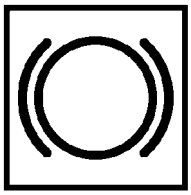
Not Used

This indicator (13) light is not used in this application.



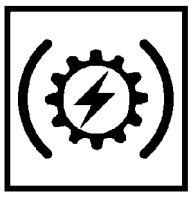
Service Brake

The service brake indicator (14) will illuminate when the service brake pedal is applied.



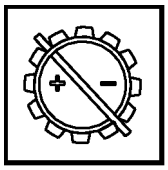
Dynamic Retarding

The dynamic retarding indicator (15) will illuminate whenever the retarder pedal is operated, or the automatic overspeed retarding circuit is energized. It indicates that the dynamic retarding function of the truck is being used.



No DC Link Voltage

The no DC link voltage indicator (16) will illuminate when the rest switch in ON, or whenever the DC link in the control cabinet is not providing voltage to the propulsion system.



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PERIODIC MAINTENANCE
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EVERY 18000 HOUR MAINTENANCE P2-20

EVERY 500 HOUR LUBRICATION AND MAINTENANCE (CONT'D)

Truck Serial Number_____ **Site Unit Number**_____ **Date**_____
Hourmeter_____ **Name of Service Technician**_____

	Item	Task	Comments	CHECKED	INITIALS
11.	ENGINE	• Change the engine oil. (Lube Key "A") • Replace engine oil filters. • Check belt tension and the condition of each accessory belt. Refer to the engine Operation & Maintenance manual for specific adjustment instructions. *NOTE: If the engine is equipped with the Centinel™oil system and/or the Eliminator™filter system, engine oil and filter change intervals are extended beyond 500 hours. Take an engine oil sample for analysis.* *NOTE: When installing spin-on filter elements, follow the instructions of the filter manufacturer. The tightening instructions are normally printed on the outside of the filter. Do not use a wrench or strap to tighten filter elements. Refer to the engine Operation & Maintenance manual for complete specifications regarding engine lube oil specifications.*			
12.	AIR INTAKE PIPING	Check all mounting hardware, joints, and connections. Ensure no air leaks exist and all hardware is properly tightened.			
13.	ACCUMULATOR PRE-CHARGE	Check all steering and brake system accumulator pre-charge pressures. Refer to Sections J and L for details. *NOTE: Pre-shift inspection is necessary*			
14.	STEERING LINKAGE	Check the torque on the pin retaining nuts located on the steering linkage. Target: **1 017 N·m (750 ft lb)**			
15.	REAR WHEEL MOUNTING	Use a flashlight and a mirror on a long rod to inspect all inner and outer wheel mounting nuts and studs. Check for loose, damaged or missing hardware.			

GENERAL INSTRUCTIONS

Lubricant Required For System

Grease requirements will depend on ambient temperatures encountered during truck operation:

- **Above 32°C (90°F) - Use NLGI No. 2 multipurpose grease (MPG).**
- **-32° to 32°C (-25° to 90°F) - Use NLGI No. 1 multipurpose grease (MPG).**
- **Below -32°C (-25°F) - Refer to local supplier for extreme cold weather lubricant requirements.**

Filter Assembly

Filter element (5, Figure 3-4) must be replaced if bypass indicator (2) shows excessive element restriction.

System Priming

The system must be full of grease and free of air pockets to function properly. After maintenance, if the primary or secondary lubrication lines were replaced, it will be necessary to prime the system to eject all entrapped air.

1. Fill lube reservoir with lubricant, if necessary.
2. To purge air from the main supply line, remove the main supply line at the grease canister. Connect an external grease supply to the line.
3. Remove plugs from each injector group in sequence (right front, left front, and rear axle).
4. Using the external grease source, pump grease until grease appears at the group of injectors and re-install the pipe plug. Repeat for remaining injector groups.
5. Remove the caps from each injector and connect an external grease supply to the zerk on the injector and pump until grease appears at the far end of the individual grease hose or the joint being greased.

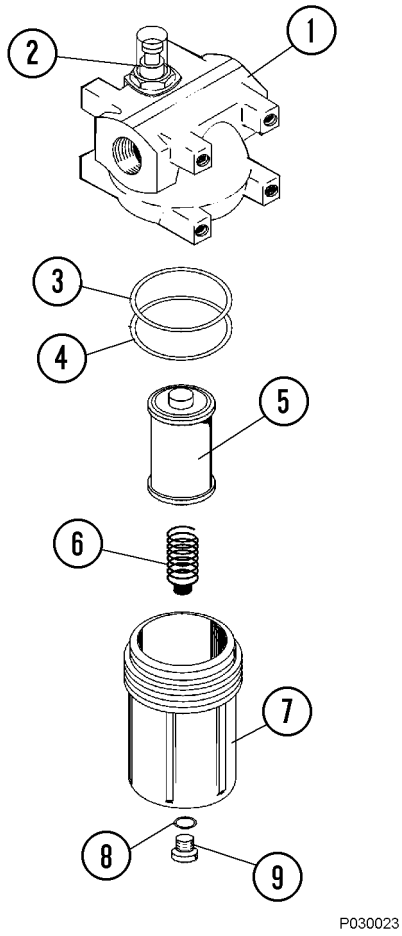


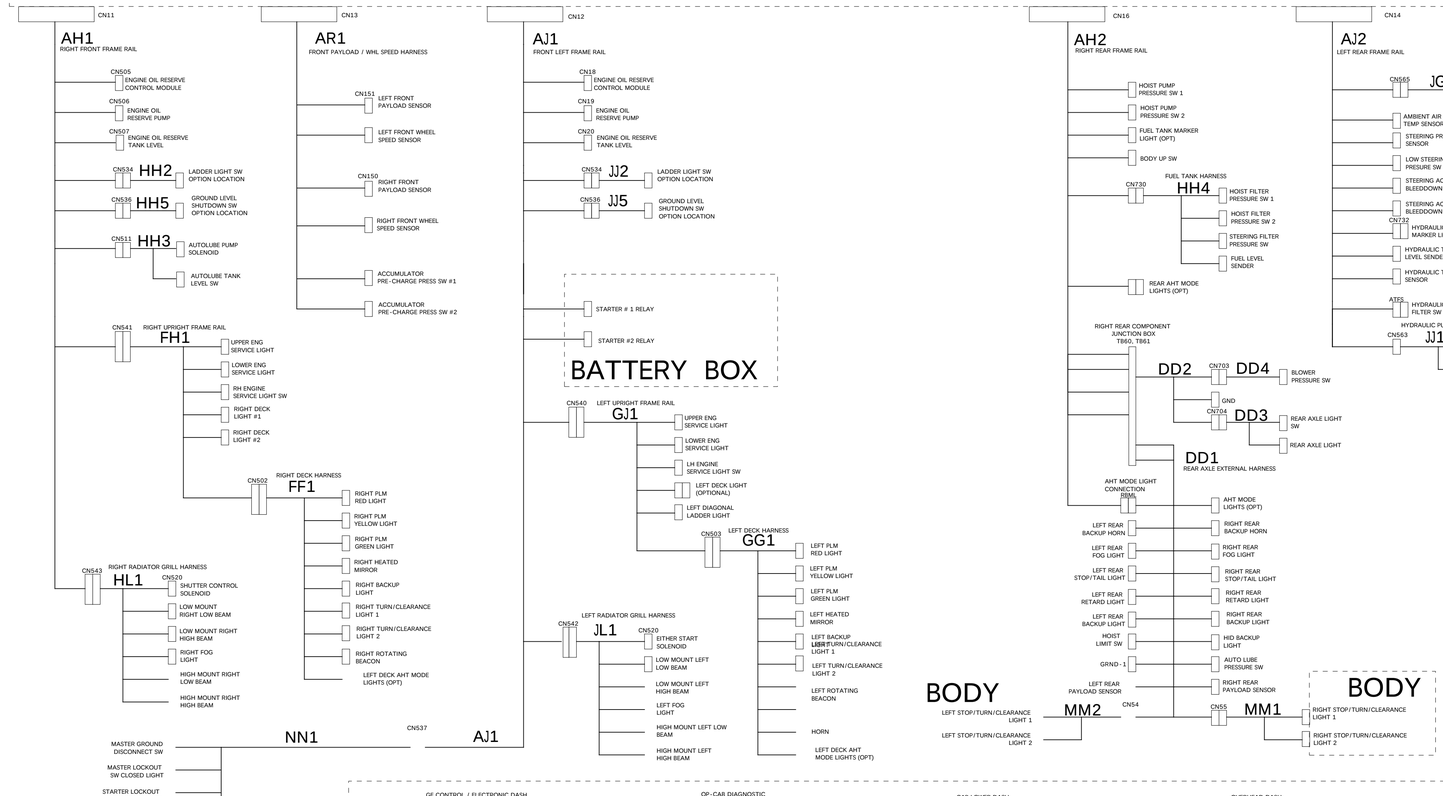
FIGURE 3-4. FILTER ASSEMBLY

1. Housing
2. Bypass Indicator
3. O-Ring
4. Backup Ring
5. Element
6. Spring
7. Bowl
8. O-Ring
9. Plug

HARNESS REFERENCE

AUXILIARY CABINET CONNECTIONS FOR FRAME HARNESSES

SEE SHEET 2



HARNESS DESIGNATION KEY

HARNESS DESIGNATION	TRUCK LOCATION
A	AUXILIARY CABINET
B	BRAKE CABINET
C	OPERATOR CAB
D	REAR CASE
E	ENGINE
F	RIGHT DECK
G	LEFT DECK
H	RIGHT FRAME
J	LEFT FRAME
K	BATTERY BOX
L	RADIATOR GRILL
M	BODY
N	ISOLATION STATION
P	PANTOGRAPH
R	FRONT FRAME
S	PROPULSION ALTERNATOR
T	CONTROL CABINET
U	AHT ODS BOX

SYSTEM CIRCUIT LOCATOR

SHEET	SYSTEM CIRCUIT
5	12VDC SUPPLY
15	AHT CONNECTION OPTION
2	AUXILIARY CABINET HARNESS LAYOUT
3	BATTERY BOX
10	BODY HOIST LIMIT
8	CAB SPARE WIRES
15	CAMERA SYSTEM OPTION
15	CAN J1939 NETWORK
15	CAN RPC NETWORK
5	CUSTOMER ACCESSORY POWER
7	DIRECTIONAL SHIFTER
8	ELECTRONIC GAUGE DISPLAY
7	ENGINE ETHER START OPTION
6	ENGINE INTERFACE
6	ENGINE OIL RESERVE SYSTEM OPTION
4	ENGINE SHUTDOWN
7	ENGINE SHUTTER OPTION
3	ENGINE START PRE-LUBE
3	ENGINE STARTERS
7	ENGINE TIER I OPTION
6	ENGINE TIER II OPTION
5	FRAME HARNESS GROUND RETURNS
11	FRONT VEHICLE HORN
15	GE ALTERNATOR
12	GE INTERFACE
10	GE INTERFACE
15	GE WHEEL MOTOR POWER CABLES
10	GE WHEEL MOTOR SPEED SENSORS
14	HEATED MIRRORS
15	HOT START OPTION
4	HYDRAULIC CABINET
15	HYDRAULIC LADDER OPTION
13	INTERFACE MODULE
4	INTERFACE MODULE
3	ISOLATION STATION
4	KEY SWITCH
12	KOMATRAX PLUS
12	KWB MODULE
14	LAMP ROTATING BEACON OPTION
5	LAMPS AUX BOX DOME
11	LAMPS BACKUP
9	LAMPS CLEARANCE
10	LAMPS ENGINE SERVICE
9	LAMPS FOG
9	LAMPS FRONT TURN
9	LAMPS HAZARDS
8	LAMPS HEADLIGHT
11	LAMPS HYDRAULIC CABINET
9	LAMPS DECK & LADDER
10	LAMPS PUMP MODULE SERVICE OPTION
11	LAMPS REAR AXLE SERVICE
11	LAMPS REAR TURN & TAIL
11	LAMPS STOP
10	OP-CAB WINDOW MOTORS
6	OPERATOR CAB HVAC
7	OPERATOR CAB SEAT
12	ORBCOMM MODULE
7	PARK BRAKE
14	PAYLOAD METER III
5	POWER DISTRIBUTION
20	REFERENCE CONNECTOR TABLE
18	REFERENCE DEVICE TABLE
19	REFERENCE DEVICE TABLE
1	REFERENCE FRAME & OP-CAB HARNESS LAYOUT
1	REFERENCE ISOLATION STATION HARNESS LAYOUT
2	REFERENCE ENGINE & HYD CABINET HARNESS LAYOUT
2	REFERENCE AUX BOX HARNESS LAYOUT
1	REFERENCE HARNESS INDEX TABLE
16	REFERENCE WIRE TABLE
17	REFERENCE WIRE TABLE
18	REFERENCE WIRE TABLE
5	VEC BLOCK POWER & GROUND
11	WINDSHIELD WIPER & WASHER

HARNESS REFERENCE	HARNESS P/N	DESCRIPTION
AA1	58E-06-00500	WIRING HARNESS, AUXB INTERN
AA2	58E-06-00510	WIRING HARNESS, AUXB INTERN PWR
AA3	58E-06-00520	WIRING HARNESS, GE INTERF
AA4	58E-06-00530	WIRING HARNESS, PLM3
AA5	58E-06-00540	WIRING HARNESS, CAN RPC
AA6	58E-06-00550	WIRING HARNESS, CAN J1939
AA7	XC2803	WIRING HARNESS, AHT PLUG1
AA8	58E-06-00570	WIRING HARNESS, AHT PLUG2
AA9	XB7690	WIRING HARNESS, CAN RPC
AA10	XB7691	WIRING HARNESS, CAN J1939
AA11	58E-06-10730	WIRING HARNESS, CAN J1939
AA12	58E-06-10720	WIRING HARNESS, CAN RPC
AB1	58E-06-00450	WIRING HARNESS, AUXB HYD
AC1	58E-06-00440	WIRING HARNESS, AUXB CAB-GE
AC2	58E-06-00460	WIRING HARNESS, AUXB CAB-DIAG
AC3	58E-06-00470	WIRING HARNESS, AUXB CAB-DASH
AC4	58E-06-00480	WIRING HARNESS, AUX CAB OH
AD1	58E-06-00630	WIRING HARNESS, REAR WHEEL SPD
AE1	58E-06-00490	WIRING HARNESS, QSK-60 T1-T2
AE2	58E-06-00580	WIRING HARNESS, ENG AUX BOX
AF1	58E-06-01850	WIRING HARNESS, PLM AUXB LH
AH1	58E-06-00640	WIRING HARNESS, RIGHT FRONT
AH2	58E-06-00140	WIRING HARNESS, RIGHT REAR
AJ1	58E-06-00650	WIRING HARNESS, LEFT FRONT
AJ2	58E-06-00130	WIRING HARNESS, LEFT REAR
AR1	58E-06-00910	WIRING HARNESS, FRONT WHEEL SPD
BB1	58E-06-01300	WIRING HARNESS, IND BRAKE HYD CAB
CC1	58E-06-00590	WIRING HARNESS, CAB GE
CC2	58E-06-00600	WIRING HARNESS, CAB DIAG
CC3	58E-06-00610	WIRING HARNESS, CAB DASH
CC4	58E-06-00620	WIRING HARNESS, CAB OH
CC5	EJ1556	HRN STR RADIO JUMPER
CC6	XC0166	CAMERA SYSTEM (OPT)
CC7	EJ6371	VHMS JUMPER PLUG (CN2B)
CC8	EJ6372	VHMS HARNESS CODE JUMPER (CN1-6)
CC9	XC0165	CAMERA DISPLAY Y CABLE (OPT)
DD1	58E-06-01270	WIRING HARNESS, REAR AXLE HSG WRG
DD2	XB0591	HRN STR AXLE BLWR PRESSS SW
DD3	XB0592	HRN STR AXLE SERVICE LIGHT
DD4	EL9925	HRN STR BLWR PRESS SW
EE1	58E-06-01240	WIRING HARNESS, EXTERNAL QSK60 T2
EE2	58E-06-01780	HRN STR PRE-LUBE
EE3	58E-06-01230	WIRING HARNESS, EXTERNAL QSK60 T1
EK1	XC2797	HRN STR STARTER RELAY / ALT SEN
FF1	58E-06-00080	WIRING HARNESS, DECK RH
FF2	XC0197	HRN STR JUMPER HEATED MIRROR (OPT)
FG1	XB2041	HRN STR SCOREBOARD DECK LH / RH
FH1	58E-06-00070	WIRING HARNESS, UPRIGHT RH
GG1	58E-06-00090	WIRING HARNESS, DECK LH
GG2	XC0197	HRN STR JUMPER HEATED MIRROR (OPT)
GJ1	58E-06-00120	WIRING HARNESS, UPRIGHT LH
HH2	EM7830	HRN STR LADDER SWITCH JUMPER RH
HH3	EM5759	HRN STR AUTOLUBE
HH4	58E-06-00030	WIRING HARNESS, FUEL TANK
HH5	EM2231	HRN STR GNDLVL SHTDN SW JUMPER RH
HL1	58E-06-01250	WIRING HARNESS, RH HEADLIGHT
HL2	EM3430	HRN STR SHUTTER CONTROL
JJ1	XB0924	HRN STR PUMP MOD LIGHT (OPT)
JJ2	EM7830	HRN STR LADDER SWITCH JUMPER LH
JJ5	EM2231	HRN STR GNDLVL SHTDN SW JUMPER LH
JL1	58E-06-01260	WIRING HARNESS, LH HEADLIGHT
JT1	XB0496	HRN STR CONTROL CABINET LIGHTS
KK1	XB3625	HRN STR BATTERY BOX
MM1	58E-06-01280	WIRING HARNESS, LEFT BODY LIGHTS
MM2	58E-06-01290	WIRING HARNESS, RIGHT BODY LIGHTS
NN1	58E-06-01310	WIRING HARNESS, ISO STATION IND
-		

CABLE REFERENCE	CABLE P/N	DESCRIPTION
AJ3	58E-06-01820	CABLE STR 2/0 BLK
AK1	58E-06-01860	CABLE STR 2/0 RED
DT1	58E-06-10480	CABLE STR 7M1A1
DT2	58E-06-10470	CABLE STR 7M1A2
DT3	CH3677	CABLE STR 7M1B1
DT4	58E-06-10420	CABLE STR 7M1B2
DT5	58E-06-10460	CABLE STR 7M1C1
DT6	58E-06-10450	CABLE STR 7M1C2
DT7	CH3692	CABLE STR 7M2A1
DT8	CH3682	CABLE STR 7M2A2
DT9	58E-06-10430	CABLE STR 7M2B1
DT10	CH3684	CABLE STR 7M2B2
DT11	58E-06-10440	CABLE STR 7M2C1
DT12	58E-06-10410	CABLE STR 7M2C2
EE10	CH4526	CABLE STR 2/0 BLK
EE4	CH4452	PRELUBE POWER CABLE 1/0 RED
EE5	CH4320	PRELUBE GND CABLE 1/0 BLK
EE9	CH4527	CABLE STR 2/0 BLK
EJ1	CH4524	CABLE STR 2/0 BLK
EK2	CH4625	CABLE STR 2/0 RED
EN1	CH5812	CABLE STR 4/0 RED
EN2	CH5813	CABLE STR 4/0 RED
EN3	CH5739	CABLE STR 4/0 BLK
EN4	CH5740	CABLE STR 4/0 BLK
EN5/EN6	58E-06-01840	CABLE ASSY PRELUBE FUSE LINK
JN1	CH4523	CABLE STR 2/0 BLK
KK2	CH5811	CABLE STR 4/0 RED
KK3	CH5810	CABLE STR 4/0 RED
KK4	CH5737	CABLE STR 4/0 BLK
KK5	CH5738	CABLE STR 4/0 BLK
KK6	CH5736	CABLE STR 4/0 BLK
KK7	CH5736	CABLE STR 4/0 BLK
KN1	58E-06-01790	CABLE STR 4/0 RED
KN2	58E-06-01810	CABLE STR 4/0 RED
KN3	CH5742	CABLE STR 4/0 BATT BLK
KN4	CH5741	CABLE STR 4/0 BATT BLK
ST1	CH4914	CABLE STR ST1
ST2	CH4915	CABLE STR ST2

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