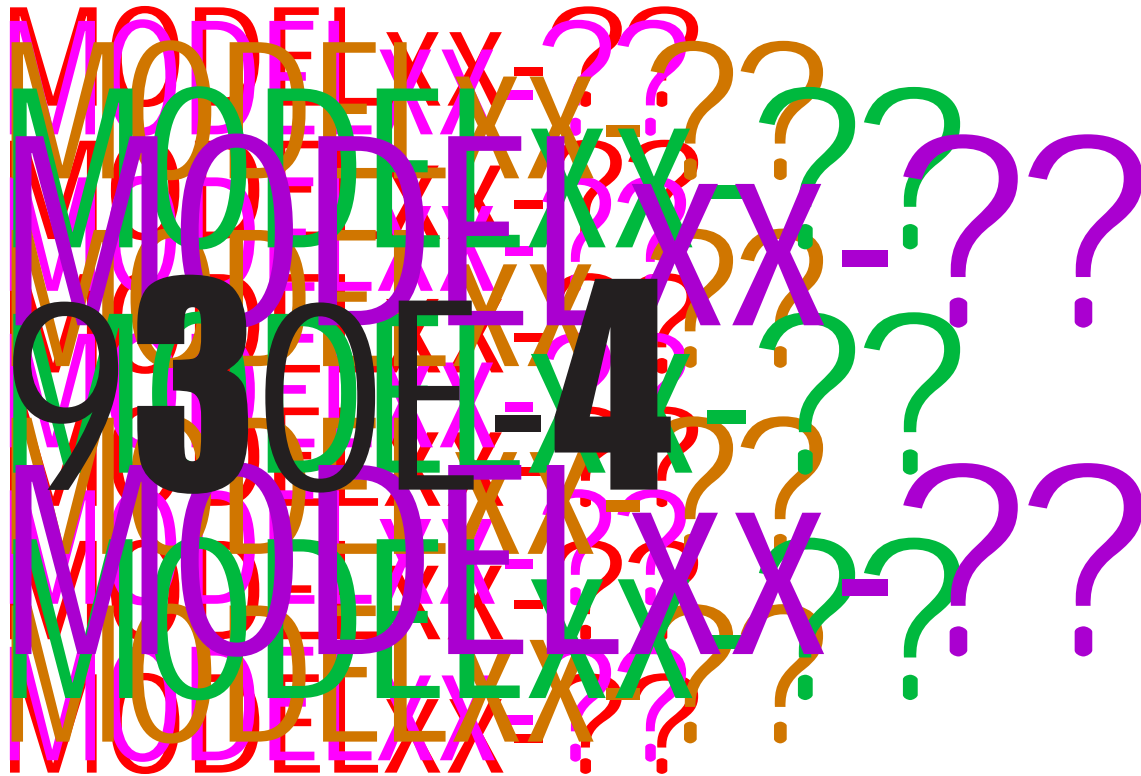


Blotter Atsise rambly

ORIGINAL INSTRUCTIONS

CEBMO30803

Blotter Support Manual Supplement



DUMP TRUCK DESCRIPTION

SERIAL NUMBERS
 SERIAL NUMBERS
 SERIAL NUMBERS
 SERIAL NUMBERS
 SERIAL NUMBERS
 SERIAL NUMBERS

MODELXXXXXXXXX
 MODELXXXXXXXXX
 MODELXXXXXXXXX
 MODELXXXXXXXXX
 MODELXXXXXXXXX
 930E-4XXXXXXXXX
 MODELXXXXXXXXX
 PC228USLC-11E0
 MODELXXXXXXXXX
 MODELXXXXXXXXX
 MODELXXXXXXXXX

SER# and up
 SER# and up
 SER# and up
 SER# and up
 SER# and up
 SER# and up
 A31879, A31880,
 SER# and up
 A31882-A31990,
 SER# and up
 A31992 and up
 SER# and up

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WEIGHT DISTRIBUTION

Empty Vehicle

Front Axle (49.3%) 103 301 kg (227,738 lb)
Rear Axle (50.7%) 107 518 kg (237,034 lb)
 Total (with 50% fuel) 210 819 kg (464,772 lb)

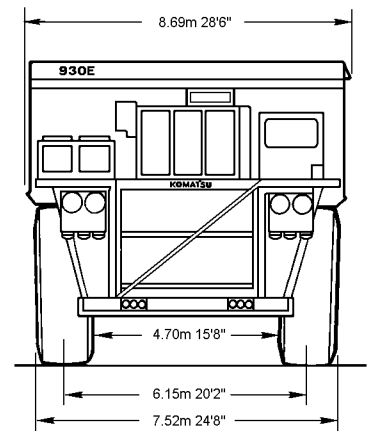
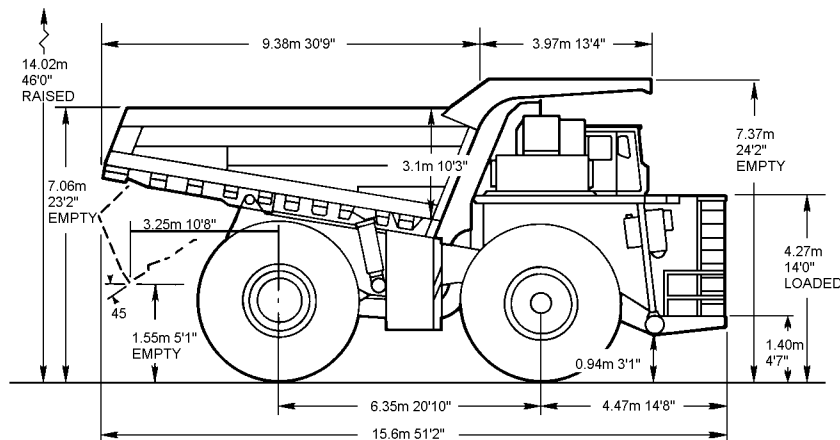
Standard Komatsu body 30 362 kg (66,936 lb)
 Standard tire weight. 26 127 kg (57,600 lb)

Loaded Vehicle

Front Axle (33.0%) 165 554 kg (364,980 lb)
Rear Axle (67.0%) 336 124 kg (741,020 lb)
 Total 501 678 kg (1,106,000 lb)

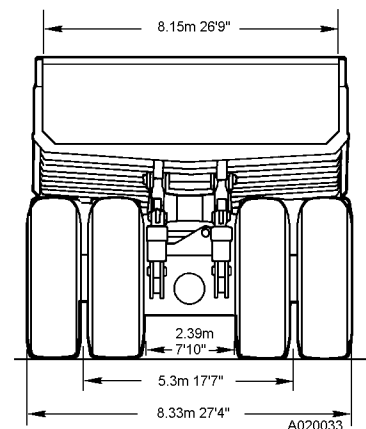
Nominal Payload* 290 859 kg (641,228 lb)

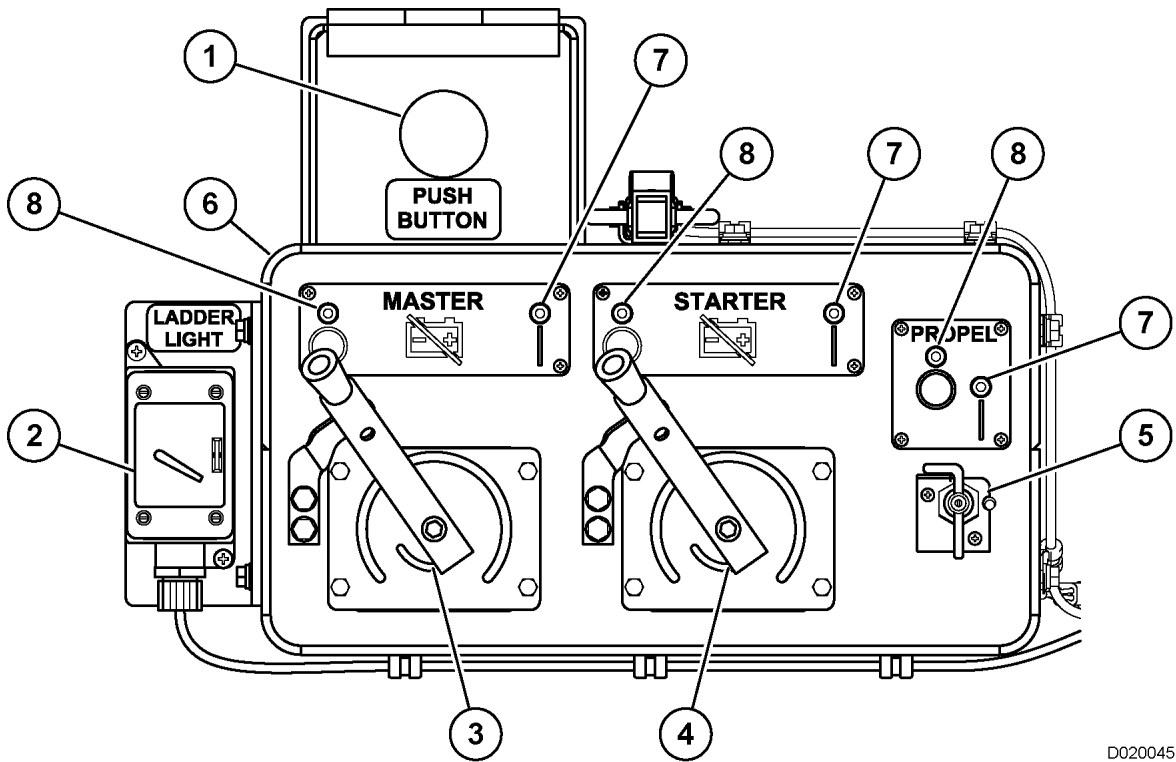
* *Nominal payload* is defined within Komatsu America Corporation's payload policy documentation. Nominal payload must be adjusted if the weight of any customized body or tires vary from that of the standard Komatsu body and tires. Nominal payload must also be adjusted to take into account the additional weight of any custom/optional extras fitted to the truck which are not stated within the Standard Features list of the applicable specification sheet.



All Dimensions with 171/211m³ 224/276 yd³ Body

BODIES	Struck		2:1 Heap		Loading Height	
	M ³	Yd ³	M ³	Yd ³	M	Feet
Standard	171	224	211	276	7.06	23'2"





D020045

FIGURE 3-1. ISOLATION BOX ASSEMBLY (COVERS REMOVED)

- | | | |
|-------------------------------|------------------------------|---------------------|
| 1. Engine Shutdown Switch | 3. Master Disconnect Switch | 6. Isolation Box |
| 2. Access Ladder Light Switch | 4. Starter Disconnect Switch | 7. LED Lights (on) |
| | 5. Propel Lockout Lever | 8. LED Lights (off) |

4. Observe both capacitor charge lights (CCL1, CCL2). CCL1 is on the outside of the contactor box. CCL2 is on the switch panel inside the low voltage area. The lights will stay illuminated as long as the voltage on the DC link is greater than 50 VDC. Refer to Figure 3-11.

⚠ 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 2000 VDC minimum to verify that no voltage is present before touching any terminal.

⚠ WARNING

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.

5. Use volt meter tester (58B-06-00770) to test the volt meter for proper operation. Voltage should read 100 VDC. If the voltmeter fails the test, repair or replace the volt meter. Do not proceed unless the volt meter is functioning properly.

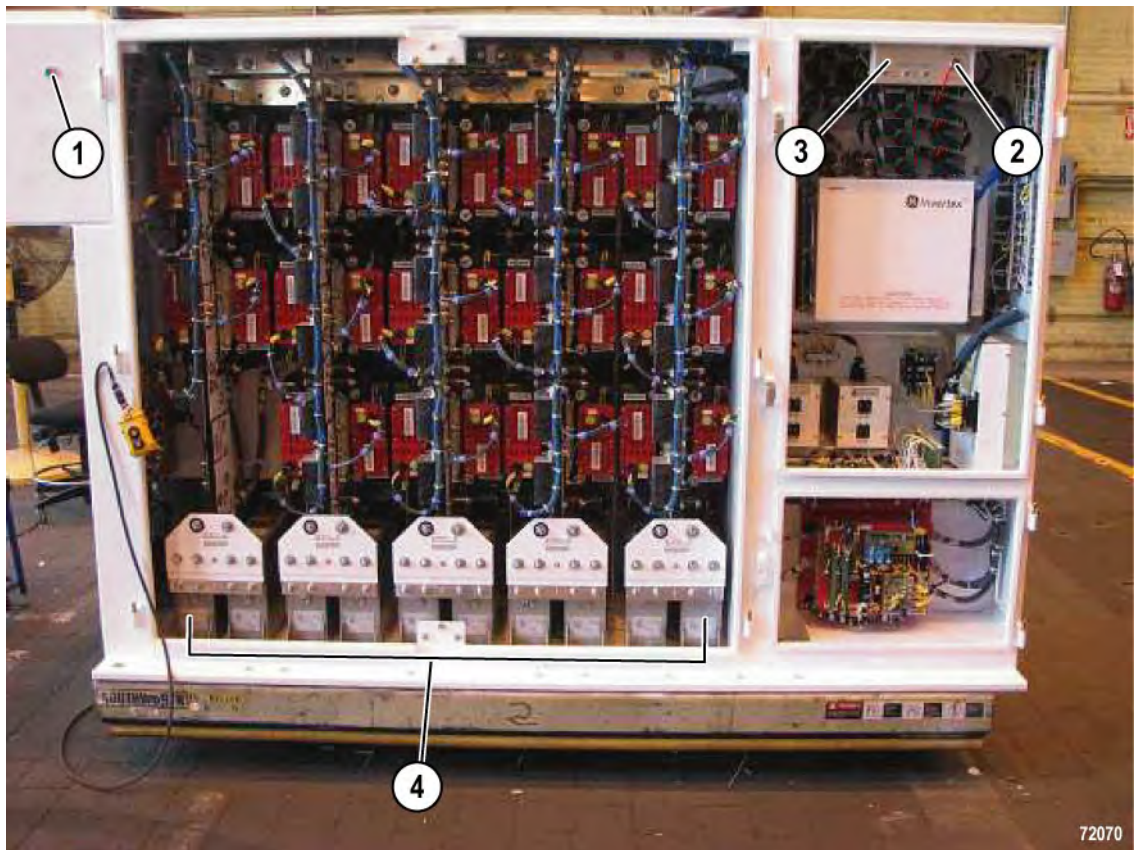


FIGURE 3-11. CAPACITOR CHARGE LIGHTS

- | | |
|---|------------------------------|
| 1. Exterior Capacitor Charge Light (CCL2) | 3. Information Display Panel |
| 2. Interior Capacitor Charge Light (CCL1) | 4. DC Link Capacitors |

USING THE GROUND LEVEL CONTROL BOX

Ground level control box (1, Figure 3-21) is located next to the ground level ladder light switch. Toggle switch (2) lowers and raises the ladder.

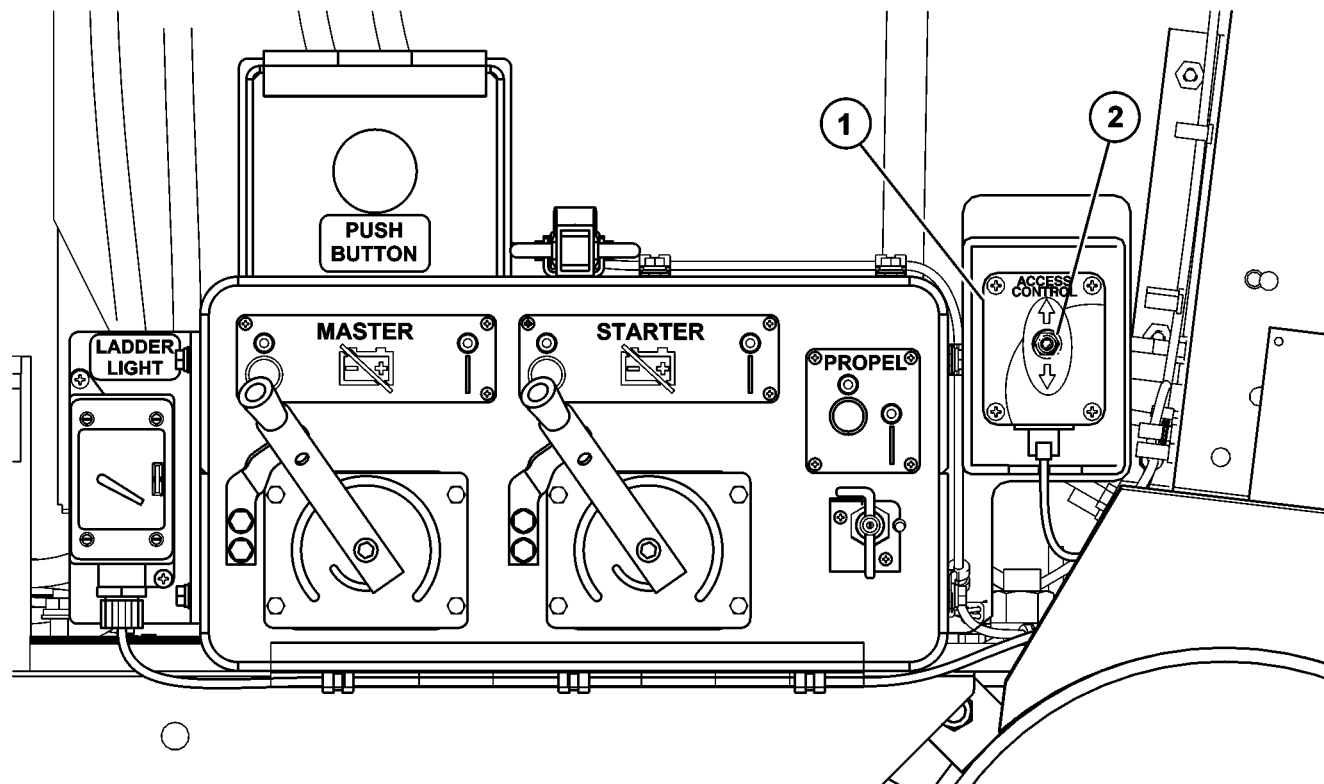
NOTE: The parking brake must be applied before the ladder can be lowered. If toggle switch (2) is held in either position for more than ten seconds, a fault will be activated and will need to be acknowledged by pressing either the [EXIT] or [ENTER] buttons located on the in-cab control panel.

Raising the Ladder

To raise the ladder, push toggle switch (2) to the LADDER UP position and release. Ladder operation via this switch is the same as using the in-cab control panel. Any ladder movement will be shown on the in-cab control panel.

Lowering the Ladder

To lower the ladder, push toggle switch (2) to the LADDER DOWN position and release. Ladder operation via this switch is the same as using the in-cab control panel. Any ladder movement will be shown on the in-cab control panel.



M320027R1

FIGURE 3-21. GROUND LEVEL CONTROL BOX

1. Ground Level Control Box

2. Toggle Switch

Lowering The Dump Body (When dumping on flat ground)

It is very likely when dumping on flat ground that the dumped material will build up enough to prevent the body from lowering. In this case, the truck will have to be driven forward a short distance (just enough to clear the material) before the body can be lowered.

1. Move the directional control lever to FORWARD, release the brake lock, depress the override button, and drive just far enough forward for the body to clear the material.
2. Stop, move the directional control lever to NEUTRAL, and apply the brake lock.
3. Move the hoist lever forward to the DOWN position. Release the lever to place the hoist control valve in the FLOAT position, which allows the body to return to the frame.

If dumped material builds up at the rear of the body and the body cannot be lowered, then perform the following steps:

- a. Move the hoist lever back to the RAISE position to fully raise the dump body. Then release the hoist lever so it returns to the HOLD position.
- b. Move the directional control lever to FORWARD, release the brake lock, depress the override button, and drive forward to clear the material.
- c. Stop, move the directional control lever to NEUTRAL, apply the brake lock, and lower the body.

NOTE: Failure to hoist the body after making an unsuccessful attempt at lowering the body may result in the dump body suddenly lowering after the truck has pulled ahead of the material that was previously preventing the body from lowering.



Do not move the truck with the dump body raised except in an emergency. Failure to lower body before moving truck may cause damage to hoist cylinders, frame and/or body hinge pins.

4. With the body returned to frame, move the directional control lever to FORWARD, release the brake lock, and leave the dump area carefully.

Lowering The Dump Body (When dumping over a berm or into a crusher)

1. Move the hoist lever forward to the DOWN position. Release the lever to place the hoist control valve in the FLOAT position, which allows the body to return to the frame.

If dumped material builds up at the rear of the body and the body cannot be lowered, perform the following steps:

- a. Move hoist lever back to the HOIST position to fully raise the dump body. Release the hoist lever so it returns to the HOLD position.

NOTE: Do not drive forward if the tail of body will not clear the crusher wall in the fully raised position.

- b. Move the directional control lever to FORWARD, release the brake lock, depress the Override button, and drive forward to clear the material.
- c. Stop, move the directional control lever to NEUTRAL, apply the brake lock and lower the body.

*NOTE: Failure to hoist the body after making an unsuccessful attempt at lowering the body may result in the dump body **suddenly lowering** after the truck has pulled ahead of the material that was previously preventing the body from lowering.*



Do not move the truck with the dump body raised except in an emergency. Failure to lower the body before moving the truck may cause damage to the hoist cylinders, frame and/or body hinge pins.

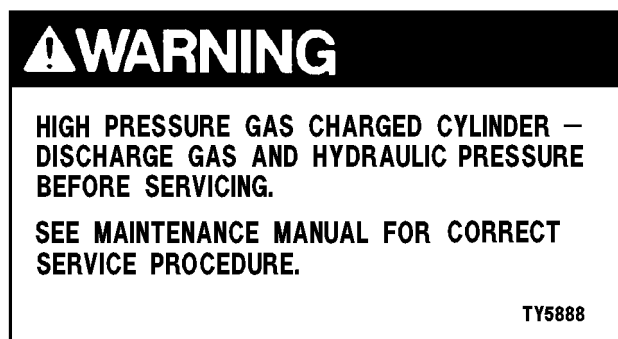
2. With the body returned to the frame, move the directional control lever to FORWARD, release the brake lock, and leave the dump area carefully.

CYLINDER PRESSURE

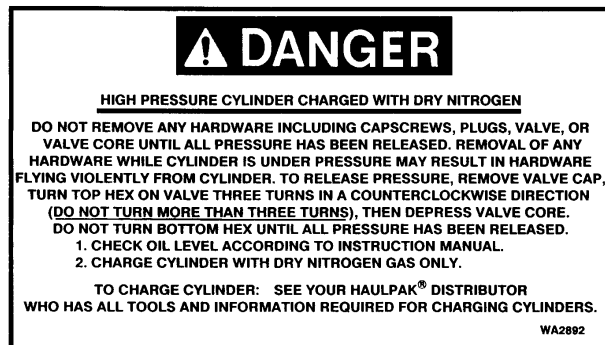
These danger decals are mounted on the outside of each frame rail to remind technicians to read the warning labels attached to the side of each of the accumulators (see below) before releasing internal nitrogen pressure or disconnecting any hydraulic lines or hardware. There are similar decals mounted on top of each of the accumulators (both steering and brake) with the same danger message.



These warning decals are mounted on the side of each of the accumulators (both steering and brake) to alert technicians to discharge all gas and hydraulic pressure, and to read the maintenance/service manual before performing any service.



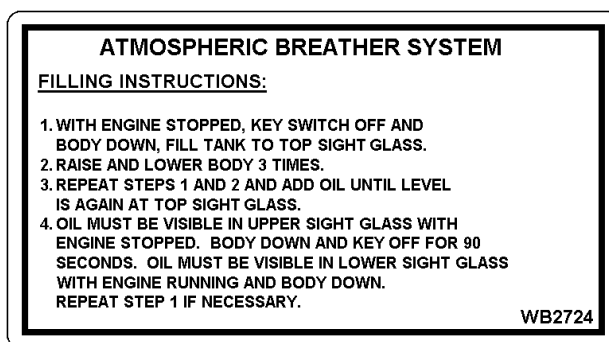
This danger decal is attached to all four suspensions. It contains instructions for releasing internal pressure before disconnecting any hardware. Serious injury can occur if these directions are not followed.



FILLING THE HYDRAULIC TANK

A decal mounted on the side of the hydraulic tank provides instructions for filling the hydraulic tank.

To lessen the chances of system contamination, keep the system open to the atmosphere only as long as absolutely necessary. Service the tank with clean Type C-4 hydraulic oil. All oil that is being put into the hydraulic tank should be filtered through 3 micron filters.



A caution decal is attached below the hydraulic tank oil level sight gauge. Check the oil level with the body down, engine stopped, and key switch OFF. Add oil per filling instructions if the oil level is below the top of the sight glass.



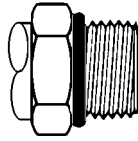


TABLE 9.
Torque Chart For
O-ring Boss Fittings

Size Code	Tube Size (OD)	Threads UNF-2B	Newton meters (N·m)	Foot Pounds (ft lb)
- 2	0.125	0.312 - 24	4 ± 3	4 ± 2
- 3	0.188	0.375 - 24	7 ± 3	5 ± 2
- 4	0.250	0.438 - 20	11 ± 4	8 ± 3
- 5	0.312	0.500 - 20	14 ± 4	10 ± 3
- 6	0.375	0.562 - 18	18 ± 4	13 ± 3
- 8	0.500	0.750 - 16	33 ± 7	24 ± 5
- 10	0.625	0.875 - 14	43 ± 7	32 ± 5
- 12	0.750	1.062 - 12	65 ± 7	48 ± 5
- 14	0.875	1.188 - 12	73 ± 7	54 ± 5
- 16	1.000	1.312 - 12	98 ± 7	72 ± 5
- 20	1.250	1.625 - 12	109 ± 7	80 ± 5
- 24	1.500	1.875 - 12	109 ± 7	80 ± 5
- 32	2.000	2.500 - 12	130 ± 14	96 ± 10

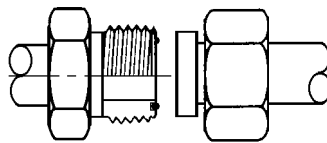


TABLE 10.
Torque Chart For
O-ring Face Seal Fittings

Size Code	Tube Size (O.D.)	Threads UNF-2B	Newton meters (N·m)	Foot Pounds (ft lb)
- 4	0.250	0.438 - 20	15 ± 1	11 ± 1
- 6	0.375	0.562 - 18	24 ± 3	18 ± 2
- 8	0.500	0.750 - 16	48 ± 5	35 ± 4
- 10	0.625	0.875 - 14	69 ± 7	51 ± 5
- 12	0.750	1.062 - 12	96 ± 10	71 ± 7
- 16	1.000	1.312 - 12	133 ± 8	98 ± 6
- 20	1.250	1.625 - 12	179 ± 10	132 ± 7
- 24	1.500	1.875 - 12	224 ± 20	165 ± 15

5. Examine all exposed machined surfaces for rust or dirt accumulation. Remove all contamination as necessary. Remove rust by using a fine abrasive paper. Old flushing compound can be removed with mineral spirits (GE-D5B8). Methanol should be used to remove all residue. When clean, coat with Tarp B rust preventive. Refer to General Electric Motorized Wheel Service Manual for specifications.
6. Loosen exciter drive belts (where applicable).
7. Open all switches in the control compartment.
8. Install a 500 watt heat source inside all control groups which house electronic control equipment. These heat sources are to be energized below 0° C (32° F) and de-energized above 5° C (41° F).
9. Install a 500 watt heat source inside the commutator chamber of both motorized wheels and inside the alternator slip ring chamber. This will minimize the accumulation of moisture. A hole in the bottom of the hubcap will accommodate the electrical cord for the heat source in the motorized wheels. These heat sources are to be energized continuously.
10. Seal the compartment doors with a weatherproof tape to prevent entry of rain, snow and dirt (allow breathing).

Storing A Truck That Is Not Operational

When a truck which is not fully operational is being stored for any period of time, perform the following:

1. Drain the oil from the gearcase and install rust preventive compound 4161 (or equivalent). Fill per General Electric Motorized Wheel Service Manual.
2. Jack up each side of the truck (one side at a time) enough to rotate the tires.
3. Connect a D-C welder as described in the Vehicle Test Instructions (Wheel Motor inst. 400A, arm & field in stress 900- 1000 rpm arm).
4. Rotate each motorized wheel (one at a time) for at least 30 minutes to ensure that the rust preventive compound has been thoroughly circulated throughout the gearcase. Disconnect the welder. Remove the jacks. Drain the gearcase.

5. If the truck is partially dismantled, pay close attention to ductwork, blower shrouds, etc., which may be exposed to weather conditions. These areas will require the same sealing measures as in Step 5 above which deals with protecting ductwork. Cover exposed blower housings to prevent entry of water and dirt.
6. Perform Steps 3 through 11 in "Storing A Truck That Is Operational" in this section.

Storing A Major Component

When storing a motorized wheel, alternator, blower or control group for any period of time, always store it inside a warm, climate-controlled environment. Do not attempt to store individual components where they would be exposed to inclement weather, climatic changes, high humidity and/or temperature extremes.

Periodic Inspections

It is important that periodic inspections (every three months) of stored equipment be performed to ensure the continued serviceability of all protective measures initially taken when the storage period began. The following items should be checked at each inspection interval:

1. Remove the weatherproof tape from the compartment doors and perform a Megger test as described in the Vehicle Test Instructions. Record the test results and compare them with the recorded Megger readings taken when storage first began, and those taken throughout the storage period. Remove all test equipment and close the compartment. Reseal the compartment doors with new weatherproof tape. If Megger readings indicate a deterioration of insulation quality (to below 2.0 megohms), more protection may need to be provided.
2. Check all other weatherproofing tape. Replace any that has become loose or is missing.
3. Check all heat sources. Replace or repair any that have become inoperative.
4. Check all machine surfaces that were coated with flushing compound when storage began. If the compound appears to be deteriorating, it must be cleaned off and renewed.

DUMP BODY

DUMP BODY

⚠ WARNING

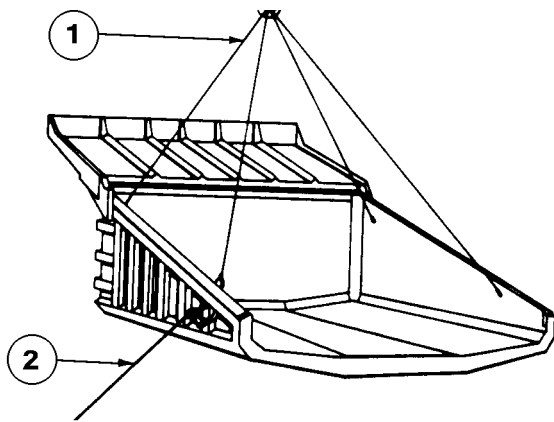
Inspect the condition and rating of all lifting devices, slings, chains, and cables. Refer to the manufacturer's manual for correct capacities and safety procedures when lifting components. Replace any questionable items.

Ensure that the lifting device is rated for at least a 45 ton capacity. Slings, chains, and cables used for lifting components must be rated to supply a safety factor of approximately 2X the weight being lifted. When in doubt as to the weight of components or any service 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, ensure there is adequate clearance between the body and overhead structures or electric power lines.



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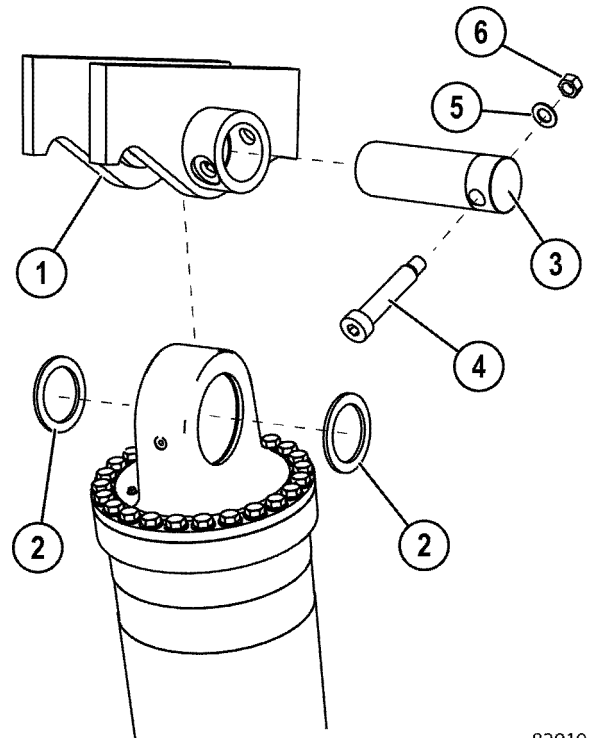
FIGURE 3-1. DUMP BODY REMOVAL

1. Lifting Cables 2. Guide Rope

Removal

1. Park truck on a hard, level surface and block all the wheels. Attach cables and a lifting device to the dump body and take up the slack as shown in Figure 3-1.
2. Remove the mud flaps from both sides of the body. Remove any electrical wiring and hoses that are attached to the body.
3. Attach chains around the upper end of both hoist cylinders to support them after the pivot pins are removed.
4. At the hoist cylinder upper mounting bracket, remove self-locking nut (6, Figure 3-2), flat washer (5) and shoulder bolt (4). Use a brass drift and hammer to drive pivot pin (3) from mounting bracket (1).

NOTE: Do not lose two spacers (2) between the cylinder bearing and mounting bracket (1).



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FIGURE 3-2. HOIST CYLINDER UPPER MOUNT

1. Mounting Bracket 4. Shoulder Bolt
2. Spacer 5. Flat Washer
3. Pivot Pin 6. Self-Locking Nut

**SECTION C
ENGINE
INDEX**

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POWER TRAIN..... C4-1

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FAN CLUTCH C7-1

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Disassembly	C3-7
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COOLANT SYSTEM TROUBLESHOOTING	C3-9

ALTERNATOR INSTALLATION



The following instructions must be followed to ensure proper alignment and engine crankshaft endplay. Failure to follow these instructions can result in serious damage to the engine and/or alternator.

- Loosen or remove fan belts before measuring crankshaft endplay to ensure that the crankshaft moves easily and completely.
- When taking measurements, always clean mating surfaces, then take four equally spaced readings and average them.
- A reference to crankshaft rotation - clockwise (CW) or counterclockwise (CCW) - is the direction of rotation when looking at the front (damper end) of engine.
- All measurements are set to three decimal places.
- Ensure that a surface reference (such as a flat steel bar) used for dial indicating is calibrated periodically for flatness and dimensional accuracy to within +/- .0009 in. Also, ensure that all instruments used for measurements are calibrated on a periodic basis.
- Forward is defined as the front of truck and rearward is defined as the rear of the truck.

Summary of Axial & Radial Runout Limits	
Description	Specification
Engine Crankshaft Endplay	0.13 mm (.005 in.) - 0.51 mm (.020 in.)
Alternator Endplay	0.51 mm (0.020 in.)
Flywheel Housing Radial Runout	0.25 mm (0.010 in.)
Flywheel Housing Face Runout	0.25 mm (0.010 in.)
Flywheel/Flexplate Radial Runout	0.08 mm (0.003 in.)
Flywheel/Flexplate Face Runout	0.89 mm (0.035 in.)
Rotor Shaft Radial Runout (assembled)	0.13 mm (0.005 in.)

Engine Flywheel Adapter Face Runout

1. Thoroughly clean all mounting surfaces: the alternator housing, rotor, flywheel, and flywheel housing.
2. Locate the dial indicator base on the machined face of the flywheel/flexplate and zero the probe on the face of the flywheel housing adapter. See Figure 4-4.

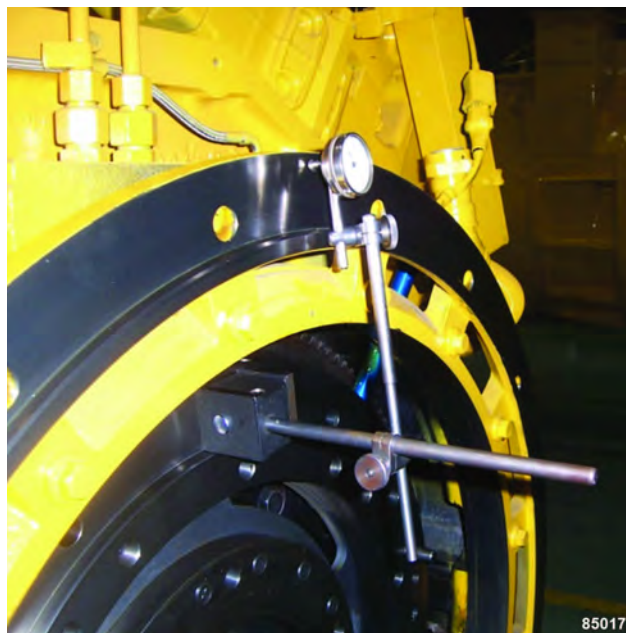


FIGURE 4-4. DIAL INDICATOR SETUP

3. Move the crankshaft frontwards. Use an engine barring device to slowly rotate the engine crankshaft 1/4 turn. Document the reading.

Move the crankshaft frontwards after every 1/4 turn and continue this procedure for two full revolutions, documenting the reading at every 1/4 turn.

4. The difference between the highest and lowest values for each revolution is the flywheel housing adapter face runout. If the average of the two measurements exceeds **0.25 mm (0.010 in.)**, contact your Komatsu representative for further instructions.

Adapter Face Runout = _____

Precleaner Section Cleaning

The tubes in precleaner section (7, Figure 5-3) should be cleaned at least once per year and at each engine overhaul. More frequent cleaning may be necessary depending upon operating conditions and the local environment.

To inspect the tubes in the precleaner section, remove the primary element. Do not remove the safety element. Loosen clamps (8) and remove dust cups (10) and O-rings (9). Use a light to inspect the tubes. All tubes should be clear and the light should be visible.

NOTE: Both the primary and safety elements must be installed in the air cleaner while Steps 1 and 2 are being accomplished to prevent any possibility of dirt being forced into the engine intake area.

Dust can be removed with a stiff fiber brush (see Figure 5-6). **Do not use a wire brush.** Dust may also be removed effectively using compressed air.

Heavy plugging of the tubes may require soaking and washing the entire precleaner section. Refer to the following procedure.

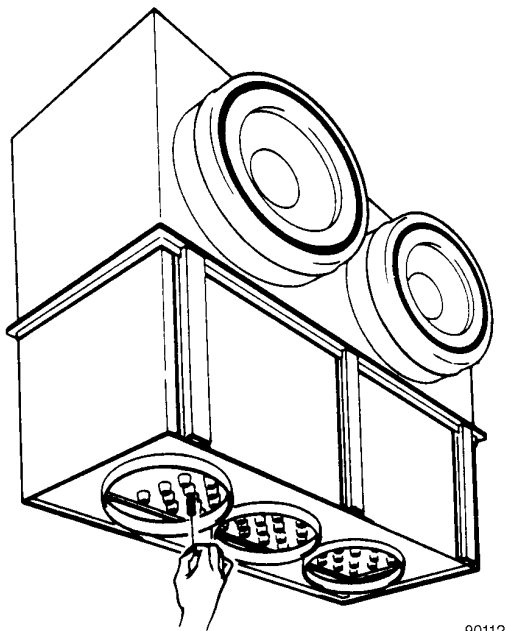


FIGURE 5-6. REMOVING DUST FROM THE TUBES

NOTE: The precleaner section may be separated from the air cleaner assembly without removing the entire air cleaner from the truck.

1. Remove air intake cover (12, Figure 5-3). Remove the mounting hardware that secures precleaner section (7) to air cleaner assembly (4). Remove the precleaner section. The safety element must remain in place to protect the engine intake.
2. Loosen clamps (8) and remove dust cups (10) and O-rings (9) from the precleaner section. Wash the dust cups with a water and liquid soap solution.
3. Submerge the precleaner section in a solution of Donaldson D-1400 and warm water (see Figure 5-7). Mix the solution according to the directions on the package. The tube section must be down. Soak for 30 minutes, then remove the precleaner section from the solution. Rinse thoroughly with fresh water and blow dry.

Severe plugging may require the use of an Oakite 202 and water solution instead. The solution should be 50% Oakite 202 and 50% fresh water.

4. Check precleaner gaskets carefully for any evidence of air leaks. Replace if necessary.
5. Install precleaner section (7) and gaskets (5) and (6) on air cleaner assembly (4). Install all mounting hardware that was removed.
6. Install dust cups (10) and O-rings (9) on the precleaner section. Secure the dust cups with clamps (8).

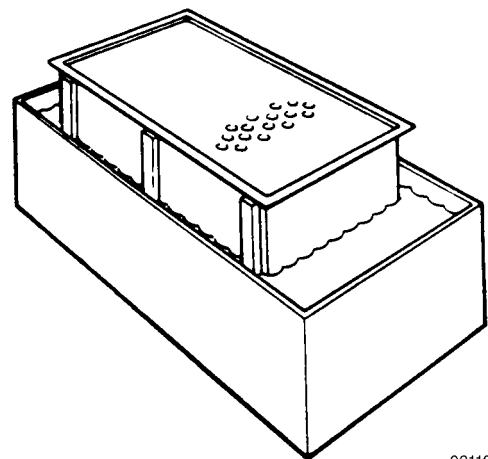


FIGURE 5-7. WASHING AND SOAKING THE PRECLEANER SECTION

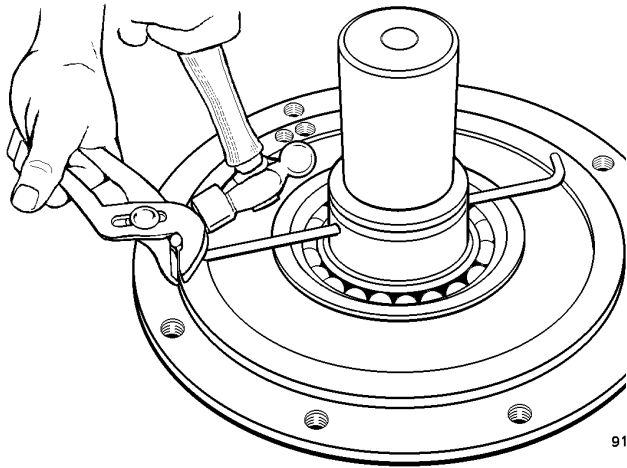


FIGURE 7-22.

21. Position the shaft as shown. Insert a phillips-head screwdriver into pitot tubes (3) to loosen and remove them from the shaft. Rotate the pitot tube until the sealant holding it tight is broken loose. Then grip the pitot tube with a pair of pliers and gently tap on the pliers to remove the pitot tubes from the hole in the shaft.

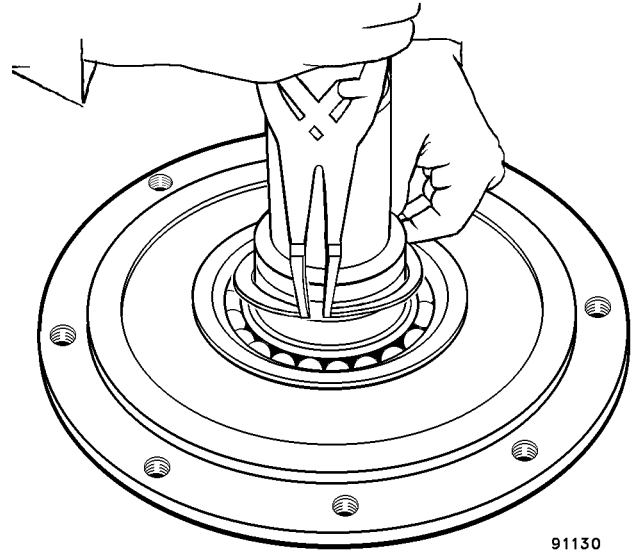


FIGURE 7-24.

23. Remove external snap ring (16).

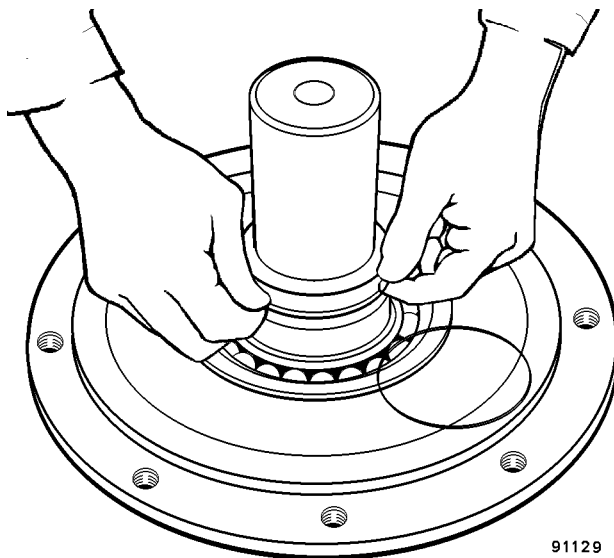


FIGURE 7-23.

22. Remove both seal rings (17).

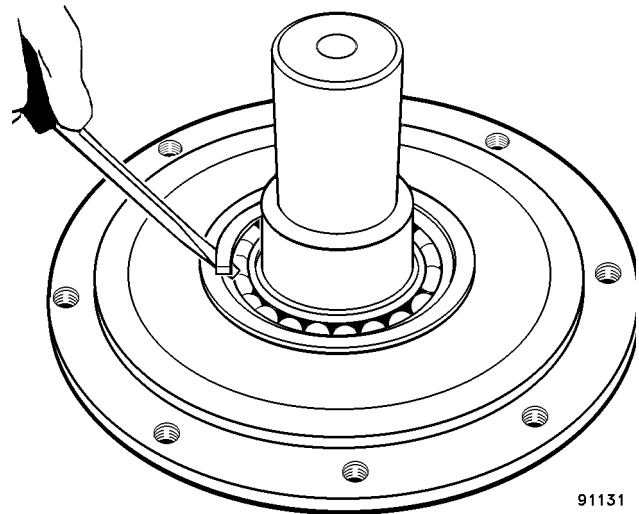


FIGURE 7-25.

24. Remove internal snap ring (15).

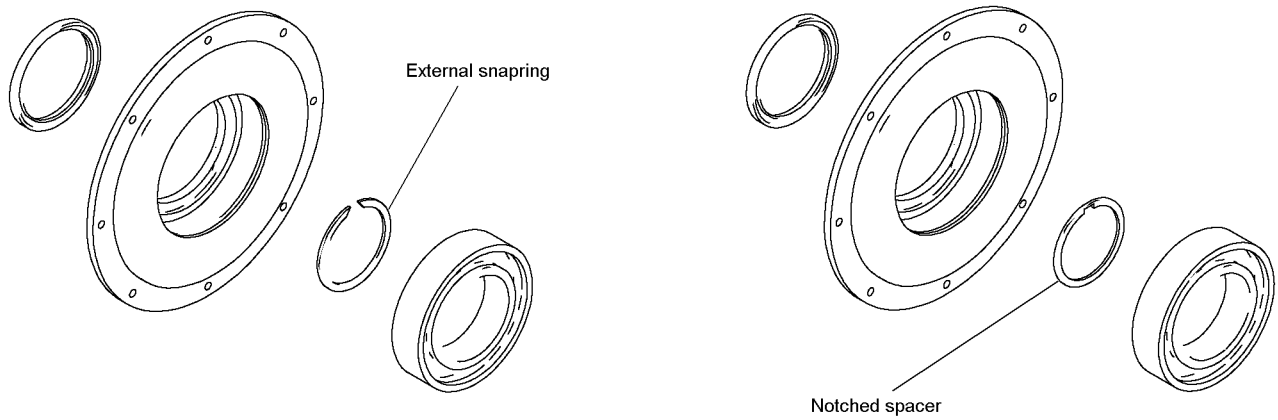
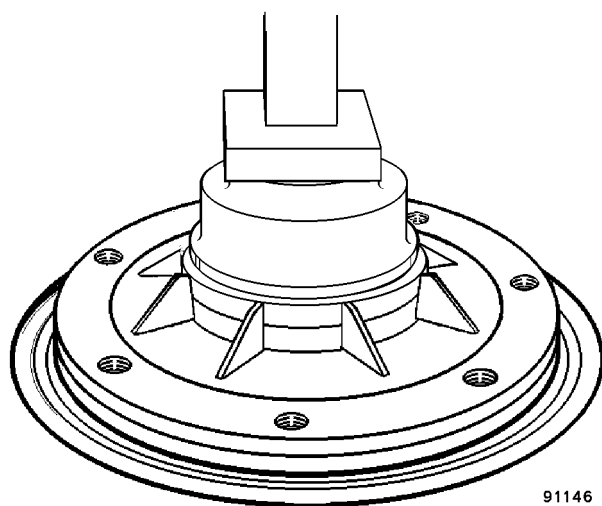


FIGURE 7-59.

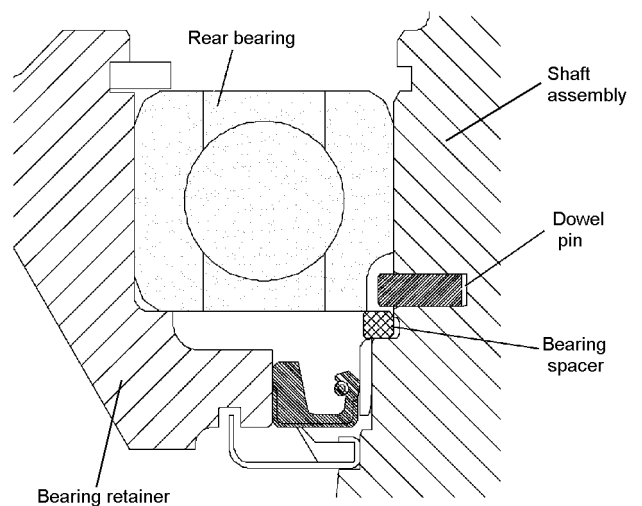
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19. Some fan clutches were assembled with an external snap ring that is used as a spacer between the bearing and the oil seal. Newer models were assembled using a notched spacer. If an external snap ring was used, place snap ring (12) on top of the bearing (oil seal side). If a notched spacer was used, the spacer will be installed in a later step. Proceed to the next step.



91146

FIGURE 7-60.



M060108

FIGURE 7-61.

20. Coat the outside diameter of rear oil seal (10) with Loctite Primer N and #242 (or equivalent). Use tooling (E) or an equivalent to install the oil seal in the rear bearing retainer until it is flush with the rear face.

Do not lubricate the seal. The seal is made of teflon and must be installed dry.

21. If a bearing spacer is used instead of a snap ring (as explained in Step 19), place the spacer into position in the groove on shaft assembly (6). Note the location of the spacer in Figure 7-61.

Pinion Clearance	D2-21
MAGNETIC SWITCH	D2-21
Removal	D2-21
Installation	D2-21
Coil Test	D2-22

Interpreting Results of Tests

1. Rated current draw and no-load speed indicates normal condition of the cranking motor.
2. Low free speed and high current draw indicates:
 - a. Too much friction; tight, dirty, or worn bearings, bent armature shaft or loose pole shoes allowing armature to drag.
 - b. Shorted armature. This can be further checked on a growler after disassembly.
 - c. Grounded armature or fields. Check Further after disassembly.
3. Failure to operate with high current draw indicates:
 - a. A direct ground in the terminal or fields.
 - b. "Frozen" bearings (are determined by turning the armature by hand).
4. Failure to operate with no current draw indicates:
 - a. Open field circuit. This can be checked after disassembly by inspecting internal connections and tracing circuit with a test lamp.
 - b. Open armature coils. Inspect the commutator for badly burned bars after disassembly.
 - c. Broken brush springs, worn brushes, high insulation between the commutator bars or other causes which would prevent good contact between the brushes and commutator.
5. Low no-load speed and low current draw indicates:
 - a. High internal resistance due to poor connections, defective leads, dirty commutator and causes listed under Number 4.
6. High free speed and high current draw indicates shorted fields. If shorted fields are suspected, replace the field coil assembly and check for improved performance.

Disassembly

The cranking motor must be disassembled only as far as necessary to repair or replace defective parts.

1. Note the relative position of the solenoid (53, Figure 2-7), lever housing (78), nose housing (69), and C.E. frame (1) so the motor can be reassembled in the same manner.
2. Disconnect field coil connector (42) from solenoid motor terminal, and lead from solenoid ground terminal.
3. Remove the brush inspection plug (52), and brush lead screws (15).
4. Remove the attaching bolts (34) and separate the commutator end frame (1) from the field frame (35).
5. Separate the nose housing (69) and field frame (35) from lever housing (78) by removing attaching bolts (70).
6. Remove armature (45) and drive assembly (71) from lever housing (78).
7. Separate solenoid (53) from lever housing by pulling apart.

RTMR1 - VEC Block

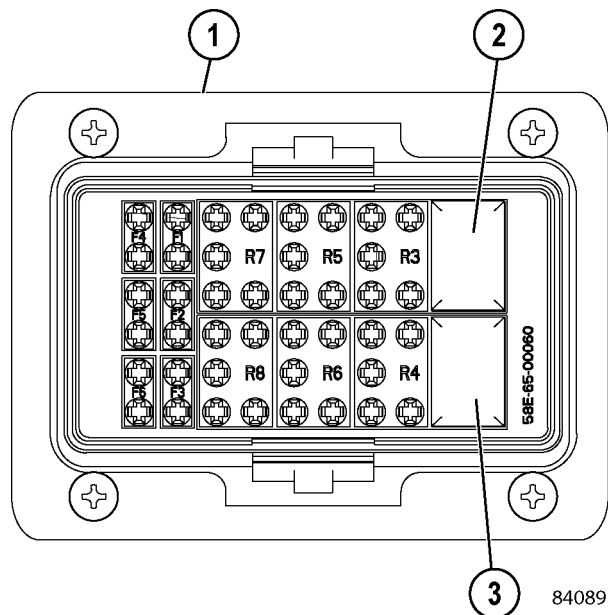


FIGURE 3-4. RTMR - VEC BLOCK

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

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 Plus usage, including:

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

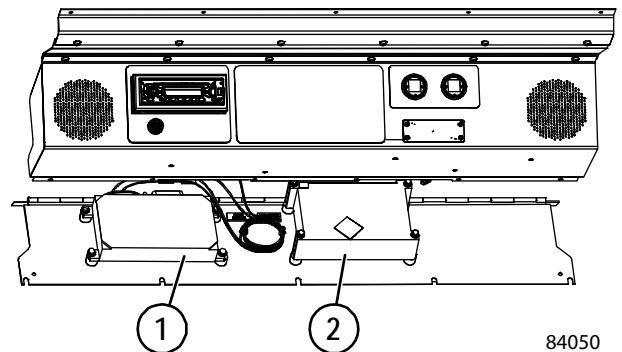


FIGURE 11-1. KOMTRAX PLUS COMPONENTS

1. Orbcmm Controller
2. KOMTRAX Plus Controller

KOMTRAX PLUS INITIALIZATION PROCEDURE

When a new truck is being assembled, there are several procedures to perform in order to initialize KOMTRAX Plus. Following the procedures will ensure a smooth initialization process which should not take longer than an hour to complete. To ensure the initialization process has been completed properly, check off each item on the list below as it is done. It is important to complete the entire procedure at one time. Submitting a data download with a date and SMR that does not match the KOMTRAX Plus initialization form will not allow the system to be initialized.

NOTE: The interface module must be fully operational before initializing the KOMTRAX Plus controller.

The initialization procedure consists of the following:

- Controller Setup Procedure
- Snapshot Procedure
- Download Procedure
- FTP Upload Procedure
- Initialization Forms

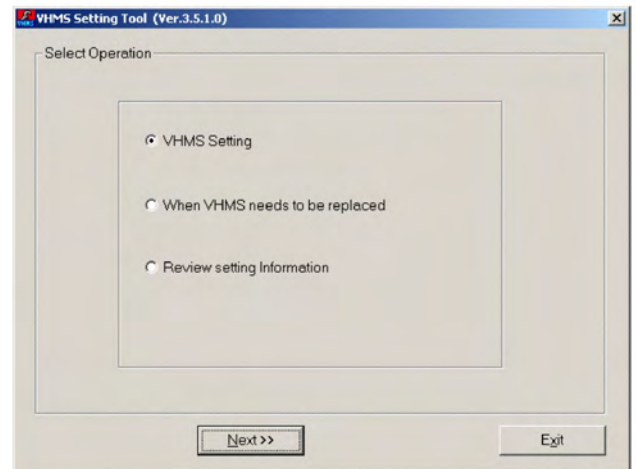
CONTROLLER SETUP PROCEDURE

VHMS Setting Tool software program

1. Start the *VHMS Setting Tool* software program. There will be three choices to choose from.
 - Use the [VHMS Setting] function to initialize a truck or change a truck's settings.
 - Use the [When VHMS needs to be replaced] function when replacing a truck's KOMTRAX Plus controller.
 - Use the [Review setting information] function when only needing to view a truck's settings.

Select Operation

2. Select VHMS Setting, then click [Next].



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7. At the prompt **>**, type "dispvhmsinf". Information similar to the following will be displayed:

```
>dispvhmsinf

---- MACHINE INFORMATION -----
PRODUCT GROUP: Dumptruck
MACHINE_MODEL: 930E-
MACHINE_SERIAL:
ENG_MODEL: QSK60
ENG_SERIAL_NO1:
ENG_SERIAL_NO2:
PRG_NO1: 12000100100
PRG_NO2: 782613R290
---- DEVICES -----
PLC NO CONNECTION
PLM Disabled
PLM CONNECTED
---- Condition -----
SMR: 90.0 H
DATE 04-10-25 TIME14:44:24
TIMEZONE: 0.0 H SUMMERTIME 0
----Controller Info -----
PartNumber: 0000000000
Serial No.: 000000
Compo Name: KDE1010
SilkyID: VA011740744
>
```

NOTE: Use the results of step 6 and 7 to confirm that the correct software is installed in the KOMTRAX Plus controller.

8. The KOMTRAX Plus controller also has two red LED lights (10 and 11, Figure 11-6). Verify the connection status and repair any problems.

PLM LED (10)

- OFF - no communication with the PLM controller
- ON - is communication with the PLM controller

Orbcomm LED (11)

- OFF - no communication with Orbcomm controller
- ON - communication with Orbcomm controller
- FLASHING - satellite in view

INTERFACE MODULE CHECKOUT

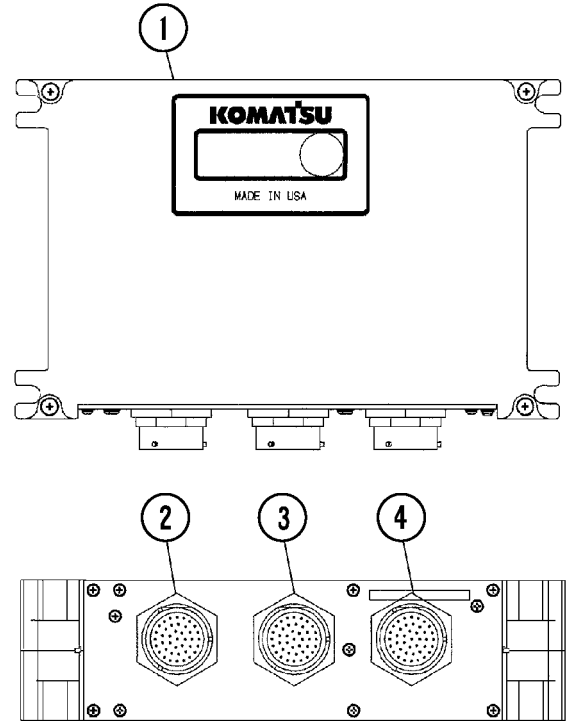
▲ IMPORTANT ▲

If a new truck with KOMTRAX Plus is being assembled, or a new KOMTRAX Plus system has just been installed, refer to the KOMTRAX Plus System for instructions regarding the initialization procedure. The initialization procedure and form must be completed before the truck can be put into service.

Necessary Equipment

- System schematic
- Laptop PC
- *Interface Module Real Time Data Monitor* software
- Serial cable (RS232)
- Jumper wire 77 mm (3 in.) or longer
- Volt Meter
- 300 to 332 ohm resistor
- 3/8 in. nut driver

NOTE: The interface module must already have the application code installed.



D110014

FIGURE 12-4. INTERFACE MODULE

- | | |
|---------------------|------------------|
| 1. Interface Module | 3. Connector IM2 |
| 2. Connector IM1 | 4. Connector IM3 |

KOMTRAX Plus AND INTERFACE MODULE ERROR CODES AND TROUBLESHOOTING

GENERAL

The center of KOMTRAX Plus is the KOMTRAX Plus controller, which gathers data about the operation of the truck from sensors and other controllers installed on the truck. Refer to Figure 13-1 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.

Structure and Purpose

The checkout procedure is in two parts. The first part verifies that the interface module is in good working condition. Refer to the Interface Module Section for specific checkout instructions. The second part verifies the KOMTRAX Plus controller operation and also reviews the settings for accuracy. Refer to the KOMTRAX Plus System Section for specific check out instructions.

The following areas are covered in this section:

- Troubleshooting
- Fault Code Tables
- Fault Tree Analysis

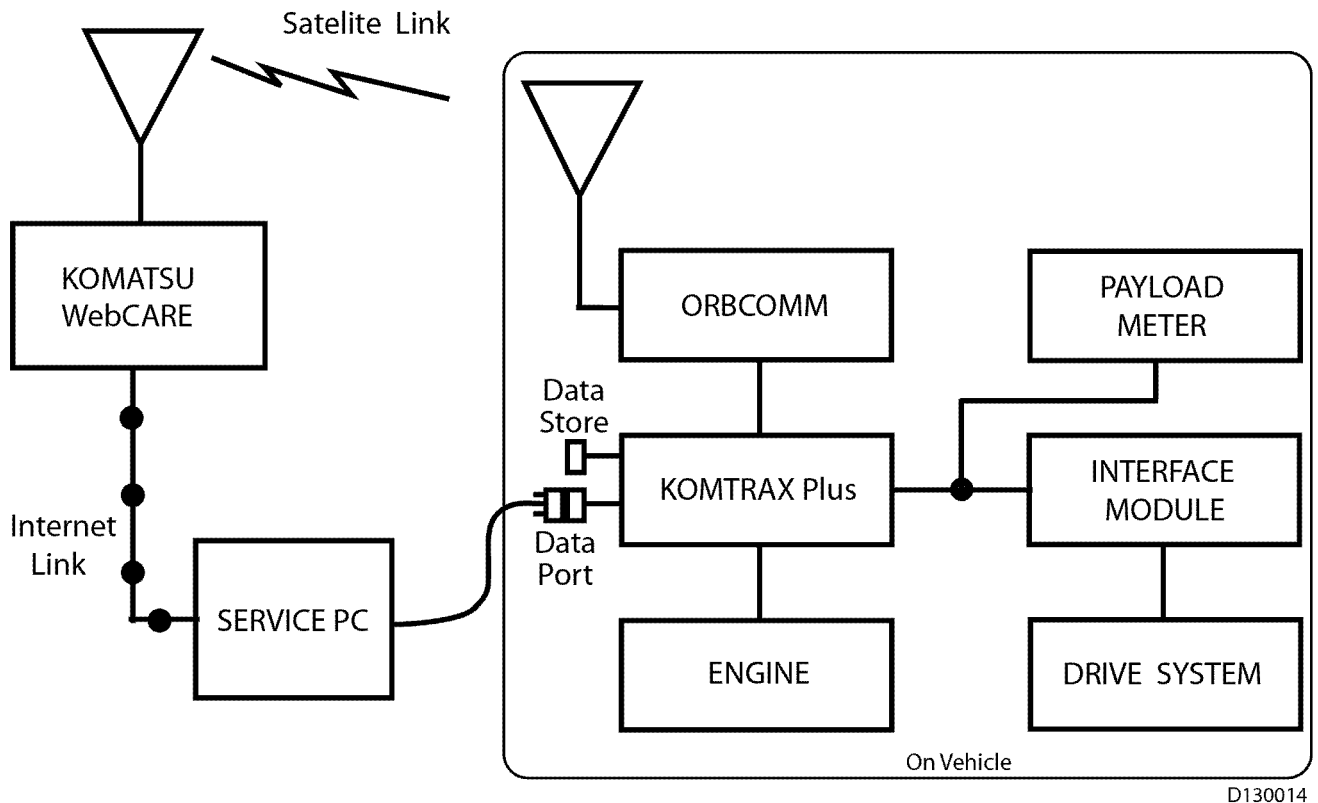
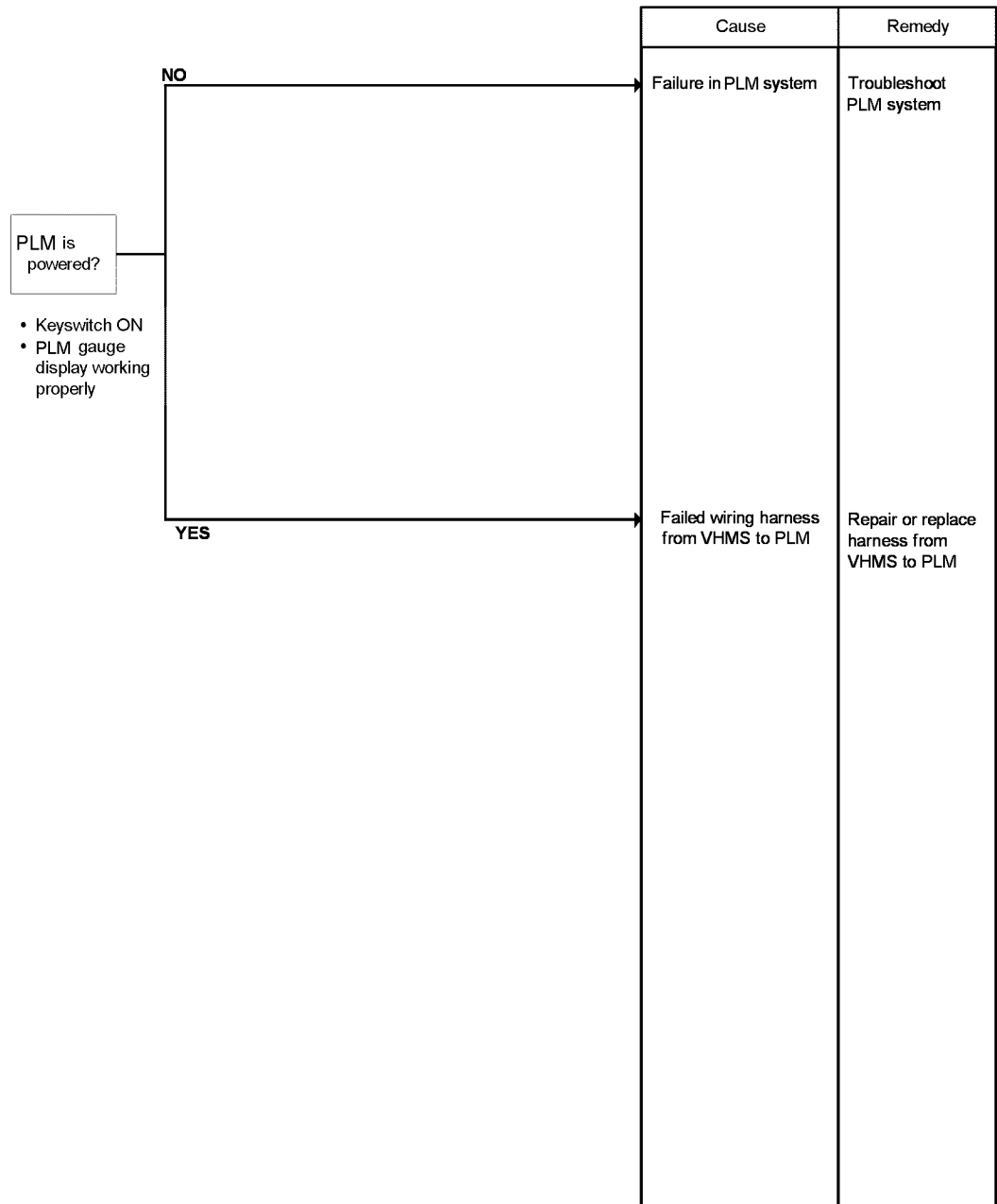


FIGURE 13-1. KOMTRAX PLUS SYSTEM

Flashing Error Code N4-23 (PLM Communications Fault)



D130010

SECTION E2

ELECTRIC PROPULSION SYSTEM COMPONENTS

INDEX

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Table 2: DID PANEL FAULT CODES
(Codes received from DSC - propulsion control)

EVENT NUMBER		EVENT DESCRIPTION	RESTRICTION	CAUSE OR DEFINITION	AUTO RESET
096	:01	Unexpected DSC /PSC CPU Card Reset	System event	The DSC or PSC CPU card reset while in Ready, Propel, Retard or Load Box Mode	Yes
098	:01	Data Store	System event	A data store has been manually requested	Yes

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

EVENT NUMBER		EVENT DESCRIPTION	RESTRICTION	CAUSE OR DEFINITION	AUTO RESET
174/ 274	:01	Inverter 12 Phase B+ Fault Inverter 22 Phase B+ Fault	Inverter 1 Disable Inverter 2 Disable	Inverter 12 or 22, Phase Module B+ did not turn OFF when commanded	Yes
	:02			During VI Test, Inverter 12 or 22, Phase Module B+ did not turn OFF when expected	No
	:03			Inverter 12 or 22, Phase Module B+ was detected as failed during VI test	No
	:04			Inverter 12 or 22 Phase Module B+ turned ON while Phase Module B- was detected ON	Yes
	:05			During VI Test, Inverter 12 or 22 Phase Module B+ did not turn ON when commanded	Yes
	:06			While running, Inverter 12 or 22, Phase Module B+ did not turn ON when commanded	Yes
	:07			Inverter 12 or 22, Phase Module B+ gate driver power supply problem detected	Yes
175/ 275	:01	Inverter 12 Phase B+ Event Inverter 22 Phase B+ Event	System event	Inverter 12 or 22, Phase Module B+ is not OFF when expected with the DC Link energized	Yes
176/ 276	:01	Inverter 12 Phase B- Fault Inverter 22 Phase B- Fault	Inverter 1 Disable Inverter 2 Disable	Inverter 12 or 22, Phase Module B- did not turn OFF when commanded	Yes
	:02			During VI Test, Inverter 12 or 22, Phase Module B- did not turn OFF when expected	No
	:03			Inverter 12 or 22, Phase Module B- was detected as failed during VI test	No
	:04			Inverter 12 or 22 Phase Module B- turned ON while Phase Module B+ was detected ON	Yes
	:05			During VI Test, Inverter 12 or 22 Phase Module B- did not turn ON when commanded	Yes
	:06			While running, Inverter 12 or 22, Phase Module B- did not turn ON when commanded	Yes
	:07			Inverter 12 or 22, Phase Module B- gate driver power supply problem detected	Yes
177/ 277	:01	Inverter 12 Phase B- Event	System event	INV B- Temp Short, Open, Warm, Hot	Yes
	:06	Inverter 22 Phase B- Event		Inverter 12 or 22, Phase Module B- is not OFF when expected with the DC Link energized	Yes
178/ 278	:01	Inverter 12 Phase B Current Fault Inverter 22 Phase B Current Fault	Inverter 1 Disable Inverter 2 Disable	Inverter 12 or 22, Phase B current sensor was determined as failed during VI test	Yes
	:02			Inverter 12 or 22, Phase B Phase Modules current sensor signal was not zero at startup	Yes
	:03			Current feedback from Inverter 12 or 22, Phase B Phase Modules is higher than expected	Yes
182/ 282	:01	Inverter 12 Phase C Fault Inverter 22 Phase C Fault	Inverter 1 Disable Inverter 2 Disable	Inverter 12 or 22, Phase C Phase Modules did not turn OFF when commanded	Yes
	:02			Inverter 12 or 22, Phase C Phase Modules excessive overcurrent condition detected	Yes
	:04			Inverter 12 or 22, Phase C+ has experienced an overcurrent (saturation) condition	Yes
	:05			Inverter 12 or 22, Phase C- has experienced an overcurrent (saturation) condition	Yes

Event History Buffer

Event history buffer is defined as a collection of event history records. A buffer contains 300 entries filled with event numbers occurring in chronological order. Also included in this buffer will be all the input and output values, time the event occurred, reset time, state information, etc, for each event. This buffer is filled continuously and overwritten (if necessary).

Limits (accept-limit) are placed on the amount of space which a given event code may consume. This prevents a frequently occurring event from using the memory space at the expense of a less frequent event. This data may be cleared (after downloading for troubleshooting) at each maintenance interval.

Data Packs

A data pack is defined as an extended collection of information relevant to a given event.

NOTE: The concepts of lockout, soft reset, and accept limit do not apply to data packs.

Thirty (30) data packs are stored with each containing 100 frames of real time snapshot data. Snapshot data is defined as a collection of key data parameter values for a single point in time). The purpose of each data pack is to show a little "movie" of what happened before and after a fault.

The time interval between snapshots is default to 50 ms, but each data pack may be programmed via the DID (or PTU) from 10 ms to 1 sec. (In multiples of 10 ms). The "TIME 0:00 frame #" at which the fault is logged is default to frame #60, but each data pack is programmable from 1 to 100.

In the above default cases, data is stored for 3 seconds (2.95 second actual) before the fault and 2 seconds after the fault.

A data pack status structure is assigned to each data pack plus any programmable settings. This status structure is used by the DSC or PTU to check for available data (event number, id, and status, should be set to zero if data pack is not frozen), as well as for control of the data packs.

If a data pack is unfrozen (not holding any particular fault data), it is continually updated each 100 frames, organized in a circular queue, with new real time snapshot data. When a fault occurs, the frame number at which the event occurred is used as a reference to mark the end of the data pack, and data is collected until the data pack is full. Only when the data pack is full will the event number, id and status be updated in the status structure.

All logic control variables are saved in battery backed RAM, in case a fault occurs and battery power is cycled before the data pack is filled with data (the software allows for proper recovery and then continues to fill the data pack). Maintenance personnel, by way of the DID (or PTU), can assign the data pack to hold only certain event numbers (for the case where it is desired to collect data on a particular fault).

However, in the default case, faults will be stored as they come until all data packs are frozen (holding fault data). When all data packs are frozen, the data pack with the fault that was RESET first (either automatically or by the DID/PTU), if any, will be unfrozen and will start storing new data in case a new fault occurs.

Event Reset

There are two basic types of event resets: *soft* and *hard*. The difference between the soft and hard reset is that a soft reset only affects events that have not been locked out and a hard reset affects events regardless of lockout status.

Events will be reset:

- *On power-up* - A soft reset will be issued against all events at power-up.
- *By DID commands* - The DSC can issue both hard and soft resets.
- *By PTU commands* - The PTU can issue both hard and soft resets.

AC DRIVE SYSTEM ELECTRICAL CHECKOUT PROCEDURE

AC DRIVE SYSTEM MAINTENANCE

DANGER

DANGEROUS VOLTAGE LEVELS ARE PRESENT WHEN THE ENGINE IS RUNNING AND CONTINUE TO EXIST AFTER SHUTDOWN IF THE REQUIRED SHUTDOWN PROCEDURES ARE NOT FOLLOWED. Before attempting repairs or working near propulsion system components, the following precautions and truck shutdown procedure must be followed:

- **DO NOT step on or use any power cable as a handhold when the engine is running.**
- **NEVER open any electrical cabinet covers or touch the Retarding Grid elements until all shutdown procedures have been completed.**
- **ALL removal, repairs and installation of propulsion system electrical components, cables etc. must be performed by an electrical maintenance technician properly trained to service the system.**
- **Power cables must be cleated in wood or other non-ferrous materials. Do not repair cable cleats by encircling the power cables with metal clamps or hardware. Always inspect power cable insulation prior to servicing the cables and prior to returning the truck to service. Discard cables with broken insulation.**
- **IN THE EVENT OF A PROPULSION SYSTEM MALFUNCTION, a qualified technician must inspect the truck and verify the propulsion system does not have dangerous voltage levels present before repairs are started.**

WARNING

- **If weld repairs are required, the welding ground electrode must be attached as close as possible to the area to be welded. NEVER weld on the rear of the Electrical Control Cabinet or the retard grid exhaust air louvers. Power cables and wiring harnesses must be protected from weld spatter and heat.**
- **Prior to welding, disconnect Engine Control System (ECS) harnesses and ground wire (MTU engine). If equipped with DDEC or Komatsu engine, disconnect ECM harnesses. GE cards must be pulled forward far enough to disconnect card from backplane connector.**
- **Some power cable panels throughout the truck are made of aluminum or stainless steel. They must be repaired with the same material or the power cables may be damaged.**

After the truck is parked in position for the repairs, the truck must be shut down properly to ensure the safety of those working in the areas of the deck, electrical cabinet, traction motors, and retarding grids.

DANGER

If a problem occurs in the AC drive system that prevents use of normal shutdown procedures, ADDITIONAL PRECAUTIONS ARE NECESSARY to ensure that dangerous drive system voltages are not present when tests or repairs are performed.

To ensure that the electrical system is properly discharged before repairs are started, always follow the capacitor discharge procedure. Refer to “Capacitor Discharge System” in the Section A3, General Safety and Operating Instructions.

Accelerator Pedal, Retarder Pedal, and Retarder Lever Calibration and Checks

When installing software on a truck, the accelerator pedal, retarder pedal, and retard lever must be calibrated. The calibration must be checked afterward to ensure proper operation. The following procedure is for recording and checking the propulsion system for the specific truck pedals and the retard speed control (RSC) potentiometer values.

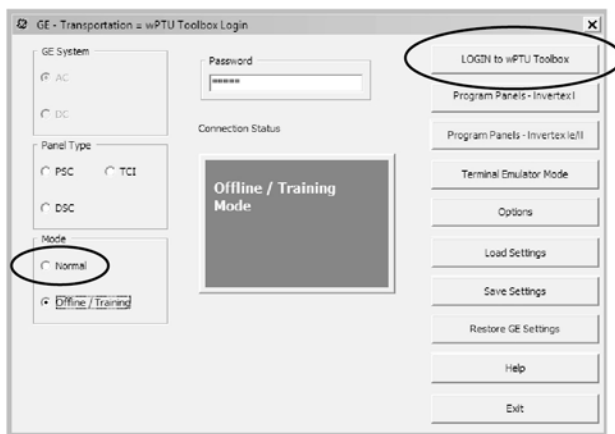
Calibration Procedure for Pedals and Retarder Lever

NOTE: The DID panel is the recommended method for pedal calibration. Use the following PTU procedure if the DID panel is not functional.

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 3-7. A truck model will be automatically selected. The PTU screens window will appear on the screen.

6. In the PTU screens window, go to Ptu_Screens -> Inverters -> Normal_Operation -> Configuration -> Pedal Calibration.
7. After clicking on Pedal Calibration, the DSC Pedal Calibration window will be displayed in the activity portion of the wPTU program screen. Click on **Run PTU Calibration**. See Figure 3-8.
8. Fully depress the accelerator pedal and then release.
9. Fully depress the retarder pedal and then release.
10. Fully move the retarder lever and then release.

The calibration process is complete.



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FIGURE 3-7. wPTU TOOLBOX LOGIN SCREEN

DC Link Positive Side Ground Check

This portion of the ground test will simulate a ground occurring on the DC+ link bus bar. This will verify the ground detection network and control system feedback displayed on the PTU. Figure 3-25 shows the block electrical diagram with an intentional ground on the DC+ link bus bar and a digital voltmeter connected to ground detection resistor GRR10.

1. Ensure that the truck directional control lever is in PARK and the rest switch is in the REST position.
2. All foreign material, tools, and loose parts must be removed from the control cabinets and the retarding grid. Remove any material around the retarding grid that may be drawn in during the self load engine test (loadbox).
3. Discharge the capacitors. Refer to "Capacitor Discharge System" in the Section A3, General Safety and Operating Instructions.
4. Install a jumper wire between the DC+ link bus bar and ground (chassis ground). The jumper wire may be installed on cable DCP08. Close the control cabinet door.
5. Initiate a self load engine test (loadbox). Refer to "Self Load Engine Test (Loadbox) Procedure".
6. The Self Load Engine Test window (Figure 3-28) will display DC link voltage (LINKV) and ground fault current (GFAULT) in milliamperes (ma). The PTU GFAULT display reads absolute value on GRR10 and is always displayed as a positive number. The ground fault current will rise with the DC link voltage until the control system faults (due to a ground), shutting down power generation. This should occur at 1000 VDC. If a fault does not occur, stop the self load engine test (loadbox) process and troubleshoot the ground detection network issue. After the issue is resolved, perform the test again.
7. After verifying the voltage and milliampere readings, shut down the engine and the PTU.
8. To determine the control system DC link voltage and the ground fault current at the time of the fault, it may be necessary to access the DSC event logs Refer to "Viewing the DSC Event Summary, Trigger Data, and Data Packs". The DC Link voltage and ground fault current will be displayed in the fault event windows.
9. Proceed to "DC Link Negative Side Ground Check" to continue ground detection network testing.

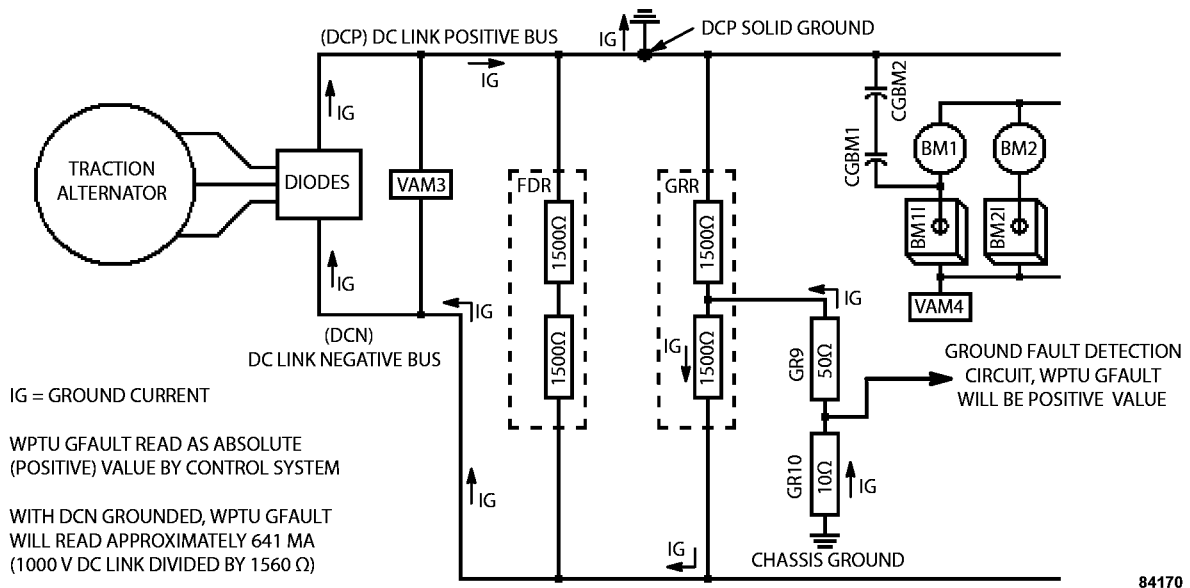


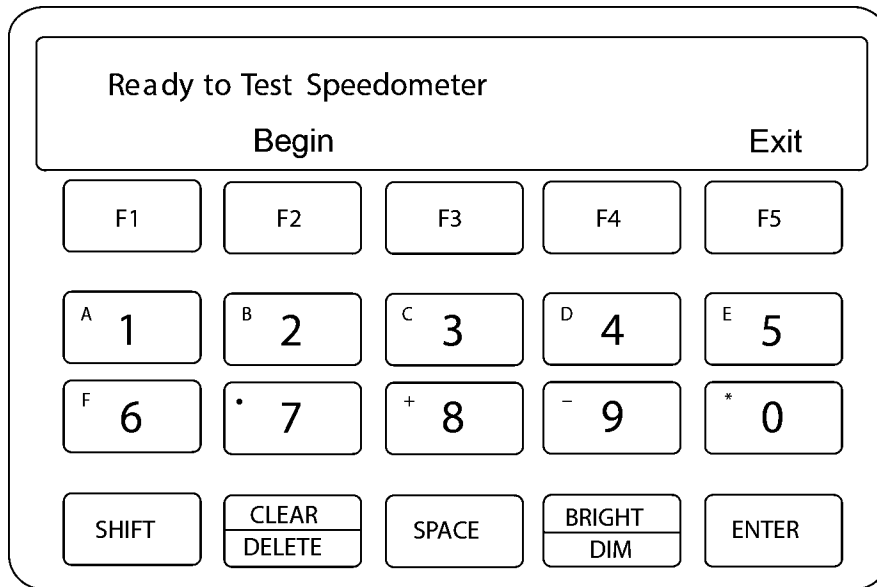
FIGURE 3-25. DC+ LINK POSITIVE SIDE GROUND SETUP AND CURRENT PATH

DID Speedometer Test

Several tests can be performed after pressing function key F1 (Test Menu) from the menu display mode. Pressing F4 (SPEEDO) will initiate the DID speedometer test. Refer to Figure 3-40.

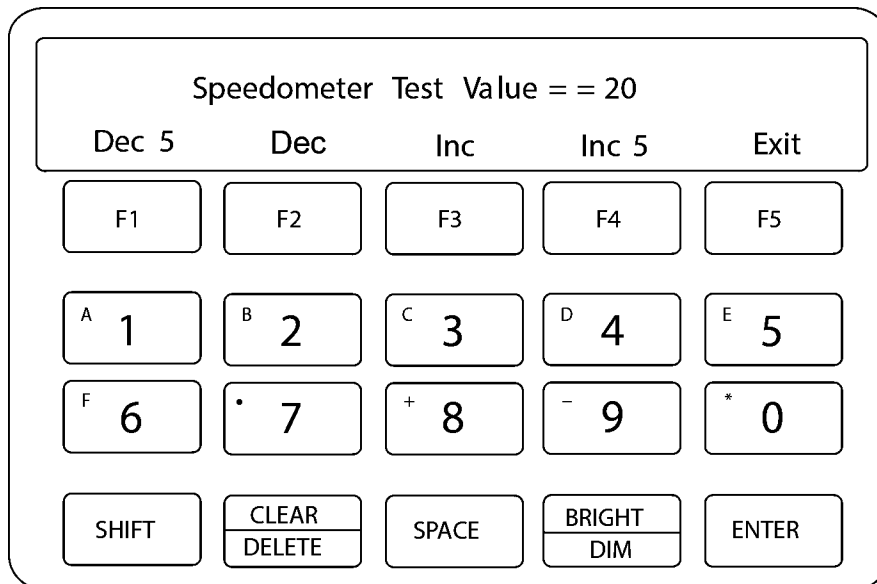
The speedometer test generates a specific mph reading so the speedometer can be tested or calibrated. The default is 20 mph.

1. Press function key F2 (Begin) to start the speedometer test.
2. Press function keys F1 (DEC 5), F2 (DEC), F3 (INC), or F4 (INC 5) as required to calibrate the speedometer by increasing or decreasing the speed. Refer to Figure 3-41.
3. Press function key F5 (Exit) to exit the speedometer test and return to the DID panel Test Menu mode.



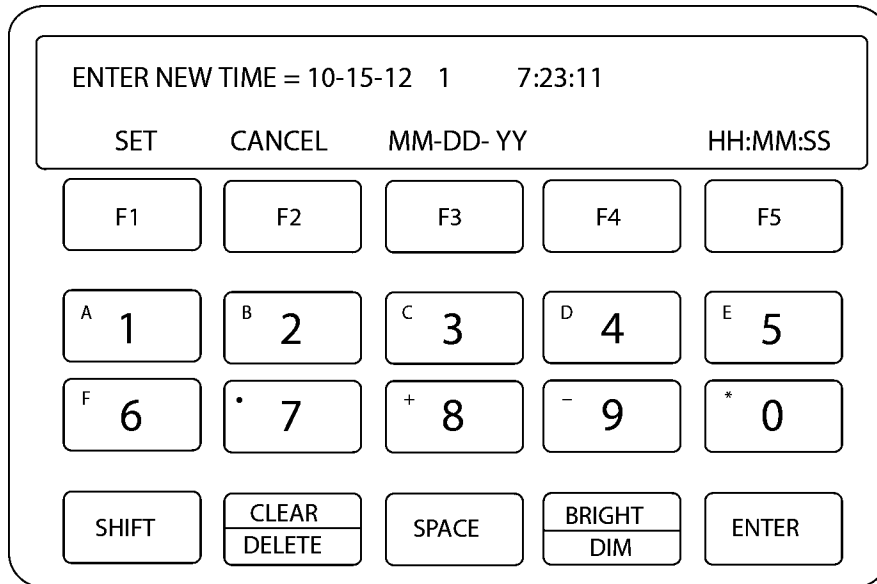
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FIGURE 3-40. DID PANEL SPEEDOMETER TEST MODE



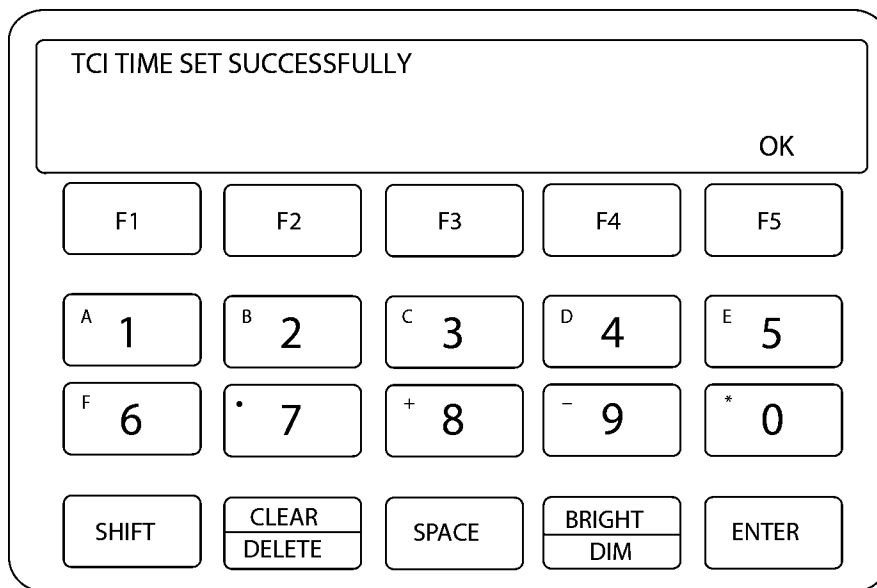
84186

FIGURE 3-41. DID PANEL SPEEDOMETER TEST IN PROGRESS



84206

FIGURE 3-61. DID PANEL CHANGE DATE AND TIME DISPLAY



84207

FIGURE 3-62. DID PANEL DATE AND TIME CHANGE SUCCESSFUL DISPLAY

Language Selection

When a second language option is selected, pressing F5 while in the menu display mode toggles between the primary and secondary language.

Fault Code A001: Left front suspension pressure sensor signal is high

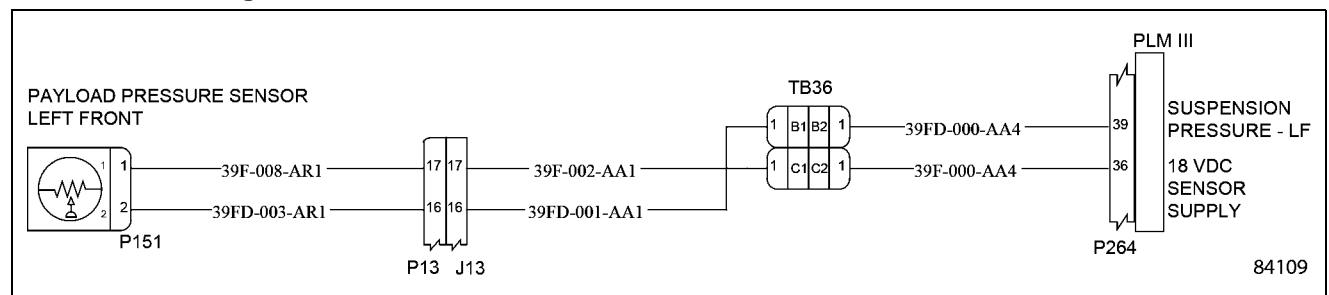
Operator Action	None
Fault Code	A001
Description	Left front suspension pressure sensor signal is high.
Fault Conditions	Sets if pressure signal is out of range high (sensor current over 22 mA). Resets if reading returns to normal.
Operator Alerting System Response	Repair Lamp Display Operator Action: None Display Fault Description: PLM LF PRESS SENS HI Display Fault Code: A001
Resulting Problem(s)	Bad payload computation.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table

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

Parameter	Expected State and/or Related Fault(s)
Left Front Pressure Sensor (PLM 36,39)	Sensor current > 22 mA: Failed high Sensor current < 2 mA: Failed low Sensor current > 2 mA but less than 22 mA: Valid readings Fault(s): A002

Related circuit diagram



Fault Code A018: Right rear flat suspension cylinder warning

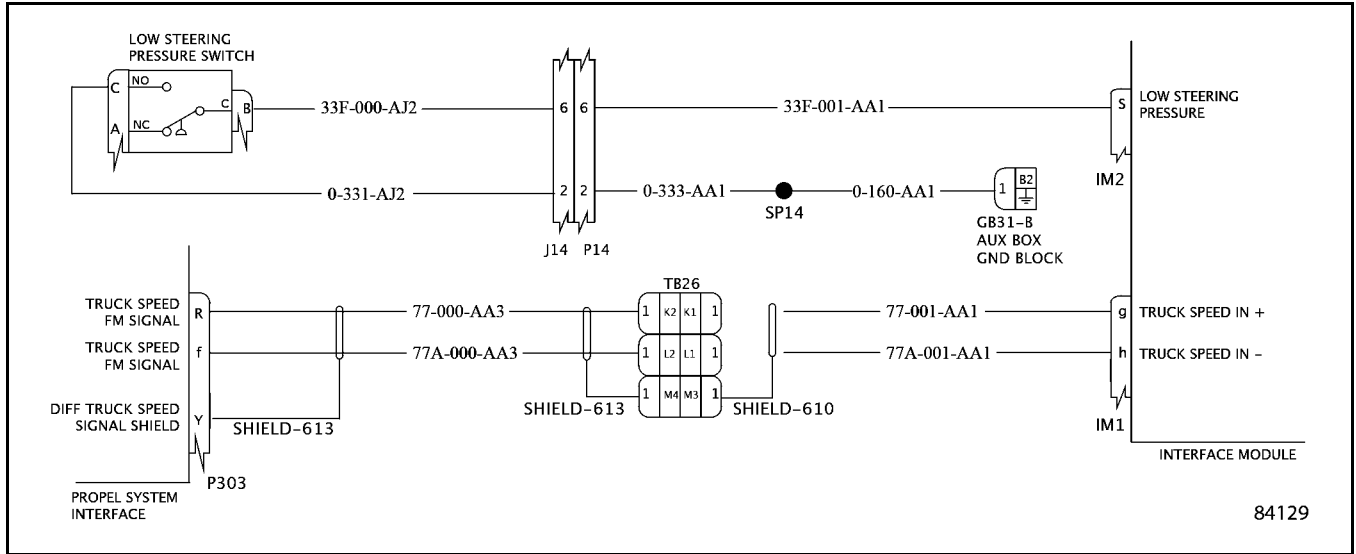
Operator Action	None
Fault Code	A018
Description	Right rear flat suspension cylinder warning.
Fault Conditions	Sets if PLM detects a flat right rear suspension cylinder. Resets if conditions clears.
Operator Alerting System Response	Repair Lamp Display Operator Action: None Display Fault Description: RR FLAT SUSP CYL FLT Display Fault Code: A018
Resulting Problem(s)	Potential damage to suspension and frame.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table

1. The logic that produces this fault is intended to identify flat suspension cylinders. The primary correction is to recharge / repair the cylinder. If the cylinder is not defective, use the following procedure to correct PLM.
2. 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).
3. 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.
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.

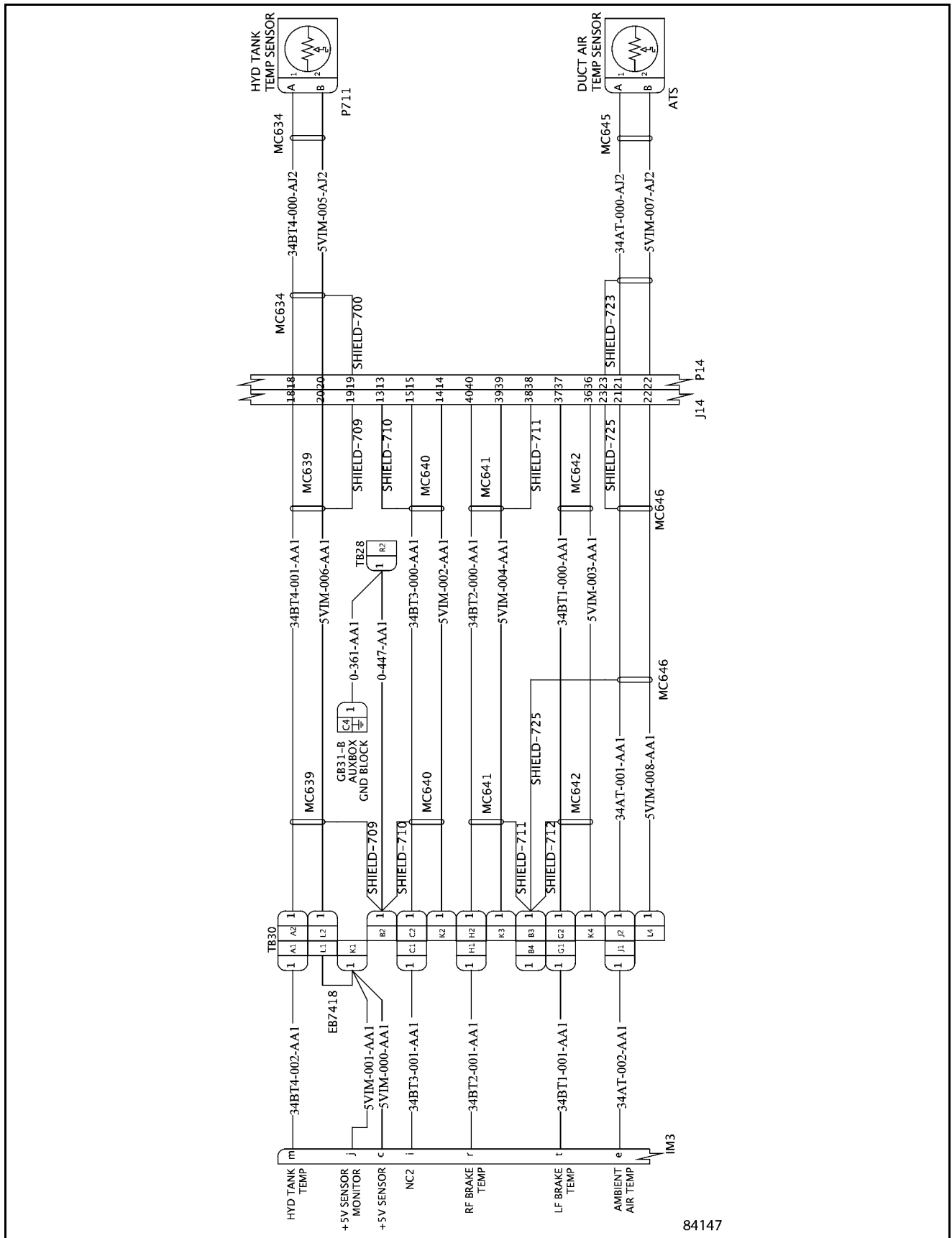
Parameter	Expected State and/or Related Fault(s)
Right Rear Pressure Sensor (PLM 36,40)	Sensor current > 22 mA: Failed high Sensor current < 2 mA: Failed low Sensor current > 2 mA but less than 22 mA: Valid readings Fault(s): A007, A008
Left Rear Pressure Sensor (PLM 36,30)	Sensor current > 22 mA: Failed high Sensor current < 2 mA: Failed low Sensor current > 2 mA but less than 22 mA: Valid readings Fault(s): A005, A006
Right Front Pressure Sensor (PLM 36,20)	Sensor current > 22 mA: Failed high Sensor current < 2 mA: Failed low Sensor current > 2 mA but less than 22 mA: Valid readings Fault(s): A003, A004
Left Front Pressure Sensor (PLM 36,39)	Sensor current > 22 mA: Failed high Sensor current < 2 mA: Failed low Sensor current > 2 mA but less than 22 mA: Valid readings Fault(s): A001, A002
Incline Sensor (PLM 36,29,19)	Sensor voltage < 0.565: Failed high Sensor voltage > 5.08: Failed low Sensor voltage > 0.565 but < 5.08: Valid readings Fault(s): A009, A010

Related circuit diagram



84129

Related circuit diagram



84147

Fault Code A158: Fuel level sensor is open or shorted high, indicating a false low fuel level

Operator Action	Go To Shop Now
Fault Code	A158
Description	Fuel level sensor is open or shorted high, indicating a false low fuel level.
Fault Conditions	Sets if fuel level indication is at -18.5% for 3 seconds, and battery voltage does not drop below 18 volts, with engine speed below 600 rpm. Resets if fuel level indication is above -12.5% for 3 seconds.
Operator Alerting System Response	Sound Buzzer Flash IM Warning Indicator Display Operator Action: GO TO SHOP NOW Display Fault Description: FUEL LEVEL SENSOR HI Display Fault Code: A158
Resulting Problem(s)	Fuel readings will show an empty tank whether there is fuel in the tank or not.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table	
<p>1. The primary correction for this fault is to correct or replace the fuel level sensor and wiring.</p> <p>2. 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).</p> <p>3. 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.</p> <p>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.</p>	
Parameter	Expected State and/or Related Fault(s)
Fuel Level Sensor (IM3g)	0.57 to 8.2 volts: Good readings at 24V battery (varies with battery voltage) < 0.57 or > 8.2 volts: Defective sensor or circuit at 24V battery (varies with battery voltage) Fault(s): A105
Battery Voltage, 24 Volt (IM1A)	> 18 volts: Good reading < 18 volts: Low battery voltage (while cranking) blocks this fault code. Fault(s): A153, A154, A155, A250
Engine Speed [RPM] (CAN/J1939) (IM1q,r,s)	< 600 RPM: Combined with low voltage means cranking is in process and fault is blocked > 600 RPM: Engine is running normally Fault(s): A184

Fault Code A197: Right rear hydraulic oil temperature is high

Operator Action	Stop; Park; Run Engine
Fault Code	A197
Description	Right Rear Hydraulic Oil Temperature is high.
Fault Conditions	Sets at 120°C (248°F) [4.13 volts] after 5 seconds. Resets at 103°C (217°F) [3.78 volts] after 5 seconds or at steering bleed down.
Operator Alerting System Response	Sound Buzzer Flash IM Warning indicator Display Operator Action: STOP: PARK: RUN ENG Display Fault Description: HOT HYD OIL R.R. Display Fault Code: A197
Resulting Problem(s)	Excessively hot oil can cause equipment damage and even reduce service brake effectiveness.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table

<p>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).</p> <p>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.</p> <p>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.</p>	
Parameter	Expected State and/or Related Fault(s)
Hydraulic Oil Temperature - Right Rear (IM3m)	0.016 to 4.89 Volts: Good readings < 0.016 Volt or > 4.89 Volts: Defective sensor or circuit Fault(s): A167, A171
Steering Bleed Valve	0: Steering bleed valve is off 1: Steering bleed valve is on

Park Brake Request (IM3V)	0: Shifter is not in the forward, neutral, or reverse positions or the engine oil pressure is below the setpoint of the engine oil pressure switch 1: Shifter is in the forward, neutral, or reverse positions and the engine oil pressure is above the setpoint of the engine oil pressure switch Fault(s): A264
Engine Speed [RPM] (CAN/J1939) (IM1q,r,s)	< 300 RPM: engine is not running > 300 RPM for 4 seconds: engine is running Fault(s): A184
Truck Speed [kph] (IM1g,h)	0: Truck is not moving > 0: Truck is moving Fault(s): A212
CAN J1939 connection (IM1q,r,s)	Fault(s): A184
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 (GE power not yet off) Fault(s): A240
Park Brake Solenoid (IM1E)	Status - Open Load: Unexpected. Troubleshoot. Status - Normal: Expected. No Problem. Status - Shorted to Ground: Expected if shifter is in the forward, neutral, or reverse positions and the engine oil pressure is above the set point of the engine oil pressure switch. Otherwise unexpected and must troubleshoot. Status - Overload: Unexpected. Troubleshoot. 0: Shifter is not in the forward, neutral, or reverse positions or the engine oil pressure is below the set point of the engine oil pressure switch and either the speed of the truck has been 0.8 kph (0.5 mph) or less for 1 second or the service brakes are applied. 1: Shifter is in the forward, neutral, or reverse positions and the engine oil pressure is above the set point of the engine oil pressure switch. Fault(s): A216, A351

Fault Code A244: The drive system temp gauge within the display panel is defective

Operator Action	Go To Shop Now
Fault Code	A244
Description	The drive system temp gauge within the display panel is defective.
Fault Conditions	Sets if the display panel detects an drive system 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: DRIVE SYS TEMP GAUGE Display Fault Code: A244
Resulting Problem(s)	Drive system 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 (IM1P)	0: Steering bleed valve is off 1: Steering bleed valve is on

Fault Code A253: Steering bleed circuit is not open while running

Operator Action	None
Fault Code	A253
Description	Steering bleed circuit is not open while running.
Fault Conditions	Sets if the steering bleed circuit is not open for 2 seconds, beginning 11 seconds after the keyswitch is turned on. Resets only at power down.
Operator Alerting System Response	Repair Status Light On Display Operator Action: None Display Fault Description: STG BLD CKT NOT OPN Display Fault Code: A253
Resulting Problem(s)	Steering Bleed Down will be possible during normal running if IM or some of its inputs should also malfunction.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table	
<p>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).</p> <p>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.</p> <p>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.</p>	
Parameter	Expected State and/or Related Fault(s)
Steering Bleed Valve (IM1P)	<p>Status - Open Load: Expected with key switch on. No problem. Otherwise, unexpected. Must troubleshoot.</p> <p>Status - Normal: Expected only with key off and steering bleed in process. Troubleshoot if found with key on.</p> <p>Status - Shorted to Ground: Unexpected. Troubleshoot.</p> <p>Status - Overload: Unexpected. Troubleshoot.</p> <p>0: Steering bleed valve is off. This is expected in normal running operation.</p> <p>1: Steering bleed valve is on. This is expected after key off initiates steering bleed operation.</p> <p>Fault(s): A262, A263, A358</p>
Keyswitch (IM3G)	<p>0: Keyswitch is off and the truck is not moving and the engine is not running</p> <p>1: Keyswitch is on or the truck is moving or the engine is running</p> <p>Fault(s): A240</p>

Table

1. This fault's logic contains more than one parameter, each of which may have its own related fault code(s).
 2. 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.
 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)
Brake Lock Switch Power Supply (IM3L)	0: No power available for brake lock switch 1: Power is available for brake lock switch Fault(s): A272
Truck Speed [kph] (CAN/IPC) (IM1i,j,k)	< 1 kph (0.6 mph): Truck is not moving > 1 kph (0.6 mph): Truck is moving Fault(s): A233
Engine Speed [RPM] (CAN/J1939) (IM1q,r,s)	< 400 rpm: Engine is not running > 400 rpm for 15 seconds: Engine is running Fault(s): A184
Park Brake Set (IM2f)	0: Parking brake pressure switch indicating higher pressure and an unapplied parking brake 1: Parking brake pressure switch indicating low pressure and an applied parking brake Fault(s): A213
Park Brake Released (IM2M)	0: Parking brake pressure switch indicating low pressure and an applied parking brake 1: Parking brake pressure switch indicating high pressure and a released parking brake Fault(s): A214
Park Brake Request (IM3V)	0: Shifter is not in the forward, neutral, or reverse positions or the engine oil pressure is below the setpoint of the engine oil pressure switch 1: Shifter is in the forward, neutral, or reverse positions and the engine oil pressure is above the setpoint of the engine oil pressure switch Fault(s): A264
Shutdown Delay Relay (IM1H)	0: Shutdown delay is off 1: Shutdown delay is on
Steering Bleed Valve (IM1P)	0: Steering bleed valve is off 1: Steering bleed valve is on

Fault Code A284: An engine shutdown delay was aborted because the secondary shutdown switch was operated

Operator Action	None
Fault Code	A284
Description	An engine shutdown delay was aborted because the secondary shutdown switch was operated.
Fault Conditions	Sets if keyswitch is turned off and Cummins shutdown delay is on and engine is running but secondary engine shutdown switch is operated. Resets if keyswitch is turned back on, Cummins shutdown delay is off, and engine is running.
Operator Alerting System Response	Repair Lamp Display Fault Description: NO SHT DWN DEL / SEC Display Fault Code: A284
Resulting Problem(s)	The engine can suffer damage when shut down immediately rather than in a controlled delay.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table	
<p>1. The normal corrective measure for this fault is to shut down the engine with the keyswitch.</p> <p>2. This fault's logic contains more than one parameter, each of which may have its own related fault code(s).</p> <p>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.</p> <p>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.</p>	
Parameter	Expected State and/or Related Fault(s)
Secondary Engine Shutdown Switch (IM3E)	0: Engine being shut down by secondary switch 1: Engine not being shut down by secondary switch
Keyswitch, Direct (IM2P)	0: Keyswitch is off 1: Keyswitch is on Fault(s): A240
Cummins Shutdown Delay (IM3F)	0: No shutdown delay 1: Cummins shutdown delay signal is on Fault(s): A283
Engine Speed [RPM] (CAN/J1939) (IM1q,r,s)	< 300 rpm: Engine is not running > 300 rpm for 4 seconds: Engine is running Fault(s): A184

Fault Code A315: DC-DC converter 12 volt circuit is low

Operator Action	None
Fault Code	A315
Description	The DC-DC converter 12 volt circuit is low.
Fault Conditions	When engine is running and battery volts are above 22, sets if voltage is below 12.5. If battery voltage is below 22, sets if voltage is more than 1.5 volts lower than battery voltage divided by 2. Resets at power down only.
Operator Alerting System Response	Repair Lamp Display Fault Description: DCDC 12V LOW Display Fault Code: A315
Resulting Problem(s)	The 12 volt DC-DC converter is putting out low voltage. Correction is required to continue good performance in the 12 volt loads.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table	
<p>1. The primary correction for this fault is to eliminate any overload, or replace the converter.</p> <p>2. 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).</p> <p>3. 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.</p> <p>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.</p>	
Parameter	Expected State and/or Related Fault(s)
DC-DC Converter, 12 Volt (IM3h)	<12.5 volts when battery voltage >22 volts: Voltage is low < (Batt Voltage / 2) - 1.5 volts: Voltage is low Otherwise: Voltage is normal Fault(s): A312
Battery Voltage, 24 Volt (IM1A)	> 22 volts: 12 volt circuit should have normal readings < 22 volts: 12 volt circuit might have abnormal readings Fault(s): A153, A154, A155, A250
Engine Speed [RPM] (CAN/J1939) (IM1 q, r, s)	< 300 rpm: Engine is not running > 300 rpm for 4 seconds: Engine is running Fault(s): A184

Fault Code A355: Overload on output 1L

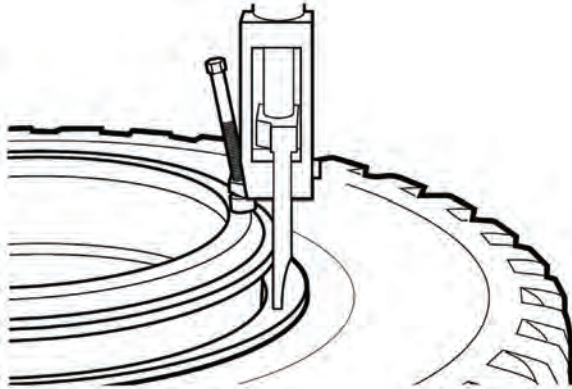
Operator Action	None
Fault Code	A355
Description	Overload on output 1L.
Fault Conditions	Sets if driver chip detects overcurrent or over temp on output 1L. Output is turned off when overload is detected. Resets at power down.
Operator Alerting System Response	Repair Lamp Display Fault Description: IM OUTPUT 1L FAULT Display Fault Code: A355
Resulting Problem(s)	Unused outputs with short circuits on them might damage the driver chip if not corrected.
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. There are no additional fault codes to investigate.	
2. Any spare wires connected to this output should be removed to prevent ultimate failure of the driver chip.	
Parameter	Expected State and/or Related Fault(s)
Spare IM Output (IM1L)	Status - Open Load: Expected. No problem Status - Normal: Expected. No problem Status - Shorted to Ground: Unexpected. Troubleshoot Status - Overload: Unexpected. Troubleshoot 0: Off 1: On

SECTION G2 TIRES AND RIMS INDEX

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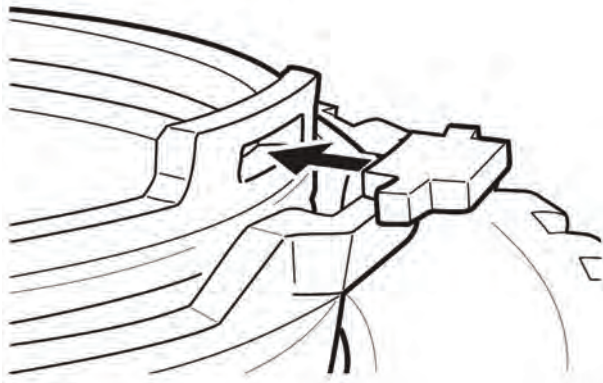
3. Mount bead breaker on the bead seat band. Operate the bead breaker, push down the side ring, and unseat the tire bead from the bead seat band.



84859

FIGURE 2-22.

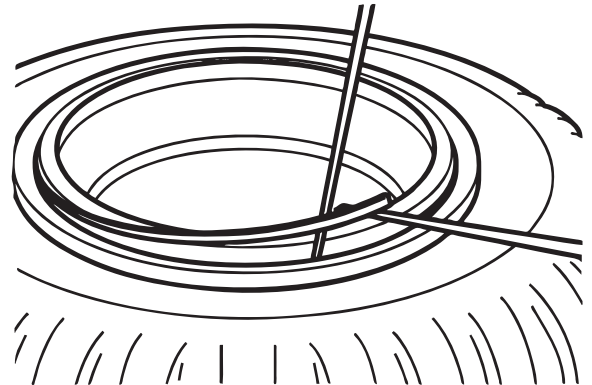
4. If equipped, remove the driver key.



84885

FIGURE 2-23.

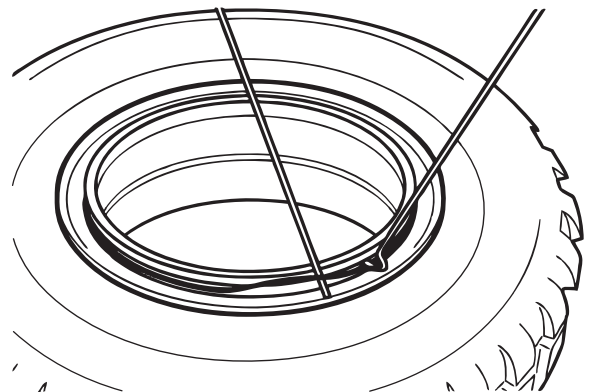
5. Remove the lock ring.
 - a. Use a tire lever to force the bead seat band free from the lock ring.
 - b. Use the tire lever to leave out one end of the lock ring from the locking groove.
 - c. Use a second tire lever to continue to dislodge the lock ring around the circumference of the rim until the lock ring is free from the assembly.



84854

FIGURE 2-24.

6. Use the tire lever to push down on the bead seat band so that the O-ring is freed. Remove the O-ring.



84855

FIGURE 2-25.

FRONT WHEEL HUB AND SPINDLE

WHEEL HUB AND SPINDLE ASSEMBLY

The following instructions will cover the complete removal, installation, disassembly, assembly and bearing adjustment of the front wheel hub and spindle. If only brake service is to be performed, refer to Section J, Brake Circuit.

WARNING

Do not loosen or disconnect any hydraulic line or component until the engine is stopped, the key switch is OFF for 90 seconds, and the brake accumulators are depressurized.

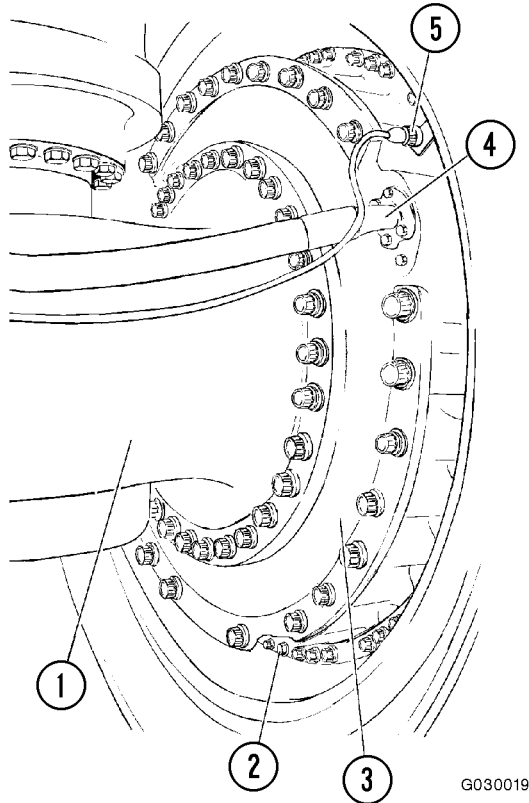


FIGURE 3-1. FRONT WHEEL & SPINDLE INSTALLATION

- | | |
|-----------------------|---------------------------|
| 1. Spindle | 4. Brake Cooling Line |
| 2. Drain Plug | 5. Speed Sensor Connector |
| 3. Disc Brake Housing | |

Removal

1. Shut down the truck. Refer to "Normal Engine Shutdown Procedure" in Section A3, General Safety & Operating Instructions.
2. Depressurize the brake accumulators by using the bleed valves on the brake manifold.
3. Activate the battery disconnect switches.
4. Remove the front tire and rim assembly. Refer to "Front Tire and Rim - Removal" in Section G2.
5. Close the hydraulic pump shutoff valves.
6. Disconnect speed sensor connector(s) (5, Figure 3-1). Tie the cables back away from the spindle to prevent damage during spindle removal.

NOTE: The left wheel has two speed sensors installed.

7. Disconnect brake cooling oil lines (4) at the inlet and outlet ports on the brake housing. Plug the hoses and ports to help prevent contamination.
8. Disconnect the brake apply line. Cap the hoses and ports to prevent contamination.
9. Remove drain plug (2) and drain the oil from the brake housing and hub bearings into a suitable container.
10. Remove the lubrication lines from the tie rod and steering cylinder.
11. Disconnect the steering cylinder and the tie rod from the spindle being removed. Refer to "Steering Cylinders and Tie Rod - Removal" in this section.

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Removal

1. With engine shut down and key switch OFF, allow at least 90 seconds for the accumulator to bleed down. Turn the steering wheel to ensure no hydraulic pressure is present.
2. Block front and back of rear wheels to prevent truck movement.
3. Disconnect hydraulic lines at the steering cylinders. Plug all line connections and cylinder ports to prevent contamination of hydraulic system.
4. Remove locknuts (12, Figure 3-11), retainers (11), and capscrews (1) from both ends of steering cylinder.
5. The steering cylinder weighs approximately 126 kg (278 lb). Attach a suitable lifting device that can safely handle the load safely to the steering cylinder and take up the slack.
6. Remove pins (2) from each end of the cylinder and move them to a clean work area. Bearing spacers (4) will be free when the pin is removed. **Ensure the bearing spacers do not drop out and become damaged when removing the pin.**
7. Use the lifting device to lift the cylinder from the truck.
8. Remove seals (3), spacers (4) and washer (10).

Installation

NOTE: Use sleeve alignment tool EH4638 (included in the tool group) to hold the bearing spacers and spherical bearings in position when the pins are inserted during assembly.

1. The steering cylinder weighs approximately 126 kg (278 lb). Use a suitable lifting device to lift the cylinder into position on the truck.

NOTE: Ensure anti-rotation retainer (7, Figure 3-11) is installed facing downwards.

2. Align bearing spacers (4), seals (3) and the barrel end of the steering cylinder with pin bores on truck frame.



Always install pin retaining capscrews from the top with the locknut on the bottom side at the steering arm.

3. Install pin (2), capscrew (1) and retainer (11) and secure with locknut (12).
4. Align bearing spacers (4), seals (3), washer (10) and rod end with pin bores on steering arm.
5. Install pin (2), capscrew (1) and retainer (11) and secure with locknut (12).
6. Tighten both locknuts (12) to $1\ 017 \pm 102$ N·m (750 ± 75 ft lb).
7. Connect the grease lines to their respective ports. Operate the steering and check for leaks and proper operation.

Bearing Replacement (Steering Cylinder and Tie Rod)

1. Remove capscrews (8, Figure 3-11) and lockwashers (9). Remove bearing retainer (7).
2. Press bearing (5) out of the bore in the steering cylinder or tie rod end.
3. Press a new bearing into the bore.
4. Install anti-rotation retainers (7) with capscrews and lockwashers. Tighten the capscrews to standard torque.

**SECTION G5
REAR AXLE AND WHEEL MOTOR
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Oil Viscosity

Viscosity of filtered oil must be monitored by oil analysis to ensure proper lubrication. Viscosities below the condemning limit indicates entry of contamination that will affect the oil film and lubricating quality. The condemning limit for 680 oil, is 53cSt when tested at 100° C (212° F), and 588cSt at 40° C (104° F). This value can be used along with element tracking to verify correct oil viscosity. Ensure the appropriate viscosity value is being maintained for the approved oil you are using. If the viscosity of the oil is below the acceptable limit, the oil should be rechecked. If the second test fails, dispose of the oil. Fill the wheel motor with new, approved oil. The contaminated oil should be properly disposed of according to local regulations.



If the viscosity of the oil is below the condemning limits, the oil may be contaminated with hydraulic oil. Make sure that all joints are properly sealed before filling the wheel motor with fresh oil. If hydraulic oil continues to contaminate the wheel motor, serious damage to internal components may result. Wheel motor gear oil contaminated with hydraulic oil is mixed with clean oil during the filtering process, the entire lot must be discarded.

Particle Size Analysis

When filtering synthetic oil for reuse, the oil must be monitored to determine when filtering is necessary. The process of monitoring the oil for this purpose is particle size analysis. The test consists of passing a beam of light through the oil as it passes through a clear tube. A computer analyzes the quantity and size of particles contained in the oil.

Particles that are smaller than 5 microns in size are not large enough to cause any gear or bearing failures. Particles over 25 microns can damage bearings and must be filtered from the oil. Oil being tested for the size and number of particles in the lubricant is an extremely important measurement of the condition of the oil.

Test the oil according to the International Standards Organization's ISO Particle Analysis 4406. This standard documents the size and number of particles permitted in the lubricant. This is an extremely important measurement of the condition of the oil.

An "ISO Cleanliness Code" is used to document the number and size of the contaminants that can be tolerated in a specific application of a lubricant. An example of an "ISO Cleanliness Code" would be 18/13. The first number (18 in this example) applies to the allowable number of particles between 5 - 15 microns in size. The second number (13 in this example) applies to the allowable number of particles between 15 - 25 microns. If the particle count identified by the "ISO Cleanliness Code" is exceeded or there are particles present larger than 25 microns, the oil should be filtered.

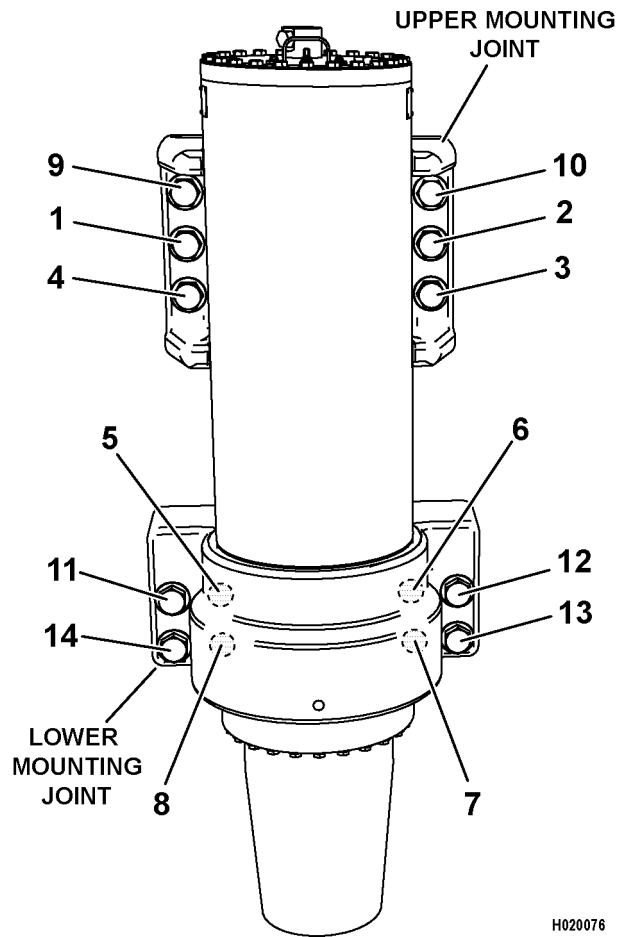
Use Cleanliness Code of 18/13 for motorized wheels. Oil qualified for reuse must be filtered to 10 microns absolute.

If particle analysis yields a result of greater than 18 for the top number or greater than 13 for the lower number the motorized wheel oil should be filtered to 10 microns absolute. On occasion, one should check the results of the filtering process to assure the filtering process is yielding the desired results. Should the result be unacceptable, check the filter type, particle size, and condition prior to filtering again.

Flushing

The transmission of the wheel motor must be flushed using the same oil that is used in normal operation. The use of solvents or low viscosity oils are not acceptable.

After flushing to remove contamination from the wheel motor, the transmission should be filled with new or filtered oil. A sample should be taken for analysis after 100 hours of operation. If results of the oil analysis are within the acceptance range, the wheel motor may return to the 250 hour interval for oil analysis. If the results of the analysis are not within the acceptance range, immediately contact your area Komatsu service representative. Large quantities of loose material in the oil may be an indication of imminent wheel motor failure.



H020076

FIGURE 2-6. TIGHTENING SEQUENCE MAP

The mounting capscrews will now need to be loosened and then tightened using angle-advance. The first set of capscrews to be adjusted will be at the upper mounting joint. The capscrews must be loosened one at a time and then tightened by advancing a specified rotational degree. Use the map shown in Figure 2-6 for proper tightening sequence.

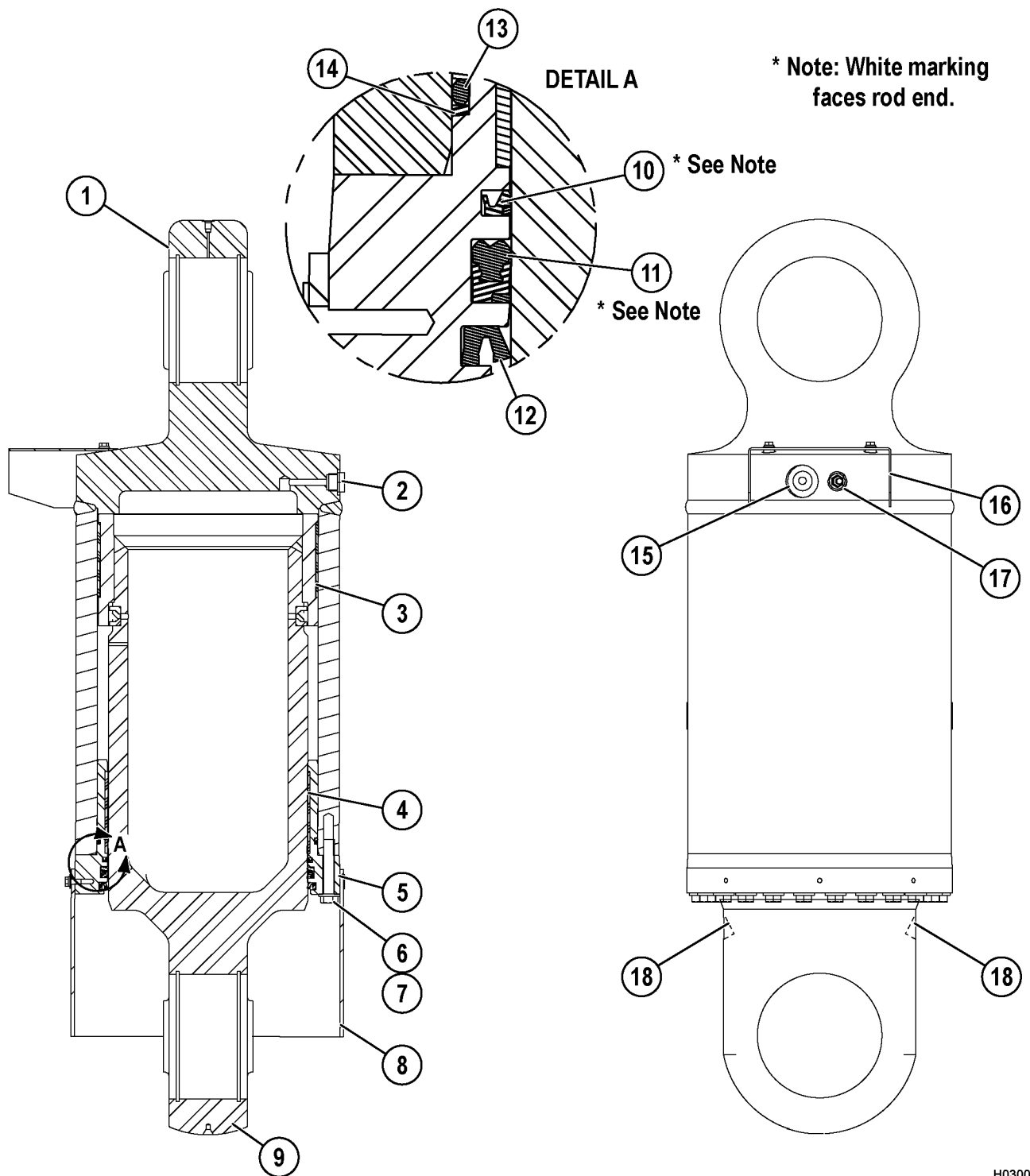


FIGURE 3-4. REAR SUSPENSION ASSEMBLY

- | | | |
|---------------------|-------------------------|---------------------|
| 1. Housing | 7. Hardened Washer | 13. O-ring |
| 2. Vent Plug | 8. Mud Flap | 14. Backup Ring |
| 3. Piston Bearing | 9. Piston Rod | 15. Pressure Sensor |
| 4. Rod Bearing | 10. Rod Buffer Seal | 16. Cover |
| 5. Bearing Retainer | 11. Rod Double Lip Seal | 17. Charging Valve |
| 6. Capscrew | 12. Wiper Seal | 18. Drain Plug |

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6. Remove the vent plug (1, Figure 4-11), pressure sensor (2) and charging valve (3).

NOTE: As an alternative to steps 7-10, to avoid the 15 minute wait period, skip to step 11 for the pressure fill method.

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.
8. Allow the suspension to settle for at least 15 minutes. Add more suspension oil mixture if necessary.

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.

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.
11. Pressure fill method:
 - a. Remove the oil drain plugs from the suspensions. To drain the oil, use the jacks or overhead crane to lower the truck.
 - b. After the oil is drained, use the jacks or overhead crane to raise the truck to the correct oiling height.
 - c. Insert a hose or fitting (PB6528) into the oil drain port. Connect either a hand pump or 12 volt transfer pump.
 - d. Pump clean suspension oil mixture (with 6% friction modifier) into the suspension. By pushing the oil from the bottom, No air is trapped in the suspension and existing air is purged from the suspension.
 - e. When oil starts to escape from the open ports near the top of the suspension, stop pumping oil.
 - f. Install vent plug (1) and pressure sensor (2) into the suspension cylinder.
 - g. Install a new O-ring into charging valve (3) and install it into the suspension cylinder.
 - h. Remove the hose or fitting from the oil drain port and install the oil drain plug. With the top ports plugged, a small vacuum is created to minimize oil loss.

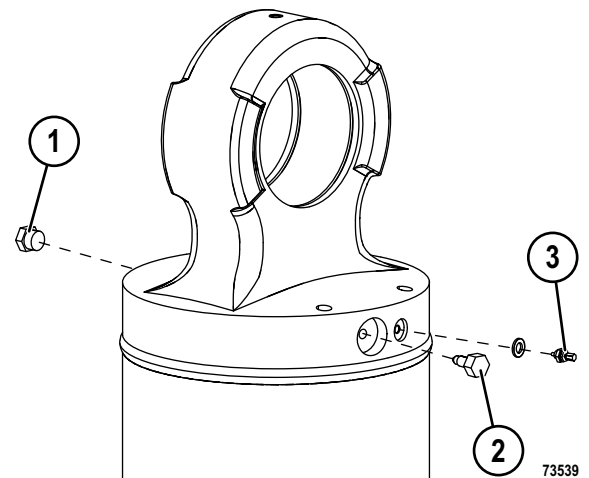


FIGURE 4-11. REAR SUSPENSION PORTS

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

**SECTION J3
BRAKE CIRCUIT COMPONENT SERVICE
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Cleaning and Inspection

1. All metal parts should be cleaned with a cleaning agent.
2. Seals and soft parts should be wiped clean.
3. Inspect the hydraulic port assembly for damage. Check the poppet plunger to see that it spins freely and functions properly.
4. Check the anti-extrusion ring and soft seals for damage and wear. Replace all worn or damaged seals with original equipment seals.
5. After the shell has been cleaned with a cleansing agent, check the inside and outside of the shell. Pay special attention to the area where the gas valve and hydraulic assembly pass through the shell. Any nicks or damage in this area could destroy the accumulator bladder or damage new seals. If this area is pitted, consult your Komatsu service manager.

Assembly

1. After shell (10, Figure 3-17) has been cleaned and inspected, secure it in place to prevent rotation during assembly.
2. Apply 2 liters (64 oz.) of clean type C-4 hydraulic oil inside the shell to lubricate and provide a cushion for the bladder.
3. With all gas completely exhausted from bladder (9), collapse the bladder and roll it longitudinally into a compact roll. To keep the bladder rolled up, insert the gas valve core to prevent air from entering the bladder.
4. Insert the bladder pull rod through the valve stem opening and through the shell hydraulic port. Attach the bladder pull rod to the bladder valve stem.
5. With one hand, pull the bladder pull rod while feeding the bladder into the shell with the other hand. A slight twisting of the bladder will ease installation.
6. Once the bladder valve stem has been pulled through the valve stem opening in the shell, install the name plate (if used) over the valve stem and install valve stem nut (13) by hand.
7. Once valve stem nut (13) is in place, remove the bladder pull rod. Tighten the nut to **76 N·m (56 ft lb)**.
8. Grasp hydraulic port assembly (1) at the threaded end and insert the poppet end into the shell. Lay the assembly inside the shell.
9. Fold anti-extrusion ring (8) to enable insertion through the shell opening, then insert the ring into the shell. Once the anti-extrusion ring has

cleared the shell opening, place the ring on the poppet assembly with the steel collar facing toward the shell hydraulic oil port.

10. Pull the threaded end of the hydraulic port assembly through the shell until it seats solidly into position in the shell fluid port opening.
11. With the hydraulic port assembly firmly in place, install the charging valve into the bladder stem.
12. Slowly pressurize the bladder with dry nitrogen. Use a sufficient pressure of 275 - 345 kPa (40 - 50 psi) to hold the poppet assembly in place.
13. Install metal backup washer (7) over the poppet assembly. Push the washer into the shell fluid port until it has bottomed out on anti-extrusion ring (8).
14. Install O-ring (6) over the poppet assembly. Push it into the shell fluid port until it has bottomed out against washer (7). DO NOT twist the O-ring.
15. Install O-ring backup (5) over the poppet assembly. Push it until it bottoms against O-ring (6).
16. Insert spacer (4) with the smaller diameter of the shoulder facing the shell.
17. Install locking ring (3) on the poppet assembly and tighten it. This will squeeze the O-ring into position. Use a wrench on the flats of the port assembly to prevent it from rotating. Tighten the nut to a final torque of **373 N·m (275 ft lb)**.
18. Release all of the nitrogen from the bladder.
19. Install bleed plug (2) and tighten it to **14 N·m (10 ft lb)**.
20. Pour approximately 4 liters (1 gallon) of clean Type C-4 hydraulic oil into the accumulator through the hydraulic port.

NOTE: The hydraulic oil added in Step 20 will act as a cushion when the accumulator is installed on the truck and precharged with nitrogen.

21. Precharge the accumulator to 690 - 827 kPa (100 - 120 psi). Refer to Accumulator Charging Procedure for more details.
22. After precharging, install a plastic cover over the hydraulic port to prevent contamination. DO NOT use a screw-in type plug.
23. Tighten cap (14) to **19 N·m (14 ft lb)**.

NOTE: If accumulator is to be stored, refer to the Accumulator Storage Procedure in this section.

CAUTION

Installing tubes incorrectly or in the wrong location can cause severe bends in the hose and possibly damage clamp channel welds.

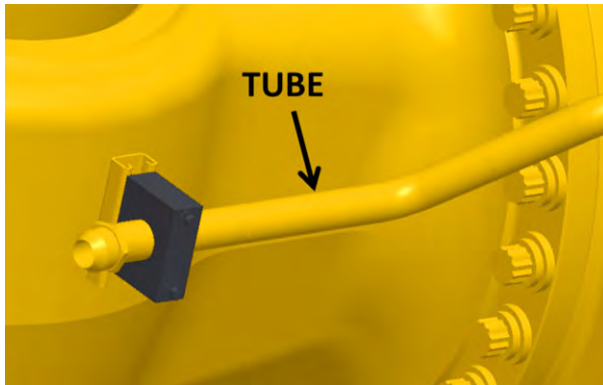


FIGURE 3-26. CLAMP LOCATIONS

7. Loosen clamp hardware and position each tube clamp near the top of the channel as shown in Figure 3-26.
8. Dimension X should be approximately 6.35 - 12.7mm (0.25 - 0.50in) as shown in Figure 3-27.

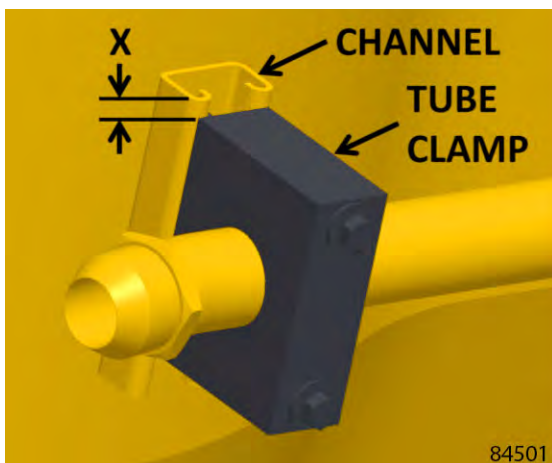


FIGURE 3-27. CLAMP POSITION

9. Tighten the clamp hardware to 10 - 12 N•m (8 - 9 ft lb).

WARNING

Do not remove or service hoses while truck is running!

10. With tires in the straight position, install the brake cooling hoses. Refer to Figure 3 for correct part numbers for each location.

CAUTION

Items that come in contact with the hose during operation can gouge or puncture the hose.

11. Check each hose for proper alignment. Each hose must not be kinked or twisted. Tighten each hose by holding the hose side of the fitting and turning only the fitting nut.



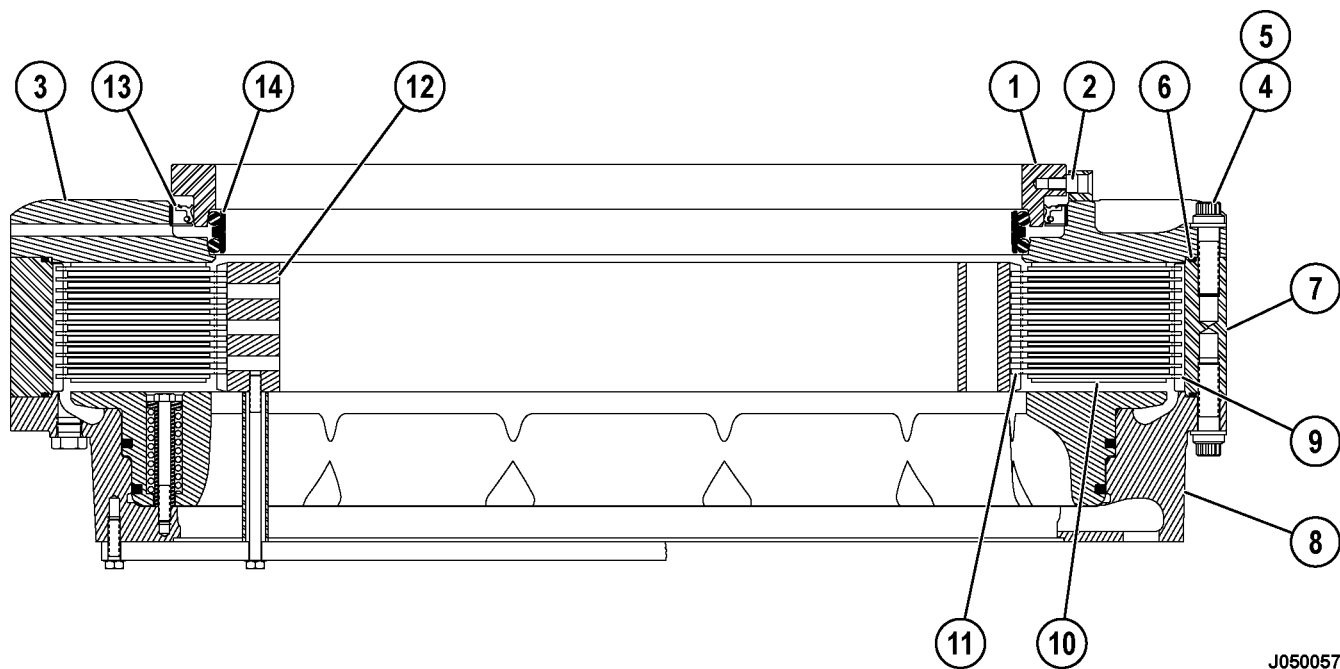
FIGURE 3-28. HOSE TIGHTENING

CAUTION

If kinking or twisting is observed, loosen fittings and reposition hose and re-tighten. Twisting and/or kinking of the hose will lead to premature hose failure.

BRAKE CIRCUIT AND BRAKE VALVE TROUBLESHOOTING CHART

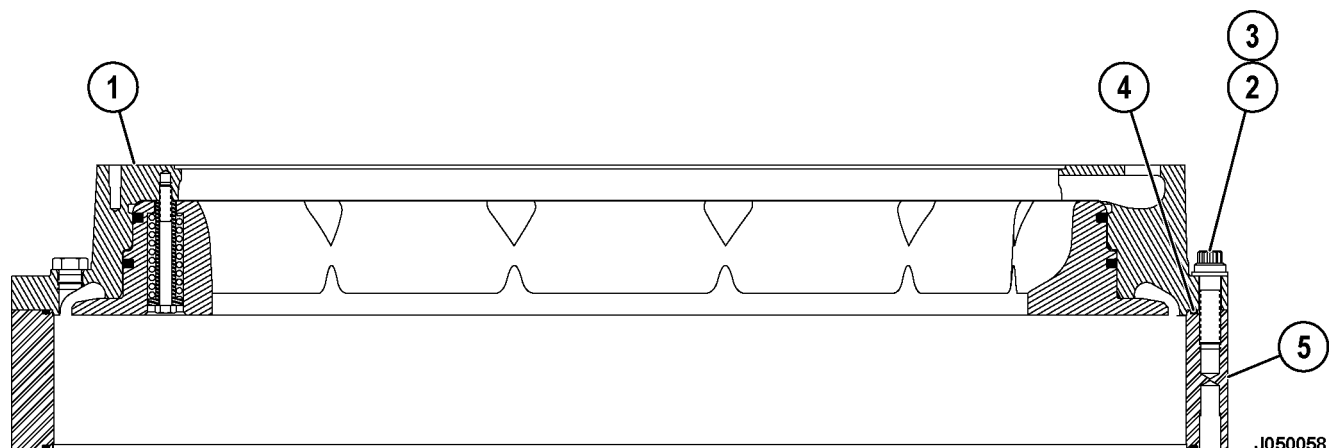
TROUBLE	POSSIBLE CAUSE	SUGGESTED CORRECTIVE ACTION
Service brakes and/or parking brake are locked.	Parking brake solenoid is de-energized. Connections to tank and pressure ports are reversed. Parking brake solenoid coil is defective. Parking brake solenoid valve is defective. Tank line is plugged or restricted.	Check power to solenoid. Correct the plumbing. Replace coil. Replace solenoid valve. Remove restriction.
Both brake circuits are dragging.	Tank line has back pressure. Pedal set screw is out of adjustment (residual pressure).	Ensure that tank line has no back pressure. Adjust pedal deadband with set screw.
One brake circuit is dragging.	There is an obstruction in the brake valve subassembly. Brake valve is out of balance. Actuator piston is defective. Brake valve is defective. A dual relay valve is defective.	Remove obstruction. Adjust balance according to instructions. Replace piston. Rebuild or replace brake valve assembly. Rebuild or replace dual relay valve assembly.
Brakes are not going to full pressure.	Supply pressure is low. Modulating section of brake valve has internal malfunction. Collar on brake valve is improperly adjusted.	Check the steering/brake pump system and accumulators. Remove, disassemble, clean, and inspect brake valve. Adjust collars according to instructions.
Low brake pressure warning occurs when the brakes are not applied.	There is a short in electrical system. Brake accumulator is bleeding down. Brake warning relay is defective.	Check wiring. Valve is open. Close valve. Replace relay.
Low brake pressure warning occurs when brakes are applied.	There is a leak or other malfunction in one brake circuit. Brake valve is out of balance. Dual relay valve(s) is defective.	Inspect brake system and repair leaks. Adjust balance according to instructions. Inspect and repair dual relay valve(s).



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FIGURE 5-5. INITIAL DISASSEMBLY

- | | | |
|--------------------|--------------------|-------------------|
| 1. Seal Carrier | 6. O-Ring | 11. Friction Disc |
| 2. Capscrew | 7. Ring Gear | 12. Inner Gear |
| 3. Back Plate | 8. Piston Housing | 13. Oil Seal |
| 4. Capscrew | 9. Separator Plate | 14. Seal Assembly |
| 5. Hardened Washer | 10. Damper | |



J050058

FIGURE 5-6. PISTON/HOUSING ASSEMBLY REMOVAL

- | | | |
|-------------------|--------------------|--------------|
| 1. Piston Housing | 3. Hardened Washer | 5. Ring Gear |
| 2. Capscrew | 4. O-Ring | |

11. Once the seal is completely dry, apply light pressure to the seal ring face at multiple locations around the seal. Visually check that the O-ring rolls down the ramp and then back up the ramp as pressure is released. If the O-ring is observed sliding or slipping down the ramp, the seal is not assembled correctly. Carefully disassembly the seal and repeat steps 1 through 10.

12. Use a caliper to measure the assembled height (Figure 5-26). Check the seal height variation (marked by arrows, Figure 5-28) between seal ring (1) and the back plate (2). Check the assembled height in four places that are 90° apart. The height variation around the assembled ring must be less than 1.0 mm (0.04 in).

If the seal is misaligned, remove the seal and repeat steps 7 through 12. The seal rings must be level as shown in Figure 5-27.

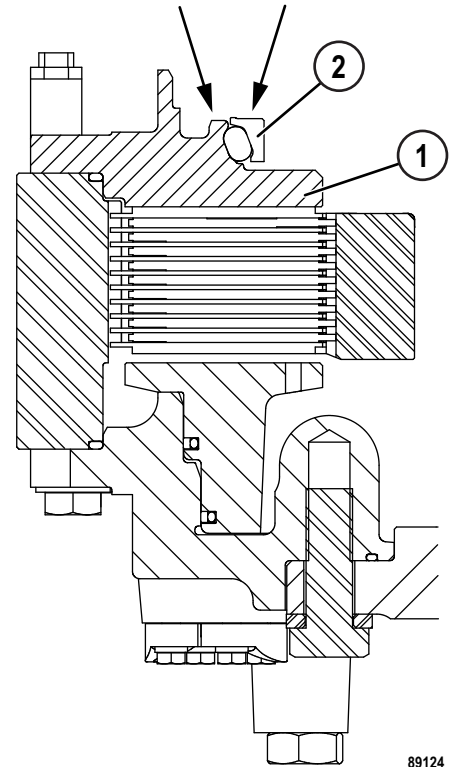


FIGURE 5-28. CHECKING SEAL HEIGHT

1. Seal Ring

2. Back Plate

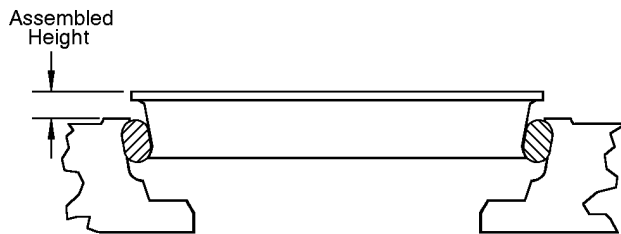


FIGURE 5-26. CHECKING SEAL RING

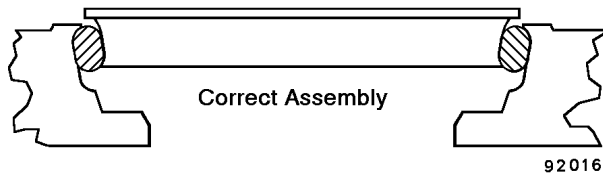


FIGURE 5-27. CORRECT ASSEMBLY

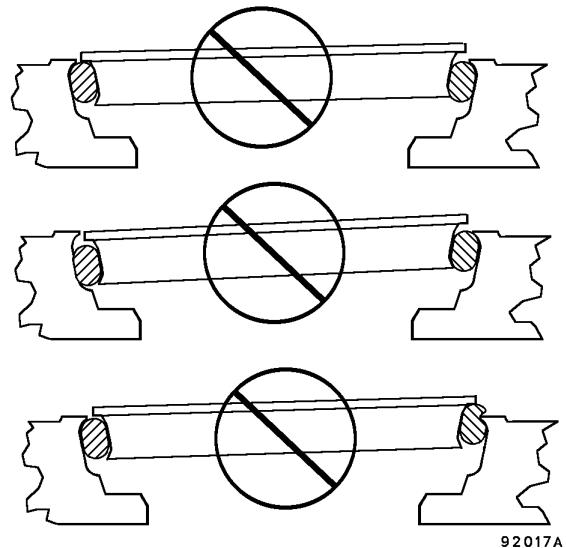


FIGURE 5-29. INCORRECT ASSEMBLY

PARKING BRAKE

OPERATION

The truck is equipped with a dry disc type parking brake assembly mounted on each wheel motor rotor shaft. The parking brake assemblies are inboard mounted and can be accessed through the louvered access tube at the rear of the rear axle housing.

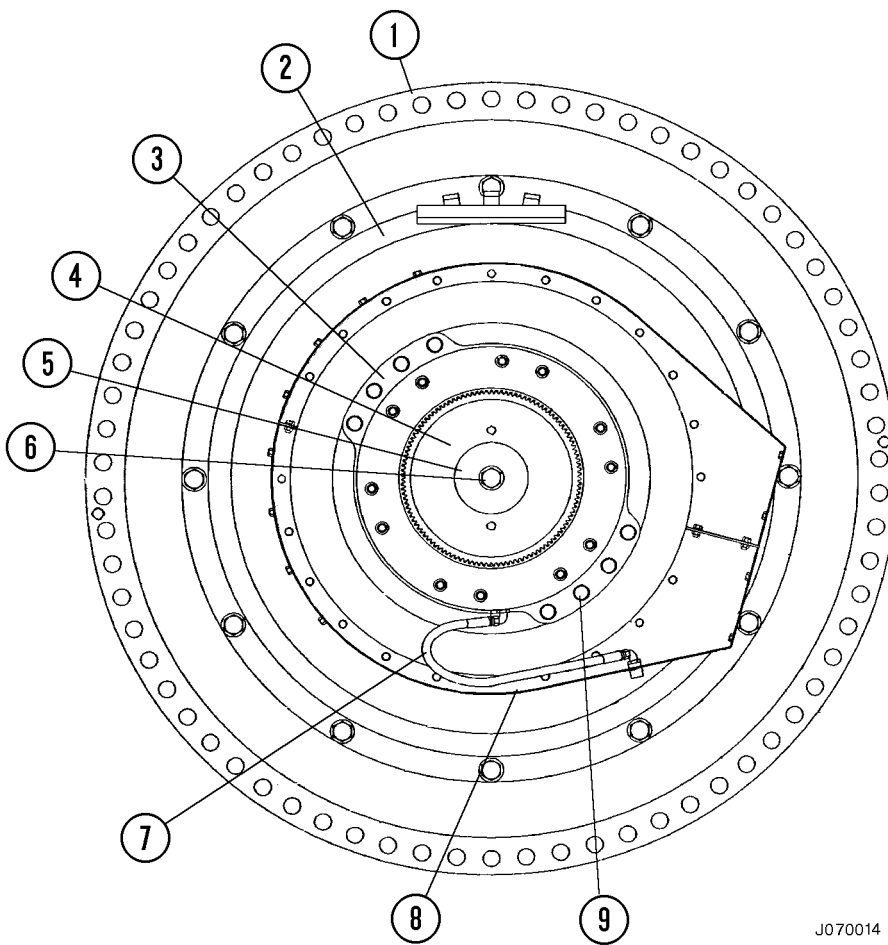
The parking brake is intended to prevent truck movement after the truck has stopped and the engine is shut off. The parking brake is not for use during truck loading or dumping operations. Refer to the Operation and Maintenance Manual for additional brake system operation instructions.

The parking brake is a spring applied, hydraulically released, multiple disc type brake that is actuated by the placing the directional control lever in PARK.

When the directional control lever is in PARK, the parking brake solenoid valve (SV2) located on the brake manifold in the hydraulic brake cabinet is de-energized, which removes hydraulic pressure from the parking brake assemblies. Internal belleville springs in the parking brake assemblies act on the piston to compress the disc pack, preventing rotation of gear (4, Figure 7-1), which is mounted on the wheel motor rotor shaft.

When the directional control lever is moved from PARK, pressurized oil is supplied to the brake assemblies through the now energized parking brake solenoid valve. Oil pressure applied to the parking brake piston compresses the belleville springs, releasing the discs to allow the wheel motor rotor gear to rotate.

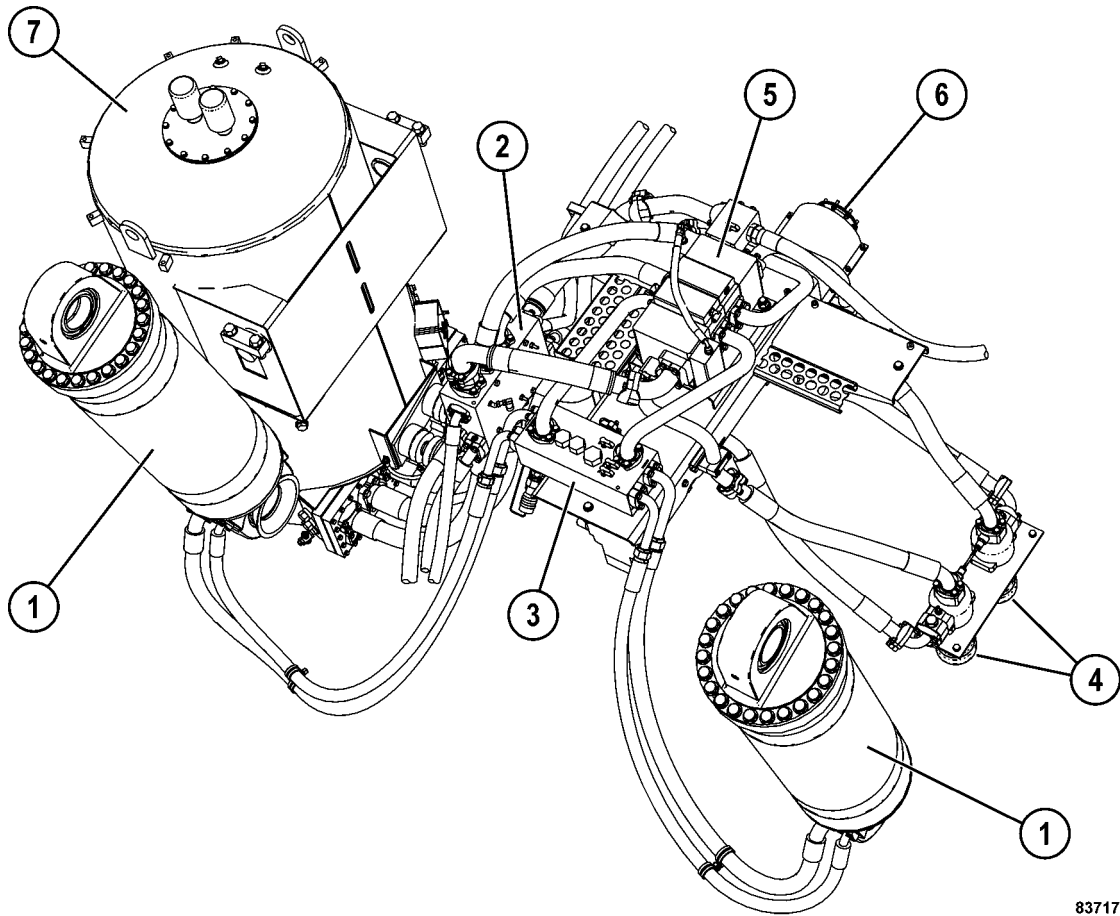
System interlocks prevent application of the parking brake if the truck is in motion.



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FIGURE 7-1. PARKING BRAKE INSTALLATION

1. Wheel Motor Mounting Flange
2. Wheel Motor
3. Parking Brake Assembly
4. Gear (Motor Rotor Shaft)
5. Retainer Plate
6. Capscrew & Hardened Washer
7. Park Brake Supply Hose
8. Cooling Air Duct Mount
9. Capscrew & Lockwasher



83717

FIGURE 2-2. HOIST CIRCUIT

- | | |
|------------------------------------|---------------------|
| 1. Hoist Cylinders | 5. Hoist Valve |
| 2. Brake/Hoist Return Oil Manifold | 6. Pump Drive Shaft |
| 3. Overcenter Manifold | 7. Hydraulic Tank |
| 4. Hoist Circuit Filters | |

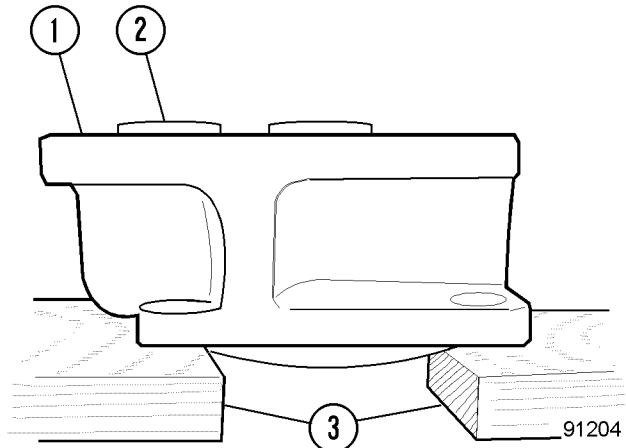


FIGURE 3-7. PREPARATION FOR SEAL REMOVAL

- 1. Flange
- 2. Bearings
- 3. Wooden Blocks

14. Remove outboard shaft seal (2), snap ring (21) and inboard shaft seal (20).

NOTE: To aid in shaft seal removal place the flange on two small wooden blocks as shown in Figure 3-7.

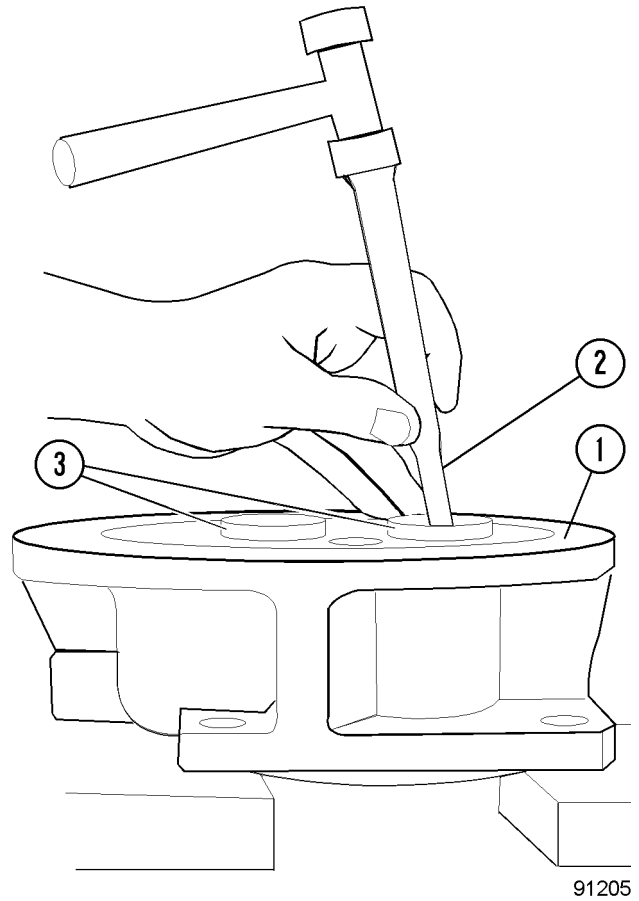


FIGURE 3-8. SHAFT SEAL REMOVAL

- 1. Flange
- 2. Punch
- 3. Bearings

15. Use a punch and hammer to tap the outboard shaft seal out of the flange bore. (Refer to Figure 3-8.) Be careful not to mar, scratch or damage the seal bore surface or bearings.

16. After the seals and snap ring have been removed, clean the bore thoroughly. If necessary, the bore may be smoothed with number 400 emery paper (only).

STEERING CIRCUIT

STEERING CIRCUIT OPERATION

Pump (8, Figure 4-1) supplies oil to bleeddown manifold (5) after passing through high pressure filter (9). This oil supply is then distributed to the brake system and steering system.

System pressure is regulated between 19 000 kPa (2,750 psi) and 20 900 kPa (3,025 psi) by an unloader valve located on the bottom of the steering pump case.

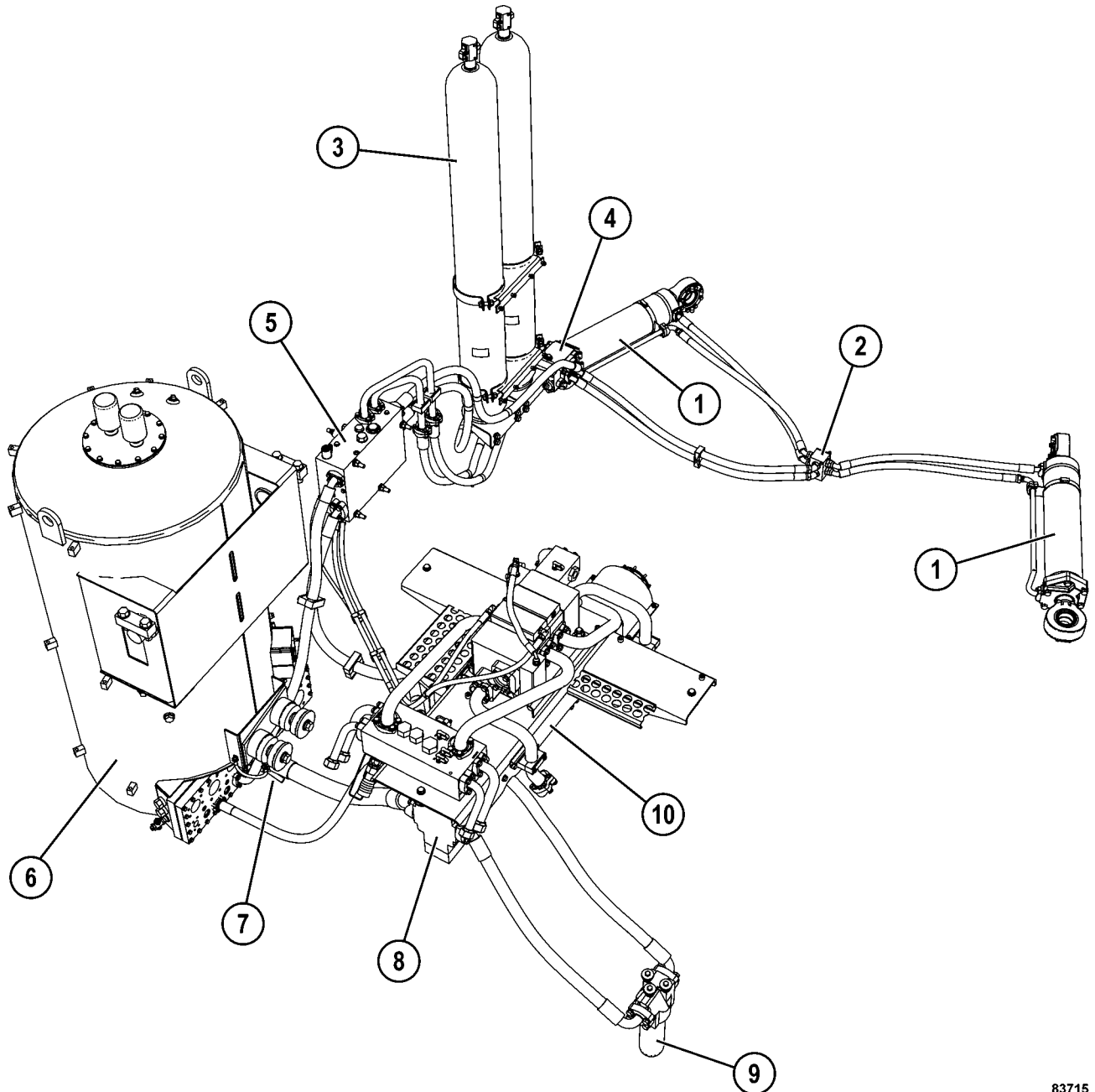


FIGURE 4-1. STEERING SYSTEM COMPONENTS

- | | | | |
|--------------------------|-------------------------|-------------------------|------------------------|
| 1. Steering Cylinders | 4. Flow Amplifier Valve | 7. Shutoff Valve | 10. Hoist Circuit Pump |
| 2. Manifold | 5. bleeddown Manifold | 8. Steering/Brake Pump | |
| 3. Steering Accumulators | 6. Hydraulic Tank | 9. High Pressure Filter | |

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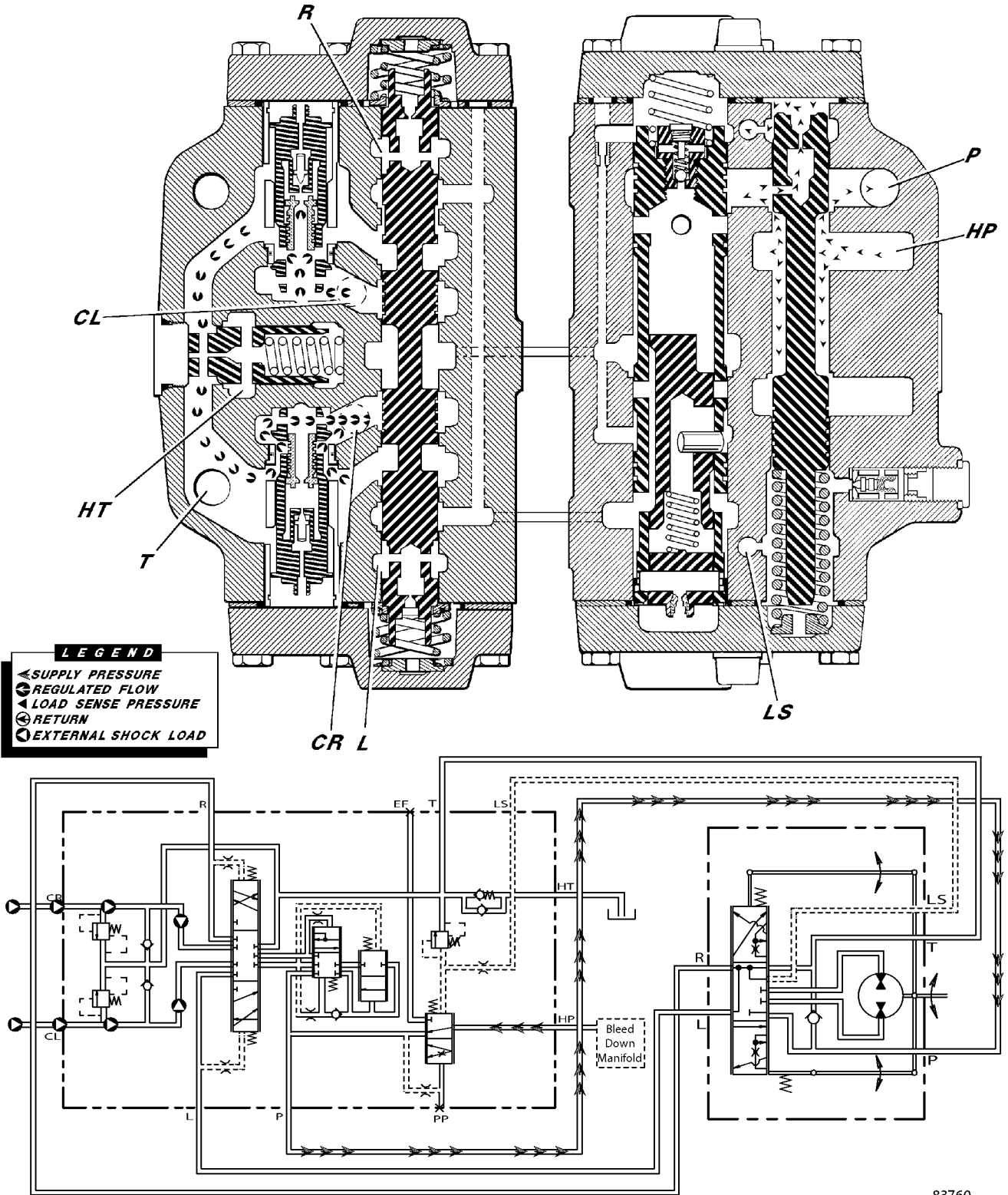


FIGURE 4-10. FLOW AMPLIFIER - NO STEER, EXTERNAL SHOCK LOAD

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6. With neutral position springs (7, Figure 5-10) centered in spool and sleeve, install ring (3), rear bearing race (4), thrust bearing (5) and front bearing race (6) in that order. The chamfer on the rear bearing race must be facing away from the bearing.

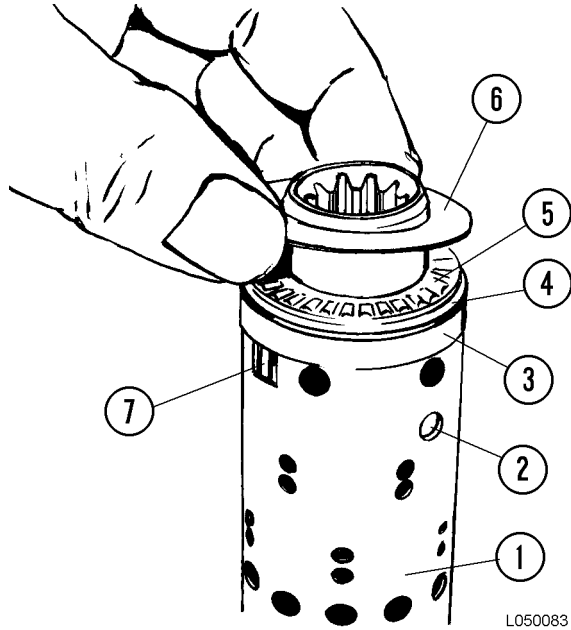


FIGURE 5-10. BEARING INSTALLATION

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

7. Place dust seal (1, Figure 5-7) in position. Using a flat iron block over the seal, tap it into the housing.
8. Position the O-ring and kin ring on the spool.

9. Position the steering control unit with the housing horizontal. Slowly guide the (lubricated) spool and sleeve with fitted parts into the bore using light turning movements. Refer to Figure 5-11.

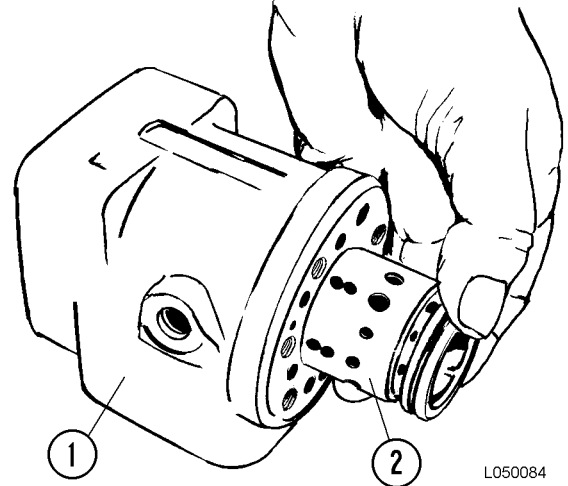


FIGURE 5-11. SPOOL INSTALLATION

- | | |
|------------|-------------------|
| 1. Housing | 2. Spool Assembly |
|------------|-------------------|

⚠ IMPORTANT ⚠

The cross pin must remain horizontal when the spool and sleeve are pushed into the bore to prevent the pin from dropping out of the spool.

10. Install the check ball in the hole shown in Figure 5-12. Install and lightly tighten the threaded bushing.
11. Lubricate O-ring (3) with petroleum jelly and install it in the housing groove.
12. Install distribution plate (15, Figure 5-7) so that the plate holes match the corresponding holes in the housing.

Rotating Group

WARNING

The rotating group weighs approximately 14 kg (30 lbs). Be careful not to damage the cylinder wear face or cylinder wear plate face, bearing diameters or piston shoes. Assistance from others and use of proper lifting techniques is strongly recommended to prevent personal injury as well.

19. To remove the rotating group, firmly grasp cylinder barrel (10, Figure 6-10) and pull the assembly outward until the cylinder spline disengages from the driveshaft spline about 63.5 mm (2.5 in.). Then rotate the cylinder barrel one or two revolutions to break any contact between piston/shoe assemblies (13) and the wear face of swashblock (25).
20. Slide the rotating group off the driveshaft and out of the pump housing and place it on a clean, protective surface with piston shoes facing upward.
21. Mark each piston, its cylinder bore and location in shoe retainer for ease of inspection and assembly.
22. Piston/shoe assemblies can be removed individually or as a group by pulling upward on shoe retainer (27).
23. Remove fulcrum ball (12).
24. If shoe retainer springs (28) are removed, mark which spring came from which bore. Each spring must be returned to its particular bore upon assembly.
25. Remove two pins (17, Figure 6-9) and pull cylinder bearing (26, Figure 6-10) straight out of the pump housing.

Swashblock Group

26. Remove two swashblock retaining pins (19, Figure 6-9). Tilt the bottom of swashblock (25, Figure 6-10) outward and remove the swashblock from the pump case.
27. Saddle bearings (24) can be removed by using a very short screwdriver or back hammer to pry them loose, or continue to the next step for further disassembly which will make their removal easier.

Driveshaft Group

28. Remove bearing retaining ring (3, Figure 6-9). Use a mallet on the tail shaft to tap driveshaft (1) out from the front of the pump housing.
29. Remove seal retainer (22) from the pump housing. Use a mallet to tap saddle (20, Figure 6-10) out from the inside of the pump housing. Saddle bearings (24) can then be easily removed. Saddle O-ring (21) may also be removed at this time.

Inspection

WARNING

Always wear safety goggles when using solvents or compressed air. Failure to wear safety goggles could result in serious personal injury.

1. Clean all parts thoroughly.
2. Replace all seals and O-rings with new parts.
3. Check all locating pins for damage and all springs for cracking and signs of fatigue.

Control Piston Group

4. Control piston (11, Figure 6-10) must slide smoothly in sleeve (4).
5. The linkage to the cradle should operate smoothly but not loosely (with slop). Check the piston and bore in the sleeve for signs of scratching and galling. Polish with a fine emery, if needed.

Valve Plate Group

6. Closely examine the mating faces of valve plate (10, Figure 6-11) and cylinder barrel (10, Figure 6-10) for flatness, scratches and grooves. If the faces are not flat and smooth, the cylinder side will "lift off" from the valve plate, resulting in delivery loss and damage to the pump. Replace if necessary.

Basic Hydraulic System Checks

Table 1: Basic Hydraulic System Checks		
Truck Condition	Verification Check	Corrective Action
Truck parked on level ground with wheels chocked, engine at low idle, steering and braking system pressurized (if possible)	Confirm reported problem: <ul style="list-style-type: none"> - Talk to operator - Operator repair report - Fault codes - Truck audible alarms - Truck fault code record (if equipped) 	Refer to the service manual to determine the cause.
Truck parked on level ground with wheels chocked, key off, engine off, hydraulic steering and braking system depressurized	Verify oil level in hydraulic tank.	Refill as needed.
	Verify hydraulic tank breather(s) are not plugged.	Repair.
	Visually inspect for external leakage.	Repair.
	Verify pump suction shut-off valve (if equipped) is fully open.	Fully open valve.
	Visually inspect hoses for kinks or damage. Look for abrasions, cracks, blisters, separations, delaminations and bulges. Disconnect and inspect interior if suspect. Inspect each hose: <ul style="list-style-type: none"> - Suction / inlet - Pressure / outlet - Accumulator feedback - Case drain 	Repair.
	Inspect for unusual odors such as burnt oil and elastomer's (seals) near pump, valves and cylinders.	Locate and repair.
	Visually inspect pump drive shaft connection.	Repair.
	Verify pump stroke adjuster setting. Altitude < 3 050 m (10,000 ft) <ul style="list-style-type: none"> - Full out Altitude > 3 050 m (10,000 ft) <ul style="list-style-type: none"> - 6.5 turns in 	Reset. Refer to Steering/ Brake Pump Stroke Adjustment in Section L10, Hydraulic Checkout Procedure.
Verify bleeddown manifold solenoid actuates while cycling the key off and on.	Repair.	
Truck parked on level ground with wheels chocked, engine at low idle, steering and braking system pressurized (if possible)	Visually inspect for external leakage	Repair.
	Visually inspect hoses for kinks, distortion, collapses and bulges. Turn off engine, depressurize, disconnect and inspect hose interior if suspect. Inspect each hose: <ul style="list-style-type: none"> - Suction / inlet - Pressure / outlet - Accumulator feedback - Pump Case drain <i>Note: Maximum pump case pressure = 172 kPa (25 psi)</i>	Repair.
	Listen for unusual sounds such as bypassing oil, mechanical grinding, aeration and cavitation (rapid popping sound in pump).	Locate and repair.
	Inspect components for abnormal local heat generation using hand contact or infrared temperature gun.	Locate and repair.
	Check for system leakage.	Refer to System Leakage Check.

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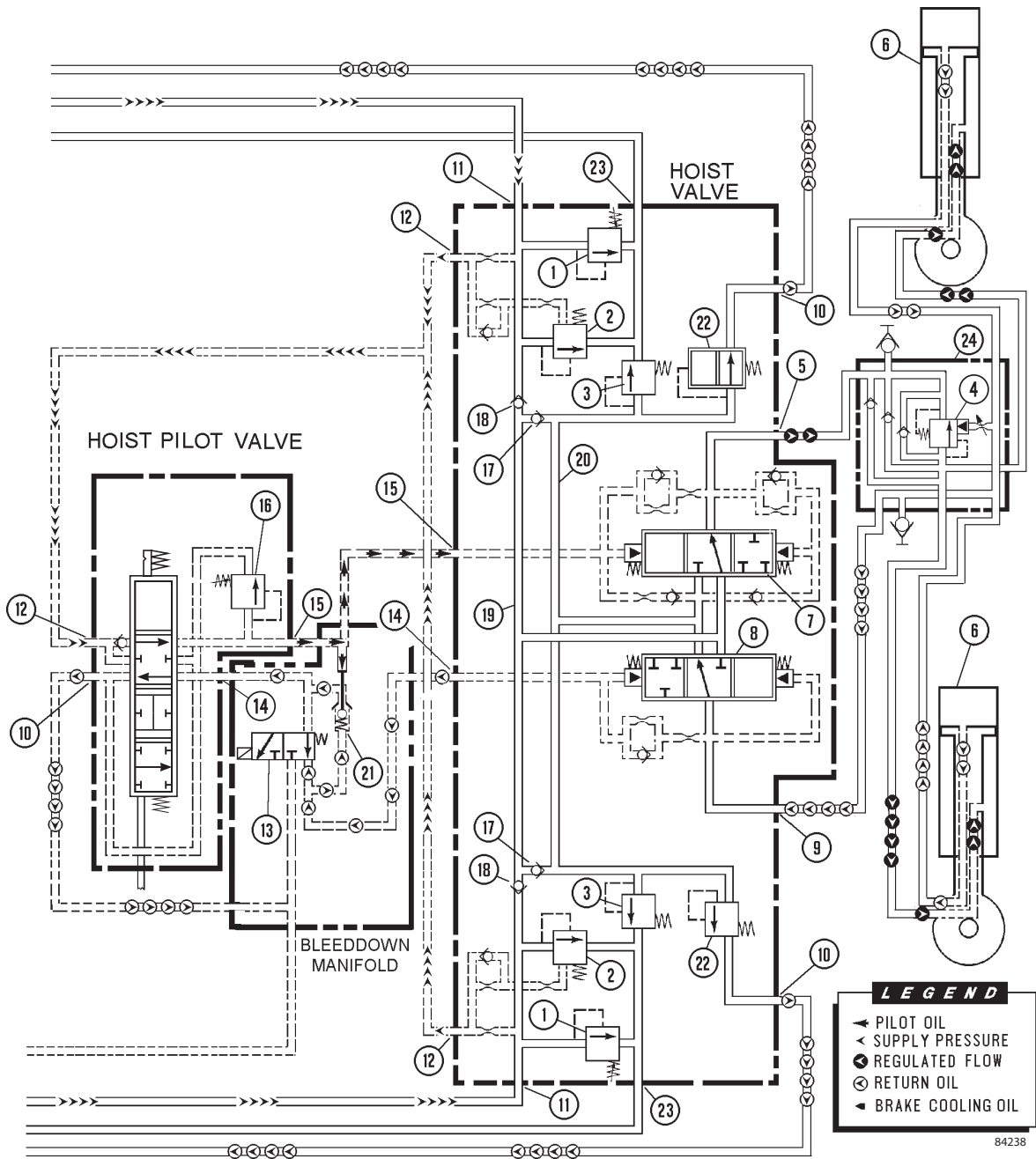
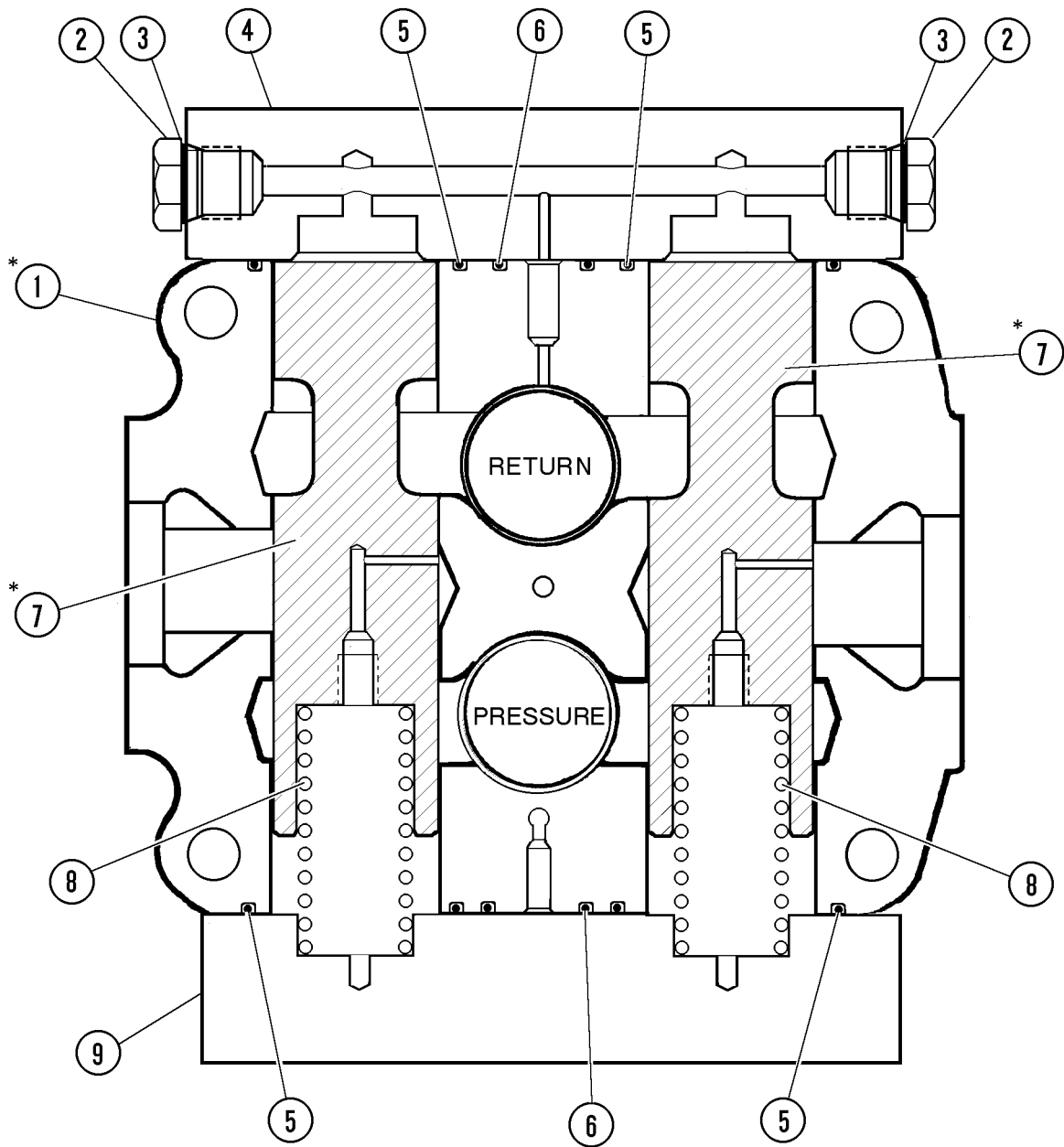


FIGURE 7-8. POWER DOWN POSITION

- | | | |
|---|---|---|
| 1. Hoist Relief Valve (2,500 psi) | 9. Head End Work Port | 17. Anti-void Check Valve |
| 2. Flow Control Valve | 10. Tank Return Port | 18. Load Check Valve |
| 3. Secondary Low Pressure Valve (250 psi) | 11. Supply Port | 19. High Pressure Passage |
| 4. Counterbalance Valve | 12. Pilot Supply Port | 20. Low Pressure Passage |
| 5. Rod End Work Port | 13. Hoist Limit Solenoid | 21. Pilot Operated Check Valve |
| 6. Hoist Cylinders | 14. Raise Pilot Port | 22. Primary Low Pressure Valve (26 psi) |
| 7. Rod End Spool | 15. Down Pilot Port | 23. Brake Cooling Circuit Port |
| 8. Head End Spool | 16. Power Down Relief Valve (1,500 psi) | 24. Overcenter Manifold |



* Not Serviceable

L080051

FIGURE 8-11. TANKS PORTS SPOOL SECTION ASSEMBLY

- | | | |
|------------------|----------------|----------------|
| 1. Spool Housing | 4. Spool Cover | 7. Spool |
| 2. Plug | 5. O-Ring | 8. Spring |
| 3. O-Ring | 6. O-Ring | 9. Spool Cover |

SECTION L9
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Initial start-up and flushing (steps 4 through 20)

4. On the bleddown manifold, use a jumper hose to connect ports QD Supply and QD Return. The hose must be rated to withstand 24 131 kPa (3500 psi) in the event it becomes fully pressurized. [1" dia. SAE 100R12 hose is rated for 27 579 kPa (4000 psi)]. During flushing, however, the pressure within the hose normally remains below 3447 kPa (500 psi).
5. Join piston end and rod end hoist cylinder hoses using the two supplied flushing blocks, PC3074, if not already assembled.
6. An optional bleddown hose assembly for manually bleeding down steering accumulators can be used. This hose/needle valve assembly is only for convenience and not required to perform this Checkout Procedure. It provides a way to manually bleed down both steering accumulators any time during the Checkout Procedure.

The hose material can be 1/4" dia. SAE 100R2, which has 34 474kPa (5000 psi) rating. A needle valve will allow simple opening/closing, and must be rated for 27 579 kPa (4000 psi) or above. The hose assembly can consist of two 1/4" dia. hoses connected to a needle valve. The opposite ends of the hoses can be connected as described below. The length of the hoses is not critical and can be selected to provide the best accessibility to the needle valve. Refer to Figure 10-1 and 10-2 for port locations.

- a. Ensure that both steering accumulators and both brake accumulators are bled down.
- b. Remove the plug from #10SAE boss port (1, Figure 10-1) located near bleddown manifold port TP3 (2). This port does not have an identification stamping. Port TP3 is shown for reference. This port has the same pressure as bleddown manifold ports Steering Supply Port and ACC2 Port (downstream steering accumulator), and will allow both steering accumulators to bleed down when the needle valve is opened.
- c. Connect one end of hose/needle valve assembly to #10 SAE boss port from step b.

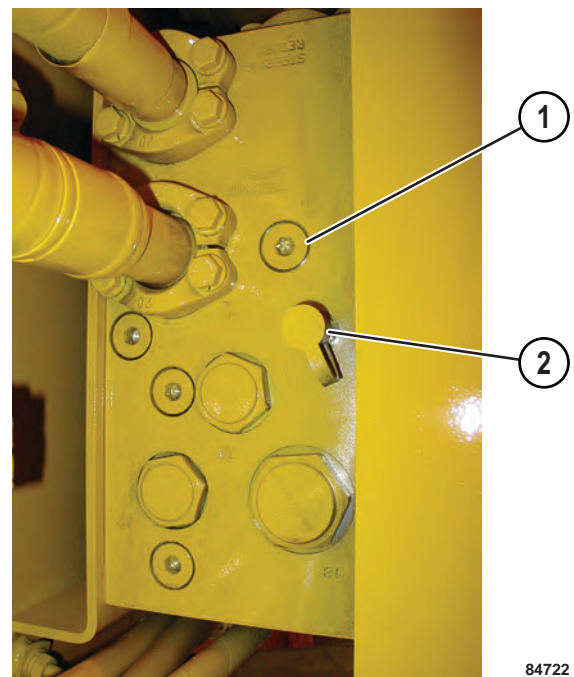


FIGURE 10-1. BLEDDOWN MANIFOLD

1. #10 SAE Boss Port
2. Port TP3

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INDEX**

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PAYLOAD METER IV SOFTWARE INSTALLATION

1. Insert a blank USB drive into the service computer. Format the USB drive to FAT32 by right-clicking on the correct drive letter and selecting "Format".
2. Copy the truck application software to the USB drive.
3. Remove the USB drive, then insert the USB drive into either USB 2.0 port (1, Figure 20-3) on the PLM IV communication module.
4. Turn the truck's engine start switch to ON.
5. Ensure that the service computer is set up to communicate with the PLM IV controller. If not, refer to "PAYLOAD METER IV SYSTEM CONFIGURATION".
6. On the home page, click on the "Program Flash" link. See Figure 20-5.
7. On the next web page, enter the password **Kac2300** in the field at the bottom of the page. Click on "Start Program" to begin installing the truck application code.

This process may take approximately 10 minutes to complete. **Do not turn off 24V truck power during this process.** The completion percentage will be shown and periodically updated on the web page as the installation progresses.

8. When the software installation is complete, payload meter will automatically restart.

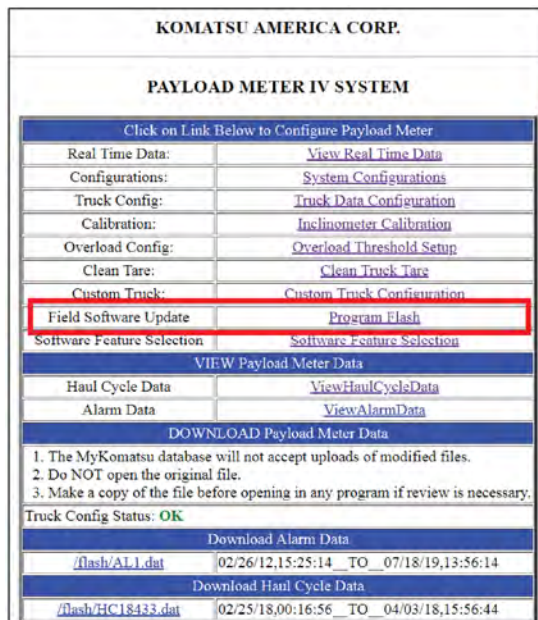


FIGURE 20-5. PLM IV HOME PAGE

INCLINOMETER CALIBRATION AND CLEAN TRUCK TARE

9. After installing or updating the PLM IV software, follow the instruction on the PLM IV web server to perform inclinometer calibration and clean truck tare. This needs to be performed to ensure accurate payload estimation. Also, confirm the overload threshold value configuration after the installation/update has completed.

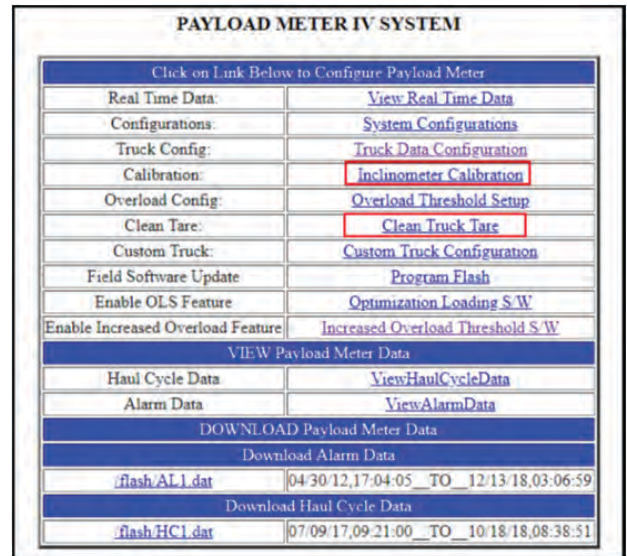


FIGURE 30-6. INCLINOMETER CALIBRATION AND CLEAN TRUCK TARE SELECTION

LED Monitor Lights

After engine startup, allow the pumping unit to run for 5 minutes before operating the truck. Green LED (3, Figure 31-3) should remain solid and red LED (4) should be off. This verifies that the system is working properly, pumps 1 and 2 are synchronized and pumping oil, and the engine oil level is correct.

If the green LED is flashing, the pump is receiving air from the engine oil pan (the oil level is below the withdrawal point of the pickup tube). The reserve oil pump should return oil back to the engine oil pan, continuously adjusting the oil level until air is no longer drawn by the reserve oil pump.

Over a period of time, both signals (solid / flashing LED lights) should be observed. This verifies that the system is operating properly and the engine oil level is correct.

A solid red LED signal indicates that the pump is not able to return oil to the engine oil pan because the pump is not working properly, the line is frozen, or the reserve tank is empty. Shut down the engine and allow adequate time for the oil to drain into the engine oil pan. Check the oil level. It should be between the normal marks, not above the high static mark.

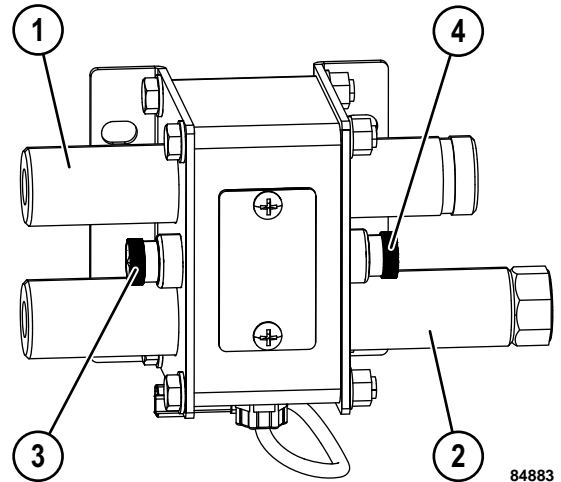


FIGURE 31-3. PUMPING UNIT

- | | |
|-----------|--------------|
| 1. Pump 1 | 3. Green LED |
| 2. Pump 2 | 4. Red LED |

Table 1: LED Monitor Light Functions		
Pumps, LED Action	Green LED	Red LED
Unit is operating with no oil pumping through pumps 1 or 2. <i>(Low oil level in engine oil pan and reserve tank.)</i>	Flashing	Flashing
Unit is running oil through pump 1. <i>(Withdrawing oil from engine oil pan. Reserve tank is low on oil.)</i>	Solid	Flashing
Pump 1 is receiving air from the engine oil pan. Pump 2 is pumping oil from the reserve tank to the engine oil pan. <i>(Pump is returning oil from reserve tank to engine oil pan. Low oil level in reserve tank.)</i>	Flashing	Off
Unit is running oil through pumps 1 and 2 simultaneously. <i>(Oil level is correct. Normal operation.)</i>	Solid	Off

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).

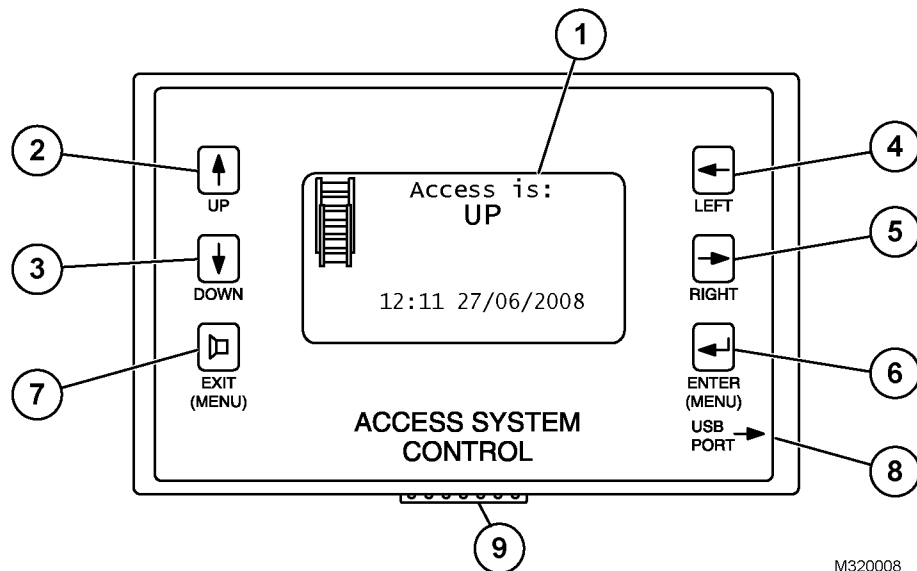


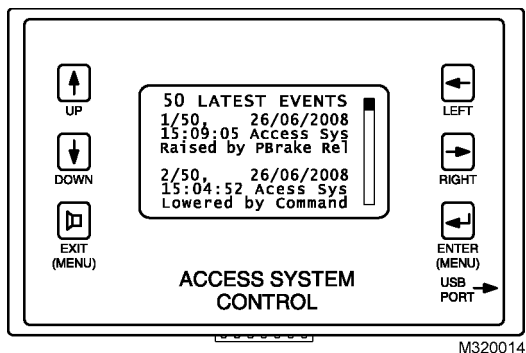
FIGURE 32-5. IN-CAB CONTROL PANEL (FRONT VIEW)

- | | | |
|-------------------|-------------------|------------------------|
| 1. Display Screen | 4. [LEFT] Button | 7. [EXIT] Button |
| 2. [UP] Button | 5. [RIGHT] Button | 8. USB Port |
| 3. [DOWN] Button | 6. [ENTER] Button | 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.



M320014

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

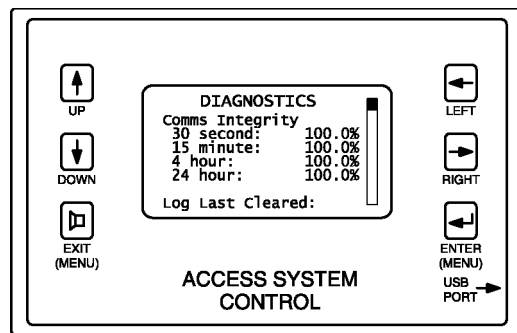
Minimum Charge Time – 1.5 Hours

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.



M320015

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:

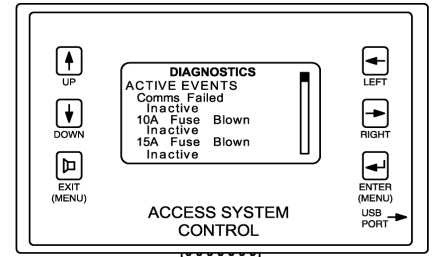
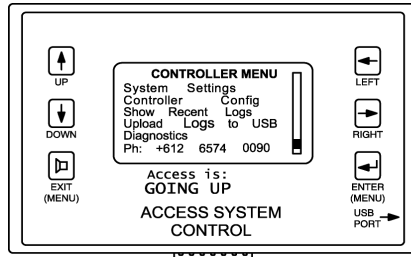
- Poor/degraded wiring
- Substantial electrical interference
- An internal fault with the controller hardware

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.



M320047

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

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

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

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

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

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)

FIGURE 32-18. Control Panel Menu Structure - Diagnostics

Error Code Display

Error codes will be displayed in the lower left part of the monitor display. If there are many error codes, use the UP arrow and DOWN arrow on the monitor panel to scroll through the list of error codes. For troubleshooting error codes see Table 26

KomVision® Troubleshooting.

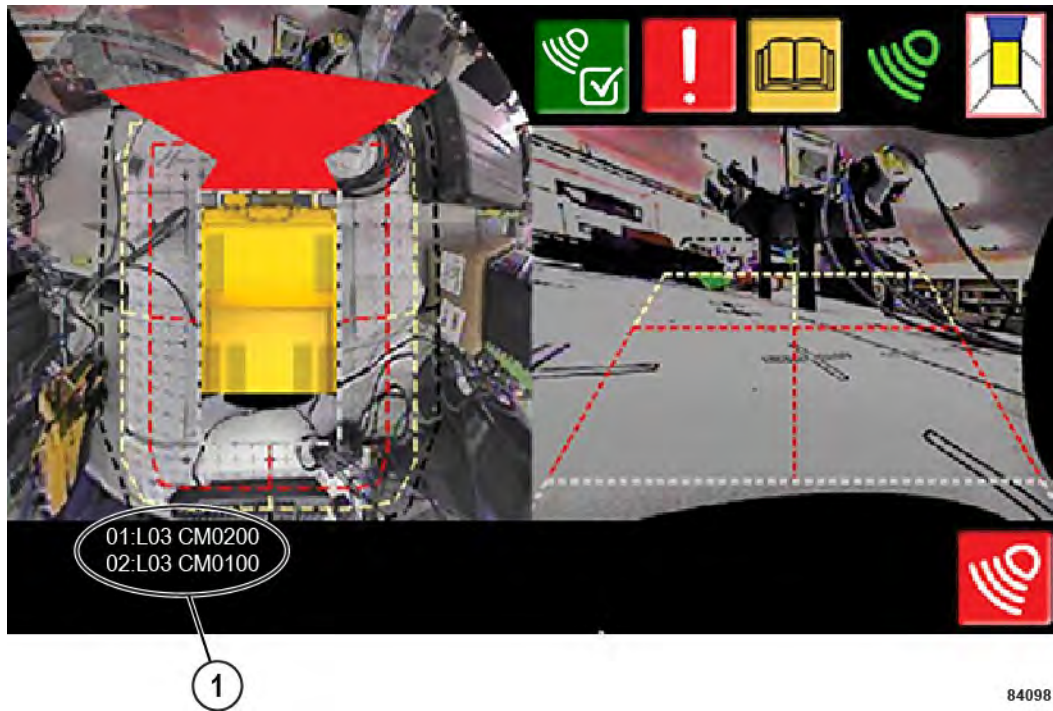
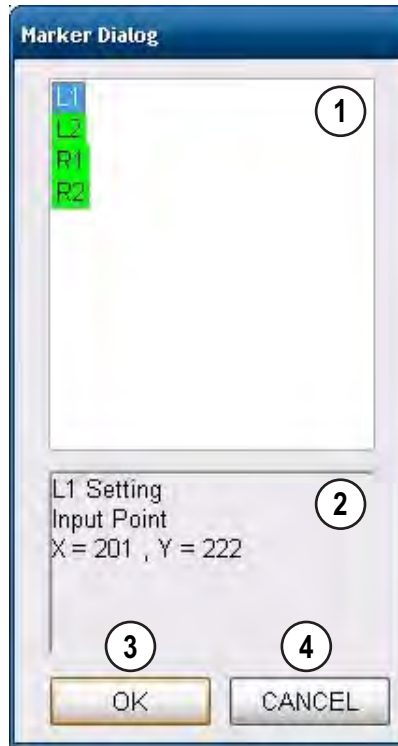


FIGURE 33-10. ERROR CODE DISPLAY

1. Error Code Display



85216

FIGURE 5-43. MARKER POSITION REGISTRATION

Table 9: MARKER POSITION REGISTRATION DESCRIPTION		
No.	Item	Function
1	Marker position select list	The center position of the cross on an expansion picture is set up as selectable markers. A set up marker is smeared away and displayed.
2	Status display text	The state of the marker selected by a list is displayed. Calculate Point: The calculated coordinates position is displayed. Input Point: An actual coordinates position is displayed.
3	OK	Opts for a marker setup.
4	CANCEL	Close the screen

RADAR DETAIL

Integration

The detection data of the radar system is displayed.

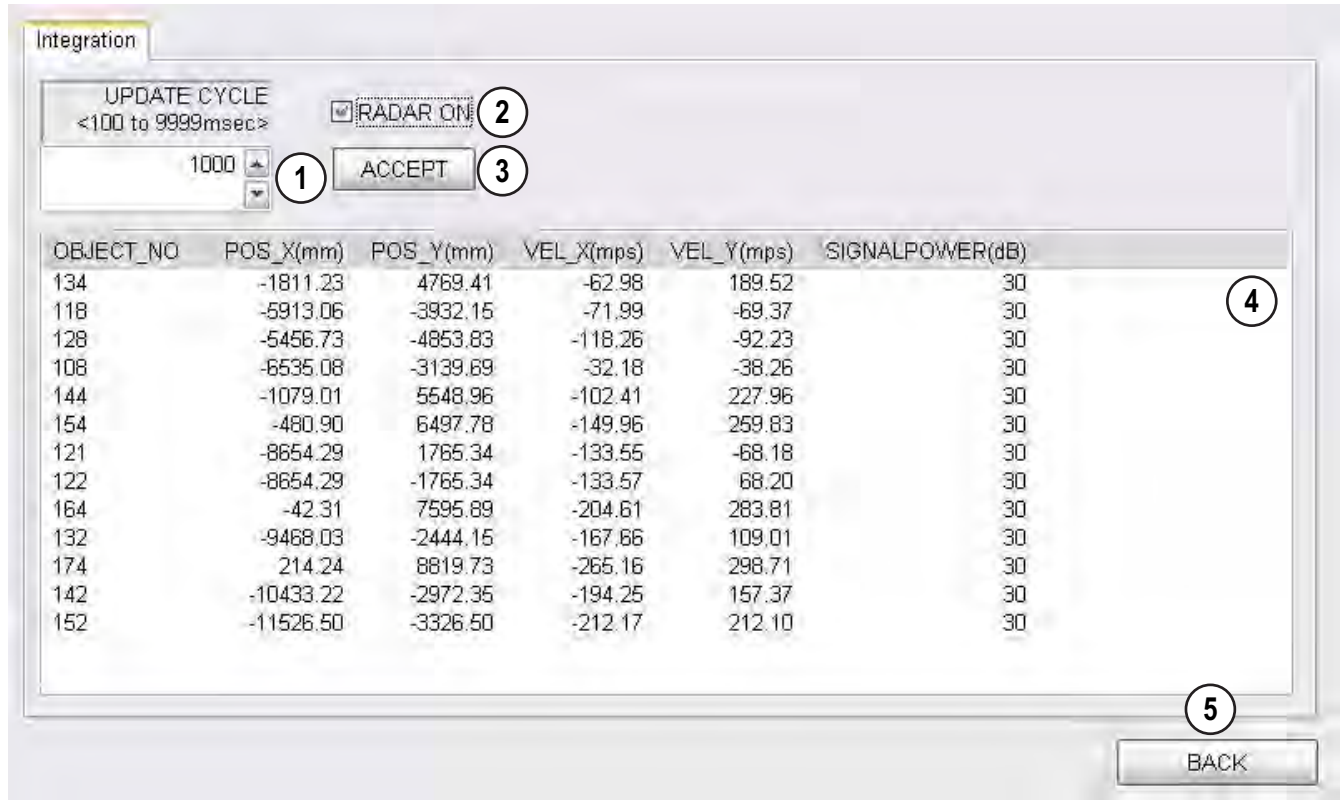


FIGURE 5-56. INTEGRATION SCREEN

85229

No.	Item	Function
1	DISPLAY UPDATE CYCLE	The updating cycle of obstacle detection data
2	RADAR (ON-OFF)	Radar ON/OFF
3	ACCEPT BUTTON	UPDATE CYCLE is updated.
4	DETECTION OBJECT LIST	Detection object information display list
5	BACK	Moves to a maintenance screen.

System configuration

To redo the 6 camera calibration again, choose “END OLD SETTING.” To perform the 6 camera calibration again, use the manual 6 camera calibration.



FIGURE 5-76. END DIALOG SCREEN 85252

Manual 6 Camera Calibration

The Manual 6 camera calibration is used when the automatic calibration does not complete successfully, or when it is being recommended by service. Use the following steps to when executing the manual 6 Camera calibration.

1. Simultaneously push the Monitor Display Mode Switch, Guide Line Display Switch, and Lower Body Display Switch for three seconds or more, and move to password mode.
2. Enter a password and move to a maintenance screen.
3. Select 6 CAMERA CALIBRATION.

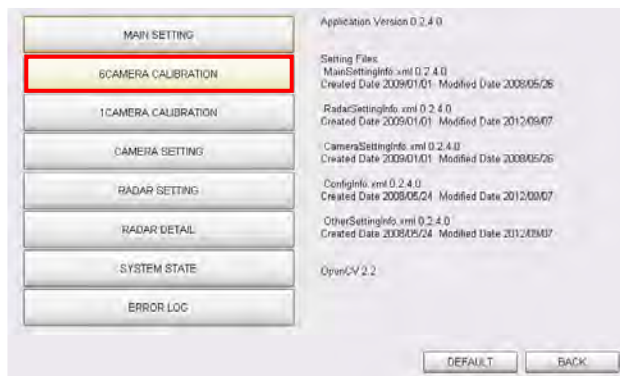


FIGURE 5-77. 6 CAMERA CALIBRATION 85245

4. When the select screen for 6 camera calibrations is displayed, choose MANUAL. A 6 camera calibration screen will display.

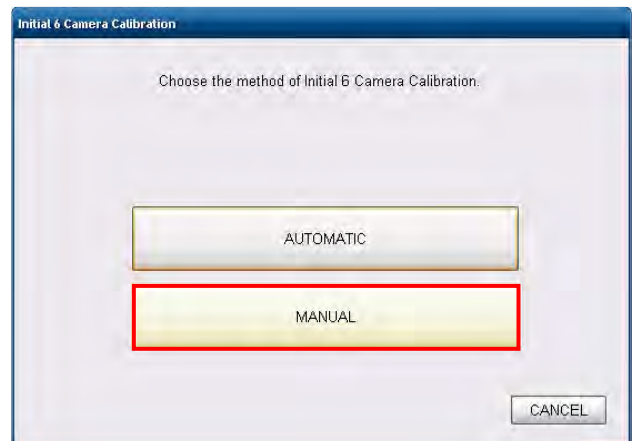


FIGURE 5-78. INITIAL 6 CAMERA CALIBRATION 85253

5. After the Configuration screen for the 6 camera calibration is displayed, choose the number of the calibration marker for each camera.

NOTE: Recommend using 4 (Default value).

The calibration sheet of the service tool corresponds only to 4.

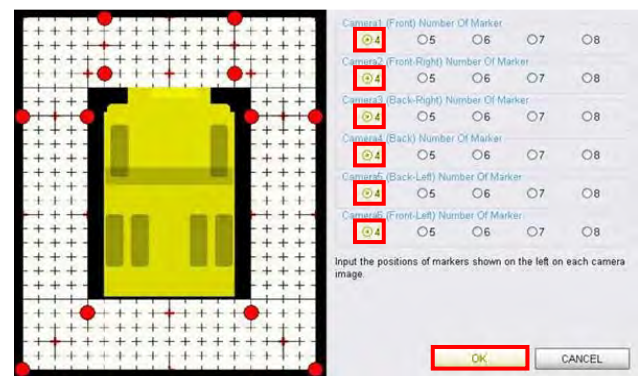
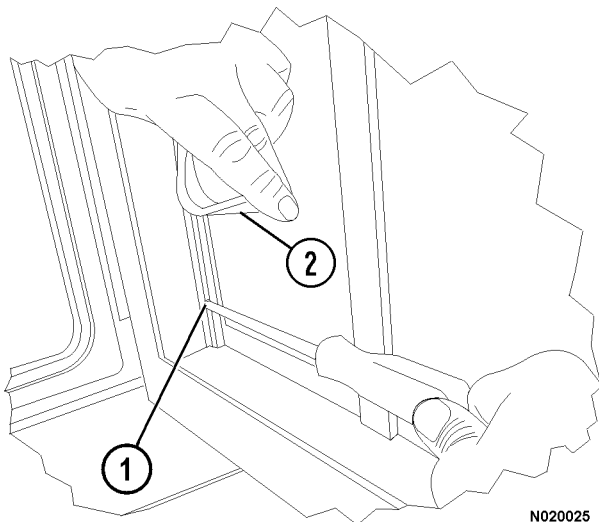


FIGURE 5-79. CALIBRATION SHEET 85254

Table 26: KomVision® TROUBLESHOOTING

KAC CODE	SUB CODE	FAULT PART	PHENOMENON NAME	ACTION	KLTD CODE
CM0700	-	UWB Radar 7	ERR_SENS_TEMP_HIG H ?107 degrees or more?	Exchange the Radar7	DQ17NR
CM0701	RC04	UWB Radar 7	ERR_SENS_VOLTAGE_I NPUT	Exchange the Radar7	DQ17MA
CM0701	RC01	UWB Radar 7	ERR_SENS_SENSITIVIT Y_LOW_EXTERNAL	Exchange the Radar7	DQ17MA
CM0701	RC02	UWB Radar 7	ERR_SENS_BLOCKAG E	Please check whether the radar is interrupted by something. If there is nothing that is interrupted, Exchange the Radar7	DQ17MA
CM0701	RC03	UWB Radar 7	ERR_SENS_SENSITIVIT Y_LOW_EXTERNAL_NO _VEL	Exchange the Radar7	DQ17MA
CM0702	-	UWB Radar 7	HARNESS_FAULT	Exchange the Radar7	DQ17KQ
CM0703	RA01	UWB Radar 7	ERR_SENS_SENSITIVIT Y_LOW_INTERNAL	Exchange the Radar7	DQ17KT
CM0703	RA02	UWB Radar 7	ERR_SENS_HARDWAR E_FAILURE_INIT	Exchange the Radar7	DQ17KT
CM0703	RA03	UWB Radar 7	ERR_SENS_CALIBRATI ON_FAILURE	Exchange the Radar7	DQ17KT
CM0703	RA04	UWB Radar 7	ERR_SENS_HARDWAR E_FAILURE_ONLINE	Exchange the Radar7	DQ17KT
CM0704	RB01	UWB Radar 7	COMMUNICATION_ERR OR	Please check whether there are any abnormalities in a controller. If there are no abnormalities in a controller, Exchange the Radar7	DQ17KR
CM0704	RB02	UWB Radar 7	ERR_SENS_CAN_MES SAGE_MISSING_OR_C ONTENT_INVALID	Exchange the Radar7	DQ17KR
CM0704	RB03	UWB Radar 7	ERR_SENS_CAN_SYNC _TIMING_INVALID	Exchange the Radar7	DQ17KR
CM0705	-	UWB Radar 7	VERSION FAULT	Exchange the Radar7 It may be caused by disconnection when the disconnection error has occurred simultaneously. Please cancel a disconnection error first.	DQ17KM
CM0800	-	UWB Radar 8	ERR_SENS_TEMP_HIG H ?107 degrees or more?	Exchange the Radar8	DQ18NR
CM0801	RC04	UWB Radar 8	ERR_SENS_VOLTAGE_I NPUT	Exchange the Radar8	DQ18MA
CM0801	RC01	UWB Radar 8	ERR_SENS_SENSITIVIT Y_LOW_EXTERNAL	Exchange the Radar8	DQ18MA
CM0801	RC02	UWB Radar 8	ERR_SENS_BLOCKAG E	Please check whether the radar is interrupted by something. If there is nothing that is interrupted, Exchange the Radar8	DQ18MA
CM0801	RC03	UWB Radar 8	ERR_SENS_SENSITIVIT Y_LOW_EXTERNAL_NO _VEL	Exchange the Radar8	DQ18MA
CM0802	-	UWB Radar 8	HARNESS_FAULT	Exchange the Radar8	DQ18KQ
CM0803	RA01	UWB Radar 8	ERR_SENS_SENSITIVIT Y_LOW_INTERNAL	Exchange the Radar8	DQ18KT



N020025

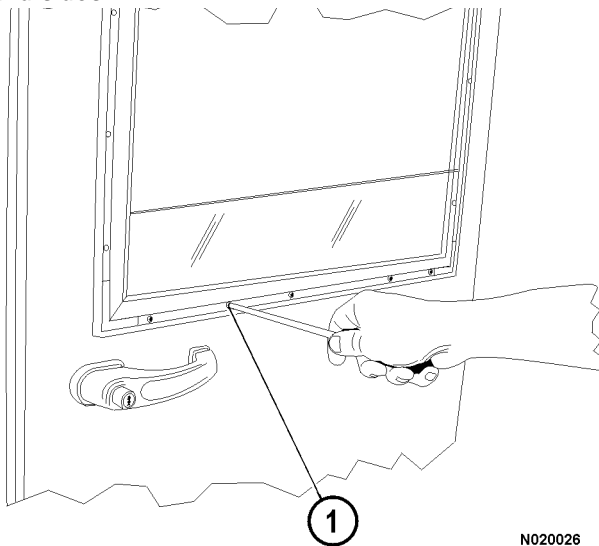
FIGURE 2-10.

1. Screws 2. Rubber Felt Insert

9. Remove the screw at the lower end of the window channels. It is necessary to pull rubber felt insert (2, Figure 2-10) out of the channel to be able to remove the screws.

10. Remove the trim material covering screws (1, Figure 2-11) that are holding the window frame to the door. Remove the screws.

NOTE: The screws along the bottom of the window frame may be shorter than the screws along the top and sides.



N020026

FIGURE 2-11.

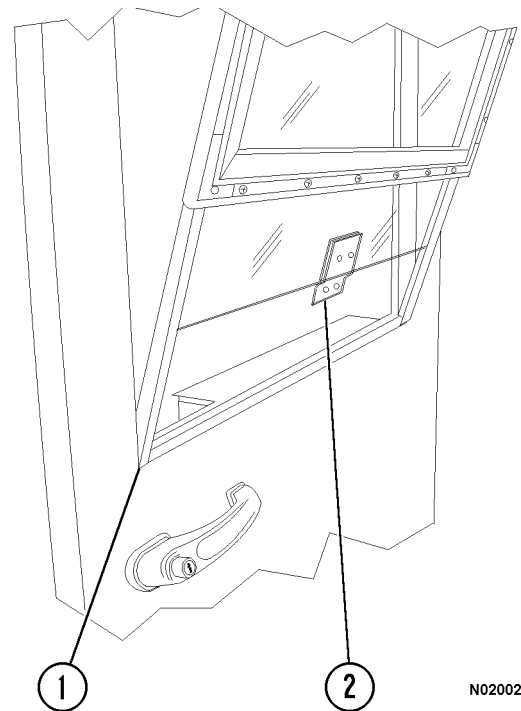
1. Screws

11. Lift the door glass up in frame (1, Figure 2-12) so that it is near the top. While holding the glass in place, tilt the frame out at the top. Lift the frame and glass straight up and out of the door.



Bracket (2, Figure 2-12) at bottom of glass must clear the door frame if still on the glass.

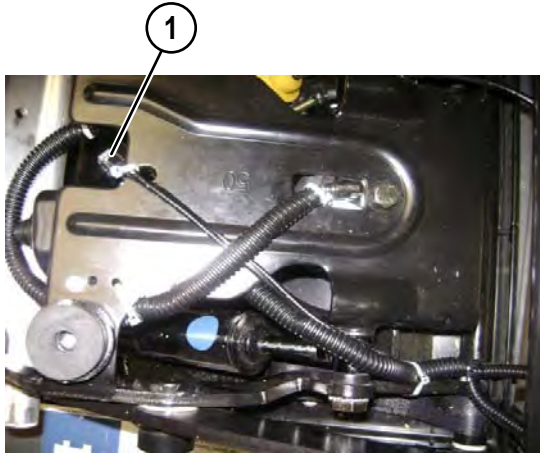
12. Move the window glass and frame to a work area where the glass can be removed. Slide the glass down and out of the window channels.



N020027

FIGURE 2-12.

1. Window Frame 2. Window Bracket



72644

FIGURE 3-11.

1. Harness Connector

9. Disconnect wire harness connector (1, Figure 3-11) from the compressor.

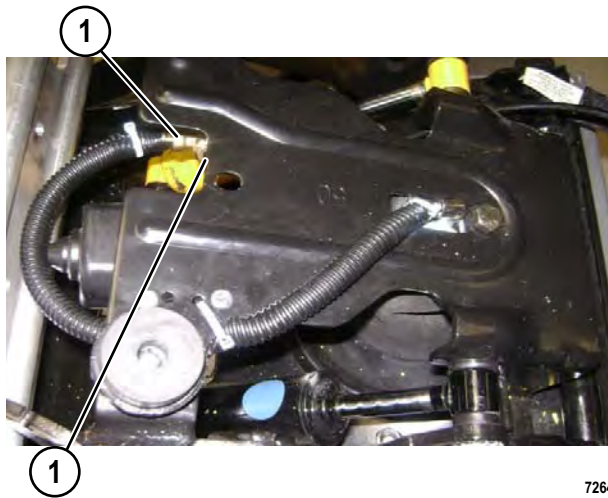


72646

FIGURE 3-13.

1. Capscrew

11. Remove two compressor mounting capscrews (1, Figure 3-13).

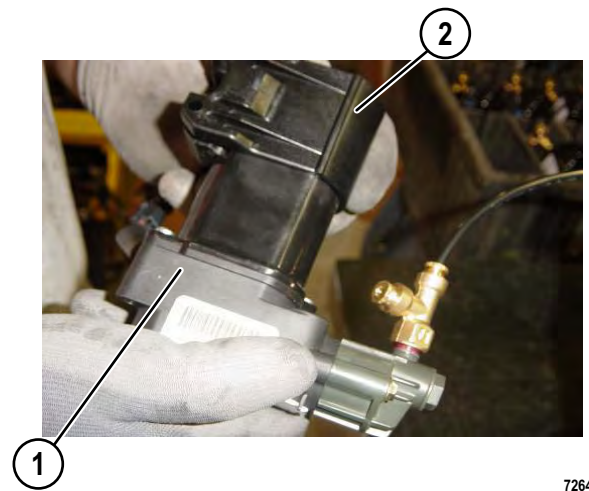


72645

FIGURE 3-12.

1. Air Hose

10. Disconnect two air hoses (1, Figure 3-12) from the compressor fitting by pushing in on the fitting collet and pulling out on the air line.



72647

FIGURE 3-14.

1. Compressor 2. Clamp

12. Remove compressor (1, Figure 3-14) and clamp (2) from the seat suspension assembly.

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SERVICE TOOLS AND EQUIPMENT

Recovery/Recycle Station

Whenever refrigerant must be removed from the system, a dual purpose station, as shown in Figure 4-6, performs both recovery and recycle procedures which follows the new guidelines for handling used refrigerant. The recovered refrigerant is recycled to reduce contaminants, and can then be reused in the same machine or fleet.

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

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

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

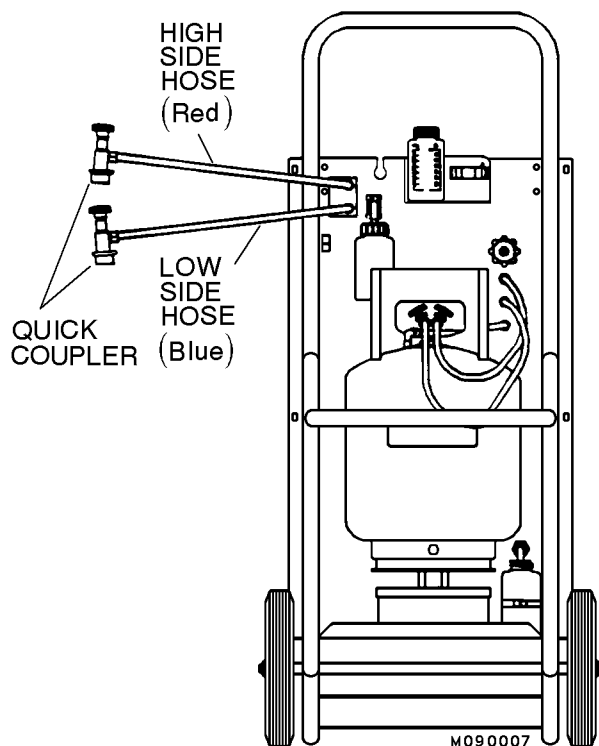


FIGURE 4-6. RECOVERY/RECYCLE STATION



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

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

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

Leak Detector

The electronic leak detector (Figure 4-7) is very accurate and safe. It is a small hand-held device with a flexible probe used to seek refrigerant leaks. A buzzer, alarm or light will announce the presence of even the smallest leak.

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

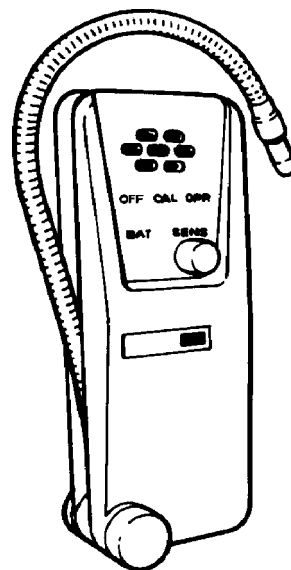


FIGURE 4-7. TYPICAL ELECTRONIC LEAK DETECTOR

TROUBLESHOOTING

Preliminary Checks

If the system indicates insufficient cooling, or no cooling, the following points should be checked before proceeding with the system diagnosis procedures.

NOTE: If equipped, ensure that the rest switch in the cab is ON. Place the GF cutout switch in the CUTOOUT position.

Some simple, but effective checks can be performed to help determine the cause of poor system performance. Check the following to ensure proper system operation.

- Compressor belt - Must be tight and aligned.
- Compressor clutch - The clutch must engage. If it does not, check fuses, wiring and switches.
- Oil leaks - Inspect all connection or components for refrigeration oil leaks (especially in the area of the compressor shaft). A leak indicates a refrigerant leak.
- Electrical check - Check all wires and connections for possible open circuits or shorts. Check all system fuses.
- Cooling system - Check for correct cooling system operation. Inspect the radiator hoses, heater hoses, clamps, belts, water pump, thermostat and radiator for condition or proper operation.
- Radiator shutters - Inspect for correct operation and controls, if equipped.
- Fan and shroud - Check for proper operation of fan clutch. Check installation of fan and shroud.
- Heater/water valve - Check for malfunction or leaking. With the heat switch set to COLD, the heater hoses should be cool.

- System ducts and doors - Check the ducts and doors for proper function.
- Refrigerant charge - Make sure system is properly charged with the correct amount of refrigerant.
- Cab filters - Ensure the outside air filter and inside recirculation filter are clean and free of restriction.
- Condenser - Check the condenser for debris and clogging. Air must be able to flow freely through the condenser.
- Evaporator - Check the evaporator for debris and clogging. Air must be able to flow freely through the condenser.

Diagnosis Of Gauge Readings And System Performance

Successfully servicing an air conditioning system, beyond the basic procedures outlined in the previous section, requires additional knowledge of system testing and diagnosis.

A good working knowledge of the manifold gauge set is required to correctly test and diagnose an air conditioning system. An accurate testing sequence is usually the quickest way to diagnose an internal problem. When correctly done, diagnosis becomes an accurate procedure rather than guesswork.

The following Troubleshooting Chart lists typical malfunctions encountered in air conditioning systems. Indications and or problems may differ from one system to the next. Read all applicable situations, service procedures, and explanations to gain a full understanding of the system malfunction. Refer to information listed under "Suggested Corrective Action" for service procedures.

Installation

1. Insert cap screw (10, Figure 5-2) with lock washers (11) and flat washers (5) through brackets (8) and (9), then through the steering column flange. Add second flat washer (5) and nut (13) to each cap screw to hold the parts together. Tighten the nuts securely.
2. Slide the entire assembly down the tapered blocks until brackets (8) and (9) contact the mounting surface in the cab. Install cap screws (4) and (12) with flat washers (5) and lock washers (6). Tighten cap screws (4) only.
3. Inspect brackets (8) and (9) to see whether they contact the mounting surface evenly and are flat and inline with the surface. If they are, tighten cap screws (12). If brackets are not quite parallel, install flat washers as needed between the brackets and mounting surface to eliminate any gaps. Tighten cap screws (12) to the standard torque.
4. After cap screws (4) and (12) are tightened to the standard torque, remove nuts (13) and flat washers (5) that were holding the steering column to the two brackets. Do not remove cap screws (10) from the brackets.
5. Lubricate the male splines on the end of the steering column shaft.

Note: There is no lower end bearing in this steering column assembly. Therefore, the male end of the shaft will have to be guided into the mating female part of the steering control unit.

6. Without removing cap screws (10) from the holes, move steering control unit (7) into place and start each of the cap screws.
7. Tighten four cap screws (10) to the standard torque.
8. Ensure that the steering wheel turns properly without binding and that the steering wheel returns to its centered position after rotating 1/4 turn to the left and to the right.
9. If disconnected, reconnect the hoses to the steering control unit.
10. Connect the steering column wire harness to the harness in the cab.
11. Install access cover (15) and trim cover (14).

STEERING WHEEL

Removal

1. Turn off the battery disconnect switch to remove battery power from the horn circuit.
2. Use a pocket screwdriver to pry horn button (4, Figure 5-3) from steering wheel (1).
3. Disconnect horn wire (3) and set the horn button aside.
4. Remove nut (2).
5. Pull the steering wheel from the column. If the steering wheel will not slide off the shaft it may be necessary to install a puller into the tapped holes (5/16" - 24NF) in the steering wheel.

Installation

1. Place steering wheel (1, Figure 5-3) into position on the steering column shaft while guiding horn wire (3) through the access hole in the steering wheel. Align the serrations and push the steering wheel onto the shaft.
2. Install nut (2). Add Loctite® Threadlocker Blue 242 to the nut. Using a 1 1/4 inch socket and torque wrench, tighten the nut to **81 ± 7 N·m (60 ± 5 ft lb)**.
3. Connect horn wire (3) to horn button (4).
4. Install the horn button onto the steering wheel. Turn on the battery disconnect switch and verify that the horn functions properly.



FIGURE 5-3. STEERING WHEEL RETAINER NUT

- | | |
|-------------------|----------------|
| 1. Steering Wheel | 3. Horn Wire |
| 2. Nut | 4. Horn Button |

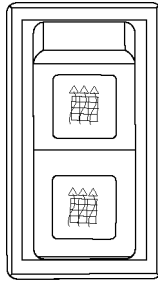
Engine Warm Up Switch

NOTE: This switch will only be functional if this feature is activated.

Engine warm up switch (12, Figure 5-9) is a rocker switch. When in the ON position, this feature is used to keep the engine warm in cold conditions because it puts a small amount of load on the engine.

This energy is created by passing a load through one bank of the grid resistors in the retarding grid.

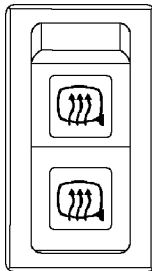
This feature can also be used in cold climates to warm up, or to maintain heat in the engine coolant while the truck is parked.



Heated Mirror Switch

NOTE: This switch will only be functional if this feature is activated.

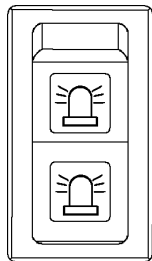
Heated mirror switch (13, Figure 5-9) controls the operation of the heated mirrors.



Rotating Beacon Light Switch (Optional)

NOTE: This switch will only be present in the lower RH dash module if the truck is equipped with this optional feature.

The rotating beacon switch controls the operation of the rotating beacon.



Key Switch



Starting

Key switch (14, Figure 5-9) is a four-position switch (ACC, OFF, RUN, START). The ACC position is not currently used.

When the switch is rotated one position clockwise, it is in the RUN position and all electrical circuits except START are activated.

1. With the directional control lever in PARK, rotate key switch fully clockwise to the START position, and hold this position until the engine starts. The START position is spring-loaded to return to RUN when the key is released. If the engine is equipped with a prelube system, a noticeable delay will occur before engine cranking begins.
2. After engine has started, place rest switch (4, Figure 5-9) in the OFF position, which will deactivate the rest mode of operation. Refer to the discussion of rest switch later in this section.

NOTE: The electric cranking motors have a 30 second time limit. If the 30 second limit is reached, cranking will be prohibited for two minutes. After two minutes, cranking will be allowed. If the 30 second limit is reached seven consecutive times, the key switch must be turned to the OFF position. This will allow the interface module to power down and reset, which requires seven minutes to complete.

Configuring the Bullet wireless radio

1. Download the KWB configuration files (.zip file) and the latest WiFi setup instructions from the Komatsu extranet to the service computer. Extract the files onto the service computer.
2. Connect POE adapter (2, Figure 5-16) to Bullet wireless radio (1) by using a CAT 5E network cable. Ensure that the cable is in the POE port as shown.
3. Connect POE adapter (2) to service computer (3) by using another CAT 5E network cable. Ensure that the cable is in the LAN port as shown.
4. Change the service computer's wired LAN settings to the following:
IP address: **192.168.1.100**
Net mask: **255.255.0.0**
5. Open an internet browser (Google Chrome™ is recommended), type **192.168.1.20** into the address bar, then press the Enter key.
6. Proceed to the website regardless of any security messages.

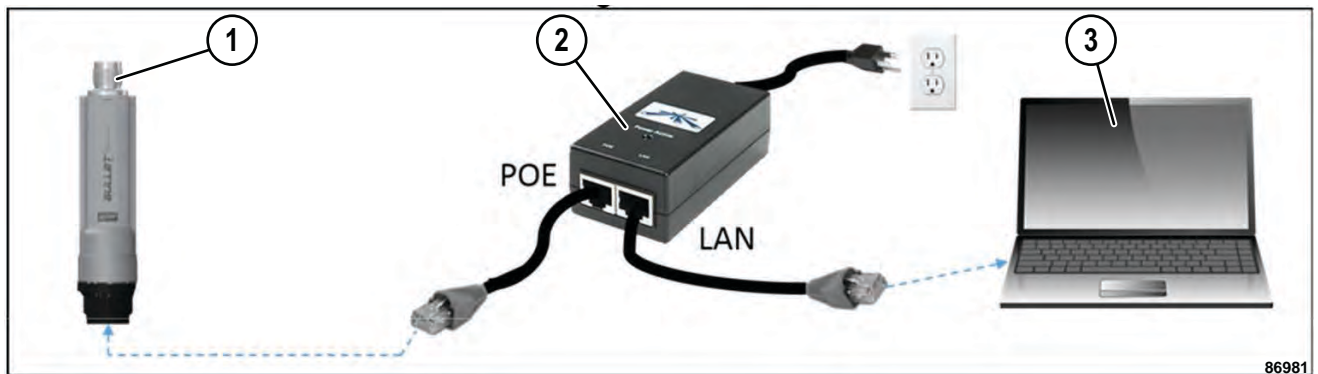


FIGURE 5-16. KWB POE ADAPTER CONNECTIONS

1. Bullet Wireless Radio
2. Power over Ethernet (POE) Adapter
3. Service Computer

PERIODIC MAINTENANCE

GENERAL

Recommended preventive maintenance will contribute to the long life and dependability of the truck and its components. The use of proper lubricants and the performance of checks and adjustments at the recommended intervals is most important.

Lubrication requirements are referenced to the lube key found in the Lubrication Chart (page 2-7). For detailed service requirements for specific components, refer to the shop manual section for that component (for example, Section H for suspensions, Section L for hydraulic system, etc).

Refer to the manufacturer's service manual when servicing any components of the General Electric propulsion system.

Refer to engine manufacturer's service manual when servicing the engine or any of its components.

The service intervals presented here are in hours of operation. **These intervals are recommended in place of an oil analysis program which may determine different intervals.** However, if the truck is being operated under extreme conditions, some or all of the intervals may need to be shortened and the service should be performed more frequently.

The 930E truck is equipped with a Lincoln Automatic Lubrication System. The initial setup for this system provides for nominal amounts of lubricant to be delivered to each serviced point. The lubrication injectors can be adjusted to vary the amount of lubricant delivered. In addition, the timer for lubrication intervals is normally adjustable. For adjustments to these devices, refer to Automatic Lubrication System.

SERVICE CAPACITIES

Component/System	Liters	U.S. Gallons
Crankcase (including 4 oil filters) Komatsu SSDA16V160 Engine	280	74
Cooling System Komatsu SSDA16V160 Engine	594	157
Hydraulic System Refer to "Hydraulic Tank Service"	1325	350
Wheel Motors (each side)	95	25
Fuel Tank (Diesel fuel only)	4542	1200

HYDRAULIC TANK SERVICE

There are two sight gauges (1, Figure 2-1) on the side of the hydraulic tank. With the engine stopped, key switch OFF, hydraulic system depressurized, and body down, the oil level should be visible in the center of the top sight gauge. If the oil level is not visible in the center of the top sight gauge, follow the instructions below for adding oil.

Adding Oil

NOTE: Keep the system open to the atmosphere only as long as absolutely necessary to lessen chances of system contamination.

Service the tank with clean Type C-4 hydraulic oil only. All oil being put into the hydraulic tank should be filtered through 3 micron filters.

1. Make sure that the engine is stopped, key switch is OFF, hydraulic system is depressurized, and body is down
2. Remove fill cap (2) and add hydraulic oil until the oil level is visible in the center of the top sight gauge.
3. Install the fill cap.
4. Start the engine. Raise and lower the dump body three times.
5. Check the hydraulic oil level again with the engine stopped, key switch OFF, hydraulic system depressurized, and body down.
6. Repeat Steps 1 - 5 until the oil level is maintained in the center of the top sight gauge.

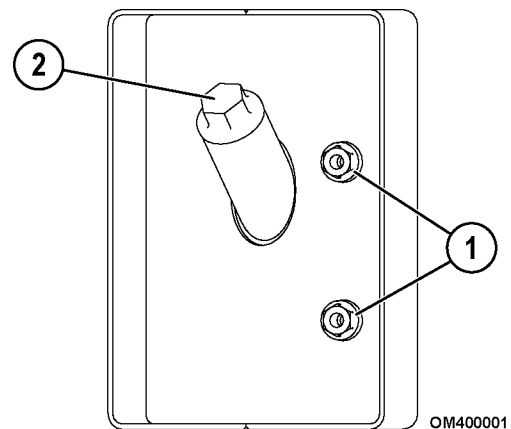


FIGURE 2-1. HYDRAULIC TANK SERVICE

1. Sight Gauges

2. Fill Cap

4000 HOUR LUBRICATION AND MAINTENANCE CHECKS

Maintenance for every 250, 500, and 1000 hour Lubrication and Maintenance Checks must also be performed at this time.

NOTE: "Lube Key" references are to the **Lubrication Chart** on page P2-7.

Truck Serial Number _____ Site Unit Number _____ Date _____ Hourmeter _____ Name of Service Technician _____				
	TASK	COMMENTS	CHECKED	INITIALS
1.	RESERVE OIL TANK - Remove the oil strainer screen and wash thoroughly in high flash point solvent until all accumulated sludge has been removed. Blow the screen dry with compressed air or leave in a well ventilated place until all the solvent has evaporated. Inspect the screen for damage and replace if necessary. Re-install the screen.			

5000 HOUR LUBRICATION AND MAINTENANCE CHECKS

Maintenance for every 250, 500, 1000, and 4000 hour Lubrication and Maintenance Checks must also be performed at this time.

NOTE: "Lube Key" references are to the **Lubrication Chart** on page P2-7.

Truck Serial Number _____ Site Unit Number _____ Date _____ Hourmeter _____ Name of Service Technician _____				
	TASK	COMMENTS	CHECKED	INITIALS
1.	AIR CLEANERS - a. Visually inspect the Vacuator™ valve to make sure it is not inverted or damaged. b. Clean the Donaclone tubes in the precleaner section of the air filter. Use low pressure cold water or low pressure air to clean the tubes. Refer to Section C5, Air Cleaners.			
2.	STEERING WHEEL RETAINER NUT - Check that the torque on the steering wheel retainer nut is 81 ± 7 N•m (60 ± 5 ft lb) . Tighten if necessary. If tightening is necessary, add Loctite® Threadlocker Blue 242 to the nut, then use a torque wrench to tighten the nut to 81 ± 7 N•m (60 ± 5 ft lb) .			

System Priming Procedure

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

To prime the main supply lines, perform the following:

1. Remove injector manifold plug (5, Figure 3-8) from the injector manifold. Always start with the injector manifold that is closest to the pump. The last grease line to be purged should be the main grease line to the rear axle (longest grease line).
2. Disconnect main supply line (2, Figure 3-8). Connect an external grease supply to the main supply line.
3. Pump grease into main supply line (2) until grease appears at the injector manifold plug.
4. Reinstall the injector manifold plug. Repeat for the remaining injector groups.

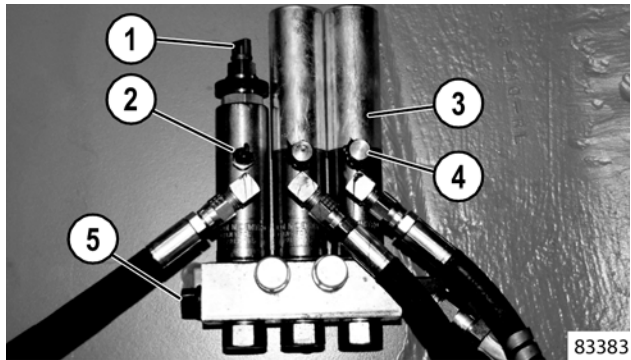


FIGURE 3-8. INJECTOR MANIFOLD

- | | |
|-------------------------|-----------------------------|
| 1. Injector Indicator | 4. Injector Grease Zerk Cap |
| 2. Injector Grease Zerk | |
| 3. Injector Cover | 5. Injector Manifold Plug |

After all main supply lines are purged of air, the injector circuits must now be primed.

To prime the secondary supply lines, perform the following:

1. If necessary, disconnect an injector grease line from the component that particular injector supplies grease to.
2. Remove injector grease zerk cap (4, Figure 3-8) from each injector and connect an external grease supply to injector grease zerk (2) on the injector.
3. Pump grease into the injector until grease appears at the far end of the individual grease line or the joint that is being greased.
4. Reconnect the injector grease line to the component, remove the external grease supply, and reinstall the injector grease zerk cap.
5. Repeat steps 1 through 4 until all secondary supply lines have been primed.
6. After all grease lines are primed, actuate manual override valve (3, Figure 3-8) to cycle the automatic lubrication pump a few times to lubricate the components.

Lubrication Cycle Operation

The time between lube events is determined by the setting selected in the dash panel. Refer to the Operator Cab Controls chapter for lubrication menu screens. With the key switch ON, scroll through the display menu screens and select either 8, 15, 24 or 30 minutes between lube cycles. The default setting is 15 minutes.

NOTE: Turning the key switch to the ON position will not initiate a lube cycle. To initiate a lube cycle while the truck is stationary, select manual lube using the dash display panel, or use the switch on the lubrication pump. The truck must be moving before the lube system will initiate lube cycles based on the time interval selected.

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