

Shop Manual

830E-AC

DUMP TRUCK

SERIAL NUMBERS **A30001 - A30035**

KOMATSU®

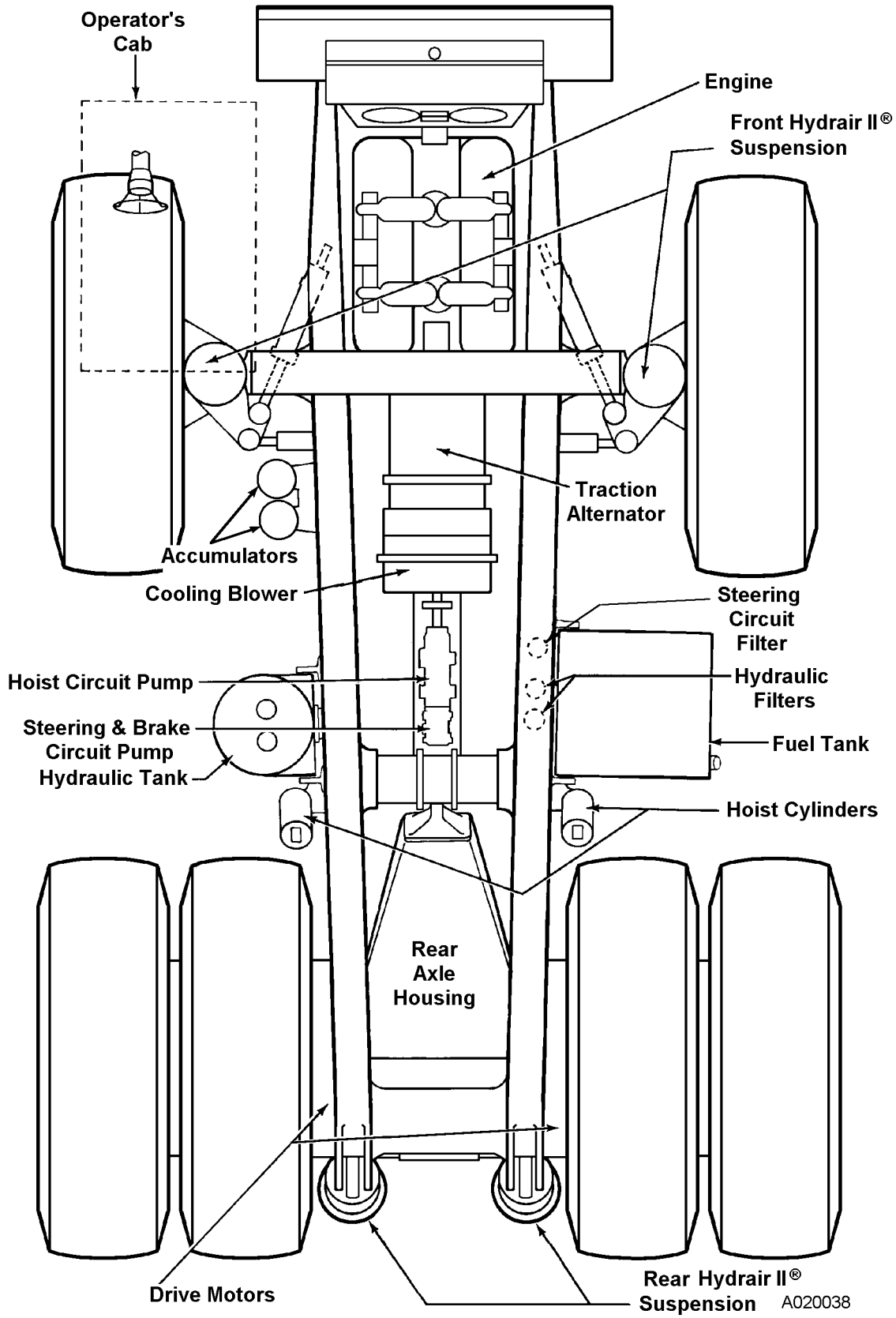
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Mirrors, Windows, And Lights

- Remove any dirt from the surface of the windshield, cab windows, mirrors and lights. Good visibility may prevent an accident.
- Adjust the mirrors to a position where the operator can see best from the operator's seat.
- Ensure headlights, work lights and taillights are in proper working order. Ensure that the machine is equipped with the proper work lamps needed for the operating conditions.
- Replace any broken mirrors, windows or lights.

In The Operator's Cab - Before Starting The Engine

- DO NOT leave tools or spare parts lying around or allow trash to accumulate in the cab of the truck. Keep all unauthorized reading material out of the truck cab.
- Keep the cab floor, controls, steps, and handrails free of oil, grease, snow, and excess dirt.
- Read and understand the contents of the Operation & Maintenance manual. Read safety and operating instructions with special attention. Become thoroughly acquainted with all gauges, instruments and controls before attempting operation of the truck.
- Read and understand the **WARNING** and **CAUTION** decals in the operator's cab.
- Ensure the steering wheel, horn, controls and pedals are free of any oil, grease or mud.
- Check operation of the windshield wiper, condition of wiper blades, and check the washer fluid reservoir level.
- Be familiar with all steering and brake system controls, warning devices, road speeds and loading capabilities, before operating the truck.
- If equipped, ensure the Retractable Ladder System (RLS) is raised.

Seat Belts

- On both driver and passenger seats, check the seat belt fabric, buckle, all belt retractors and hardware for damage or wear. Replace any worn or damaged parts immediately.
- Even if there are no signs of damage, replace both driver and passenger seat belts 5 years after seat belt manufacture, or every 3 years after start of use, whichever comes first. The passenger seat belt date of manufacture label is sewn into the seat belt near the buckle. The driver seat belt date of manufacture label is sewn into the shoulder harness belt, near the retractor end.

OPERATING THE MACHINE

Starting The Engine

- NEVER ATTEMPT TO START THE MACHINE BY SHORTING ACROSS THE STARTER TERMINALS. This may cause fire, or serious injury or death to anyone in machine's path.
- NEVER start the engine if a warning tag has been attached to the controls.
- When starting the engine, sound the horn as an alert.
- Start and operate the machine only while seated in the operator's seat.
- DO NOT allow any unauthorized persons in the operator's compartment or any other place on the machine.

Truck Operation - General

- WEAR SEAT BELTS AT ALL TIMES.
- Only authorized persons are allowed to ride in the truck. Passengers must be in the cab and belted in the passenger seat.
- DO NOT allow anyone to ride on the decks or on the steps of the truck.
- DO NOT allow anyone to get on or off the truck while it is in motion.
- DO NOT move the truck in or out of a building without a signal person present.
- Know and obey hand signal communications between the operator and spotter. When other machines and personnel are present, the operator must move in and out of buildings, loading areas and through traffic, under the direction of a signal person. **Courtesy at all times is a safety precaution!**
- Immediately report any adverse conditions on haul road, pit or dump area that may cause an operating hazard.
- Check for flat tires periodically during a shift. If the truck has been operating on a "flat", the truck must not be parked indoors until the tire cools. If the tire must be changed, DO NOT stand in front of the rim and locking ring when inflating a tire mounted on the machine. Observers must not be permitted in the area and must be kept away from the side of such tires.

Tire Maintenance

If the proper procedure for performing maintenance or replacement of the wheel or tire is not used, the wheel or tire may burst, causing damage, serious injury, or even death. When performing such maintenance, consult your authorized regional Komatsu distributor, or the tire manufacturer.

Refer to the Society of Automotive Engineers (SAE), SAE J1337, Off-Road Rim Maintenance Procedures and Service Precautions, Section 4.2 for additional information on demounting the tires and rim assemblies. Also, refer to Section 4.4 of SAE J1337 for assembly and inflation recommendations.

The U.S. Department of Labor Mine Safety and Health Administration (MSHA) addresses tire repairs in its Title 30 Code of Federal Regulations, 30 CFR 57.14104.

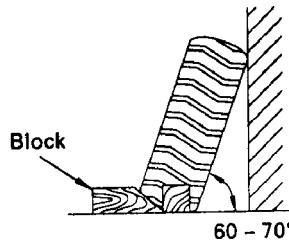


DO NOT stand in front of a rim and locking ring when inflating a tire mounted on the machine. Observers must not be permitted in the area.

DO NOT weld or heat the rim assembly with the tire mounted on the rim. Resulting gases inside the tire may ignite, causing explosion of the tire and rim.

Storing Tires After Removal

- As a basic rule, store the tires in a warehouse in which unauthorized persons cannot enter. If the tires are stored outside, erect a fence around the tires with No Entry and other warning signs.
- Stand the tire on level ground, and block it securely so that it cannot roll or fall over.
- If the tire falls, flee the area as quickly as possible. The tires for mining equipment are extremely heavy. **DO NOT** attempt to hold a tire upright when the tire is falling. The weight of these tires may lead to serious injury or death.



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Mounted tires stored as spares must be inflated to the minimum inflation pressure necessary to keep the tire beads properly seated. Maximum inflation pressure of the stored tire must, in no instance, exceed 15% of the tire's cold inflation pressure.

MANUAL DISCHARGE OF CAPACITORS

If the voltage is greater than 1V on any of the capacitors, the capacitor must be manually discharged. With a suitable capacitor discharge device, such as ground stick pair (PC3299), discharge the capacitors where needed per the following instructions:

1. With the control cabinet high voltage compartment doors closed, connect the ground stick pair ground lead to ground. The most convenient location is the middle top bolt that attaches the door center post to the control cabinet frame.
2. Verify the ground connection and ground stick resistance levels. Measure the resistance between each individual ground stick tip to either the GND1 or GND2 ground block in the low voltage compartment of the control cabinet using a multimeter (Figure 3-9). Ensure that the resistance is within the manufacturer's specifications for the ground sticks.

For PC3299 grounding sticks, the valid range is 80 to 125 ohms per stick.



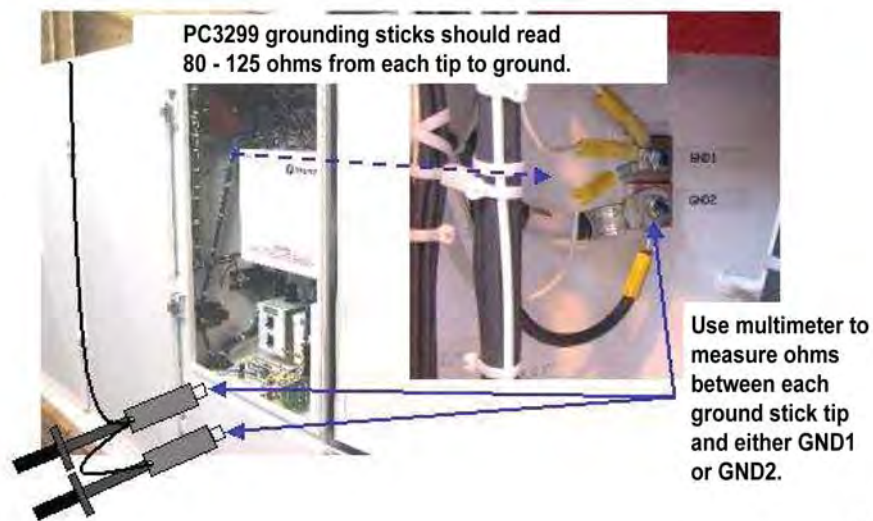
Hazardous voltages are present in this equipment. Avoid touching any energized equipment when the door to the low voltage area is open. Failure to do so may result in personal injury and equipment damage.

3. Discharge the relevant capacitors. Open the door(s) and place one grounding stick on one of the positive (+) capacitor terminals and the other on the diagonally located negative (-) terminal. Refer to Figure 3-8 and Figure 3-10. Attempt to minimize the time between application of the positive stick and the negative stick so that the current flow will be positive to negative rather than either to ground. Leave sticks in place until capacitors are discharged. Refer to Figure 3-10.

NOTE: On the capacitors located behind the door post, it is difficult to access diagonal terminals on the same capacitor. If using adjacent terminals, use care to keep the tips separated while discharging or else use a positive terminal on one capacitor and negative terminal of the adjacent capacitor on the same bus bar.

For PC3299 grounding sticks, the discharge times from 2000 volts are:

- 15 seconds (maximum) for 2 capacitors
- 75 seconds (maximum) for 10 capacitors



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FIGURE 3-9. GROUNDING STICK LEAD CONNECTION AND CHECK

7. Shut the engine off by using the engine stop button located on the center console. Leave the key switch in the ON position. This allows the steering accumulators to retain their hydraulic charge.

- a. If the warning light and buzzer do activate, turn the key switch OFF and notify maintenance personnel. DO NOT operate the truck until the problem is corrected.
- b. If the steering accumulators are adequately charged, the low steering pressure warning light and the low accumulator precharge warning light will not illuminate. Continue to the next step.

8. Turn the steering wheel from stop to stop. The front wheels must turn fully to the left and to the right. Eventually, the low steering pressure warning light will illuminate and the warning buzzer will sound. This is normal.

If the front wheels cannot be turned fully to the left and right, or if the warning light and buzzer do not activate, immediately notify maintenance personnel. DO NOT operate the truck until the problem is corrected.

If the truck passes this test, the emergency steering system is functioning properly.

Additional Guidelines

1. When the truck body is raised, DO NOT allow anyone below it unless the body-up retaining cable is in place.
2. DO NOT use the fire extinguisher for any purpose other than putting out a fire! If an extinguisher is discharged, report the occurrence so the used unit can be refilled or replaced.
3. DO NOT allow unauthorized personnel to ride in the truck. DO NOT allow anyone to ride on the ladder or outside of the truck cab. Passengers must be belted into the passenger seat during travel.
4. DO NOT leave the truck unattended while the engine is running. Move the directional control lever to PARK, then shut the engine off before getting out of the cab.

MACHINE OPERATION SAFETY PRECAUTIONS

After the truck engine is started and all systems are functioning properly, the operator must follow all local safety rules to ensure safe machine operation.



If any of the red warning lights illuminate or if any gauge reads in the red area during truck operation, a malfunction is indicated. Stop the truck as soon as safety permits, and shut the engine off. Have the problem corrected before resuming truck operation.



The truck is equipped with "slip/slide" control. If this function becomes inoperative, operating the truck with stalled or free spinning wheel motors may cause serious damage to wheel motors! If the truck does not begin to move within ten seconds after depressing the throttle pedal (directional control lever in a drive position), release the throttle pedal and allow wheels to regain traction before accelerating again.

1. Always look to the rear before reversing the truck. Watch for and obey the ground spotter's hand signals before traveling in reverse. Sound the horn (three blasts). The spotter will have a clear view of the total area at the rear of the truck.
2. Operate the truck only while properly seated with seat belt fastened. Keep hands and feet inside the cab compartment while the truck is in operation.

TOWING

Before towing a truck, many factors must be carefully considered. Serious personal injury and/or significant property damage may result if important safety practices, procedures and preparation for moving heavy equipment are not observed.

A disabled machine may be towed after the following precautions have been taken.

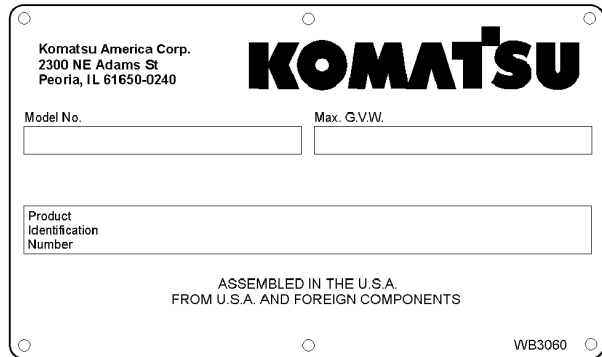
- Do not tow the truck any faster than 8 kph (5 mph).
- Tow with a solid tow bar. DO NOT tow with a cable. Use a towing device with ample strength for the weight of this truck.
- Never tow a truck on a slope.
- Inspect towing components, such as tow bars and couplings, for any signs of damage. Never use damaged or worn components to tow a disabled vehicle.
- Keep a safe distance from the trucks and towing apparatus while towing a vehicle.
- After connecting a truck that is to be towed, do not allow anyone to go between the tow vehicle and the disabled vehicle.
- Set the coupling of the truck being towed in a straight line with the towing portion of the tow truck, and secure it in position.
- An operator is to remain in the cab of the towed vehicle at all times during the towing procedure.

Towing Procedure

1. Shut the engine off.
2. Block the wheels on the disabled truck to prevent movement while preparing the truck for towing and while attaching the tow bar.
3. Ensure the towing vehicle has adequate capacity to both move and stop the towed truck under all conditions.
4. Ensure that the tow bar has adequate strength (approximately 1.5 times the empty vehicle weight of truck being towed). Install tow bar between the two vehicles.
5. Block the wheels on the tow vehicle to prevent movement while preparing the disabled truck for towing.

6. If necessary, install quick disconnect fittings to the bleed down manifold to allow the hydraulic system to be operational. Install hydraulic connections for steering/braking between the tow vehicle the and disabled vehicle. An auxiliary power unit can also be used.
7. After the hydraulic connections are made, check the disabled vehicle braking and steering systems for normal operation. Install 24 100 kPa (3,500 psi) pressure gauges on both the BF test port and the BR test port on the brake manifold in the brake cabinet. Ensure proper pressure is displayed on the gauge when depressing the brake pedal.
8. If the truck is loaded, dump the entire load. Never pull or tow a loaded truck. Refer to "Disabled Truck Dumping Procedure".
10. Ensure the operator in the towing vehicle has 2-way radio communications with the driver in the disabled truck.
11. When ready to tow the disabled truck, remove blocking from the wheels.
12. Move the directional control lever to NEUTRAL position. Tow the disabled truck. Sudden movement may cause tow bar failure. Smooth, gradual truck movement is preferred. Do not tow the truck any faster than 8 kph (5 mph).
13. Minimize the tow angle at all times. **Never exceed 30 degrees.** The towed truck must be steered in the direction of the tow bar.
14. When the desired location has been reached, the operator in the towed vehicle is to apply the service brakes, then move the directional control lever to the PARK position. This will apply the parking brakes.
15. Block the wheels on the towing vehicle and the disabled truck to prevent roll-away.
16. Shut down the engine in the towing vehicle. Disconnect the hydraulic hoses.
17. Disconnect the tow bar.

A product identification plate is located on the frame in front of the right side front wheel and shows the truck model number, maximum GVW and Product Identification Number (PIN).



The PIN consists of 19 total characters. The first and last characters are tamper preventative symbols (*). The remaining 17 alpha/numeric characters are used to identify 5 characteristics of the machine. The 5 characteristics are detailed below.

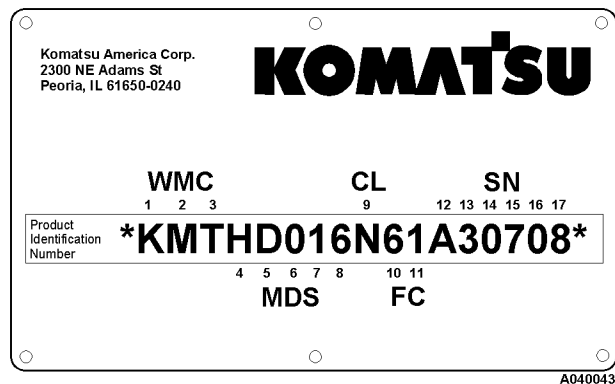
WMC - Character positions 1, 2 and 3 identify the Worldwide Manufacturer Code (WMC). The WMC designates the manufacturer of the product. Komatsu brand products are identified with the letters KMT.

MDS - Character positions 4, 5, 6, 7 and 8 identify the Machine Descriptor Section (MDS). The MDS code identifies general information regarding machine specifications. The MDS is a code for the machine type and model.

CL - Character position 9 identify the Check Letter (CL). The CL is used to verify the accuracy of the individual PIN.

FC - Character positions 10 and 11 identify the Factory Code (FC). The FC identifies the Komatsu factory in charge of claims for the product. The FC for electric drive trucks is 61.

SN - Character positions 12, 13, 14, 15, 16, and 17 identify the Serial Number (SN). The SN is a unique sequential number.



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TABLE 12.
Common Conversion Multipliers
English to Metric

To Convert From	To	Multiply By
inch (in.)	millimeter (mm)	25.40
inch (in.)	centimeter (cm)	2.54
foot (ft)	meter (m)	0.3048
yard (yd)	meter (m)	0.914
mile (mi)	kilometer (km)	1.61
square inch (in. ²)	square centimeters (cm ²)	6.45
square feet (ft ²)	square centimeters (cm ²)	929
cubic inches (in. ³)	cubic centimeters (cm ³)	16.39
cubic inches (in. ³)	liters (l)	0.016
cubic feet (ft ³)	cubic meters (m ³)	0.028
cubic feet (ft. ³)	liters (l)	28.3
ounce (oz)	kilogram (kg)	0.028
fluid ounce (fl oz)	milliliter (ml)	29.573
pound (lb)	kilogram (kg)	0.454
pound (lb)	Newton (N)	4.448
inch pounds (in. lb)	Newton meters (N·m)	0.113
foot pounds (ft lb)	Newton meters (N·m)	1.356
foot pounds (ft lb)	kilogram meters (kg·m)	0.138
kilogram meters (kg·m)	Newton meters (N·m)	9.807
pounds/square inch (psi)	kilopascals (kPa)	6.895
pounds/square inch (psi)	megapascals (MPa)	0.007
pounds/square inch (psi)	kilograms/square centimeter (kg/cm ²)	0.0704
short ton (tn)	kilogram (kg)	907.2
short ton (tn)	metric ton (t)	0.0907
quart (qt)	liters (l)	0.946
gallon (gal)	liters (l)	3.785
horsepower (hp)	Watts (w)	745.7
horsepower (hp)	kilowatts (kw)	0.745

4. While the engine is warming up, check the engine and related components for any leaks. Check the hydraulic pump for leakage as well as all hydraulic lines.
5. Listen for any abnormal engine noises.
6. Check the transmission and piping for leakage. If leakage is evident, shut down the engine and correct before continuing the checkout. Listen for unusual sounds, which may indicate problems in components.
7. When the engine is up to operating temperature, check operation of the throttle circuit - acceleration should be smooth. Watch the gauges closely for any abnormal activity. Proper temperatures and pressures are shown in the Engine Operation and Maintenance Manual.

AFTER ENGINE HAS STARTED

Any machine which is unsafe and/or not in top operating condition should not be assigned to an operator for production use.

1. Become thoroughly familiar with steering and emergency controls. Test the steering in extreme right and left directions. If the steering system is not operating properly, shut the engine down, immediately. Determine the steering system problem and have repairs made before resuming operation.
2. Operate each of the brake circuits at least twice prior to operating and moving the machine. These circuits include individual activation of the service brake and parking brake from the operator's cab.
 - a. Activate each circuit individually with the engine running and with the hydraulic circuit fully charged.
 - b. If any application or release of any brake circuit does not appear proper or if sluggishness is apparent on application or release, shut the engine down and notify maintenance personnel. Do not operate the machine until the brake circuit in question is fully operational.

3. Check gauges, warning lights and instruments before moving the machine to insure proper system operation and proper gauge functioning. Give special attention to braking and steering circuit warning lights. If warning lights come on, shut down the engine immediately and determine the cause.
4. Cycle hoist controls and steering several times to remove trapped air. Complete steering cycles in both directions to verify steering response, smoothness and reliability. Check seals and lines for leaks.
5. When satisfied that all discrepancies have been corrected, the vehicle is ready for a road test. This test should be done only by a capable and experienced operator and should be accomplished in a large open area where plenty of maneuvering room is available. Some of the road test items which should be covered will include:
 - a. Repeated test of braking efficiency at progressively higher speeds. Start at slow speeds. Don't take chances with higher speeds until the machine has been determined to be completely safe.
 - b. Progressive upshifting and downshifting through all speed ranges to insure proper transmission shifting and synchronization.
6. When all tests and checks have been made and the vehicle is ready for work, it should be visually rechecked and fully serviced according to Section P, Lubrication and Service.

Some of the conditions (others may be found) which might be encountered after a machine has been exposed to the elements for a long period would include:

- Increased corrosion and fungus growth on electrical components in humid/tropical areas.
- Accelerated rust formation in humid climates.
- Increased sand and dust infiltration in windy, dry dusty areas. (These conditions can approach sand blasting effects.)
- Deterioration of rubber products in extreme cold areas. Cables, hoses, O-rings, seals and tires may become weather checked and brittle.
- Animal or bird's nests in unsealed openings.

SECTION B2
STRUCTURAL COMPONENTS
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5. Remove cap screws (4, Figure 3-3) and locknuts (5) from each pivot pin.
6. Remove body pivot pins (6) far enough to allow shims (9) to drop out. Complete removal is not necessary unless a new pin is to be installed.
7. Lift dump body clear of the chassis and move to storage or work area. Block the body to prevent damage to the body guide etc.
8. Inspect bushings (8, 11, and 12) for excessive wear or damage. Replace as required.

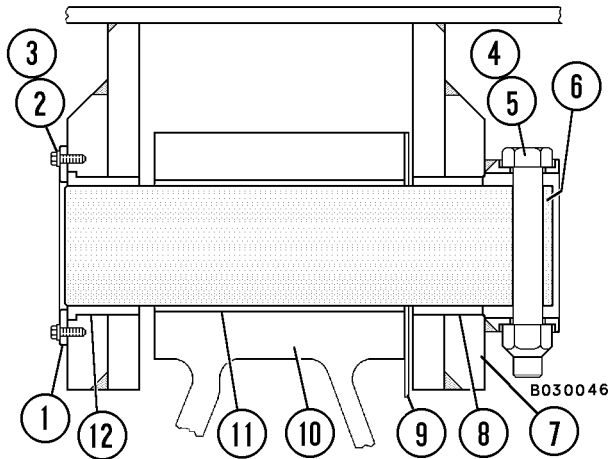


FIGURE 3-3. DUMP BODY PIVOT PIN

- | | |
|--------------------|------------------------|
| 1. Retainer | 7. Body Ear |
| 2. Cap Screw - M10 | 8. Body Pivot Bushing |
| 3. Lockwasher | 9. Shim |
| 4. Cap Screw | 10. Frame Pivot |
| 5. Locknut | 11. Pivot Bushing |
| 6. Body Pivot Pin | 12. Body Pivot Bushing |

Installation

WARNING

Inspect all lifting devices. Slings, chains, and/or cables used for lifting components must be inspected daily for serviceable condition. Refer to the manufacturer's manual for correct capacities and safety procedures when lifting components. Replace any questionable items.

Slings, chains, and/or cables used for lifting components must be rated to supply a safety factor of approximately 2X the weight being lifted.

When in doubt as to the weight of components or any assembly procedure, contact the Komatsu area representative for further information.

Lifting eyes and hooks should be fabricated from the proper materials and rated to lift the load being placed on them.

Never stand beneath a suspended load. Use of guy ropes are recommended for guiding and positioning a suspended load.

Before raising or lifting the body, be sure there is adequate clearance between the body and overhead structures or electric power lines.

Be sure that the lifting device is rated for at least a 45 ton capacity.

1. Park truck on a hard, level surface and block all the wheels.
2. Attach cables and a lifting device to the dump body and take up the slack as shown in Figure 3-1. Lower the body over the truck frame and align the body pivots with the frame pivot holes.
3. Install shims (9, Figure 3-3) in both body pivots, as required, to fill the outside gaps and center the body on the frame pivot. **Do not install shims at the inside.**

NOTE: A minimum of 1 shim is required at the outside end of both frame pivots.

FUEL TANK BREATHER VALVE

NOTE: The relief pressure of the fuel tank breather valve is 70 - 89 kPa (10 - 13 psi).

Disassembly

1. Remove clamp (3, Figure 4-2), cover (2) and screen (1).
2. Remove ball cage (10), solid ball (11) and float balls (12).
3. Unscrew end fitting (7) from body (4).
4. Remove stem (8) and valve spring (5).

Assembly

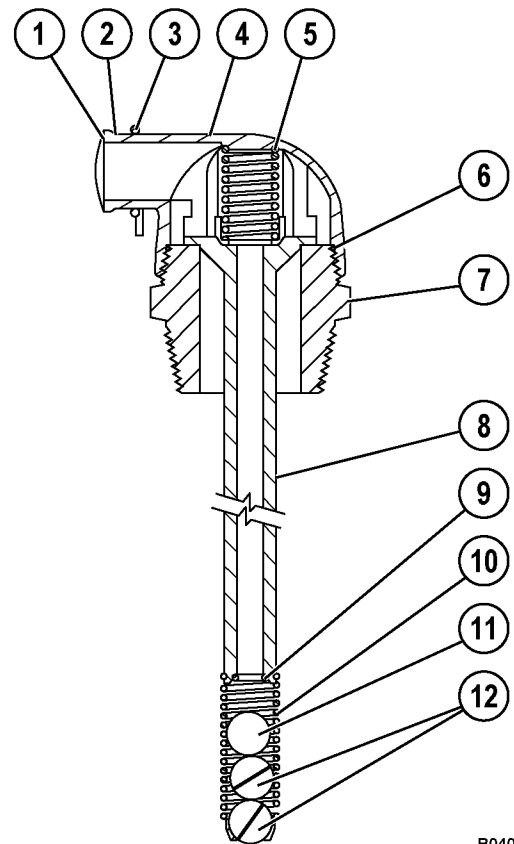
1. Clean and inspect all parts. If any parts are damaged, replace the entire assembly.
2. Place valve spring (5) into position in body (4).
3. Insert stem (8) into end fitting (7).
4. Screw end fitting (7) into body (4). Ensure the components are properly aligned and seated.
5. Place screen (1) and cover (2) into position on the breather. Install clamp (3).
6. Insert the balls into ball cage (10) with solid ball (11) on top.
7. Insert the ball cage onto the stem. A minimum of two cage coils must be seated in the groove on the stem. Ensure the solid ball is able to seat properly on the stem. If not, adjust the cage accordingly.

FUEL RECEIVERS (WIGGINS QUICK FILL)

Fuel receiver assembly (2, Figure 4-1) is mounted on the side of the fuel tank.

Keep the cap on the fuel receiver to prevent dirt build up in valve area and nozzle grooves.

If fuel spills from the fuel tank breather valve (7), or if the tank does not completely fill, check the breather valve to see whether the float balls are in place and the outlet screen is clean. If the breather valve is operating properly, the problem will most likely be in the fuel supply system.



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FIGURE 4-2. BREATHER VALVE

- | | |
|-----------------|----------------|
| 1. Screen | 7. End Fitting |
| 2. Cover | 8. Stem |
| 3. Clamp | 9. O-Ring |
| 4. Body | 10. Ball Cage |
| 5. Valve Spring | 11. Solid Ball |
| 6. O-Ring | 12. Float Ball |

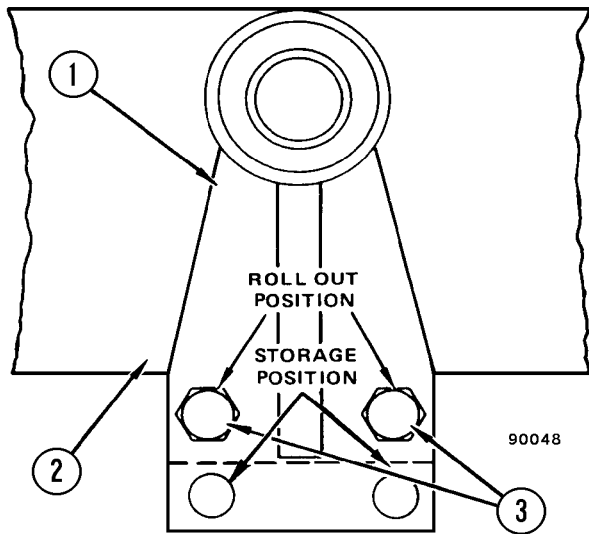


FIGURE 2-5. SUBFRAME ROLLERS

- 1. Roller Assembly
- 2. Subframe
- 3. cap screws

23. Attach lifting device to hoist and attach to engine/alternator cradle structure and front subframe lifting points as shown in Figure 2-6. Remove safety chain.

24. Raise the power module slightly to determine if module is on an even plane. Move the power module straight out of truck to a clean work area for disassembly.

For further disassembly of the engine, alternator, and radiator, refer to the appropriate section of this manual.

Installation

1. Inspect the main frame guide rails. Remove any debris which would interfere with power module installation.
2. Clean the main frame rear support brackets. Apply a light film of soap solution to each rubber bushing (5, Figure 2-4) located at the rear of the subframe.
3. Check the subframe rollers making sure they roll freely and are in the "roll-out" position. (Figure 2-5).
4. Attach a lifting device to engine/alternator cradle structure and front subframe lifting points. (Figure 2-6)

▲WARNING

The complete power module weighs approximately 16 760 kg (36,950 lbs.). Make sure lifting device to be used is of an adequate capacity.

5. Raise the power module and align the subframe rollers within the main frame guide rails.
6. Lower the power module to the subframe guide rails, relax the hoist slightly and roll the power module into truck frame until lifting chains contact frame cross member.

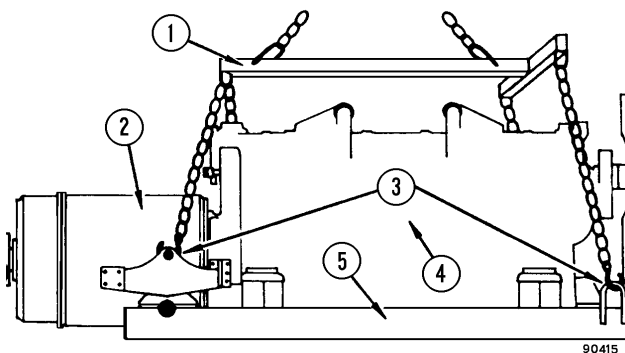


FIGURE 2-6. POWER MODULE LIFT POINTS

- 1. Module Lifting Tool
- 2. Main Alternator
- 3. Module Lift Points
- 4. Engine
- 5. Power Module Subframe

Installation

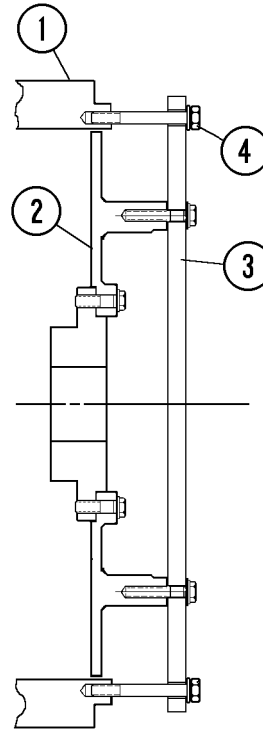
1. Reinstall shroud (1, Figure 3-4), air conditioner condenser, and fuel cooler. Install air conditioner receiver/drier (10) if removed.



The radiator assembly weighs approximately 1907 kg (4,200 lbs) Ensure lifting device is capable of lifting the load.

2. Attach lifting eyes in tapped blocks at upper corners of radiator assembly (6, Figure 3-4). Attach hoist and lift into place on power module sub-frame.
3. Position radiator assembly to equalize gap between tip of fan blades and shroud at right and left sides. Install mounting hardware (2, Figure 3-3) through lower mounts and tighten to **298 N·m (220 ft lbs)** torque.
4. Install radiator support rods (3, Figure 3-4). If necessary, adjust to position radiator perpendicular to the subframe. Tighten the support strut locknuts. Install upper support rods to brackets on front upright supports.
5. Adjust fan shroud ring vertically to equalize gap between tip of fan blades and ring.
6. Lift grille structure (2, Figure 3-2) into position and install mounting hardware.
7. Route headlight wire harness to lights. Attach connectors to lights and clamp harness at weld studs.
8. Install upper and lower radiator piping. Seat hoses and clamps securely.
9. Position fan guard against shroud and tighten mounting hardware to **55 N·m (40 ft lbs)** torque. (If halves of guard were disassembled, tighten cap screws clamping halves together to **34 N·m (25 ft lbs)** torque.
10. Attach hoses to fuel cooler.
11. Route A/C condenser hoses to condenser and attach. Install lower grille sections. Install receiver/drier (10) hoses. Connect pressure switch (11).
12. Install surge tank hoses and electrical wiring to the coolant level probe (9, Figure 3-4). Clamp hoses and electrical cables to the shroud. Install surge tank cover.
13. Make sure all coolant drains are closed, hoses are installed, and all wiring reconnected. Close drain valve on main air tank.
14. If the truck is equipped with air conditioning, the system must be evacuated and recharged. Refer to "Heater/Air Conditioning System" in Section M for detailed instructions for recharging with refrigerant.
15. Service the cooling system per the instructions below.
16. Check for static leakage and correct any leaks. After servicing is complete, start the engine and run until normal operating temperature is reached. Repeat check for leaks and correct as required.

4. Refer to Figure 4-6. Alternator End-play:
- Using flat steel bar (3, Figure 4-6) bolted rigidly to the alternator rotor (2), install a 5/8" - 11 cap screw (4) at each end into the alternator housing (1). Leave cap screws finger-tight.
 - Move alternator rotor (2) axially towards the rear (slip-ring end) by alternately tightening the cap screws (4) one-half-turn-at-a-time. Do NOT exceed **16.3 N·m (12 ft lbs)** torque on each cap screw. This establishes the maximum permissible rear travel for the alternator rotor.
 - Alternately loosen cap screws (4) one-turn-at-a-time, until all torque is released. Carefully remove steel bar (3).
Note: The object is to leave the rotor in its most rearward position.



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FIGURE 4-6. ALTERNATOR END-PLAY

- | | |
|-----------------------|--------------|
| 1. Alternator Housing | 3. Steel Bar |
| 2. Alternator Rotor | 4. Cap Screw |

Refer to Figure 4-5.

- Carefully measure Dimension "A" (Do not move alternator rotor) at four locations, 90° apart, and average the measurements.

1st measurement: _____

2nd measurement: _____

3rd measurement: _____

4th measurement: _____

Dimension "Aavg": _____ Average

- Add 0.25 mm (0.010 in.) to Dimension "Aavg".

- Record (Step 4d + 4e) as Measurement "A" _____

- To determine the correct shims to use, compare Measurement "C" (Step 3c) with Measurement "A" (Step 4f).

- If C is greater than A, subtract: $(C - A) = B$
B = _____ Shim pack thickness to be installed at location "B", Figure 4-5.

- If A is greater than C, subtract: $(A - C) = D$
D = _____ Shim pack thickness to be installed at location "D", Figure 4-5.

Rotor-to-Drive Ring, Location "B"	
Shim Part Number	Shim Thickness
TM3467	0.10 mm (0.004 in.)
TM3469	0.18 mm (0.007 in.)

Alternator-to-Flywheel Housing Adapter, Location "D"	
Shim Part Number	Shim Thickness
TM3466	0.10 mm (0.004 in.)
TM3468	0.78 mm (0.007 in.)

Precleaner Section Cleaning

The tubes in precleaner section (2, Figure 5-1) 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 main filter element. Do not remove the safety filter element. Loosen the clamps and remove dust collector (1, Figure 5-2). Use a light to inspect the tubes. All tubes should be clear and the light should be visible.

NOTE: Both the main 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 5-5). **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.

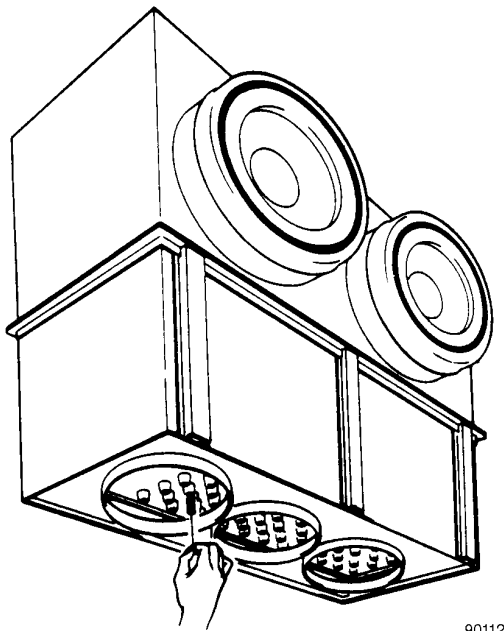


FIGURE 5-5. REMOVING DUST FROM THE TUBES

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 (3, Figure 5-1). Remove the mounting hardware that secures the precleaner section to the air cleaner assembly. Remove the precleaner section. The safety filter element must remain in place to protect the engine intake.
2. Loosen the clamps and remove dust collector (1) from the precleaner section. Wash the dust collector with a water and liquid soap solution.
3. Submerge the precleaner section in a solution of Donaldson D-1400 and warm water (see Figure 5-6). 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 the precleaner gaskets carefully for any evidence of air leaks. Replace if necessary.
5. Install the precleaner section and gaskets on the air cleaner assembly. Install all mounting hardware that was removed.
6. Install the dust collector and gasket on the precleaner section. Secure the dust collector with mounting clamps.

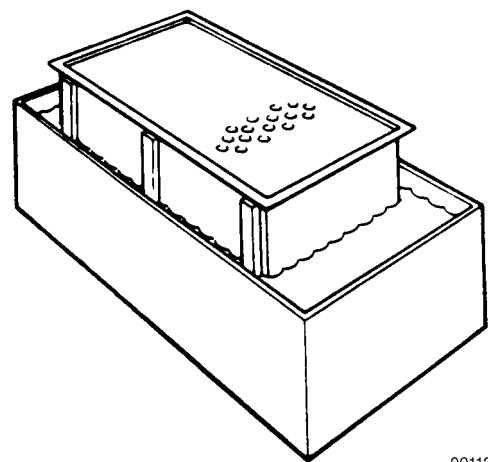


FIGURE 5-6. WASHING AND SOAKING THE PRECLEANER SECTION

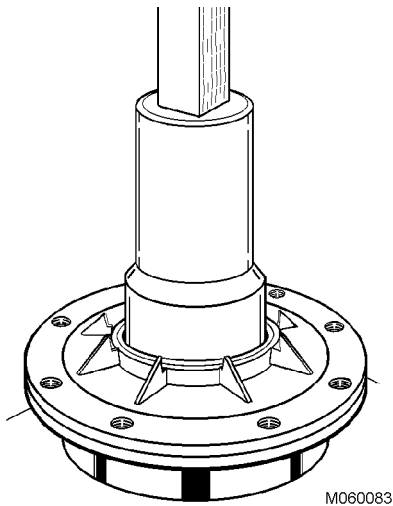


FIGURE 7-10.

9. Turn bearing retainer (35) over on the press bed. Press front bearing (33) out of the bearing retainer using tooling (D).

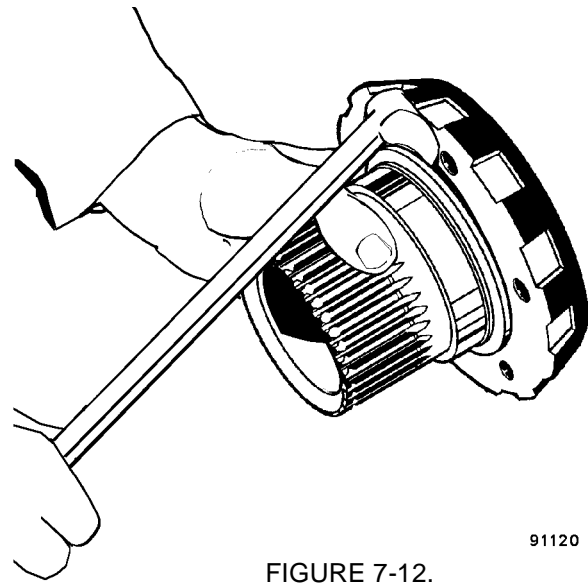


FIGURE 7-12.

11. Remove front retainer/seal assembly (40). Wedge a large chisel or other appropriate tool behind the retainer to force it off fan mounting hub (42).

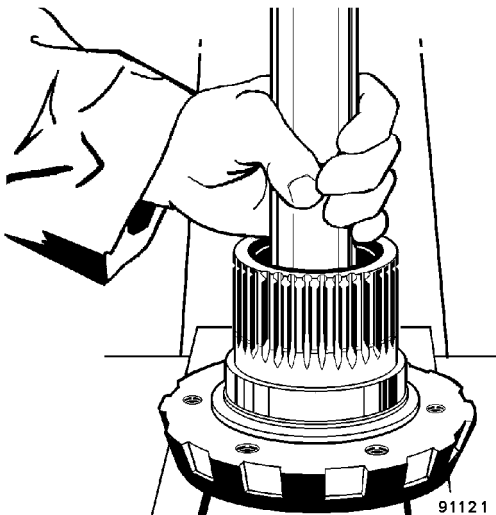


FIGURE 7-11.

10. Support beneath the fan mounting hub with end cap (45) down, but approximately 50 mm (2 in.) above the press bed. Using a solid steel bar or equivalent, press the end cap from the fan mounting hub.

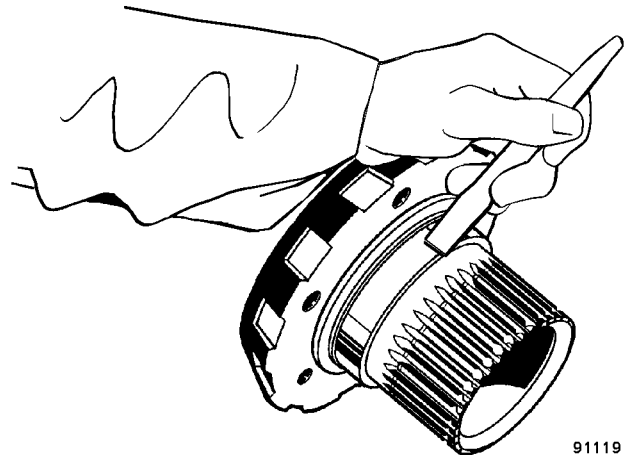


FIGURE 7-13.

Use a chisel to make three indentations in wear sleeve (39) in order to loosen the sleeve. The indentations should be approximately 120 degrees apart from one another. Remove the wear sleeve.

NOTE: Use caution when using the chisel. Do not cut through the sleeve. Damage to the shaft can cause future leaks.

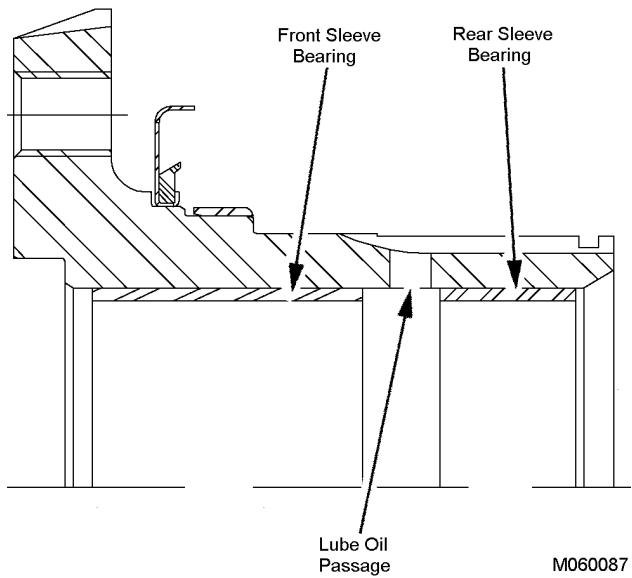


FIGURE 7-40.

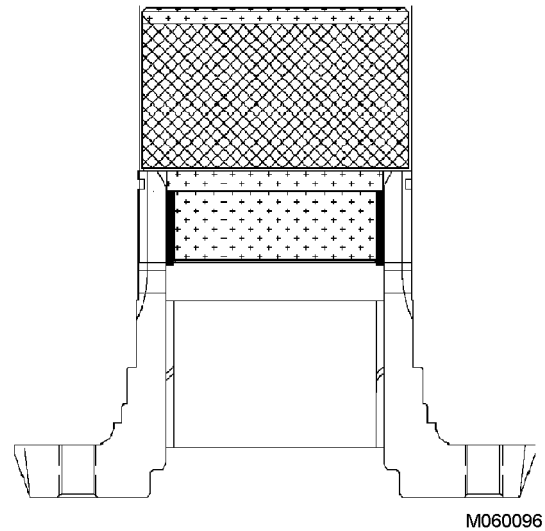


FIGURE 7-42.

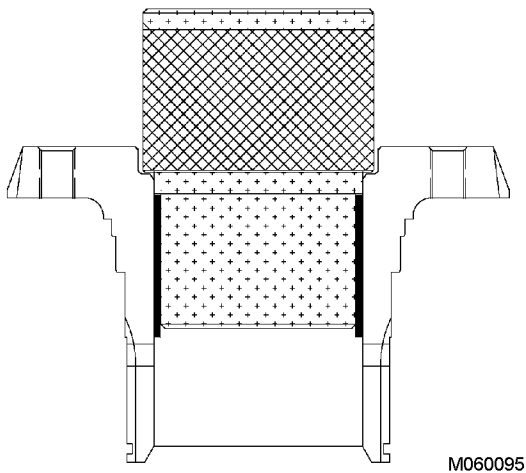


FIGURE 7-41.

3. Using tooling (A), press front (long) sleeve bearing (44) into the fan mounting hub until the tool contacts the shoulder of the hub. Ensure the correct bearing is installed. There are two sleeve bearings, and each one must be installed in the proper area of the hub to ensure the lube passage is not restricted. Refer to Figure 7-40.

4. Turn the hub over on the bed of the press. Using tooling (B), press rear sleeve bearing (41) into the fan mounting hub until the tool contacts the shoulder of the hub.

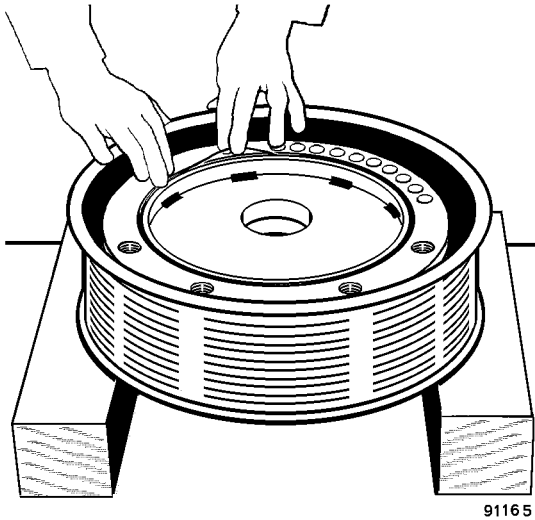


FIGURE 7-74.

34. Lubricate O-ring seal (13) with petroleum jelly or an oil-soluble grease and install it in the pulley groove.

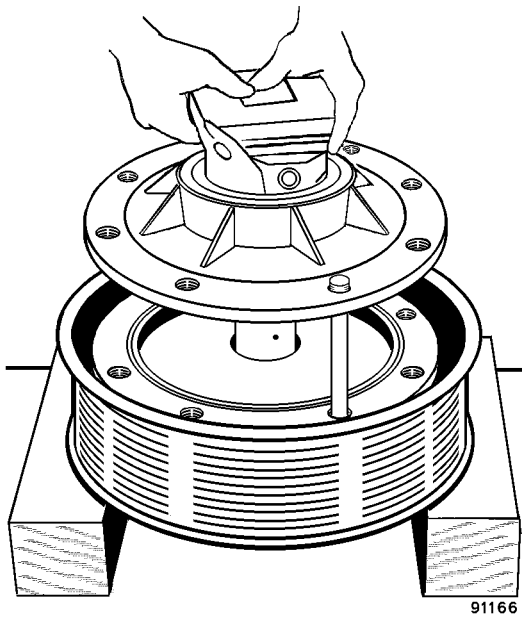


FIGURE 7-75.

35. Lubricate hook-type seal rings (17) on the shaft assembly. Carefully lower the shaft sub-assembly into the pulley bore and onto the pulley until the retainer rests on the pulley.

Use caution when lowering. Damage to the sleeve bearings may result if the shaft is cocked during installation.

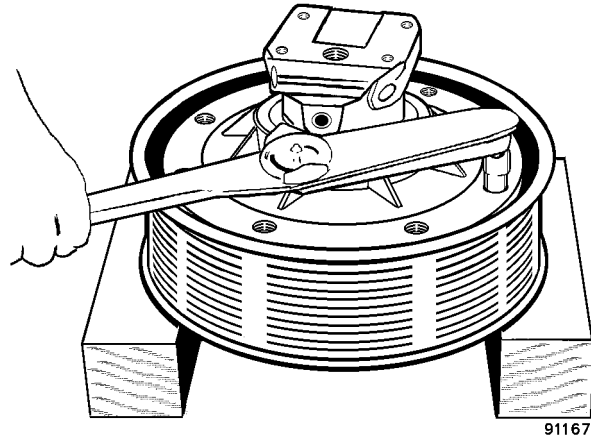


FIGURE 7-76.

36. Install bolts (9) with lockwashers (8). Tighten each bolt to **49 - 58 N•m (36 - 43 ft lbs)**.

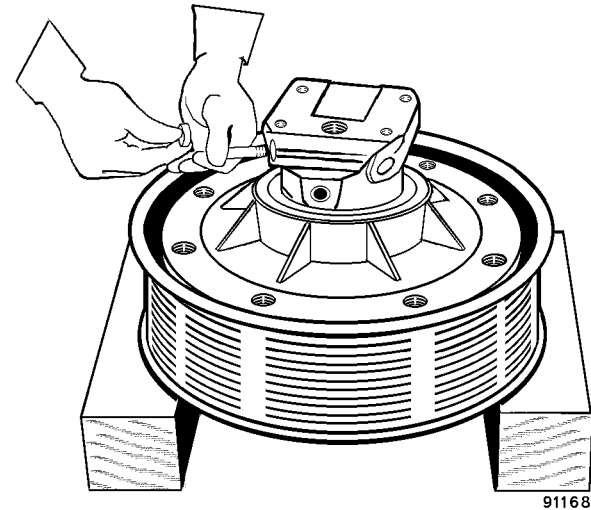


FIGURE 7-77.

37. If removed, install orifice fitting (1) in the "oil in" port of the bracket.

24 VDC ELECTRIC CRANKING MOTOR SYSTEM (WITH PRELUBE)

The Komatsu SDA16V160 engine includes an engine pre-lubrication system designed to reduce wear due to dry starts.

The prelube system automatically, safely and quickly fills filters and all oil passages prior to cranking at each engine startup. In addition, the system prevents startup if no oil is present in the engine.

The prelube system includes:

- Remote mounted 24VDC powered pump
- Timer solenoid
- Oil pressure switch
- Oil suction line
- Oil outlet line
- Check valve
- Electrical harness.

Operation

The prelube system is activated when the operator turns the key switch and holds it in the “start” position. This allows the current to flow to the prelube cranking motor solenoid timer (3). When this solenoid timer is activated, current flows through fusible link (9) to the prelube motor (10), driving the prelube pump, but does not allow the cranking motor motors to engage the cranking motor pinion gears at this time. The prelube pump supplies oil from the engine oil pan to fill the engine oil filters and oil passages prior to cranking.

When the pressure in the engine cam oil rifle reaches 17.2 kPa (2.5 psi), the circuit to the timer solenoid is opened. After a 3 second delay, the current is supplied to the cranking motor solenoids (8); the cranking motor motors will then be activated and the pinion gears will be engaged into the flywheel ring gear. Normal cranking will now occur with sufficient lubrication to protect the engine bearings and other components.

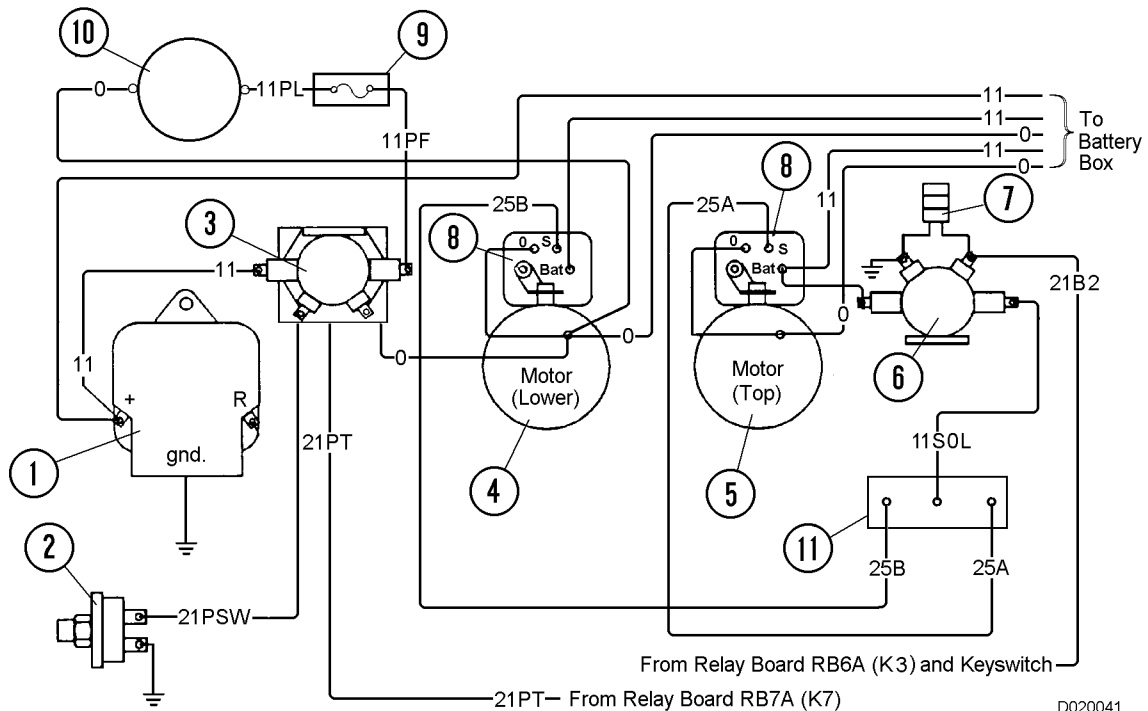


FIGURE 2-3. PRELUBE MOTOR AND CRANKING MOTOR ELECTRICAL DIAGRAM

- | | | |
|---|-----------------------------|----------------------------|
| 1. Battery Charging Alternator | 4. Cranking Motor No. 2 | 8. Cranking Motor Solenoid |
| 2. Oil Pressure Switch (N.C.)
17.2 kPa (2.5 psi) | 5. Cranking Motor No. 1 | 9. Fusible Link (400 AMP) |
| 3. Prelube Timer Solenoid | 6. Magnetic Switch | 10. Prelube Pump & Motor |
| | 7. Diode (Coil Suppression) | 11. Isolation Diode |

Assembly

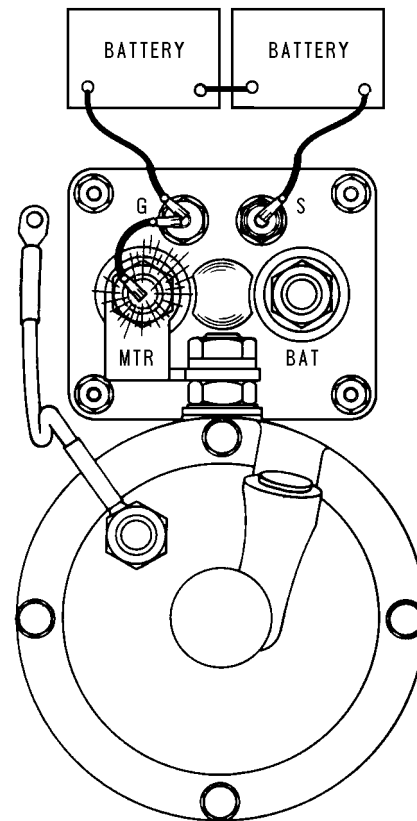
Lubricate all bearings, wicks and oil reservoirs with SAE No. 20 oil during assembly.

Bearing Replacement:

1. If any of the bronze bearings are to be replaced, dip each bearing in SAE No. 20 oil before pressing into place.
2. Install wick, soaked in oil, prior to installing bearings.
3. Do not attempt to drill or ream sintered bearings. These bearings are supplied to size. If drilled or reamed, the I.D. will be too large and the bearing pores will seal over.
4. Do not cross-drill bearings. Because the bearing is so highly porous, oil from the wick touching the outside bearing surface will bleed through and provide adequate lubrication.
5. The middle bearing is a support bearing used to prevent armature deflection during cranking. The clearance between this bearing and the armature shaft is large compared to the end frame bearings.

Motor Assembly:

1. Install the end frame (with brushes) onto the field frame as follows:
 - a. Insert the armature (45, Figure 2-6) into the field frame (35). Pull the armature out of the field frame just far enough to permit the brushes to be placed over the commutator.
 - b. Place the end frame (1) on the armature shaft. Slide end frame and armature into place against the field frame.
 - c. Insert screws (34) and washers (33) and tighten securely.
2. Assemble lever (63) into lever housing (78) if removed.
3. Place washer (79) on armature shaft and install new O-ring (80). Position drive assembly (71) in lever (63) in lever housing. Apply a light coat of lubricant (Delco Remy Part No. 1960954) on washer (75) and install over armature shaft. Align lever housing with field frame and slide assembly over armature shaft. Secure with screws (76) and washers (77).
4. Assemble and install solenoid assembly through lever housing and attach to field frame. Install nut (64) but do not tighten at this time. Install brush inspection plugs (52).



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FIGURE 2-10. PINION CLEARANCE CHECK CIRCUIT

5. Using a new gasket (72), install drive housing (69) and secure with screws (70).
6. Assemble field coil connector (42) to solenoid.
7. Adjust pinion clearance per instructions on the following page.
8. After pinion clearance has been adjusted, install gasket (74) and plug (73).

Hot Switch Inverter (Not Used)

The optional oil level card is used to turn on the low oil level indicator light to warn the operator that the engine oil/hydraulic tank oil level is below acceptable levels. The oil float is connected to a variable resistor. As the oil level decreases, the resistance goes down, causing Q3 to turn on and grounding the indicator light and alarm horn.

The optional temperature card is used to turn on the high oil temperature indicator light. The indicator light tells the operator hydraulic tank oil temperature has exceeded acceptable levels. Normal temperature setting is 121°C (250°F). As the temperature goes up, the resistance in the probe decreases providing a ground path for the indicator light and alarm horn.

Temperature and Latch

The temperature and latch card has two circuits to operate two different indicator lights. The temperature circuit is controlled by a coolant temperature sensor which decreases electrical resistance as its temperature increases. It will have a resistance of approximately 1000 ohms at 85°C (185°F) and 500 ohms at 121°C (250°F). The normal setting is 96°C (204°F).

When the temperature is low and the resistance is high, Q1 is off and no high temperature indication occurs. When the coolant temperature is excessive, resistance decreases to a point where Q1 will turn on and ground the flasher through D8, the alarm horn through D12, and the high temperature light through terminal D8. R14 can adjust the temperature (resistance) at which the circuit is activated.

NOTE: Some electronic engine controls monitor coolant temperature. If the engine controls monitor the circuit, a 2K ohm resistor is installed to replace the temperature sensor and disable the AID system circuit.

The latch circuit monitors the accumulator precharge pressure switches. When one of the pressure switches closes, Q5, which supplies power to the gate of SCR Q7, will be turned off. With Q7 turned on, Q9 will supply the ground path to turn on the low accumulator precharge indicator light and sound the alarm horn. The indicator light is connected to 12F and will flash off and on. The SCR will remain on until power is removed from the card by turning the key switch OFF.

Coolant Level & Flasher

The coolant level and flasher card contains two separate circuits. The flasher circuit at the top of the card has Q12 transistor biased to be saturated when no malfunction is present, resulting in 24 volt positive output on pin "H" of the card and on wire 12F. When an indicating circuit is activated, the ground side of the circuit connected to card pin "K" is grounded. Q12 will turn off initially and then after a delay, adjusted by R20, will turn on and off to give the intermittent 24 volt output.

The other half of the circuitry on the coolant level and flasher card operates the coolant level light. The water level probe connected to terminal B11 grounds the 31L circuit when the coolant in the radiator is above the probe position. The coolant saturates the probe and electrically grounds the circuit. When the circuit is grounded, Q6 transistor is off, resulting in no indication. When the coolant level drops below the probe, 31L is no longer grounded and Q6 turns on to ground the flasher through D5, the coolant level light through terminal D11, and the alarm horn through D6. The light and alarm horn will operate intermittently as their 24 volt supply is from circuit 12F, the flasher output.

NOTE: Some electronic engine controls monitor coolant level. If the engine controls monitor the circuit, a 2KΩ resistor is installed to replace the probe and disable the AID system circuit.

NOTES:

Set Point: The voltage value to which the regulator is set. The voltage value is established by the battery type and the vehicle duty cycle. There are four values available on the regulator. The set point value may be fixed (flat compensation) or variable, based on operating temperature (negative temperature compensation).

Significant Magnetism: A change in the strength or intensity of a magnetic field present in the alternator rotor shaft when the field coil is energized. The magnetic field strength when the field coil is energized must be stronger than when the field is not energized.

Surface Charge: A higher than normal battery voltage occurring when the battery is removed from a battery charger. The surface charge must be removed to determine true battery voltage and state of charge.

Voltage B+: A voltage value obtained when measuring voltage at the battery positive terminal or alternator (B+) terminal.

Voltage, Battery: The steady-state voltage value as measured with the battery in an open circuit with no battery load. This value relates to the battery state of charge.

Voltage, Charge: A voltage value obtained when the charging system is operating. This value will be higher than the battery voltage and must never exceed the regulator voltage set point.

Voltage Droop or Sag: A normal condition which occurs when the load demand on the alternator is greater than rated alternator output at a given rotor shaft rpm.

Voltage Regulator (also Regulator): Device to control the alternator output voltage. Modern regulators are solid-state devices. The regulator is mounted on the alternator. Some regulators have several voltage set points available for different operating conditions or battery types.

STATIC TESTING



Static tests must confirm on-vehicle and bench tests. For best results, disassemble the alternator, as needed, to access the parts.

Equipment

- Digital Multimeter (DMM)
- Ammeter (digital, inductive)
- Regulator tester

Identification Record

- Alternator model number _____
- Regulator model number _____
- Set point(s) listed on regulator _____

Regulator Tester

A regulator tester can test all regulator functions. If a regulator tester is used, follow the regulator tester manufacturer's instructions.

If a regulator tester is not available, the regulator can only be tested for a shorted power transistor.

Check For Shorted Power Transistor

1. Set the DMM to the diode test scale and zero the meter.

CONNECTIONS

- A → F-
- B → Phase
- C → B-
- D → B+
- E → D+
- F → F+

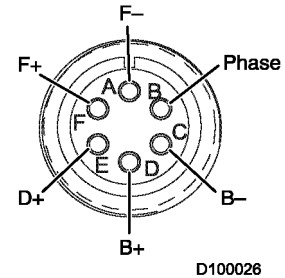


FIGURE 10-11. PIN CONNECTION IDENTIFICATION

2. Connect one meter lead to pin A (F-, Figure 10-11) connector socket in the regulator, and connect the other lead to pin C (B-) connector socket in the regulator. Observe the meter reading.
3. Reverse the leads and observe the meter reading.
4. In one direction, the DMM must register a tone. In the other direction, the DMM must show OL (out of limits).
5. If the DMM shows zero in both directions, the power transistor is shorted and the regulator must be replaced.

NOTE: If regulator failure is indicated, field coil failure must also be suspected.

- Remove ground strap (1, Figure 10-19) from the alternator by removing cap screw (1, Figure 10-20). It is not necessary to completely remove the ground cable unless it is damaged and must be replaced.

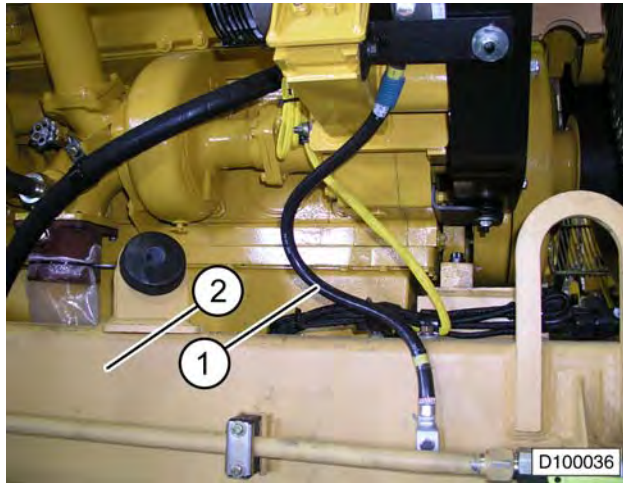


FIGURE 10-19. GROUND STRAP

- Ground Strap
- Sub Frame

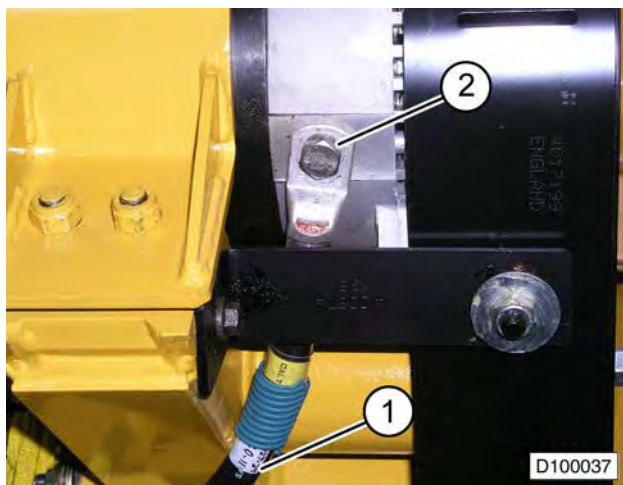


FIGURE 10-20. GROUND STRAP CONNECTION

- Ground Strap
- Cap Screw

- Remove eight lock nuts (1, Figure 10-21) from the front cover of the belt guard assembly.
- Remove cover (2).

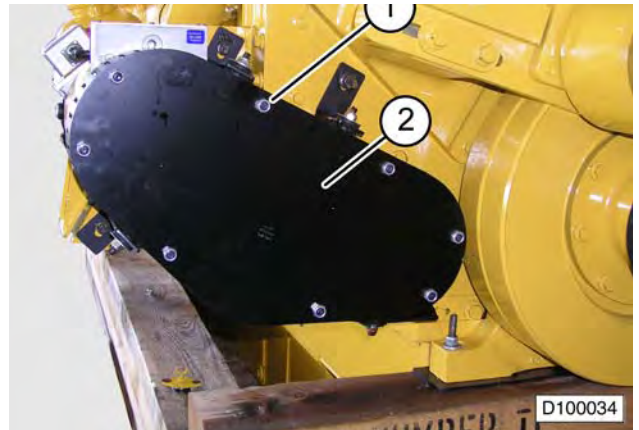


FIGURE 10-21. BELT GUARD ASSEMBLY

- Lock Nuts
- Cover

- Use a $\frac{3}{4}$ inch square drive breaker bar to release the tension on automatic belt tensioner (1, Figure. 10-22.)
- Remove belt (2). Replace the belt if signs of wear or damage are found.

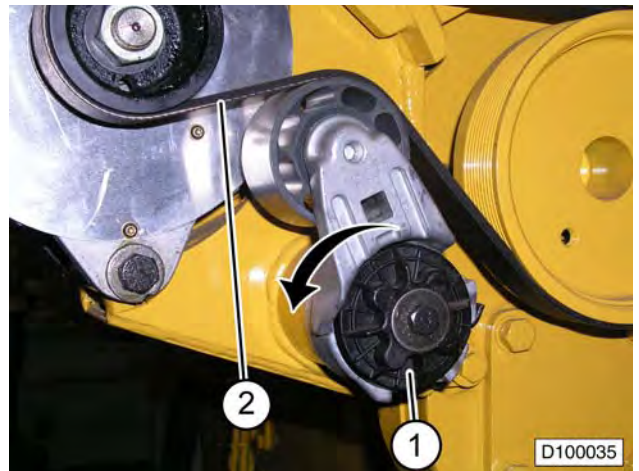


FIGURE 10-22. AUTOMATIC BELT TENSIONER ASSEMBLY

- Automatic Belt Tensioner
- Belt

CAUTION

The rotor retaining screws have been installed with a thread lock compound (Loctite). DO NOT use air impact tools to remove screws (46). Use only hand tools to carefully remove these screws. Using air tools can cause the screws to break, resulting in damage.

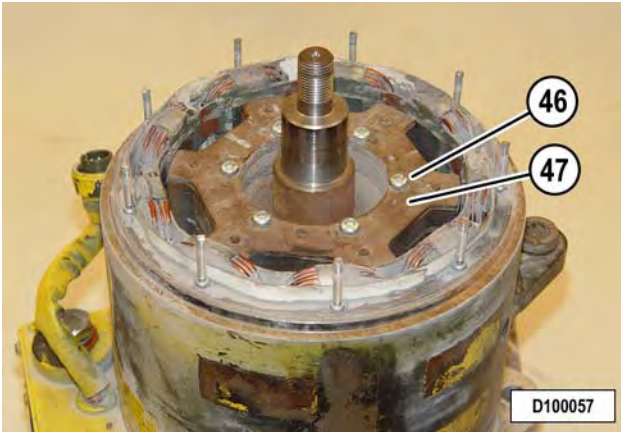


FIGURE 10-46.

46. Screw 47. Rotor

2. Remove remaining five Torx screws (46) using a number T25 Torx bit.
3. Clean out three threaded puller holes in top of rotor (47).

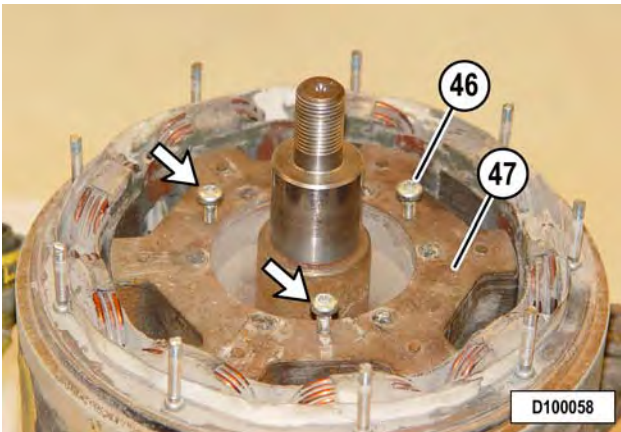


FIGURE 10-47.

46. Screw 47. Rotor

NOTE: If necessary to loosen rust, use an air chisel with a rounded-point hammer bit to vibrate the area between screw holes on the rotor face.

4. Thread three screws (46) into the puller holes. Tighten the screws evenly to start removing rotor (47) from rotor shaft (48).

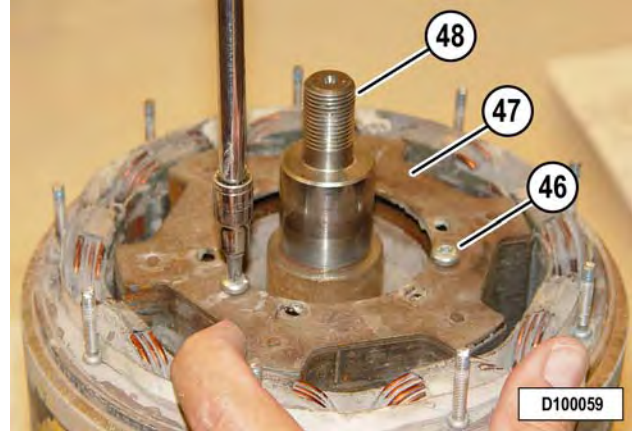


FIGURE 10-48.

46. Screw 48. Rotor Shaft

CAUTION

Threaded screws (46) may not be long enough to completely remove rotor (47) from the rotor shaft. If necessary, use a three jaw gear puller to completely remove the rotor. Using the three jaw gear puller may damage the rotor if it is rusted to the rotor shaft.

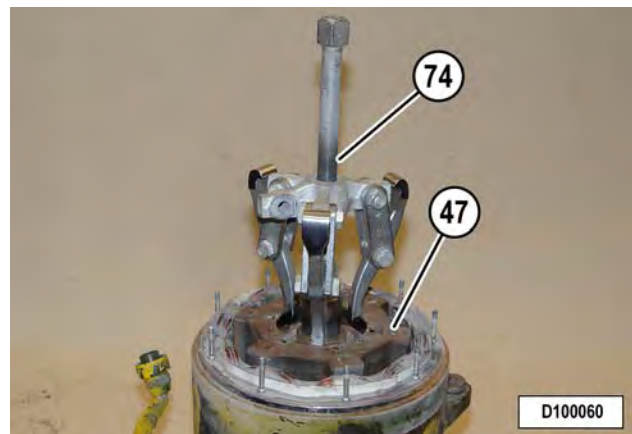


FIGURE 10-49.

47. Rotor. 74. Three Jaw Gear Puller

5. Remove the shell assembly from the support stand. Remove hex head nuts (54) from studs (61) using a deep well 6 mm socket. Discard nuts (54). Use expandable pliers to hold the enlarged portion of the stud.

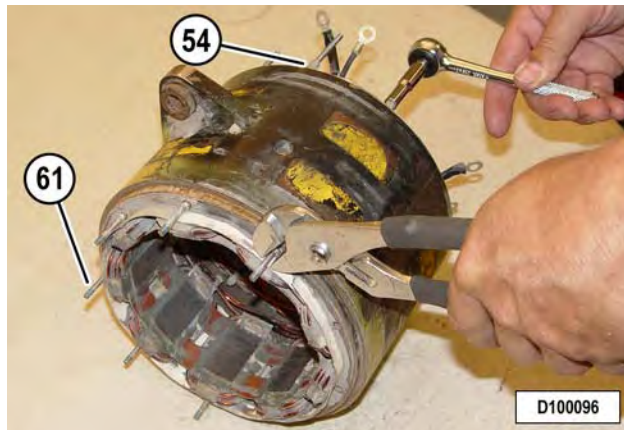


FIGURE 10-85.

54. Hex Head Nuts 61. Studs

NOTE: Hex head nuts (54) have been installed using a thread locking compound. Use care when removing.

6. Remove and save nine studs (61) from the stators.
7. If a stator needs to be replaced, remove only the faulty stator.
 - a. If removing the anti-drive end stator, place a mark on the drive end stator where each anti-drive end phase lead is located. Cut the three terminals off the anti-drive end phase leads and discard.
 - b. If removing the drive end stator, break out the six glued in wedges on the drive end stator with the anti-drive end phase leads behind them.

8. Position the shell in the support stand with the faulty stator in a downward position. Place stator installation/removal tool XA3320 on top of the tabs of the stator being removed. Ensure the recessed portion of the tool is fully engaged with the stator tabs

⚠ IMPORTANT ⚠

Ensure the stator installation/removal tool is engaged with the stator tabs of the part being removed and not the stator in the upper position. The shell assembly is manufactured with a raised area in the center of the shell. The stators can only be removed by pushing them out through the end of the shell.

9. Place the shell assembly into a hydraulic press and remove the faulty stator. Figure 10-86 shows the drive end stator being removed.



FIGURE 10-86.

NOTE: The tabs of the stator may bend slightly downward during the removal process. Continued downward pressure will push the stator out of the shell.

Drive End Housing Installation

1. Place shell assembly (58) into the support stand with the drive end facing up.

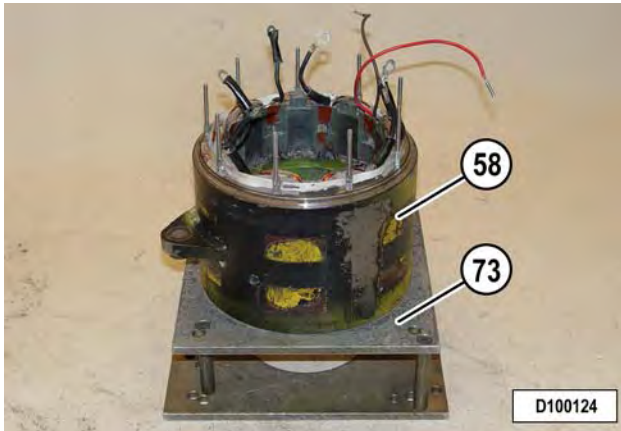


FIGURE 10-119.

58. Shell Assembly 73. Support Stand



DO NOT damage the stator windings or studs while repositioning the alternator.

2. Align the scribed marks on the drive end housing and the shell. Install the rotor shaft and housing assembly onto the shell. A rod can be used to verify the mounting tabs on the shell and the drive end housing are properly aligned.



FIGURE 10-120.

3. As the drive end housing is installed, guide the two field coil leads and the six stator phase leads through the proper openings in the drive end housing.

NOTE: If necessary, install new terminal ends on the wires. On the stator phase leads cut the wires to length, strip the correct amount of wire insulation, install insulating sleeves over the wires, and solder on the new terminal ends. On the new field coil leads, cut the wires to length, strip the correct amount of wire insulation, and crimp on the new terminal pins.

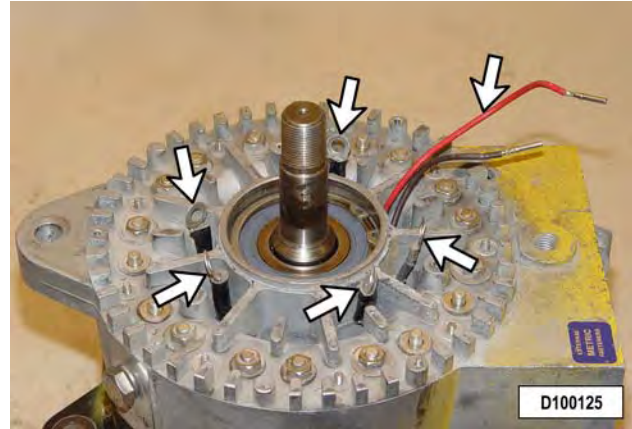


FIGURE 10-121.

Installation

1. Place the appropriate diameter heat shrink insulation onto the thermal switch wires.
2. Solder the new thermal switch wires into the wiring terminal sleeves.
3. Position the heat shrink insulation over each wiring connection and apply heat to seal the connection.
4. Reposition the insulation sleeve over each wiring connection.
5. Place the wiring terminal connections in the correct order. Refer to Step 6, Removal, for the proper installation order. Install hex head bolt (23) with lock washer (24) and flat washer (25). Tighten the bolt to **28 N·m** (20 ft lb).



The thermal switch connection is coated with a Dow Corning® 1-2577 low VOC RTV coating, or equivalent. DO NOT use a coating containing acetic acid (vinegar smell) on any electrical components. Using any other coating will cause part damage.

6. Coat the thermal switch connection with Dow Corning® 1-2577 low VOC RTV coating, or equivalent.
7. Secure the wires together using a plastic tie strap.
8. Apply Dow Corning® 1-2577 low VOC RTV coating, or equivalent, onto the cover plates before installing. Install control unit cover plates (21, 26). Apply a thread lock compound (Loctite) to the screws with nine Torx screws (6) using a T20 Torx bit. Tighten to **3 N·m** (30 in. lb).
9. Connect wiring harness (36) to voltage regulator (37).

SUPPORT STAND

Disassembly of the alternator can be made easier by using a support stand, as shown. This drawing provides the dimensions to manufacture the stand.

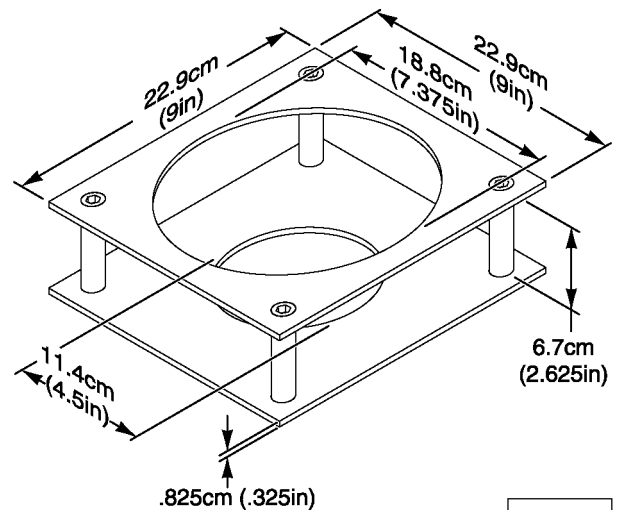


FIGURE 10-158.

Trends

The KOMTRAX Plus controller develops trends by monitoring real-time data, and reducing the data into 20 hour statistical values. For each trended data item, the KOMTRAX Plus controller can determine the maximum value, minimum value, and average value during the preceding 20 hour period. Table 4 shows the type of statistical data recorded for each item.

NOTE: Trend data is only collected when the engine is running.

Histogram (Load Map) Data

The KOMTRAX Plus controller develops histograms by sampling data every 100ms while the engine is running. The data is presented as a two dimensional histogram showing time-at-level for various combinations of the two input data items.

The KOMTRAX Plus controller maintains an engine speed vs. fuel rate histogram called the Engine Load Map, and a brake pressure vs. speed histogram.

The Engine Load Map histogram shows time-at-level for specific engine speed and fuel rate combinations.

The Brake Pressure vs. Speed histogram shows time-at-level for specific brake pressure and vehicle speed combinations.

Two engine load maps are maintained in the KOMTRAX Plus controller. The Permanent Load Map contains load map data for the life of the engine. The Temporary Load Map contains load map data since the most recent memory clear action.

Although the engine data is sampled every 100ms internally, the histograms are only updated every two hours.

Table 3: Trend Data

Data Item	Data Source	MAX	AVG	MIN	Model Notes
Engine Coolant Temperature	QUANTUM Controller	X		X	
Engine Oil Pressure	QUANTUM Controller	X		X	
Engine Speed	QUANTUM Controller	X			
Atmospheric Pressure	QUANTUM Controller		X		
Exhaust Gas Temperature	CENSE Controller	X			
Engine Oil Temperature	CENSE Controller	X			
Fuel Rate	QUANTUM Controller		X		
Boost Pressure	QUANTUM Controller	X			
Blow-by Pressure	QUANTUM Controller	X			
Brake Pressure	Interface Module	X	X		
Hoist Pressure 1	Interface Module	X			
Hoist Pressure 2	Interface Module	X			
Steering Pressure	Interface Module	X			
Front Left Brake Oil Temperature	Interface Module	X	X		930E Only
Front Right Brake Oil Temperature	Interface Module	X	X		930E Only
Rear Left Brake Oil Temperature	Interface Module	X	X		930E Only
Rear Right Brake Oil Temperature	Interface Module	X	X		930E Only
Ambient Temperature	Interface Module	X	X	X	
Hydraulic Oil (Tank) Temperature	Interface Module	X	X		830E Only

KOMTRAX Plus SOFTWARE

To work with the KOMTRAX Plus System (formally called VHMS), several special tools and software programs are required. Refer to Tables 1 & 2 for detailed information on KOMTRAX software and tools

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

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

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

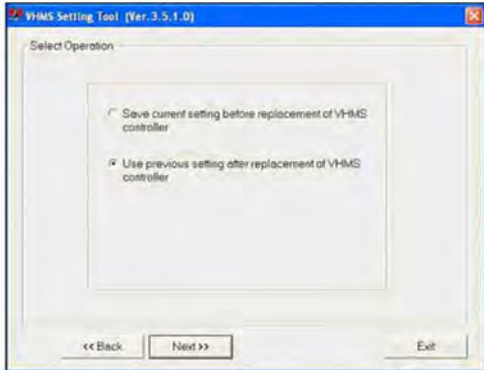
NECESSARY SOFTWARE

Table 1: KOMTRAX Plus Software			
Part Number	Name	Description	Source
Version 3.04.03.01	VHMS Technical Analysis Tool Box	To maintain KOMTRAX Plus system	Komatsu Distributor
Version 3.06.00.00	VHMS Setting Tool	To initialize KOMTRAX Plus system	Komatsu Distributor
1.1.0.0 Install.exe	Interface Module Realtime Data Monitor Software Version 1.1.0.0 Install.exe	Use to watch inputs and outputs in the interface module	Komatsu Distributor
EJ3055-2.exe	Flashburn Software	To install application code in interface module	Komatsu Distributor
EM2126-0.exe	830E-AC Application Code	Application code for interface module	Komatsu Distributor
1.4.7.39	PDM	Payload Meter III Data Manager	Komatsu Distributor
EJ0575-5	PLM III	PLM III Controller Software to work with KOMTRAX Plus	Komatsu Distributor

NECESSARY TOOLS

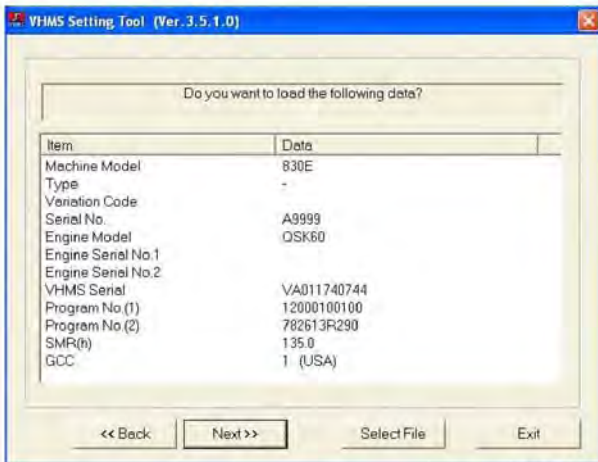
Table 2: KOMTRAX Plus Tools			
Part Number	Name	Description	Source
	Laptop PC	200 MHz or higher 64 MB RAM or more Serial or USB Port CD/DVD -Rom drive Floppy Drive Windows 95/98/2000/ME/XP	Purchased Locally
	Serial cable	(RS232) Purchase locally Male DB9 connector at one end Female DB9 connector at other end	Purchased Locally
	Adaptor	USB port to RS232 (serial) port adaptor (If laptop PC does not have an RS232 port, this adaptor is required)	Purchased Locally

6. Select the [Use previous setting after replacement of VHMS controller] function.



D120054

7. Verify that the data showing is the data to be loaded and then click the [Next] button.



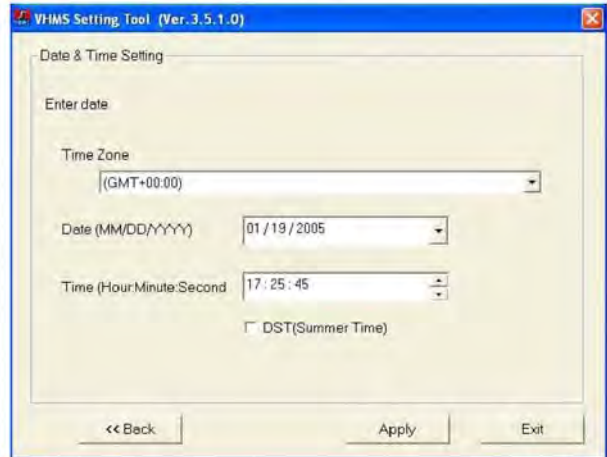
D120055

8. If the correct data is not showing, click the [Select File] button and choose the correct data. Then click the [Next] button.



D120056

9. Enter the correct Time Zone, Date and Time information. Check [DST (Summer Time)] if the machine's location uses Daylight Savings Time. Click the [Apply] button.



D120057

7. Pump Filter Switches (IM2-Y) - short wire 39L to ground at TB44-N momentarily and confirm state change (one to zero).
8. No Propel (IM2-p) - short wire 75NP to ground at TB25-P momentarily and confirm state change (one to zero).
9. Propel System Caution (IM2-t) - short wire 79W to ground at TB26-D momentarily and confirm state change (one to zero).

10. Reduced Propel System (IM3-B) - short wire 72LP to ground at TB25-W momentarily and confirm state change (one to zero).
11. Park Brake Set (IM2-M) - disconnect park brake pressure switch in brake cabinet at CN240 momentarily and confirm state change toggles continually (zero to one).

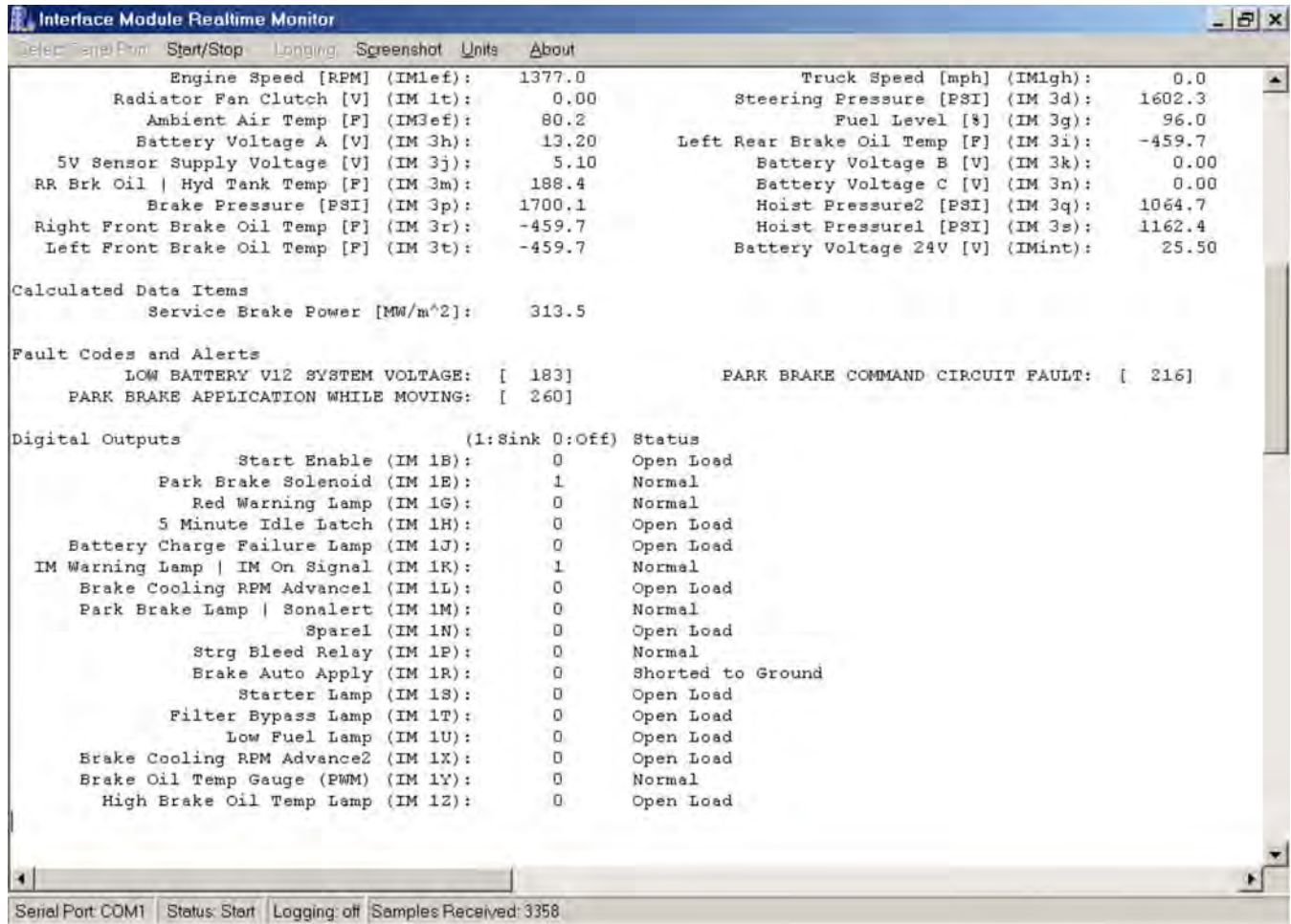
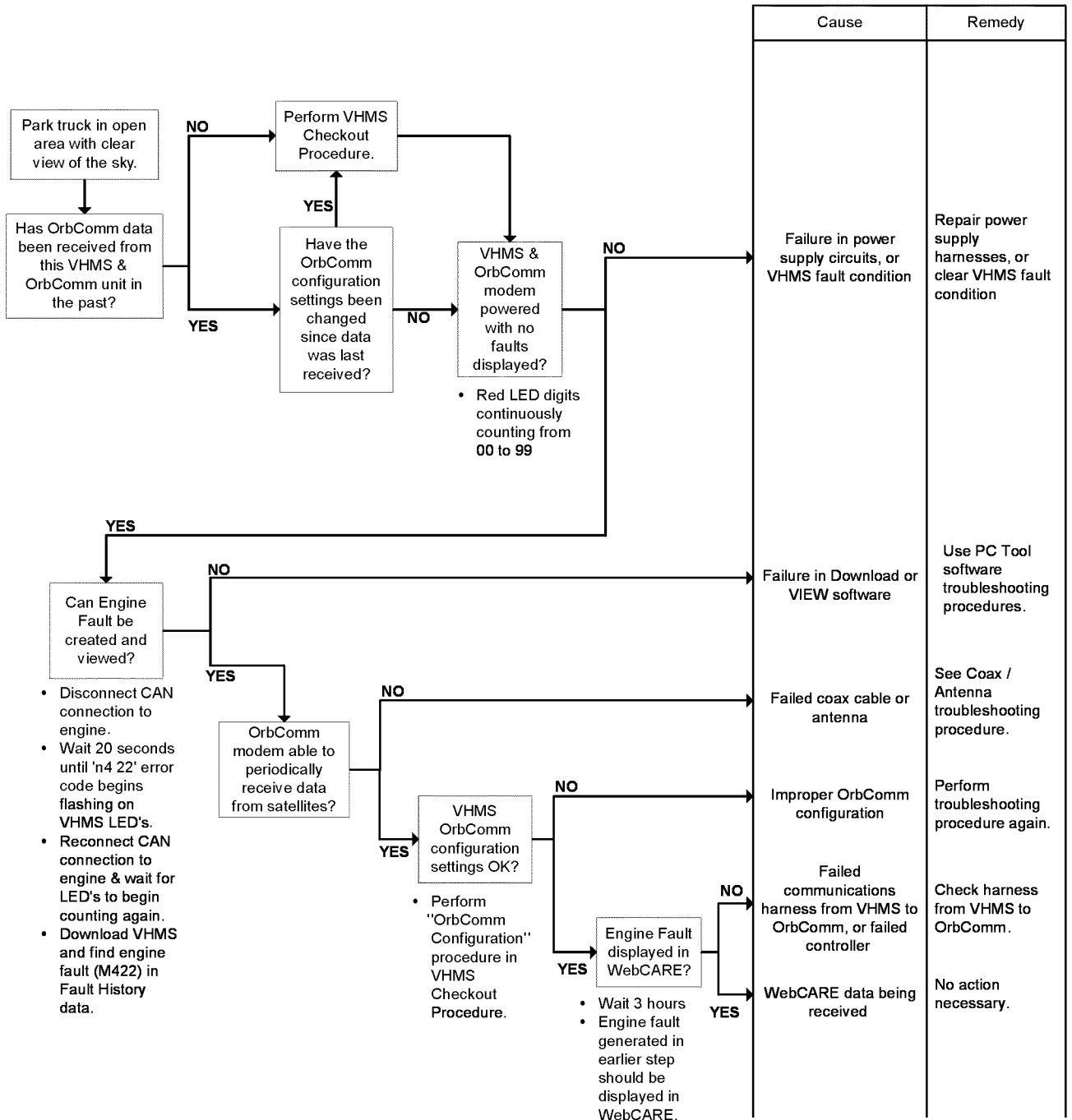


FIGURE 13-5. Interface Module Real Time Data Monitor

Table 3: Chassis Fault Codes (continued)

KOMTRAX Fault Code	KOMTRAX Fault Description	Source	Sent via OrbComm	Snapshot Trigger	Model Notes
#A101	Hydraulic Oil Filter Differential Pressure High	IM			830E-AC
#A103	Hydraulic Tank Temp - Sensor Low	IM			830E-AC
#A104	Hydraulic Tank Temp - Sensor High	IM			830E-AC
#A105	Fuel Level Sensor Low	IM			830E-AC
#A107	Propel System Caution	IM/GE	X		830E-AC
#A108	Propel System Temp Caution	IM/GE	X		830E-AC
#A109	Propel System Reduced Level	IM/GE	X		830E-AC
#A115	Low Steering Precharge	IM	X		830E-AC
#A123	Reduced Retard Level	IM/GE			830E-AC
#A124	No Propel / Retard	IM/GE	X		830E-AC
#A125	No Propel	IM/GE	X		830E-AC
#A126	Hydraulic Tank Level Low	IM	X		830E-AC
#A127	IM Sensor +5V Low	IM	X		830E-AC
#A128	IM Sensor +5V High	IM	X		830E-AC
#A139	Low Fuel	IM			830E-AC
#A152	Starter Failure	IM			830E-AC
#A153	Low Battery Voltage - Engine Running	IM			830E-AC
#A154	High Battery Charge Voltage	IM			830E-AC
#A155	Low Battery Charge Voltage	IM			830E-AC
#A158	Fuel Level Sensor High	IM			830E-AC
#A159	Battery Voltage, 12V System Low	IM			830E-AC
#A164	Battery Voltage, 12V System High	IM			830E-AC
#A182	System Battery, 12V High	IM			830E-AC
#A183	System Battery, 12V Low	IM			830E-AC
#A184	J1939 Not Connected	IM			830E-AC
#A190	Auto Lube Pressure Warning	IM	X		830E-AC
#A193	High Hydraulic Tank Oil Temp	IM	X	X	830E-AC

No Data Received By WebCARE



D130012

DANGER

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

Before attempting repairs or working near 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 control cabinet covers or touch the retarding grid elements. Additional procedures are required before it is safe to do so. Refer to “SAFETY”, Section A3, for additional propulsion system safety checks to be performed by a technician trained to service the system.
- **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.
- **IN THE EVENT OF A PROPULSION SYSTEM MALFUNCTION**, a qualified technician should inspect the truck and verify the propulsion system does not have dangerous voltage levels present before repairs are started.
- **THE LINK VOLTAGE LIGHTS MUST NOT BE ILLUMINATED WHEN TEST OR REPAIRS ARE INITIATED.** It requires approximately 5 minutes after the truck is shut down before the link voltage has dissipated.
- **BEFORE WELDING ON THE TRUCK**, disconnect the ECM harnesses. In the PSC and TCI enclosures, pull cards forward far enough to disconnect the card connector from the backplane connector. Disconnect the battery charging alternator lead wire and open the battery disconnect switches. The welding ground electrode should 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. Avoid laying welding cables across or near truck wiring harnesses or power cables. Voltages can be induced in adjacent cables, damaging electrical components.

**Table 2: DID PANEL FAULT CODES
(Codes Received from PSC)**

EVENT NUMBER	EVENT DESCRIPTION	EVENT RESTRICTION	DETECTION INFORMATION
036	GY19 GRID BLOWER FAILURE	No power	A grid blower has failed.
:01	blower 1 stall		
:02	blower 2 stall		
:03	blower 1 open		
:04	blower 2 open		
:05	blower 1 & 2 delta too large		
037	COMPUTER POWER SUPPLY	Speed limit	+5V power supply is out of limits. +15V power supply is out of limits. -15V power supply is out of limits. +24V power supply is out of limits. -24V power supply is out of limits.
:01	VOLTS 5 POS		
:02	VOLTS 15 POS		
:03	VOLTS 15 NEG		
040	VOLTS 24 POS		
041	VOLTS 24 NEG		
042	DIRECTION SELECTED IN LOAD BOX MODE	No propel	Selector switch moved to FORWARD or REVERSE during self load.
043	DRIVE SYSTEM BATTERY LOW	Speed limit	Battery volts are below limit.
044	DRIVE SYSTEM BATTERY HIGH	None	Battery volts are above limit.
045	CHOPPER OPEN CIRCUIT	Speed limit	Open circuit in a chopper
:01	chopper 1		Open circuit in chopper 1
:02	chopper 2		Open circuit in chopper 2
046	RETARD SHORT CIRCUIT	Speed limit & engine speed	Failure during chopper self test. Link voltage decayed too quickly when AFSE command set low, prior to starting test.
047	ENGINE STALL	No power	An engine stall condition has occurred.
048	SHORTED DC LINK	No power	DC link short detected at startup.
051	TACH LEFT REAR	INV1 disable	Input from M1 sensor is out of tolerance.
:01	zero output with truck moving		Zero output from sensor with front wheels moving, brake released.
:02	high output with truck stopped		High output from sensor with all other wheel speeds at zero.
052	TACH RIGHT REAR	INV2 disable	Input from M2 sensor is out of tolerance.
:01	zero output with truck moving		Zero output from sensor with front wheels moving, brake released.
:02	high output with truck stopped		High output from sensor with all other wheel speeds at zero.
053	TACH LEFT FRONT	SYS Event	Input from left front wheel sensor is out of tolerance.
:01	zero output with truck moving		Zero output from sensor with rear wheels moving, brake released.
:02	high output with truck stopped		High output from sensor with all other wheel speeds at zero.
054	TACH RIGHT FRONT	SYS Event	Input from right front wheel sensor is out of tolerance.
:01	zero output with truck moving		Zero output from sensor with rear wheels moving, brake released.
:02	high output with truck stopped		High output from sensor with all other wheel speeds at zero.

**Table 3: DID PANEL FAULT CODES
(Codes Received from Inverter 1 & 2)**

EVENT NUMBER	EVENT DESCRIPTION	EVENT RESTRICTION	DETECTION INFORMATION
146/246	INVERTER, TACH 2 (NR)	None	
:01	tach2 one channel		Tach 2 single channel operation
148/248	INVERTER, CHOPPER 1 (NR)	None	
:01	chop1 fb not off		Chopper 1 feedback is not off.
:02	chop1 fb not on		Chopper 1 feedback is not on.
:03	chopA temp short		ChopA thermistor short
:04	chopA temp open		ChopA thermistor open
:05	chopA temp warm		ChopA thermistor warm
:06	chopA temp hot		ChopA thermistor hot
:07	DB1 fb not off S		Chopper 1 not off with DC volts
150/250	INVERTER, CHOPPER 2 (NR)	None	
:01	chop2 fb not off		Chopper 2 feedback is not off.
:02	chop2 fb not on		Chopper 2 feedback is not on.
:03	chop B temp short		Chop B thermistor short
:04	chop B temp open		Chop B thermistor open
:05	chop B temp warm		Chop B thermistor warm
:06	chop B temp hot		Chop B thermistor hot
:07	DB2 fb not off S		Chopper 2 not off with DC volts
151/251	MISCELLANEOUS	INV1 (INV2) off	
:01	tach differential		Too much speed difference
153/253	INVERTER, MOTOR	INV1 (INV2) off	
:01	motor open		Motor connection open
:02	motor short		Motor connection short
154/254	INVERTER MOTOR FAULTS (NR)	None	
:01	rotor temp hi		Motor rotor temperature is high.
:02	stator temp hi		Motor stator temperature is high.
155/255	INVERTER, SECOND LOAD	None	
:01	second load open		Second load connection open
175/275	INV 1 GENERIC EVENT	None	Inverter shutdown with no event code
176/276	INV 1 GENERIC EVENT	INV1 (INV2) off	

- *DC Link Capacitance Test* - This test will run once every 24 hours when conditions allow, normally after a VI-test during the normal power-up sequence. This test can also be run from the DID panel to aid in troubleshooting. During test execution, engine speed is set to 1500 rpm and the DC link is charged to 120 VDC. The engine is then returned to idle while the DC link is allowed to discharge to 100 VDC. Total link capacitance is then calculated using the time it took to discharge.

If capacitance is getting low, but is still OK, event 70 is logged. If capacitance is below the minimum allowable level, event 71 is logged and the truck is restricted to 10 MPH. If the test is not able to be completed after numerous attempts, event 72 is logged, indicating a problem in the truck's ground detection circuit, and truck speed is limited to 10 mph.

Initiated Tests

These tests are performed when requested by maintenance personnel. The truck must be in the Test state for these tests to run.

- *Maintenance Tests* - The purpose of these tests is to facilitate verification of system installation and wiring, particularly the "digital" interfaces (relays, contactors, etc).
- *Self-Load Test* - Self-load testing is a means by which the truck's diesel engine can be checked for rated horsepower output.

Periodic Tests

These automatic tests are run continuously during the operation of the truck to verify certain equipment.

EVENT RESTRICTIONS

The PSC software will not override an event restriction as long as the "limp home" mode is not active. Transitions to restricted states will not be allowed. If the system is in a state which becomes restricted, it will transition down to the highest unrestricted state. The order of the states, from lowest to highest, is Startup/Shutdown, Rest, Test, Ready, Retard, Propel.

Transitions to the Test state or lower states in reaction to event restrictions will not be allowed until the truck is not moving. The "limp home" mode is a state which is entered when the truck has suffered a failure and is not able to continue normal operation, but is still capable of getting back to the maintenance area, or at least out of the way of other trucks.

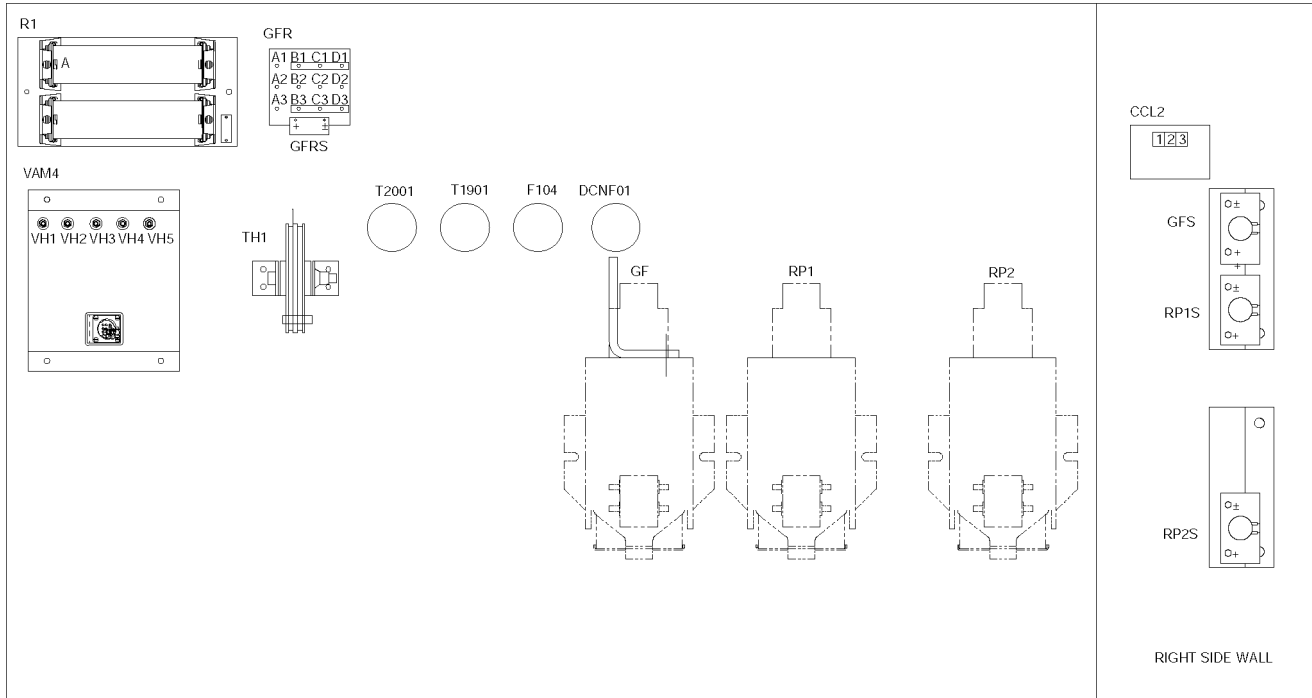
Event Restrictions associated with a given event are listed in Table 1 earlier in this section.

EVENT LOGGING AND STORAGE

This software function is responsible for the recording of event information. There are two basic levels of event storage: event history buffer and data packs. The event history buffer provides a minimum set of information for a large number of events, while data packs provide extensive information for a limited number of events.

The following requirements apply to both data packs and the event history buffer:

- Fault information is maintained until overwritten; it is not cleared out following a reset. This allows the user to examine data associated with events that have been reset, as long as there have not been so many new events as to necessitate reuse of the storage space.
- If a given event is active (logged and not reset), logging of duplicate events (same event and sub-ID numbers) will not be allowed. If the event is reset and subsequently reoccurs, it may be logged again. Likewise, if an event reoccurs with a different sub-ID from the original occurrence, the event may be logged again.



E020124

FIGURE 2-5. CONTROL CABINET COMPONENTS - CONTACTOR COMPARTMENT

Checks with Key Switch OFF

5. With key switch OFF, verify 25VDC to ground minimum for the following circuits:
 - 11
 - 11s on TB30
 - 11L on CB30
 - 11A on TB30
 - 11SL on TB28

NOTE: The voltage should be at least 25VDC. If the voltage is significantly low, check the battery circuits. If the voltage is slightly low, install a battery charger.

6. Check circuit 11B1 voltage to ground.
 - The voltage should be approximately 12VDC.
7. Make sure that the CN1 connector on the power supply is connected. Install the BATFU fuse.
8. Activate the battery disconnect switches and turn on the ground level engine shutdown switch. Make sure all circuit breakers are closed.
10. Use a digital multimeter to check the polarity of the battery voltage at the BATFU fuse holder. Connect the positive lead to BATH and the negative lead to RTN.
 - The voltage at BATH should be +24V.

Checks with Key Switch ON

1. Deactivate the battery disconnect switches. Turn the key switch ON.
2. Check the voltage of circuit 712 to ground.
 - The voltage should be 25VDC.
3. Check the voltage of circuit 71CK to ground.
 - The voltage should be 25VDC.
4. Turn control power switch (1, Figure 3-1) to ON. Verify that all five green lights in the power supply are lit.
5. Verify that the display on the DID panel is lit.
6. Check the voltage on the following circuits in the auxiliary control cabinet. Voltage at each should be at least 25VDC:
 - 71 on TB32
 - 71GE on TB22

7. Verify the specified voltage to ground at the following locations in the auxiliary control cabinet:
 - +15VDC at the 15PV wire on TB29 (from TCI, supply to operator control pedals)
 - +15VDC at the 15V wire on TB21 (from TCI, power to cab gauges)
 - +15VDC at the 15SPD, 15RWS and 15LWS wires on TB21 (from TCI, power to front wheel speed sensors)
 - Approximately 11VDC at the 10V wire on TB28
 - +15VDC at the 15VL wire on TB32
 - Approximately 14.8VDC at the 15SIM wire on TB32.
8. Measure voltage between circuit 72E (+) (TB24) and circuit 0 (-) (TB24-H) in the auxiliary control cabinet.
 - The voltage should be 5VDC.
9. Install a jumper from 22F0 @ TB32 to ground.
 - The voltage should change to 7VDC.
10. Remove the jumper to 22F0.
11. Verify 12VDC to ground for the following circuits:
 - 65
 - 67C
 - 67R
 - 67P

CPU Battery Checks

12. Turn the control power switch to OFF.
13. Connect a VOM across the screws securing the green plate on the edge of the PSC CPU card in the ICP panel. Connect the positive lead to top screw (2, Figure 3-2) and the negative lead to bottom screw (4).
 - The value should be approximately 3.5 volts.
14. Connect a VOM across the screws securing the green plate on the edge of the TCI CPU card in the TCI panel. Connect the positive lead to top screw (2) and the negative lead to bottom screw (4).
 - The value should be approximately 3.5 volts.

NOTE: If battery voltage is low in either battery check, refer to "Memory Backup Battery Replacement" instructions on the following page.

- ◆ Close the “TCI Real Time Data” screen, then double-click “TCI Serial Data”.
- Verify that the analog and digital values are similar to the example in Figure 3-8.

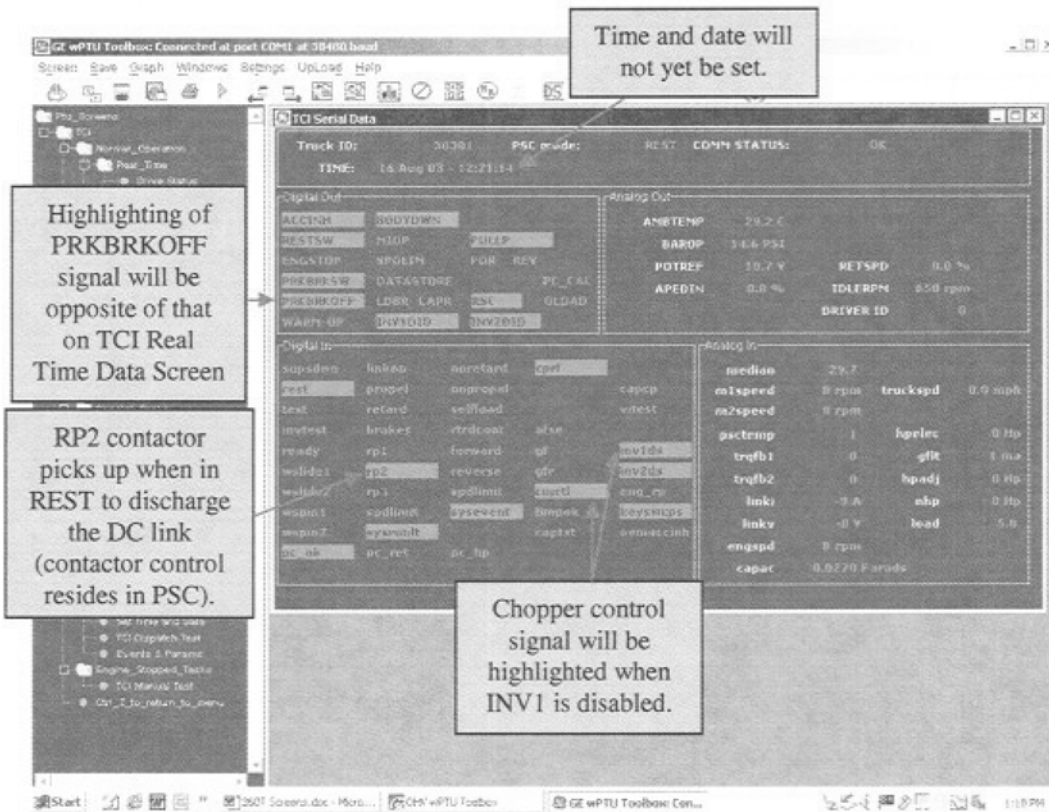


FIGURE 3-8. TCI SERIAL DATA SCREEN

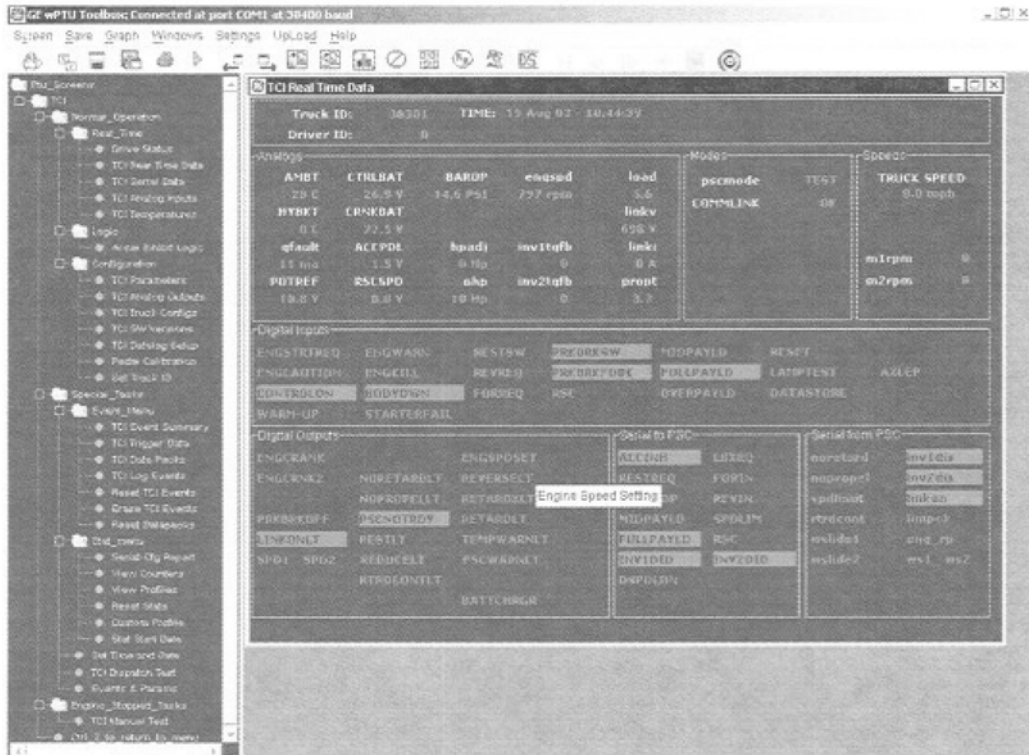


FIGURE 3-15. TCI REAL TIME DATA SCREEN

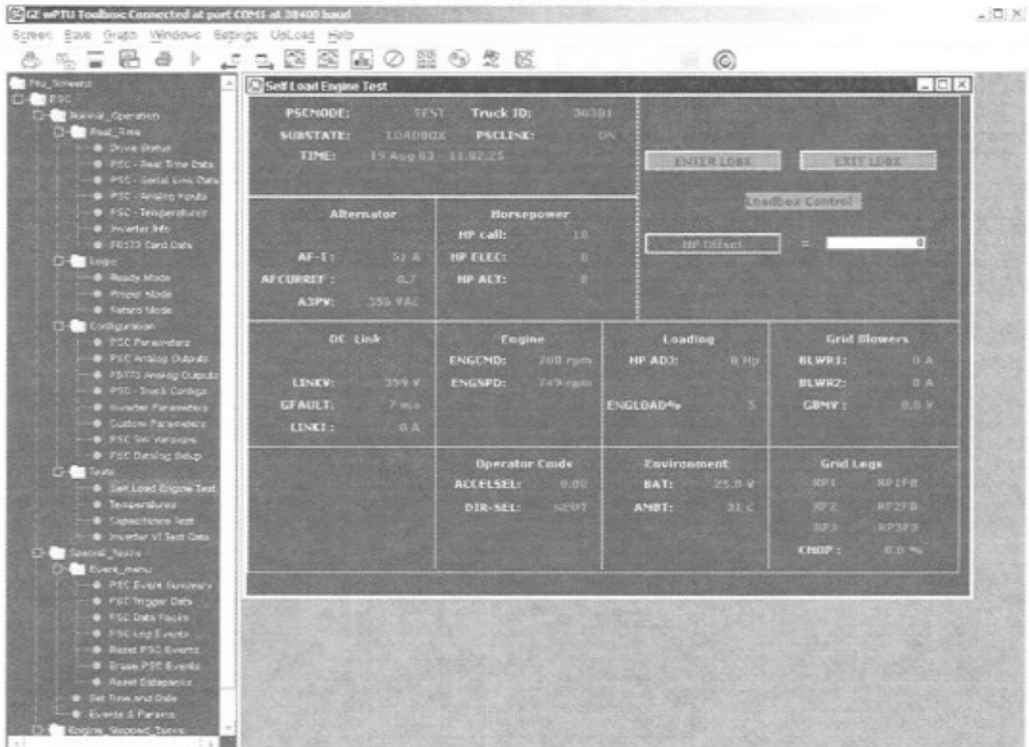


FIGURE 3-16. INITIAL SELF LOAD ENGINE TEST SCREEN

2. Turn the key switch OFF to stop the engine, and allow at least 90 seconds for the accumulator to bleed down. Turn the steering wheel to be sure no pressure remains. As a safety precaution, bleed down brake accumulators.
3. Place jack under spindle or under frame at the front cross tube.
4. Raise front end of truck until tires clear ground and block up securely under frame.
5. Visually inspect all brake components for damage or wear. Inspect hydraulic brake lines for damage or leaking fittings.
6. Secure wheel assembly to hoist or fork lift and take up slack. Remove wheel nuts (8, Figure 2-1), and wheel retainer lugs (7) securing wheel assembly to wheel hub. Remove the clamp that secures the tire inflation valve to the wheel hub.

CAUTION

Care should be taken not to damage the inflation stem during tire removal.

7. Move wheel assembly away from wheel hub and into clean work area.

WARNING

Do not attempt to disassemble wheel assembly until all air pressure is bled off.

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

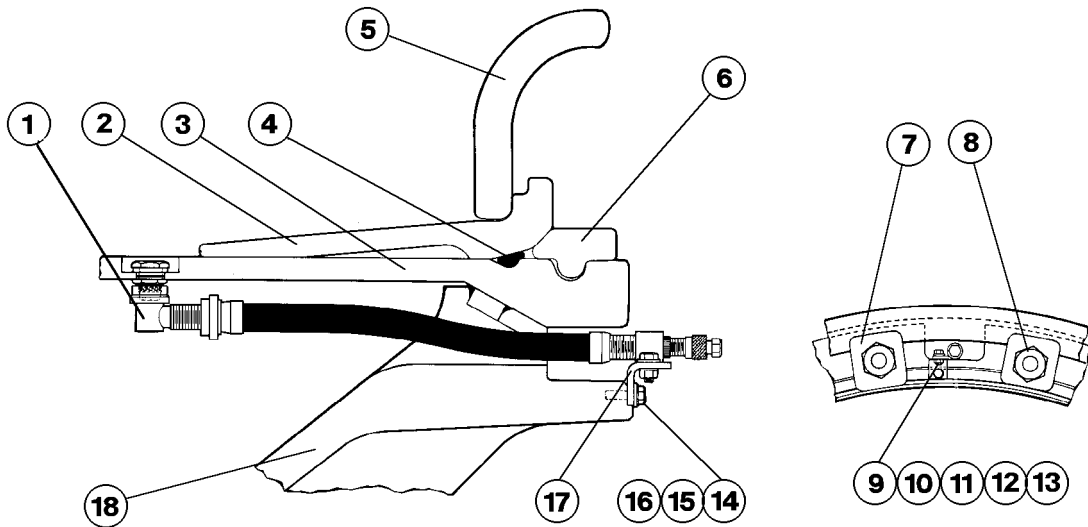


FIGURE 2-1. FRONT WHEEL ASSEMBLY

- | | | | |
|-------------------|-----------------------|----------------|----------------|
| 1. Valve Assembly | 6. Lock Ring | 11. Lockwasher | 16. Lockwasher |
| 2. Bead Seat Band | 7. Wheel Retainer Lug | 12. Nut | 17. Bent Plate |
| 3. Rim | 8. Nut | 13. Clamp | 18. Hub |
| 4. O-Ring | 9. Cap Screw | 14. Cap Screw | |
| 5. Side Flange | 10. Flat Washer | 15. Flatwasher | |

NOTE: Older pusher tools (5, Figure 3-5) may have been made with a round tube (shown as a dotted line) welded on one side. The tool can be installed upside down and used with a hydraulic ram as shown.

Refer to Section "M", Options & Special Tools for dimensions for fabricating the spindle pusher tool and spacers (6, Figure 3-5). Special cap screws and washers are also required.

The hydraulic ram must be a low profile hydraulic ram (pancake jack) to fit in this area. Most hydraulic rams that will fit in this area are rated at 150 tons.

CAUTION

The maximum force that can be applied during the spindle removal process is not to exceed 408 233 kgf (900,000 lb).

11. Locate 13 cap screws (1, Figure 3-5) and washers (2) as specified below:

Cap Screw P/N KC70951.25 x 8 in.

Washer P/N WA036641.1 mm (1.62 in.)

12. Lubricate the cap screw threads and flat washers with chassis grease.
13. Install pusher tool (5) as shown in Figure 3-5 using the only three cap screws (1), three washers (2) and three spacers (6). The three cap screws must be evenly spaced. Tighten the three cap screws to **68 N·m (50 ft lb)**.

NOTE: Verify minimum thread engagement is 41.1 mm (1.62 in.) on pusher cap screws when inserted.

14. Ensure hydraulic ram (4) is completely retracted. Install hydraulic ram with reaction plate (3) on top of the hydraulic ram.

NOTE: If there is a large gap between the reaction plate and the suspension, it may be necessary to add steel spacers below the hydraulic ram.

CAUTION

Do not apply pressure to the hydraulic ram until all 13 cap screws are installed.

15. Install the remaining 10 cap screws and tighten them to **68 N·m (50 ft lb)**. This is to ensure all cap screws will pull evenly when pressure is applied by the hydraulic ram.

CAUTION

The maximum force that can be applied during the spindle removal process is not to exceed 408 233 kgf (900,000 lb).

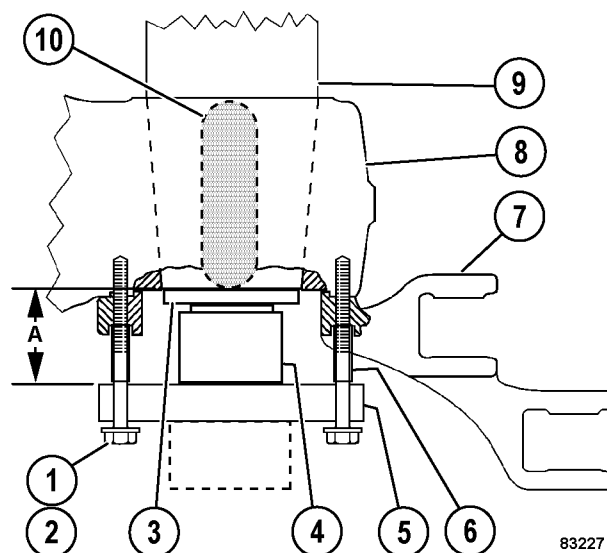


FIGURE 3-5. PULLER TOOL WITH RAM

- | | |
|-----------------------------|----------------------|
| 1. Cap Screw (KC7095) | 5. Pusher Tool |
| 2. Hardened Washer (WA0366) | 6. Spacer |
| 3. Reaction Plate | 7. Steering Arm |
| 4. Hydraulic Ram | 8. Spindle |
| | 9. Suspension Piston |
| | 10. Area to heat |

13. Tighten two cap screws 180° apart and adjacent to the 13 mm (0.50 in.) diameter depth measurement holes (3) to **81 N·m (60 ft lb)**. Some movement of the retainer and bearing race must be observed. If no movement is observed, repeat Step 11. Then rotate the wheel hub a minimum of three revolutions.
14. Tighten the same two cap screws to **149 N·m (110 ft lb)** while rotating the hub.
15. Using a depth micrometer, measure and record the depth to the end of the spindle from the face of the retainer plate through each of the two holes in the retainer plate adjacent to the cap screws tightened in step 12.
16. Add the two depth dimensions measured in step 13 and divide the total by 2, to obtain an averaged depth dimension.

Record average Depth (d_a): _____

17. Subtract the dimension stamped on the face of the retainer plate from the averaged depth above to determine the required shim pack.

ave. Depth(d_a) - plate Thickness(t_p)=Shim Pack

$d_a - t_p =$ _____ Shim Pack

NOTE: The above procedure results in a shim pack which will provide a nominal 0.178 mm (0.007 in.) preload for the bearings.

18. Assemble a shim pack equal to the dimension established in step 16 within 0.03 mm (0.001 in.).

NOTE: Shim pack must be compressed when measuring.

19. Reinstall tire support chains (2 & 3, Figure 3-15).
20. Remove cap screws and retainer.
21. Install new O-ring on retainer. Install shim pack and reinstall retainer, cap screws, and hardened washers.
22. Remove tire support chains (2 & 3, Figure 3-15).

23. Tighten all cap screws alternately to **1017 ± 102 N·m (750 ± 75 ft lb)** torque in several successive increments while rotating the hub.
24. Using a new O-ring (10, Figure 3-10), install cover (3). Install cap screws and washers (2) and tighten to standard torque.
25. Rotate the wheel hub to position the fill plug (4) at the 12 o'clock position. Remove the fill plug. Add SAE 80W-90 oil to the wheel hub assembly using the fill hole. When properly filled, the floating ball in the sight gauge will be at its highest position. The wheel hub holds approximately 21 liters (5.5 gal) of oil. Replace fill plug.
26. Remove suspension support chain (1, Figure 3-15) if installed, and all cribbing. Lower truck chassis so tire is on the ground.

OIL SAMPLING PROCEDURE

The front wheel bearings must be removed and inspected every 5,000 hours.

However, Komatsu will now allow the use of scheduled oil sampling as an alternate method of monitoring the front wheel bearings. Customers using this method must check the condition of the oil at regular intervals. A history of these inspections must also be maintained, and reviewed after each oil sample. This review is an important part of the oil sampling process, as it identifies trends and/or significant changes in the condition of the oil, which are indicative of a pending bearing problem.

Customers that use the oil sampling method of monitoring the wheel bearings will not be required to perform the 5,000 hour disassembly and inspection of the front wheel bearings until a problem is identified in the oil samples.

The oil sampling method requires a magnetic drain plug in the wheel hub cover. If needed, order and install magnetic drain plug (R2491) to replace the standard drain plug (H6881) in the front wheel hubs.

REAR AXLE HOUSING ATTACHMENT

PIVOT PIN

Removal

1. Park truck on firm, level surface and block front and rear side of all tires.



Truck body must be empty and down against frame before attempting this procedure.

2. Release all brakes.
3. Charge rear suspensions with nitrogen until pistons are fully extended.
4. Place blocks or stands under each frame member beneath the hoist cylinders.



Blocks must be securely in place before lowering the frame. Check blocks on wheels to make sure they are in place.

5. Release nitrogen out of front suspensions.
6. Release nitrogen out of rear suspensions.
7. Place a jack below the pivot pin to control any downward movement when the pin is removed.
8. Disconnect pin lube line. Remove ground wire between pivot structure and frame.
9. Remove cap screw and lockwasher (3, Figure 4-1). Remove cap screws (4). Remove retainer plate (2).
10. Install puller using tapped holes in head of pin. Remove pin (6).

NOTE 1: Placement of a jack between mounting structure and pivot eye may be necessary to push the pivot eye down away from frame structure. Pivot eye may also need to be moved to one side to clear welded spacer.

NOTE 2: If the bore for the Pivot Pin (6, Figure 4-1) in the Mounting Structure (1, Retainer Plate side) has been damaged, a rework procedure to install a sleeve is available. The rework drawing, EG4670, is available in AK4952 Nose Cone Repair Kit.

Installation

1. Raise pivot eye into position.
2. Be certain spherical bearing inner race (7) is aligned. Install spacers (5, Figure 4-1) and pin (6).
3. Line up cap screw holes in pin with cap screw holes in retainer plate (2). Install cap screws (4).
4. Rotate pin and retainer plate to align cap screw holes in frame mounting structure.
 - a. Install cap screws and lockwashers (3).
 - b. Tighten cap screws (3) to **170 N-m (125 ft lbs)** torque.
 - c. Tighten cap screws (4) to **2325 N-m (1715 ft lbs)** torque.

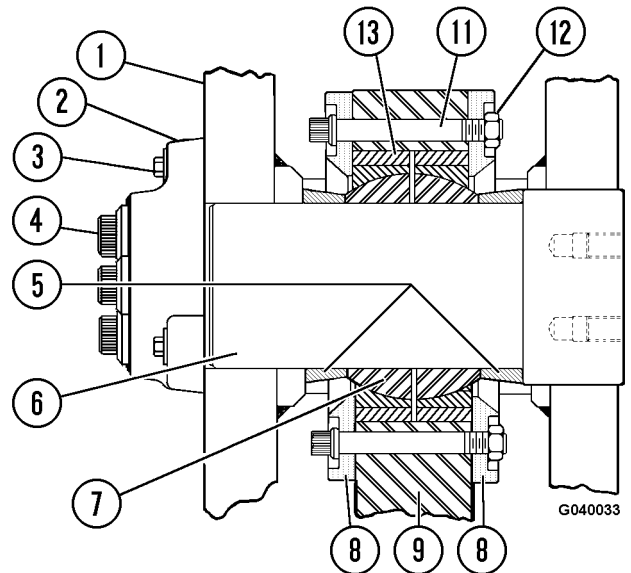


FIGURE 4-1. PIVOT PIN INSTALLATION

- | | |
|--|----------------------------|
| 1. Mounting Structure | 6. Pivot Pin |
| 2. Retainer Plate | 7. Bearing |
| 3. Retainer Cap Screw & Lockwasher | 8. Bearing Retainer |
| 4. Cap Screw (12pt. - G9) & Hardened Flat-washer | 9. Pivot Eye Structure |
| 5. Bearing Spacer | 10. Bearing Carrier |
| | 11. Cap Screw (12pt. - G9) |
| | 12. Locknut |

WHEEL MOTOR GEAR OIL

Change/Filter The Gear case Oil

Due to the use of synthetic oil, replacement or filtration of the oil on a time based interval is not required. The oil should be replaced or filtered based on the oil sample tests of viscosity, element levels and particle size and count. Refer to the drive system shop manual for oil replacement or filtration information.

NOTE: Gear case oil should be replaced/filtered on new or rebuilt motorized wheels after the first 500 hours of operation. Thereafter, follow the normal schedule for oil replacement/filtration.

Timely and consistent oil sampling, testing of the oil samples, tracking the test results, and interpretation of the test results must be done on motorized wheels. Failure to do so may affect warranty coverage on the components.

Oil

Viscosity recommendations have been expanded. Refer to the drive system shop manual for more detailed information on approved oils.

NOTE: The highest viscosity oil should be selected unless sustained temperatures are routinely below the rated minimum temperature range of the oil for consecutive multiple days.

Remove And Clean Magnetic Plugs

The magnetic plugs (3, Figure 5-5) are located in the center of the sun pinion cover and on the oil sump. The magnetic plugs remove magnetic ferrous material from the gear case oil. Small particles will attach to the magnetic during operation preventing the material from recycling through the gears and bearings. Between oil changes, remove only the magnetic plugs located on the sun pinion cover. Removal of the oil sump magnetic plug will drain the oil from the sump. Refer to the drive system shop manual for detailed information regarding magnetic plugs.

Flushing The Gearbox

The gearbox may be flushed to remove accumulated debris or external debris contamination. Flushing must be done with same oil normally used in the gearbox. Use of lighter oils or solvents should not be used due to the residual oil or solvent remaining in the gearbox resulting in misleading oil samples after flushing.

Check Gear Case Oil Level

The oil level is checked at filler cap (2). Allow the truck to remain stationary for at least 30 minutes to allow all of the oil to drain to the sump before checking. Remove the oil filler cap to ensure the oil level is at the top of the oil sump. Fill plugs (1) can also be used to check oil level. If equipped with a sight gauge, the oil level should be in the middle of the sight gauge. Add oil if the oil level is low. If low, check for leaks that would allow gear case oil to leak. Always fill to the top of the sump.

NOTE: Over filling the gear case of the motorized wheel may lead to leaks and seal damage.

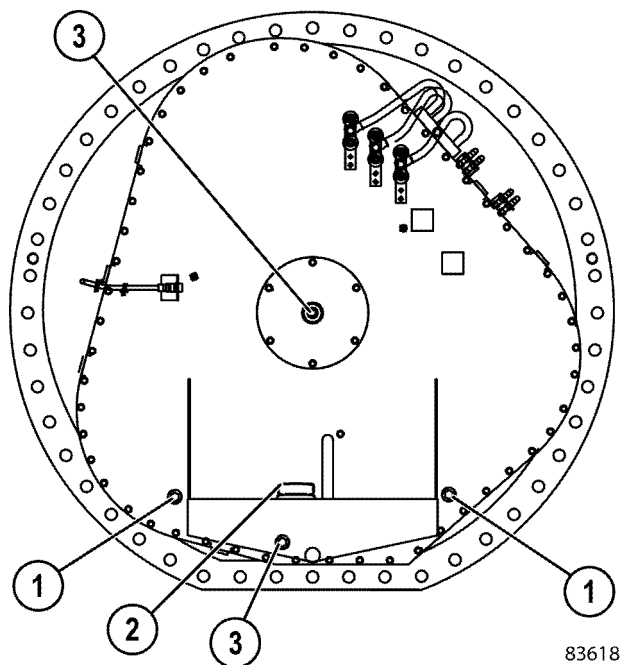


FIGURE 5-5. WHEEL MOTOR

- | | |
|-------------------------|--------------------|
| 1. Plug - Oil Level | 3. Plug - Magnetic |
| 2. Fill Cap - Oil Level | |

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MINOR REPAIR ONLY (Lower Bearing Structure & Seals)

Bearing Structure Removal

If only rod seals, O-rings, and backup rings (and if necessary, bearing structure) are to be replaced, refer to steps below for lower bearing structure removal.

1. Remove lower bearing structure cap screws and hardened washers (18 & 19, Figure 2-11). Install pusher bolts into tapped holes in bearing flange.
2. Tighten pusher bolts evenly and prepare to support bearing structure as it exits the suspension housing. Remove bearing (16).
3. Remove wiper (26), rod lip seal (25), and buffer seal (24). Remove O-ring (20) and backup ring (21).

Bearing Structure Installation

1. Install new rod buffer seal (24, Figure 2-11), lip seal (25) and rod wiper (26).

⚠ IMPORTANT ⚠

When installing backup rings with rod seal (25) and buffer seal (24), be certain radius is positioned toward the seal as shown in Figure 2-8.

2. Install new O-rings (20) and backup rings (21) in their appropriate grooves in the lower bearing structure (16).

NOTE: Backup rings must be positioned toward the flange of bearing structure as shown in Figure 2-13.

3. Install temporary, guide bolts to ensure bolt hole alignment as bearing retainer is seated. Lift lower bearing structure (16) assembly into place and carefully start into suspension housing. Install cap screws and hardened washers (18 & 19). Tighten cap screws to **420 N·m (310 ft lb)** torque.
4. Install wheel, tire and spindle assembly. Refer to steps in Section G, Wheel, Tire and Spindle Installation for installation instructions.

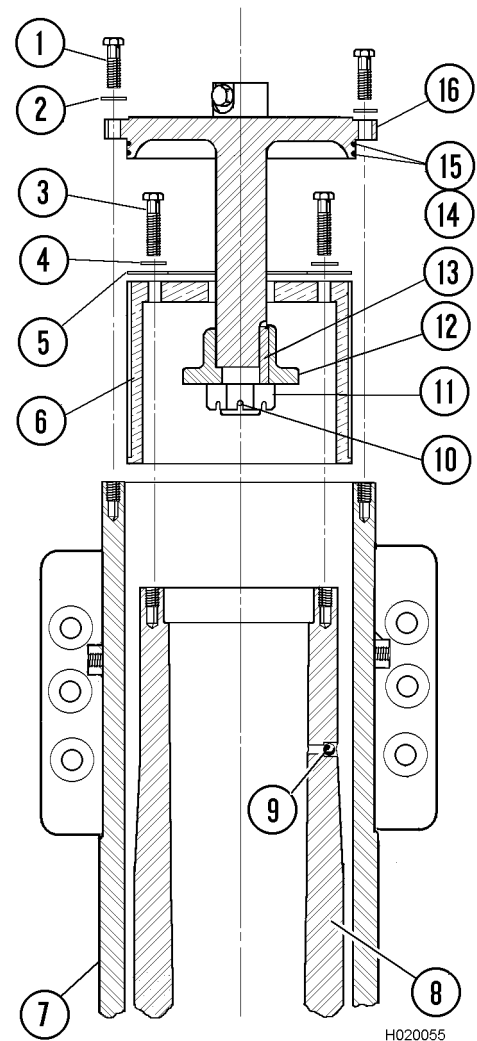


FIGURE 2-10. PISTON ROD REMOVAL

- | | |
|----------------------------|-----------------------|
| 1. Cap Screw | 9. Steel Ball (2 ea.) |
| 2. Hardened Flatwasher | 10. Roll Pin |
| 3. Cap Screw | 11. Nut |
| 4. Hardened Flatwasher | 12. Piston Stop |
| 5. Plate | 13. Key |
| 6. Upper Bearing Structure | 14. O-Ring |
| 7. Housing | 15. Backup Ring |
| 8. Piston | 16. End Cap Structure |

Installation

NOTE: Do not mix rod up with rod down designed suspensions on the same truck. Both rear suspensions must be of the same type.

1. Inspect mounting bore sleeves (9, Figure 3-3) and bearing spacers for damage or wear. Check fit of pins in bores prior to installing suspension. If necessary, replace sleeves (9). Install cap screw (7) and washer (8). Tighten cap screw (7) to standard torque.
 2. Secure suspension to fork lift and raise into position. (Suspension assembly should be retracted as far as possible prior to installation.)
 3. Position top suspension eye with its spherical bearing, between the ears on the frame as shown in Figure 3-3. Ensure that the upper and lower mounting eyes are aligned and the vent plugs are positioned to the rear.
 4. Lubricate the pin (1), align the shoulder bolt hole with the hole in the mounting bore and drive in far enough to hold pin in position.
 5. Insert the spacer (4) and continue to drive the pin in through the spherical bearing. Insert the remaining spacer and continue to drive the pin in until the retaining cap screw hole is aligned with the hole in the pin.
 6. Install bolt (2, Figure 3-3) and locknut (3). Tighten the locknut to **68 N-m (50 ft lbs)**.
- NOTE: Some trucks may be equipped with a shoulder bolt (2) at this location. Tighten the locknut to **68 N-m (50 ft lbs)**. The shoulder bolt should be free to move, not tight after the nut is tightened.*
7. Lower the suspension housing until the lower mount bearing aligns with the bore in the rear axle housing and repeat the above procedure to install the bottom pin. The parts in the top and bottom joint are identical.
 8. Install the nitrogen charging kit and add nitrogen to raise frame off stands or cribbing, or use a lifting device if available.
 9. Connect lubrication lines. Connect pressure sensor.
 10. Service the suspension with oil and nitrogen. For instructions, refer to HYDRAIR® II Oiling and Charging Procedure, this section.
 11. Install piston rod shield (2, Figure 3-1) with the cap screws, flat washers, and lockwashers.
 12. Re-calibrate the payload meter system. Anytime a suspension is serviced, the pressures inside the cylinder changes, which will affect the accuracy of the payload meter.

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

1. Housing
2. Cap Screws
3. Hardened Flatwashers
4. Piston Bearing
5. Piston Rod
6. Bleeder Screw
7. Vent Plug
8. Shield
9. Cap Screw
10. Washers
11. Vent Plug
12. Charging Valve
13. Plug (or Pressure Sensor)
14. Vent Plug
15. Wiper Seal
16. Rod Lip Seal
17. Buffer Seal
18. Socket Head Cap Screw
19. Backup Ring (See note)
20. O-Ring
21. Housing Bearing
22. Ball Check

OILING AND CHARGING PROCEDURE

GENERAL

These procedures cover the Oiling and Charging of HYDRAIR®II suspensions on Komatsu Electric Drive Dump Trucks.

Suspensions which have been properly charged will provide improved handling and ride characteristics while also extending the fatigue life of the truck frame and improving tire wear.

Any time the suspensions are recharged, the calibration of the Payload Meter system is affected. Refer to the Payload Meter III™ section and perform a "Clean Truck Tare". This will ensure accurate payload records.

NOTE: Inflation pressures and exposed piston lengths are calculated for a normal truck gross vehicle weight (GVW). Additions to truck weight by adding body liners, tailgates, water tanks, etc. should be considered part of the payload. Keeping the truck GVW within the specification shown on the Grade/Speed Retard chart in the operator cab will extend the service life of the truck main frame and allow the HYDRAIR®II suspensions to produce a comfortable ride.



All HYDRAIR®II suspensions are charged with compressed nitrogen gas with sufficient pressure to cause injury and/or damage if improperly handled. Follow all safety instructions, cautions, and warnings provided in the following procedures to prevent any accidents during Oiling and Charging.

Proper charging of HYDRAIR®II suspensions requires that three basic conditions be established in the following order:

1. Oil level must be correct.
2. Suspension piston rod extension for nitrogen charging must be correct.
3. Nitrogen charge pressure must be correct.

For best results, HYDRAIR® II suspensions should be charged in pairs (fronts together and rears together). If rears are to be charged, the fronts should be charged first.

NOTE: For longer life of suspension components, a Friction Modifier should be added to the suspension oil. See Specifications Chart, Figure 4-7 at the end of this chapter.

NOTE: Set up dimensions specified in the charts must be maintained during oiling and charging procedures. However, after the truck has been operated, these dimensions may vary.

EQUIPMENT LIST

- HYDRAIR® Charging Kit
- Jacks and/or Overhead Crane
- Support Blocks (Front and Rear) for:
 - Oiling Height Dimensions
 - Nitrogen Charging Height Dimensions
- HYDRAIR® Oil (See Specifications Chart)
- Friction Modifier (See Specifications Chart)
- Dry Nitrogen (See Specifications Chart)

If both front and rear suspension are to be serviced at the same time, service the front suspensions first. Do not remove the front suspension nitrogen charging blocks until after the rear suspensions have been completely serviced.

Rear Suspension Nitrogen Charging (Rod Down Only)

WARNING

Lifting equipment (overhead or mobile cranes, or hydraulic jacks) must be of sufficient capacity to lift the truck weight. Be certain that all personnel are clear of lift area before lift is started. Clearances under the truck may be suddenly reduced.

IMPORTANT

Ensure the automatic apply circuit has not applied the service brakes during truck maintenance. If the front brakes are applied during rear suspension charging, the axle cannot pivot for frame raising / lowering, and the rear suspension may be unable to move up or down.

1. If removed, install charging valve with new O-ring (9, Figure 4-3). Lubricate the O-ring with clean HYDRAIR[®] oil.
2. Tighten valve body (large hex, 6) to **23 Nm (17 ft lb)** torque. The valve swivel nut (small hex, 4) must be unseated by turning counterclockwise three full turns.

WARNING

Dry nitrogen is the only gas approved for use in HYDRAIR[®] II suspensions. Charging of these components with oxygen or other gases may result in an explosion which could cause fatalities, serious injuries and/or major property damage. Use only nitrogen gas meeting the specifications shown in chart (Figure 4-7).

3. Install HYDRAIR[®] Charging Kit and a bottle of pure dry nitrogen. Refer to Installation of Charging Kit.
4. Charge the suspensions with nitrogen gas to 38 mm (1.5 in.) greater than the charging height listed in Table 3.
5. Remove the oiling charging blocks.

WARNING

Be aware when relieving nitrogen gas, the truck may lower suddenly.

6. Slowly release gas until the suspensions match the charging height listed in Table 3.
 7. Close inlet valve (4, Figure 4-1). Leave outlet valves (3) open for five minutes in order to allow the pressures in the suspensions to equalize.
 8. Ensure both of the suspension cylinders are extended the same distance ± 10 mm (0.39 in.). If the difference in the extension from side to side exceeds 10 mm (0.39 in.), check the front suspensions for equal extension. Adjust the front as necessary.
- NOTE: A low left front suspension will cause the right rear suspension to be high. A low right front suspension will cause the left rear suspension to be high.*
9. Close outlet valves (3) and remove charging kit components. Refer to Removal of Charging Kit.
 10. If the charging valve is being reused, tighten swivel nut (4, Figure 4-3) to **6 N·m (50 in. lbs)** torque. Install valve cap (1) and tighten finger tight.

If a new charging valve is being used, tighten swivel nut to **15 N·m (11 ft lbs)** torque, then loosen and retighten the swivel nut to **15 N·m (11 ft lbs)** torque. Again, loosen the swivel nut and retighten to **6 N·m (50 in. lbs)** torque. Replace valve cap (1) and tighten finger tight.

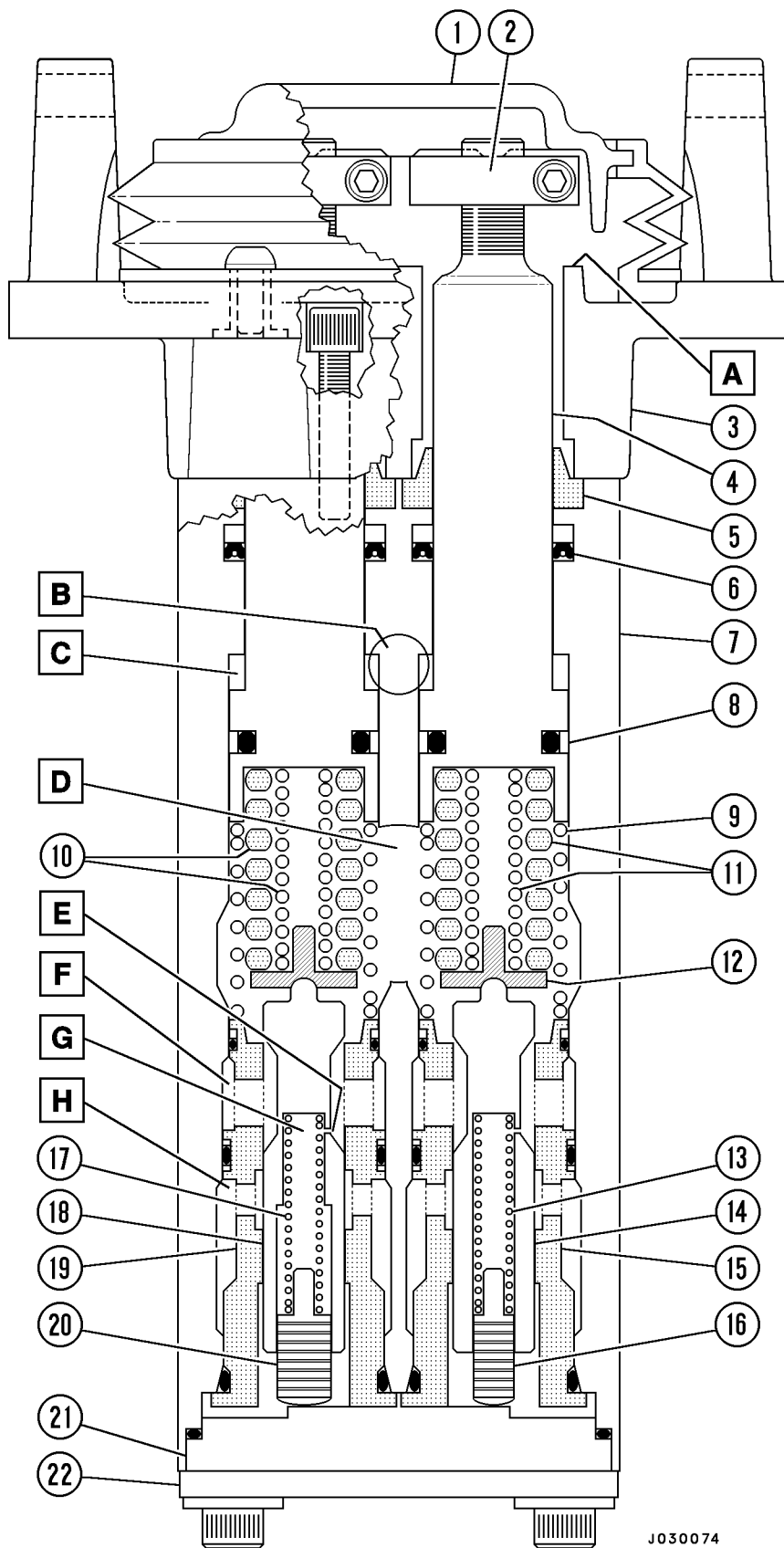


FIGURE 2-2. BRAKE VALVE
(FULL CUT-AWAY)

- 1. Actuator Cap
- 2. Adjustment Collar
- 3. Actuator Base
- 4. Actuator Plunger
- 5. Wiper Seal
- 6. Poly-Pak Seal Assembly
- 7. Valve Body
- 8. Glyde Ring Assembly
- 9. Plunger Return Spring
- 10. Regulator Springs (B1)
- 11. Regulator Springs (B2)
- 12. Spring Seat

(B2 Parts 13-16)

(Front Brake)

- 13. Spool Return Spring
- 14. Regulator Spool
- 15. Regulator Sleeve
- 16. Reaction Plunger

(B1 Parts 17-20)

(Rear Brake)

- 17. Spool Return Spring
- 18. Regulator Spool
- 19. Regulator Sleeve
- 20. Reaction Plunger
- 21. Retainer Plug
- 22. Base Plate

- A. Adjustment Collar
- Contact Area
- B. PX Port
- C. Automatic Apply Piston Area
- D. Tank Port
- E. Orifice
- F. Brake Apply Port
- G. Reactionary Pressure Area
- H. Supply Port

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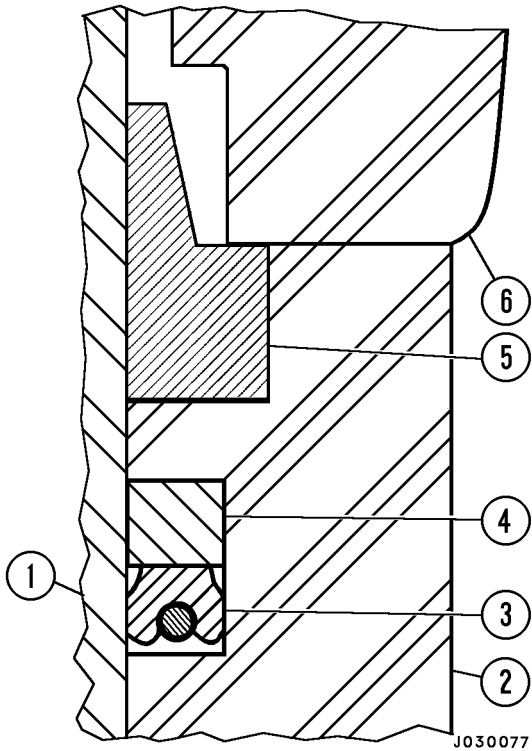


FIGURE 3-6. VALVE BODY SEAL INSTALLATION

- | | |
|---------------------|------------------|
| 1. Actuator Plunger | 4. Back-Up Ring |
| 2. Valve Body | 5. Wiper Seal |
| 3. Poly-Pak Seal | 6. Actuator Base |

Valve Body Seal Installation

1. Install the poly-pak seal (3, Figure 3-6) in the seal groove first. Position the seal in the groove so that the internal O-ring inside the poly-pak seal is facing down toward the bottom of the valve.
2. Make sure the internal O-ring is still seated inside the poly-pak seal (3) and did not get dislodged during installation. Position the poly-pak seal to the bottom of the groove.
3. Install the orange back-up ring (4) on top of the poly-pak seal. Start by hand and then continue to work into the groove either by hand or by using an O-ring installation tool.
4. Install the wiper seal (5) in the top counterbore. Position the seal in the groove so that the register lip is facing up toward the actuator.
5. Repeat Steps 1- 4 for the second bore.

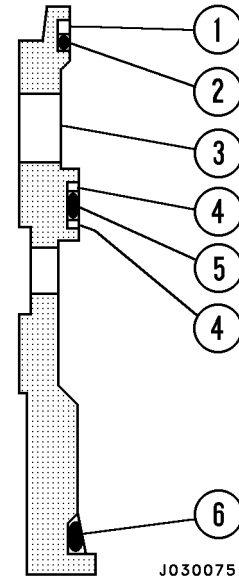


FIGURE 3-7. SLEEVE SEAL PLACEMENT

- | | |
|---------------------|-----------------|
| 1. Back-Up Ring | 4. Back-Up Ring |
| 2. O-Ring | 5. O-Ring |
| 3. Regulator Sleeve | 6. O-Ring |

Regulator Sleeve O-Ring Installation

1. Install O-ring (2, Figure 3-7) onto the smallest groove (on the top) of the regulator sleeve (3). Install O-ring (5) onto the middle groove on the regulator sleeve. Install O-ring (6) onto the largest groove (on the bottom) on the regulator sleeve.
2. Install a split nylon back-up ring (4) onto each side of O-ring (5) located in the middle of the regulator sleeve.
3. Install one split nylon back-up ring behind the O-ring (2) located at the top end of the sleeve. This O-ring is the smallest of the three O-rings. Position the back-up ring so that it is next to the top of the regulator sleeve. The top of the sleeve is the end with the smallest O.D.
4. Repeat Steps 1-3 for the second regulator sleeve.

Cleaning and Inspection

1. All metal parts should be cleaned with a cleaning agent.
2. Seals and soft parts should be wiped clean.
3. Inflate bladder to normal size. Wash bladder with a soap solution. If soap solution bubbles, discard bladder. After testing, deflate bladder immediately.
4. Inspect assembly for damage; check the poppet plunger to see that it spins freely and functions properly.
5. Check anti-extrusion ring and soft seals for damage and wear; replace all worn or damaged seals with original equipment seals.
6. After shell has been cleaned with a cleansing agent, check the inside and outside of shell. Special attention should be given to the area where the gas valve and hydraulic assembly pass through the shell. Any nicks or damages in this area could destroy the accumulator bladder or damage new seals. If this area is pitted consult your Komatsu Service Manager.

Assembly

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

1. After shell has been cleaned and inspected, place accumulator shell in vise or on table.
2. Thoroughly coat the inside of the accumulator shell with a liberal amount of clean hydraulic oil to lubricate and cushion the bladder. Make sure the entire internal of the shell is lubricated.
3. With bladder assembly on bench, expel all air to completely collapse bladder and fold bladder longitudinally into a compact roll. To maintain rolled condition of bladder, install gas valve core into the valve stem, thereby preventing air from entering the bladder.
4. Attach bladder pull rod to bladder valve stem.
5. Pass bladder pull rod through shell oil port and out through valve stem opening. (Refer to Figure 3-18).

6. Pull bladder pull rod out of shell with one hand while feeding bladder into shell with other hand.

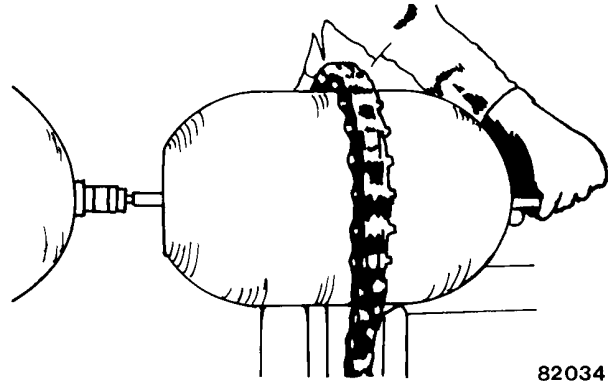


FIGURE 3-18. BLADDER INSTALLATION

7. Position name plate over valve stem and install valve stem nut by hand (Figure 3-19). Remove bladder pull rod.
8. Hold bladder valve stem on the flats with a wrench and tighten nut (5) securely.

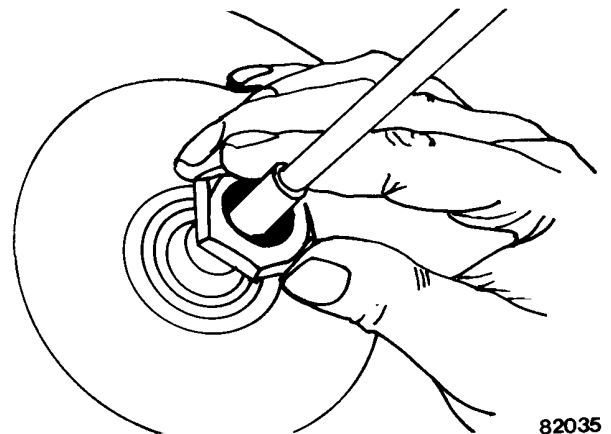


FIGURE 3-19. VALVE STEM INSTALLATION

9. Grasp threaded section of plug and insert poppet end into shell mouth
10. Install anti-extrusion ring inside shell. Fold anti-extrusion ring to enable insertion into shell. Place anti-extrusion ring on plug and poppet assembly with its steel collar toward shell mouth.

INITIAL SYSTEM SET-UP

Prior to checking the brake system, the hydraulic steering system must have proper accumulator pre-charge and be up to normal operating temperatures. Refer to Section "L" this manual for steering system operation procedures and specifications. With the steering system functioning properly, proceed as follows:

1. Park truck on a level surface, then turn engine and key switch OFF. Place wheel chocks on both sides of all wheels to prevent truck from moving during this procedure.
2. Fully open each brake accumulator bleeddown valve and precharge both accumulators to 9653 kPa (1400 psi). Allow gas temperature to approach ambient temperature before completing precharge process.
 - Record on data sheet.

NOTE: For best performance, charge accumulators in the ambient conditions in which the machine will be operating.

3. Close both accumulator bleeddown valves.
4. Install pressure gauges at:
 - a. Front Brake Test Port "BF" (brake cabinet) - 34,475 kPa (5000 psi) gauge.
 - b. Rear Brake Test Port "BR" (brake cabinet) - 34,475 kPa (5000 psi) gauge.
 - c. Low Accumulator Pressure Test Port "LAP1" (brake manifold) - 34,475 kPa (5000 psi) gauge.
5. Move directional control lever to PARK position. Release brake lock.
6. Start engine. Observe rising brake pressures as system charges. Brake pressure should begin to fall when Auto Apply Valve releases. Brakes should release at approximately 14,479 ± 690 kPa (2100 ± 100 psi) front and 10,894 ± 517 kPa (1580 ± 75 psi) rear.
 - Record on data sheet.
7. If a brake caliper or brake line was replaced, the brakes need to be bled before proceeding. Partially depress brake pedal and bleed air from bleeders located at each brake caliper.

PARKING BRAKE

NOTE: Move one of the pressure measuring instruments from the BF or BR locations to the PK2 test port above the Park Brake Solenoid.

8. Actuate brake lock. Move directional control lever to Neutral. Verify that Park Brake Status Light indicates parking brake is released. Park brake release pressure should be 17,238 ± 690 kPa (2500 ± 100 psi).
 - Record on data sheet.
9. Turn brake lock switch OFF. Measure the lining to disc clearance with feeler gauge and record the clearances.
 - Record on data sheet.



If there is no clearance between a brake lining and the disc, the brake will drag and overheat the brake components, which may result in reduced braking capability. Refer to ARMATURE SPEED REAR DISC BRAKE chapter to service the brake caliper.

NOTE: If the rear brake calipers were just installed, a parking brake adjuster may be out of adjustment which can cause a brake lining to drag. Refer to ARMATURE SPEED REAR DISC BRAKE chapter to service the brake caliper.

10. Move directional control lever to PARK.
11. Return the pressure gauge to the BF or BR location from which it was removed.

WHEEL SPEED FRONT DISC BRAKES

BRAKE CALIPER

Each front wheel speed brake assembly has three* calipers on one disc. Each caliper has six pistons and two linings (three apply pistons and one lining for each side of disc). Lining should be changed when friction material is worn to 0.125 in. (3.22 mm) thickness.

**NOTE: Some trucks may be equipped with FOUR (4) Brake Calipers per wheel. Service and adjustment for these calipers are the same as presented here.*

If inspection of front brake calipers and disc assembly indicate repair beyond lining replacement, it is necessary to remove calipers and disc from front wheel hub and spindle. Refer to Figure 5-4 for maximum wear limits of front disc.

Clean brake assemblies before performing any service. If brake has not accumulated excessive surface dirt, preliminary cleaning can be done in the overhaul area. However, preliminary cleaning should be done before removal of pistons from housing.

- Cleaning may be done by brush or spray, using a petroleum base cleaning solvent.
- Clean diesel fuel is acceptable for this operation.
- Cleaning should be thorough enough for preliminary inspection and disassembly.
- Subassemblies should be blown dry with compressed air after cleaning. Dust shields should be wiped dry with a clean cloth.
- The use of vapor degreasing or steam cleaning is **not recommended** for the brake assemblies or the component parts. Moisture will cause parts to rust.



Be certain that all wheels are securely blocked to prevent truck from moving.

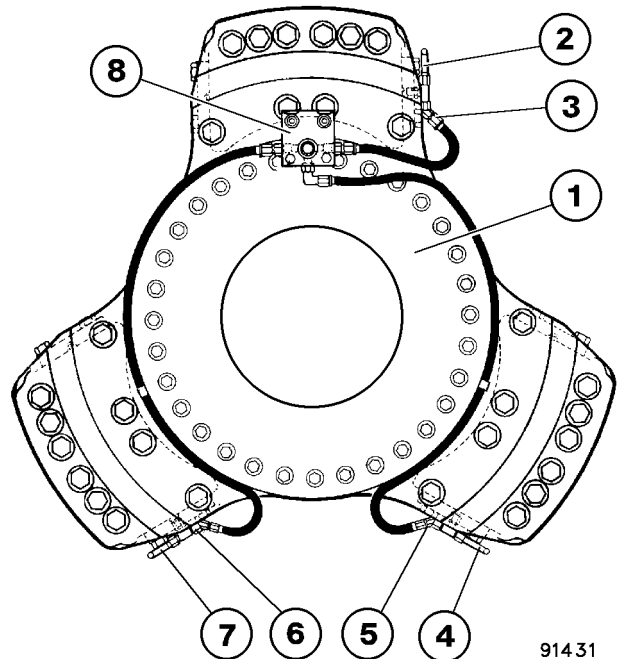
Do not loosen or disconnect any hydraulic brake line or component until engine is stopped, key switch is OFF and drain valves on brake accumulators are opened and steering accumulators are bled down. Turn steering wheel to be sure steering accumulators are completely bled down.

Caliper Removal

1. Remove front tires and rims according to procedure in Section G.
2. If necessary, remove disc from front wheel hub. Refer to Section G, Front Wheel Hub and Spindle Removal.

NOTE: Mark or tag each brake caliper assembly for reassembly at its correct location. Do not interchange parts.

3. Open the brake bleed valves (2, Figure 5-3) at each caliper and bleed down the caliper by disconnecting the two lower hoses at "T" connection (5 & 6, Figure 5-1). Drain the fluid into a container. Do not reuse fluid.
4. Disconnect the top brake hose at "T" connection (3).
5. Disconnect and remove crossover tubes (2, 4, & 7).



914 31

FIGURE 5-1. FRONT BRAKE ASSEMBLY

- | | |
|-------------------|-------------------|
| 1. Brake Adapter | 5. "T" Connection |
| 2. Crossover Tube | 6. "T" Connection |
| 3. "T" Connection | 7. Crossover Tube |
| 4. Crossover Tube | 8. Junction Block |

7. Remove the caliper half. Each caliper half weighs approximately 45 kg (100 lbs).
8. Support outer disc (12) and remove disc mount cap screws (11) and washers. Slide disc from outboard adapter (10). Shims (7) will be found between disc and adapter. Remove bushing (8). Mark all shims so they will be installed in the same location during assembly.
9. Use small diameter wire and wrap it around the brake lining and inner caliper half (5).
10. Remove cap screws and flat washers (9). Remove adapter (10). Remove inner caliper half from adapter (2).
11. Remove the two center caliper mount cap screws (13) from inboard caliper (14) and install two 7/8-9 NC X 14 in. studs.
12. Slowly remove the four remaining caliper mount cap screws. The brake lining is under spring pressure, and it will extend out as the cap screws are loosened. Do not let the brake lining pull away from the caliper housing (14, Figure 6-2).
13. Use small diameter wire and wrap it around the brake lining and caliper. Slide caliper half off studs and remove from wheel motor.
14. Support inner disc (12) and remove cap screws and flat washers (11). Remove inboard disc (12). Remove shims (7) and bushing (8) between disc and adapter.
15. Use small diameter wire and wrap it around the brake lining and inner caliper half (14).
16. Remove inner half of caliper (14). A brake bleeder may have to be removed temporarily to obtain clearance around adapter (15). Cover or plug hole in caliper to prevent dirt contamination inside caliper.
17. Remove cap screws and flat washers (3) and remove adapter (2).

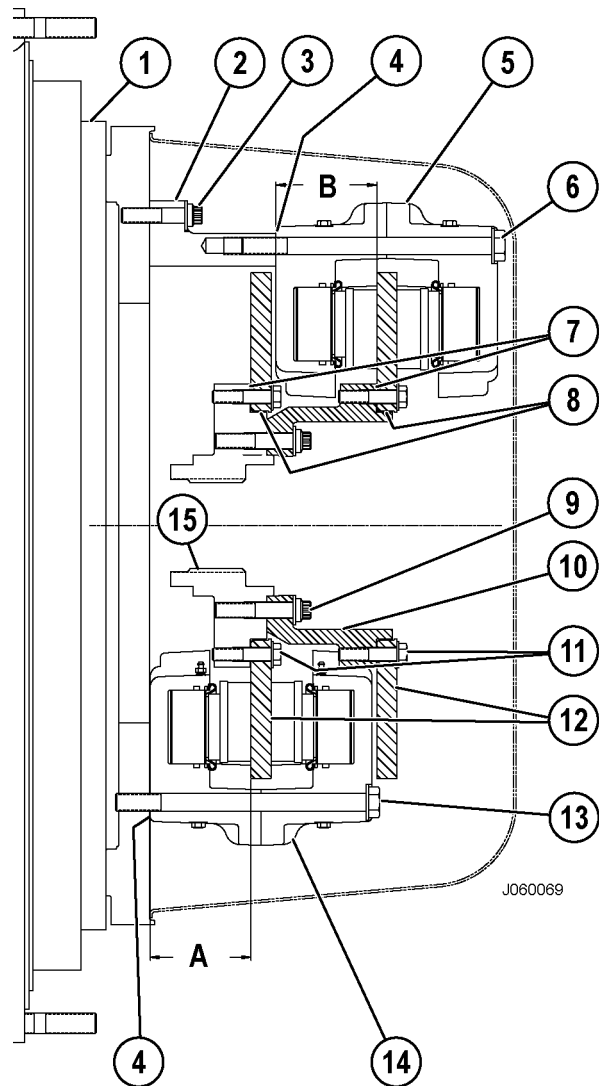


FIGURE 6-2. REAR DISC BRAKE

- | | |
|--------------------------|----------------------------------|
| 1. Wheel Motor | 9. Cap Screw |
| 2. Adapter | 10. Adapter, Brake Disc |
| 3. Cap Screw/Flat-washer | 11. Cap Screw & Flatwasher |
| 4. Shims | 12. Disc |
| 5. Caliper Assembly | 13. Cap Screw & Flatwasher |
| 6. Cap Screw/Flat-washer | 14. Caliper Assembly |
| 7. Shims | 15. Adapter/Armature Shaft Drive |
| 8. Bushing | |

Shoes, Linings and End Plates

To help prevent abnormal lining wear, replace worn, bent or cracked end plates and distorted shoes. Inspect the end plate cap screws for wear. Replace the bolts if worn.

NOTE: End plate cap screws are highly stressed.

Inspect linings

1. Lining Wear. Replace the linings when the thickness of the lining is less than 3.2 mm (0.125 in.) from the back plate.
2. Lining Wear Not Even. Replace the linings if the thickness of the two linings is significantly different. Check the pistons for correct operation. Replace the piston and/or housing if a piston is cocked in the bore. Check that the disc surface is flat and parallel to the linings.
3. Oil or Grease on the Linings. Replace the linings.



Always replace both linings. If only one lining is replaced, possible disc damage can occur.

4. Cracks on the Linings. Replace linings that have larger or deeper cracks than the small, tight cracks on the surface of the lining which are normal when the caliper is used under high temperature conditions. These cracks are referred to as heat check cracks.

PISTON ASSEMBLY RETURN SPRING FORCE AND BUILT-IN CLEARANCE (BIC)

1. Place the piston subassembly onto a spring tester table. Install a special sleeve (2, Figure 6-17) over the exposed adjuster pin (6).
2. Set a dial indicator between the spring tester arbor and table. Use a dial indicator with a total range of 2.54-3.1 mm (0.100-0.125 in.) such as Federal Mod C6K or C71, or equivalent, having a ± 0.508 or 0.635 mm (± 0.020 or 0.025 in.) scale with 0.0127 mm (0.0005 in.) increments.
3. Lower the spring tester arbor to compress the spring to minimum height (7, Figure 6-17). The indicator pointer will stop rotating.

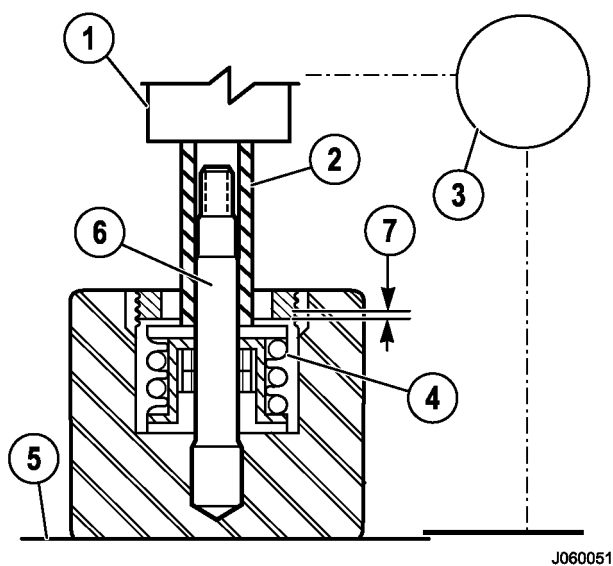


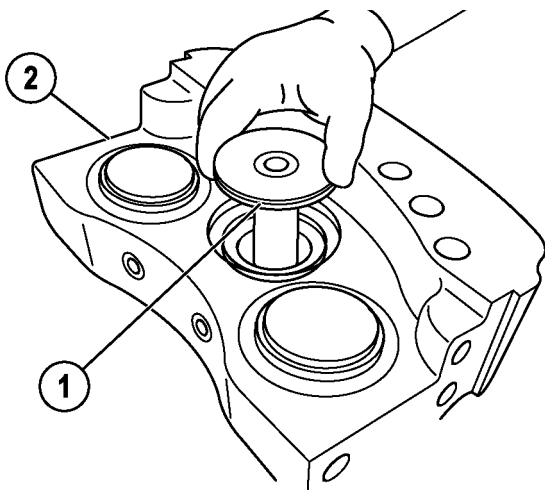
FIGURE 6-17. SPRING TESTER SETUP

- | | |
|---------------------------|---|
| 1. Arbor Of Spring Tester | 5. Spring Tester Table |
| 2. Special Sleeve A | 6. Adjuster Pin |
| 3. Dial Indicator | 7. 1.40-1.65 mm (BIC)
(0.055-0.65 in.) |
| 4. Return Spring | |

22. Screw the adjusting piston (1, Figure 6-32) into the adjusting collar finger tight, until fully seated into the parking piston.
23. Remove the safety wire.
24. Press a new parking piston boot into each caliper housing until fully seated. Snap the inner lip of the parking piston boot into the groove of the parking piston adjusting bolt.

NOTE: The end plates have left and right orientation. Verify that the end plates are correctly installed to match the contour of each brake lining backing plate. Verify that the lining assembly slides freely in the end plates and is not binding.

25. Install end plates (2, Figure 6-33) and end plate cap screws into each caliper half. Tighten the cap screws to **515-624 N·m (380-460 ft lb)**.



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FIGURE 6-32. PARK PISTON

1. Adjusting Piston
2. Caliper

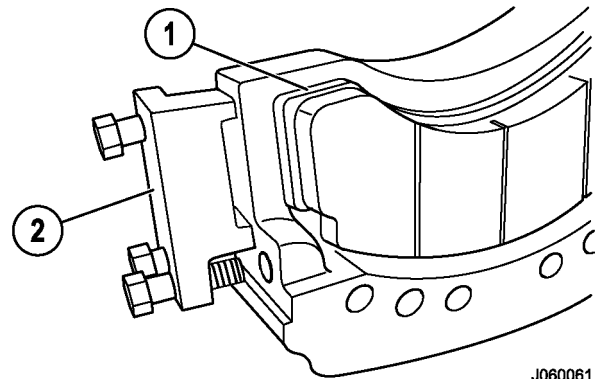
26. Ensure thread engagement by inserting the shoulder bolt into the lining pad threaded hole. The shoulder bolt must be completely bottomed against the back-face of the lining pad.

NOTE: If a shoulder bolt is not bottomed against the lining pad, it is recommended to re-tap the lining pad threaded hole and check thread engagement again. Do not use a lining pad which will not provide enough thread engagement.

27. Install a new lining assembly (1) into the caliper half. Position the threaded hole into each lining assembly backing plate, to align with the hole in the parking piston adjusting bolt.
28. Secure the lining assembly to the caliper housing using safety wire so that it cannot move.

⚠ CAUTION

Secure the lining assembly to the caliper housing using safety wire so that it cannot move. Movement of the lining assembly after the next steps will affect the parking piston adjustment which may cause the brake to drag after installation. The lining must remain tight against the caliper housing until the brake is installed onto the truck.



J060061

FIGURE 6-33. END PLATES

1. Brake Lining
2. End Plate

SECTION L2
HYDRAULIC SYSTEM
INDEX

HYDRAULIC SYSTEML2-3

 HYDRAULIC SYSTEM OPERATIONL2-3

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 HOIST SYSTEML2-7

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4. Disconnect and remove the hose at the alternator end and swing clear of work area.
5. Close the shut-off valves (2 & 10, Figure 3-1).

⚠ IMPORTANT ⚠

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

6. Cap or cover all lines and pump inlets and outlets to prevent contamination.
7. Remove the cap screws securing the hoist pump drive flange to the drive shaft.
8. Loosen the cap screws securing the inlet hoses (3) and outlet hoses (6) on the hoist pump and allow oil to drain. Remove inlet and outlet hoses.

⚠ WARNING

The hoist pump weighs approximately 128 kg (282 lbs). The hoist and steering pump together weigh approximately 227 kg (500 lbs). Use a suitable lifting or support device that can handle the load safely.

9. Attach a suitable lifting or support device to the hoist pump capable of handling approximately 113 kg (250 lbs). Attach a support to the front end of the steering pump to hold it in place during removal of the hoist pump.
10. Remove the four cap screws securing the hoist pump to the front support bracket. Remove the six cap screws holding the support bracket to the "T" bracket and remove support bracket.

11. Make sure the lifting and support devices are in place on both pumps. Loosen (but do not remove) the rear support bracket cap screws holding the steering pump. Lower the pumps allowing hoist pump to come down further than steering pump.
12. Remove the four cap screws (10, Figure 3-2). Slide hoist pump forward to disengage the splines of drive coupling (9) from the steering pump.
13. Move pump to a clean work area for disassembly.

Installation

NOTE: The following procedure assumes the steering pump is already in position on the truck.

1. Install O-ring (16, Figure 3-2) to steering pump (11). Install coupler (9) to hoist pump. If removed coupler has a snap ring, remove the snap ring and dispose.

⚠ WARNING

The hoist pump weighs approximately 128 kg (282 lbs). The hoist and steering pump together weigh approximately 227 kg (500 lbs). Use a suitable lifting or support device that can handle the load safely.

2. Attach a suitable lifting or support device to the hoist pump capable of handling approximately 113 kg (250 lbs). Move pump into position in truck.
3. Lubricate the steering pump spline shaft and align with coupling (9). Install hoist pump to steering pump and install cap screws (10) with hardened washers and tighten to standard torque. Raise pumps up into position.

22. Repeat steps 15 and 16 for installation of the remaining pressure plate, steel rings, backup ring, O-ring, and retainer and isolation plate.
23. Lubricate and install O-ring (24, Figure 3-14) in connector plate (11). Install dowel (23) if removed. Lubricate I.D. of bearing in the connector plate (11). Install connector plate (11) with flat washers and nuts.
24. Install dowel (22) if removed. Lubricate and position O-ring (17) in transition plate (16). Assemble bearing plate (15) to transition plate and install cap screws (14). Tighten cap screws to standard torque.
25. Lubricate O-ring (21) and position on bearing plate (15). Install the assembled bearing plate and transition plate (15 & 16) to the connector plate (11) and secure in place with nuts (20). Tighten nuts to standard torque.
26. Install coupling (19).
27. Lubricate the thru stud threads and install two opposite stud nuts and hardened washers. Tighten nuts to **325 to 339 N·m (240 to 250 ft lbs)** torque.
28. Using an 18 inch (45 cm) adjustable wrench, check pump drive shaft rotation. The drive shaft will be tight but should turn freely with a maximum of **7 to 14 N·m (5 to 10 ft lbs)** torque, after the initial surge. (Refer to Figure 3-15.)
29. If the shaft will not turn properly, disassemble the pump and examine the parts for burrs or foreign material causing buildup or interference between parts.
30. When the input shaft turns properly install the remaining hardened washers and nuts. Tighten nuts to **325 to 339 N·m (240 to 250 ft lbs)** torque.

31. Install a new O-ring on steering pump flange and install steering pump to the transition plate (16, Figure 3-14). Install cap screws and tighten to standard torque.
32. Install companion flange on pump driveshaft. If necessary, heat to 204° to 260°C (400° to 500°F) to ease installation.

⚠ IMPORTANT ⚠

Do not force flange onto shaft. Be certain flange is bottomed on shaft before it cools.

33. After flange has cooled, install nut and washer on pump shaft. Tighten to **407 N·m (300 ft lbs)** torque.

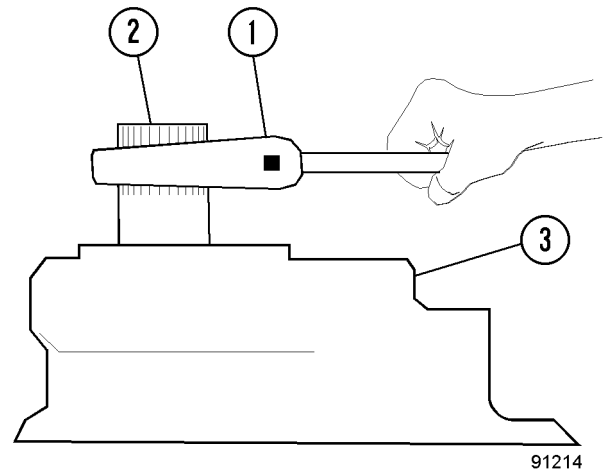


FIGURE 3-15. PUMP ROTATION CHECK

- | | |
|----------------|---------|
| 1. Wrench | 3. Pump |
| 2. Input Shaft | |

Hydraulic oil flows to the closed center steering valve via the flow amplifier. The flow amplifier is pilot-controlled by the steering valve. Due to large oil displacement in the steering cylinders, the flow amplifier is incorporated in the steering circuit. The steering column is connected directly to the steering valve. When the steering wheel is rotated, oil is directed to the steering cylinders via the flow amplifier to the appropriate side of the pistons in the steering cylinders. When steering circuit pressure reaches 17 238 kPa (2,500 psi) at the flow amplifier, or during a no steer situation, flow is blocked at the priority valve within the flow amplifier.

COMPONENT DESCRIPTION

STEERING CONTROL UNIT

The steering control unit is located behind an access cover on the front of the operator's cab. The steering control unit is connected directly to the steering column. The valve incorporates a rotary meter which ensures the oil volume supplied to the steering cylinders is proportional to the rotation of the steering wheel.

Operation of the steering control unit is both manual and hydraulic in effect, providing the operator with power steering. The valve will be spring returned automatically to its closed, neutral position when turning is stopped.

FLOW AMPLIFIER

The flow amplifier (Figure 4-2) is located on the left outside frame rail just forward of the bleed down manifold. The flow amplifier is required in the steering circuit due to the large volume of oil displacement required for steering. The flow amplifier uses the amount of flow from the steering control valve to determine the amount of amplified flow to send from the bleed down manifold to the steering cylinders. Reference Figures 4-3 through 4-6 for oil flow paths during the neutral, steering and external shock load conditions.

ACCUMULATORS

The accumulators (6, Figure 4-1) are a bladder type. The accumulators are charged to 9 653 kPa (1,400 psi) with pure dry nitrogen.

Oil entering the accumulator pushes the bladder upward compressing the nitrogen. The nitrogen pressure increases directly with steering circuit pressure. When brake/steering circuit pressure reaches 24 132 to 24 476 kPa (3,500 to 3,550 psi), the unloader valve will unload the pump output to approximately 2 758 kPa (400 psi). The accumulators will contain a quantity of oil under pressure available for steering the truck. When system pressure drops to 22 063 kPa (3,200 psi), the pump output will again increase to refill the accumulators and increase steering system pressure. The accumulators also provide oil, for a limited amount of use, to be used in case of an emergency situation should the pump become inoperative.

Low Precharge Warning Switch

Pressure switches located in the top of each accumulator monitor nitrogen pressure and are used to activate the accumulator precharge warning light if the nitrogen pressure drops below 7584 kPa (1,100 psi).

The switches monitor nitrogen pressure when the key switch is turned ON and before the engine is started. If nitrogen pressure is too low, the warning lamp turns ON - a latching circuit prevents the warning lamp from turning off when the engine is started and steering system pressure compresses the nitrogen remaining in the accumulator.



Do not operate the truck with less than 7 584 kPa (1,100 psi) nitrogen precharge in the accumulators because there may be inadequate oil supply in some emergency conditions. If low nitrogen precharge pressure is determined, recharge the accumulators to 9 653 kPa (1,400 psi).

HIGH PRESSURE FILTER

The high pressure filter (1, Figure 4-1) filters oil for the steering and brake circuits.

If the filter element becomes restricted, a warning indicator located in the cab, on the overhead display is activated at 241 kPa (35 psi) and oil will bypass the element at 345 kPa (50 psi).

STEERING/BRAKE PUMP

The Steering/Brake pump (2, Figure 4-1) is mounted on the rear of the tandem hoist pump. This pump supplies oil to both the brake system and steering system. Figure 4-8 shows the location of various steering pump components. Refer to Figure 4-13 for a hydraulic circuit schematic of the pump with unloader and compensator.

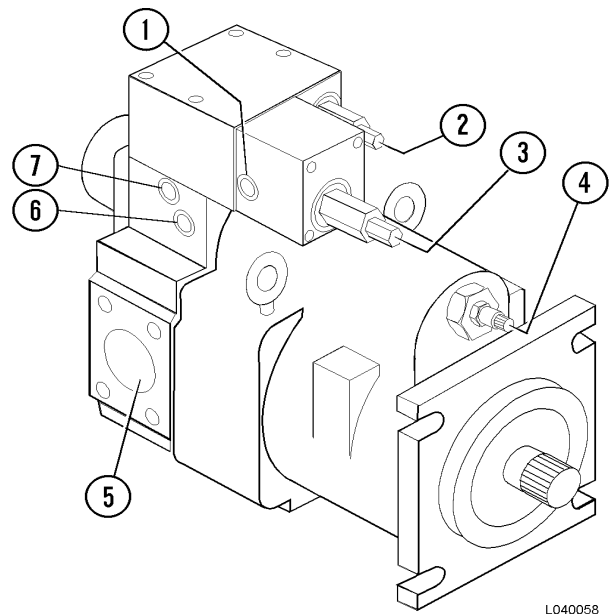


FIGURE 4-8. STEERING / BRAKE PUMP

- | | |
|----------------------------------|--------------------|
| 1. Accumulator Connection | 4. Stroke Adjuster |
| 2. Pressure Compensator Adjuster | 5. Outlet Port |
| 3. Unloader Adjuster | 6. GP2 Port |
| | 7. GPA Port |

3. Remove spacer (9), then push the hydraulic port assembly into the shell prior to Step 4.
4. Insert hand into the accumulator shell and remove the O-Ring backup (8), O-Ring (7), and metal backup washer (6). Separate the anti-extrusion ring from the hydraulic port. Fold anti-extrusion ring to enable removal of anti-extrusion ring from shell.
5. Remove hydraulic port from accumulator shell.
6. Secure bladder valve stem from twisting with an appropriate wrench applied to the valve stem flats and remove gas valve manifold (14). Then remove nut (5) while still holding bladder valve stem from turning.
7. Fold bladder and pull out of accumulator shell. A slight twisting motion while pulling on the bladder reduces effort required to remove bladder from shell. If bladder is slippery, hold with a cloth.

Cleaning and Inspection

1. All metal parts should be cleaned with a cleaning agent.
2. Seals and soft parts should be wiped clean.
3. Inflate bladder to normal size. Wash bladder with a soap solution. If soap solution bubbles, discard bladder. After testing, deflate bladder immediately.
4. Inspect assembly for damage; check the poppet plunger to see that it spins freely and functions properly.
5. Check anti-extrusion ring and soft seals for damage and wear; replace all worn or damaged seals with original equipment seals.
6. After shell has been cleaned with a cleansing agent, check the inside and outside of shell. Special attention should be given to the area where the gas valve and hydraulic assembly pass through the shell. Any nicks or damages in this area could destroy the accumulator bladder or damage new seals. If this area is pitted consult your Komatsu Service Manager.

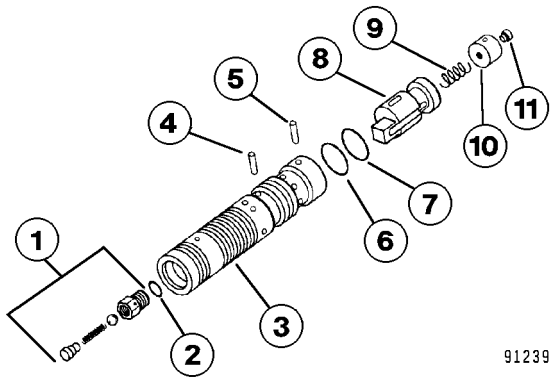


Repair of the housing by welding, machining or plating to salvage a worn area is NOT APPROVED. These procedures may weaken the housing and result in serious injury to personnel when pressurized.

Assembly

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

1. After shell (4, Figure 5-5) has been cleaned and inspected, place accumulator shell in vise or on table.
2. Thoroughly coat the inside of the accumulator shell with a liberal amount of clean hydraulic oil to lubricate and cushion the bladder. Make sure the entire internal of the shell is lubricated.
3. With all gas completely exhausted from bladder, collapse bladder and fold longitudinally in a compact roll.
4. Insert the bladder pull rod into the valve stem opening and out through the shell fluid 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. Slight twisting of bladder will assist in this insertion.
6. Once the bladder valve stem has been pulled through the valve stem opening in the shell, install the valve stem nut (5) by hand. Once the valve stem nut is in place, remove the bladder pull rod.



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FIGURE 5-10. AMPLIFIER SPOOL ASSEMBLY

- | | |
|-------------------|-------------------|
| 1. Check Valve | 7. Retaining Ring |
| 2. O-Ring | 8. Inner Spool |
| 3. Spool | 9. Spring |
| 4. Pin | 10. Plug |
| 5. Pin | 11. Orifice Screw |
| 6. Retaining Ring | |

NOTE: Disassembly of the amplifier spool assembly is only necessary should O-ring (2, Figure 5-10), spring (9) or orifice screw (11) require replacement, otherwise replace the amplifier spool assembly as a complete unit. For complete disassembly refer to steps 12 & 13.

12. Remove retainer ring (7, Figure 5-10), remove pin (5). Remove plug (10) and spring (9). Remove retaining ring (6) and pin (4) and remove inner spool (8).
13. Unthread check valve (1) and remove. Remove O-ring (2). Remove orifice screw (11) from plug (10).
14. Clean and inspect all parts carefully. Make any replacements as necessary.

Reassembly

1. Thoroughly lubricate each part prior to installation using clean, type C-4 hydraulic oil.
2. Reassemble the Amplifier spool assembly in reverse order. Refer to steps 12 & 13, and Figure 5-10 under disassembly.
3. Install orifice screw (13, Figure 5-8). Tighten orifice screw to **0.5 N·m (4 in. lbs)**. Install check valve (54). Tighten check valve to **1 N·m (8 in. lbs)**. Install orifice screw (53). Tighten orifice screw to **1 N·m (8 in. lbs)** torque.
4. Install seal (21). Install relief valve assembly (20), seal (5), and plug (20). Tighten plug to **2.5 N·m (22 in. lbs)** torque.
5. Install counterpressure valve assembly (15). Install plug (17) using new O-ring (16).
6. Install both shock and suction valves (12 & 28) as complete units. Install spring stop (22) springs (23 & 24) and spring control (25). Install orifice screws (26 & 35) if removed from main spool (29). Install main spool (29). Install main spool (29).
7. Install amplifier spool assembly (51). Install priority valve spool (43) and spring (42). Install spring (55).
8. Install spring control (31), springs (32 & 33) and spring stop (34).
9. Lubricate O-rings (6, 7 & 8) with molycote grease and position on cover (5). Install end cover (5). Install cap screws (3) with lockwashers (4). Tighten cap screws to **2.5 N·m (2 ft lbs)**. Install cap screw (1) and lockwasher (2). Tighten cap screw to **8 N·m (6 ft lbs)** torque.
10. Lubricate O-rings (40 & 49) with molycote grease and install on cover (47). Install end cover (47). Install cap screws (36) with lockwashers (39). Tighten cap screws to **2.5 N·m (2 ft lbs)**. Install cap screw (37) with lockwasher (38). Tighten cap screw to **8 N·m (6 ft lbs)** torque.
11. To help prevent contamination during storage or installation, install plastic plugs in each valve port.

STEERING AND BRAKE PUMP

Removal

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

▲WARNING

Relieve pressure before disconnecting hydraulic and other lines. Tighten all connections before applying pressure.

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

1. Turn the key switch OFF and allow 90 seconds for the accumulators to bleed down. Turn the steering wheel to be sure no oil remains under pressure.

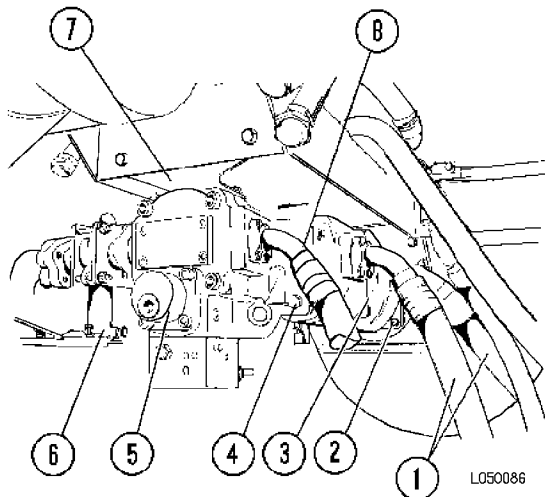


FIGURE 5-23. STEERING PUMP REMOVAL

- | | |
|----------------------------|------------------------|
| 1. Hoist Pump Outlet Hoses | 5. Steering/Brake Pump |
| 2. Mounting Cap Screws | 6. Shut-off Valve |
| 3. Hoist Pump | 7. Pump Mount Bracket |
| 4. Mounting Cap Screws | 8. Outlet Hose |

NOTE: If oil in the hydraulic tank has not been contaminated, the shut-off valve (6, Figure 5-23) between the tank and steering pump can be closed, eliminating the need to completely drain the tank.

2. Drain the hydraulic tank by use of the drain located on the bottom side of the tank.

NOTE: Be prepared to contain approximately 901 l (238 gal) of hydraulic oil. If the oil is to be reused, clean containers must be used with a 3 micron filtering system available for refill.

3. Disconnect the suction and discharge lines at the steering pump (5, Figure 5-23). Disconnect and cap pump case drain line from fitting at top of pump housing. Plug all lines to prevent oil contamination.

▲CAUTION

The steering pump weighs approximately 113 kgs (250 lbs). Use a suitable lifting device capable of handling the load safely.

4. Support the steering pump (5) and the rear section of the hoist pump (3). Remove mounting cap screws and rear support bracket (7). Remove the four pump mounting cap screws (4).
5. Move the steering pump rearward to disengage the drive coupler splines from the hoist pump and remove pump.
6. Clean exterior of steering pump.
7. Move the steering pump to a clean work area for disassembly.

32. Pull free end of control link (17, Figure 5-25) toward back of pump housing until the open hole in the link lines up with open ports on sides of pump case.
33. Install maximum volume stop gland (14, Figure 5-24) and adjusting screw (12) to hold swash-block in place.

Valve Plate Group

34. Be sure driveshaft bearing (15, Figure 5-26) is in place. Using assembly grease (to hold desired position), place valve plate gasket (16) in position on valve plate (17).
35. Support valve plate assembly from an overhead crane (lifting lug holes are provided) in preparation for mating to the pump housing.
36. Assemble one control link retainer ring (14, Figure 5-25) and one control link washer (15) onto the threaded hole side of the control link pin (16). Then thread a 1/4 in - 20 UNC cap screw into pin to ease holding.
37. Carefully maneuver valve plate assembly, supported by overhead crane, over driveshaft and into pump housing so slot on control piston (11) engages control link (17).
38. With hole in control piston lined up with hole in the link, carefully insert control link pin (16).

⚠ IMPORTANT ⚠

Care should be taken during this next step to prevent the washer and retaining ring from falling into pump housing.

39. Install second control link washer (15) and control link retaining ring (14) onto pin.

40. Once assembled, remove cap screw from pin.

NOTE: Valve plate is a slight press fit into pump housing. Make sure pilot diameter on valve plate (17, Figure 5-26) is aligned with mating diameter on the pump housing prior to assembly.

41. Insert four cap screws (20, Figure 5-26) and alternately tighten until valve plate is drawn up to the pump housing. Tighten cap screws evenly to **330 N·m (244 ft lbs)** torque.
42. Clean end cap (24) and ensure the seal groove is clean and free of any flaws.
43. Lightly lubricate new seal (22) with clean hydraulic oil and install the seal onto the end cap. Refer to Figure 5-29 for the correct orientation of the seal. **DO NOT** use any tools to install the seal. Damage to the seal may occur and oil leakage may result.

NOTE: Previous seal was an O-ring with a back-up ring. Current seal is a lip seal (red) with out a back-up ring.

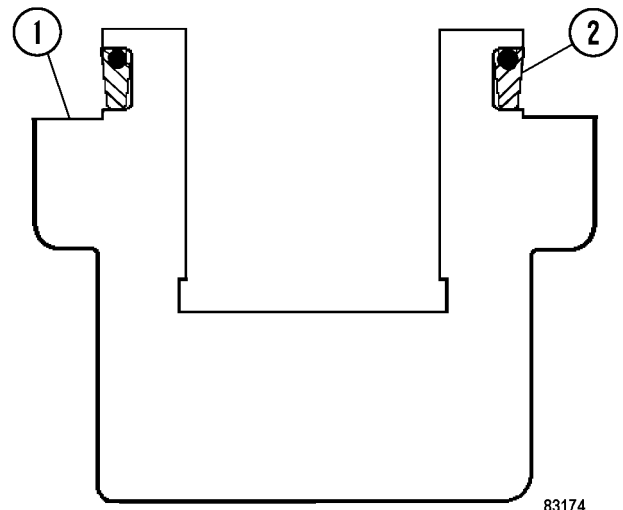


FIGURE 5-29. SEAL INSTALLATION

1. End Cap 2. Seal

Power Up Operation (Figure 7-7)

The Hoist Pilot Valve spool is moved to the Power Up position when the operator moves the lever in the cab. The pilot supply oil coming in Port 12 is prevented from returning to the tank and, instead, is directed out Port 14 through hoist limit solenoid 13 and into Port 14 of the Hoist Valve. There it goes to the top of the Head End Spool 8, builds pressure on the end of the spool, causes the spool to move down compressing the bottom spring, and connects the High Pressure Passage 19 to Head End Port 9. Working oil flow in the High Pressure Passage is now allowed to flow through the spool and out Port 9 to extend the hoist cylinders. Even though a small amount of oil flows through the check poppet in the top of Spool 8, raise pilot pressure at Ports 14 increases to slightly higher pressure than the required hoist cylinder pressure. As a result, the pilot supply pressure in Ports 12 also increases causing back pressure to occur in the spring area of Flow Control Valve 2. This overcomes the pilot pressure on the other end of the Flow Control Valve causing it to close and direct the incoming pump oil through Head End Spool 8 to the hoist cylinders to extend them.

If at any time the resistance to the flow of the pump oil coming into the inlet section causes the pressure to increase to 17237 kPa (2500 psi), the pilot pressure against Hoist Relief Valve 1 causes it to open and allow flow to exit out Port 10 and return to the tank.

As the hoist cylinders extend, oil in the annulus area of the second and third stages must exit from the cylinders. Initially, the Rod End Spool 7 ports are closed. As the returning oil entering Port 5 builds low pressure, it flows through the check-poppet in the top of the spool, through Port 15, through the Pilot Valve spool, and out Port 10 of the Pilot Valve to the tank. No pressure is present on the top of Spool 7. Cylinder return pressure passes through the check-poppet in the bottom of Spool 7 to build pressure under the spool which moves the spool upward compressing the top spring. This movement allows the returning cylinder oil to flow into the Low Pressure Passage 20 to the Low Pressure Relief Valve 3. Approximately 517 kPa (75 psi) causes this valve to open, allowing the oil to flow out Port 10 to the tank.

The counterbalance valve 4 will open as the body is raised and close as the operator releases the hoist lever and the raise pressure at port 22 decreases. If the load were to stick near the tail of the body and the body is overcenter, pressure in the annulus area of the hoist cylinders will increase.

If the pressure exceeds 20684 kPa (3000 psi) at port 23, the counterbalance valve will open again to direct oil back to the hoist valve, preventing damage to the hoist cylinder seals from excessive pressure.

When the operator releases the lever, the valves change to the HOLD position. If the body raises to the position that activates the hoist limit switch located above the right rear suspension before the operator releases the lever, the Hoist Limit Solenoid 13 is energized. The solenoid valve closes the raise pilot Port 14 on the hoist and releases the Hoist Pilot Valve raise pilot pressure at Port 24 to tank, allowing the Head End Spool 8 to center and shut off supply of oil to the hoist cylinders. This prevents maximum extension of the hoist cylinders.

FIGURE 7-7. HOIST CIRCUIT: POWER UP POSITION

1. Hoist Relief Valve 17237 kPa (2500 psi)
2. Flow Control Valve
3. Low Pressure Relief Valve 517 kPa (75 psi)
4. Counterbalance Valve
5. Rod End Work Port
6. Hoist Cylinders
7. Rod End Spool
8. Head End Spool
9. Head End Work Port
10. Return Port
11. Supply Port
12. Pilot Supply Port
13. Power Up Pilot Line Solenoid Valve
14. Raise Pilot Port
15. Down Pilot Port
16. Power Down Relief Valve, 10342 kPa (1500 psi)
17. Anti-void Check Valve
18. Load Check Valve
19. High Pressure Passage
20. Low Pressure Passage
21. Pilot Operated Check Valve
22. Manifold Power Up Port
23. Manifold Power Down Port
24. Solenoid Valve Return Port
25. Overcenter Manifold Check Valve (CV)

HOIST CIRCUIT COMPONENT REPAIR

HOIST VALVE

⚠ DANGER

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

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

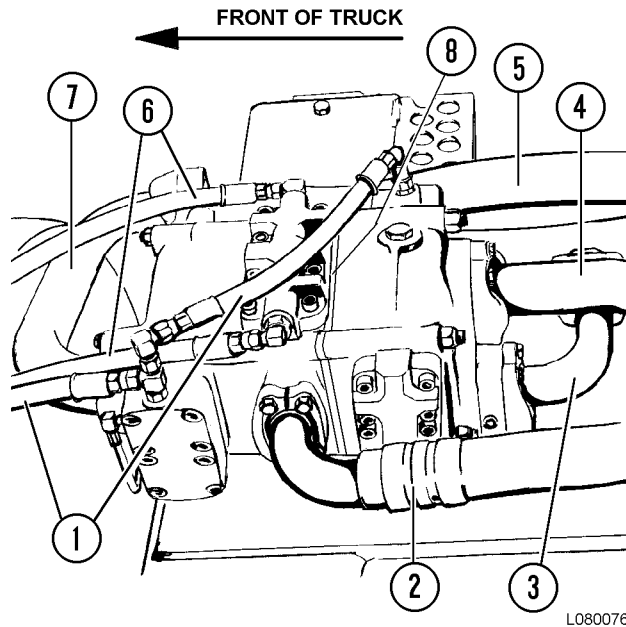


FIGURE 8-1. HOIST VALVE INSTALLATION

- | | |
|-----------------------------|-------------------------|
| 1. Hoist Pilot Valve Supply | 5. Power Down Line |
| 2. Power Up Line | 6. To Hoist Pilot Valve |
| 3. Inlet From Filters | 7. Return To Tank |
| 4. Return To Tank | 8. Separator Plate |

Removal

1. Shift directional control lever to PARK. Turn key switch OFF to stop engine.
2. Thoroughly clean the exterior of the hoist valve.
3. Disconnect and cap or plug all line connections to help prevent hydraulic oil contamination, refer to Figure 8-1.
4. Remove cap screws and lockwashers securing the hoist valve to its mounting bracket.

⚠ WARNING

The hoist valve weighs approximately 145 KgS (320 lbs). Use a suitable lifting device that can handle the load safely.

5. Attach a suitable lifting device (that can handle the load safely) to the hoist valve and remove hoist valve from truck.
6. Move the hoist valve to a clean work area for disassembly.

Installation

1. Attach a suitable lifting device to the hoist valve. Move the hoist valve into position with the separator plate (8, Figure 8-1) located to the rear. Secure in place with cap screws, nuts and lockwashers. Tighten cap screws to standard torque.

Note: Be certain hoist valve assembly is positioned with separator plate (8, Figure 8-1) towards rear of truck when valve is lowered onto mounting plate.

2. Using new O-rings at the flange fittings, connect hydraulic lines. Tighten flange cap screws to standard torque. Refer to Figure 8-1 for hydraulic line location.

BODY UP LIMIT SOLENOID

The body up limit solenoid valve (11, Figure 8-11) is located inside the hydraulic cabinet behind the operators cab. This valve has no serviceable parts except for O-ring replacement. Should the solenoid valve malfunction, replace as a unit.

PILOT OPERATED CHECK VALVE

The pilot operated check valve (12, Figure 8-11) is located inside the hydraulic cabinet behind the operators cab. This valve has no serviceable parts except for O-ring replacement. Should the pilot operated check valve malfunction, replace as a unit.

HOIST CYLINDERS

Removal

⚠ DANGER

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

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

1. Ensure engine and key switch has been OFF for at least 90 seconds to allow accumulator to bleed down. Be sure Park Brake is applied.
2. Disconnect the lubrication lines to the upper and lower bearings of the hoist cylinder.
3. Remove cap screw and lockwashers from clamps securing the hydraulic hoses to the hoist cylinder. Cap and plug lines and ports to prevent excessive spillage and contamination. Secure cylinder to frame to prevent movement during next step.

⚠ WARNING

The hoist cylinder weighs approximately 1000 kgs (2200 lbs). Some means of support is necessary to prevent it from falling or causing injury when removing from the truck. Use a suitable lifting device that can handle the load safely.

4. At the upper mount, remove self-locking nut (4, Figure 8-16) from pin retaining cap screw. Remove cap screw (5). Use a brass drift and hammer to drive pin (1) from bore of mounting bracket.
5. Carefully lower cylinder until it lays against the inside dual tire. The hoist cylinder weighs approximately 1000 kg (2200 lbs). Attach a suitable lifting device that can handle the load safely to the upper cylinder mounting eye.

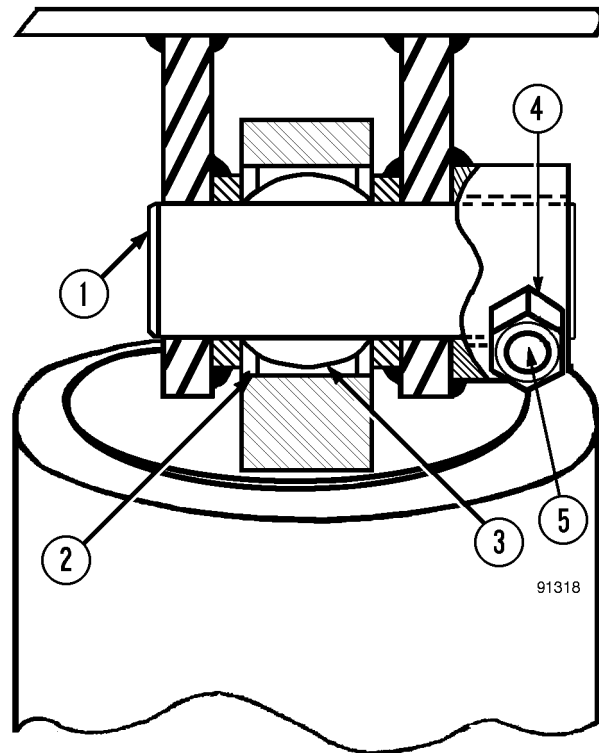


FIGURE 8-16. HOIST CYLINDER UPPER MOUNT

- | | |
|------------------|--------------|
| 1. Pin | 4. Locknut |
| 2. Retainer Ring | 5. Cap Screw |
| 3. Bearing | |

SECTION L10
HYDRAULIC CHECKOUT PROCEDURE
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TROUBLESHOOTING CHART (Steering Pump)		
Trouble	Possible Cause	Suggested Corrective Action
No pump output	<p>Trapped air inside steering pump.</p> <p>Broken pump drive shaft.</p> <p>Excessive circuit leakage.</p> <p>No oil to pump inlet.</p>	<p>Bleed trapped air. Refer to "Pressure Check And Adjustment Procedure", this Section.</p> <p>Replace pump drive shaft.</p> <p>Check for loose fittings, broken or cracked tubes.</p> <p>Check hydraulic tank oil level. Make sure shut-off valve is open.</p>
Low pump output	<p>Low pump pressure.</p> <p>Compensator valve, seat, spring or packing failure.</p> <p>Worn or scored pistons and bores.</p> <p>Maximum volume stop limiting pump stroke.</p> <p>Worn or damaged piston shoes, swashblock or swashblock wear plate.</p> <p>Worn or grooved cylinder wear plate and/or port plate.</p> <p>Restricted inlet.</p> <p>Insufficient inlet oil.</p>	<p>Check or adjust compensator pressure setting.</p> <p>Repair or replace compensator.</p> <p>Repair or replace pistons or pump housings.</p> <p>Turn volume stop screw counterclockwise.</p> <p>Tighten jam nut.</p> <p>Repair or replace defective parts.</p> <p>Repair or replace defective parts.</p> <p>Clear restriction. Make sure suction line shut-off valve is open. Clean suction strainer.</p> <p>Check for proper hydraulic tank oil level and make sure suction line shut-off valve is open.</p>
Unresponsive or sluggish control	<p>Control piston seals broken or damaged.</p> <p>Swashblock saddle bearings worn or damaged.</p>	<p>Repair or replace broken parts.</p> <p>Repair or replace broken parts.</p>
Loss of pressure	<p>Faulty output circuit components.</p> <p>Worn piston pump.</p> <p>Worn or grooved cylinder wear plate and/or port plate: wear plate and/or port plate separation from cylinder, each other or valve plate.</p> <p>Worn pistons, shoes or piston bores.</p>	<p>Repair or replace relief valve or pressure compensator valve.</p> <p>Repair or replace worn parts.</p> <p>Repair or replace worn parts.</p> <p>Repair or replace worn parts.</p>
Excessive or high peak pressure	<p>Faulty output circuit components.</p>	<p>Repair or replace relief valve or pressure compensator valve.</p>

⚠ WARNING

If any hydraulic pressure is detected on the pressure gauge installed at the "TEST" port, there is residual oil pressure in the system. Do not loosen or remove any hydraulic hoses, fittings or components. The steering accumulators have not been properly depressurized. Locate and correct the depressurization problem. Always relieve all hydraulic pressure before disconnecting any hydraulic lines or fittings. Always tighten all connections securely before applying pressure. Confirm that the steering pressure is released by turning the steering wheel. No steering movement should occur.

11. Connect jumper hose (XB5776) between QD SUPPLY disconnect (4, Figure 10-10) and QD RETURN disconnect (3) on the bleed down manifold.

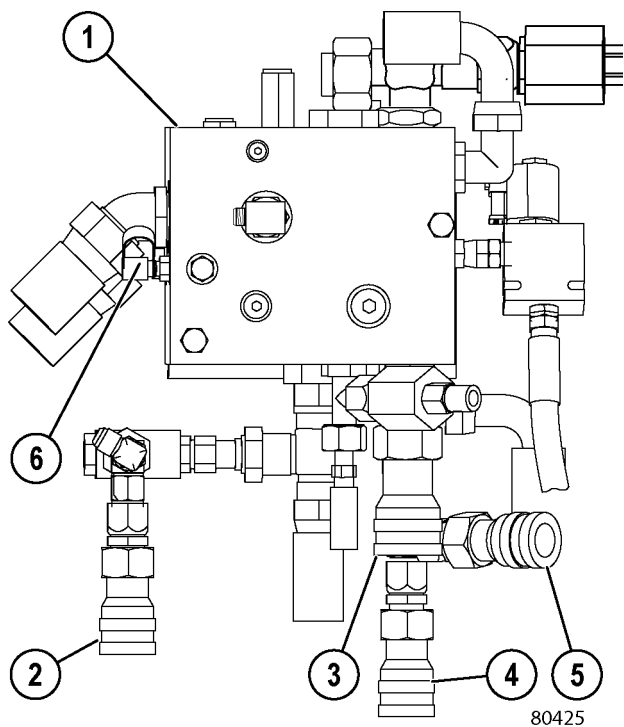


FIGURE 10-10. BLEED DOWN MANIFOLD

1. Bleed Down Manifold
2. Brake Disconnect
3. QD RETURN Disconnect
4. QD SUPPLY Disconnect
5. Brake Disconnect
6. Test Port TEST

NOTE: Do not connect any hoses to disconnect fittings (2 & 5, Figure 10-10).

12. Connect the four hoist cylinder hoses (2, Figure 10-12) together as shown using bypass blocks (3). Ensure that all hose connections are secure. The hardware for connecting the hoses to the blocks is the same hardware for connecting the hoses to the hoist cylinders. Cover all open ports to prevent contamination.
13. Ensure the steering pump case is full of oil before startup to avoid pump damage. Disconnect the hose connected to fitting (1, Figure 10-11). Then remove fitting (1). Fill the steering pump case with clean type C-4 hydraulic oil through the case drain port. It may require up to 2.9 liters (3 quarts) of oil. Reinstall fitting (1) and reconnect the hose.

NOTE: Filling the steering pump case does not eliminate the need to bleed air from the pump suction line.

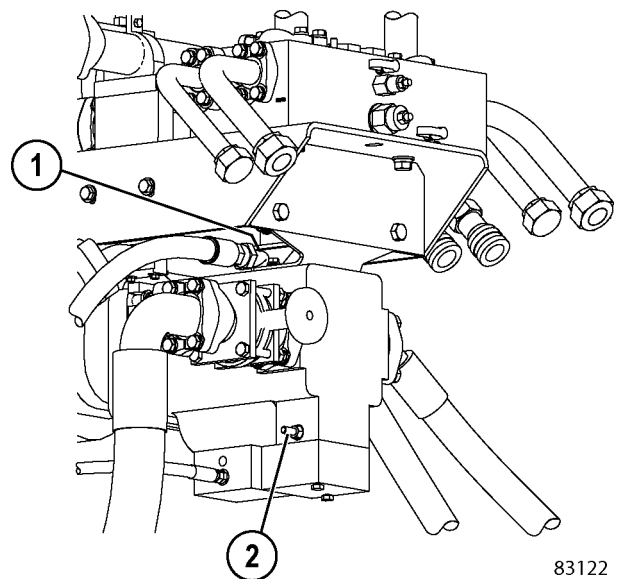


FIGURE 10-11. STEERING PUMP

1. Pump Case Drain Fitting
2. Test Port GPA

6. Loosen setscrew (3, Figure 7-3) and remove heater element (2) from element cover (1).

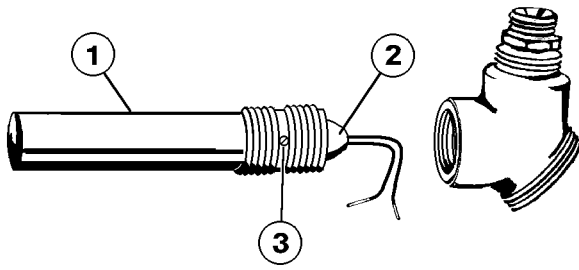


FIGURE 7-3. HEATER ELEMENT REMOVAL

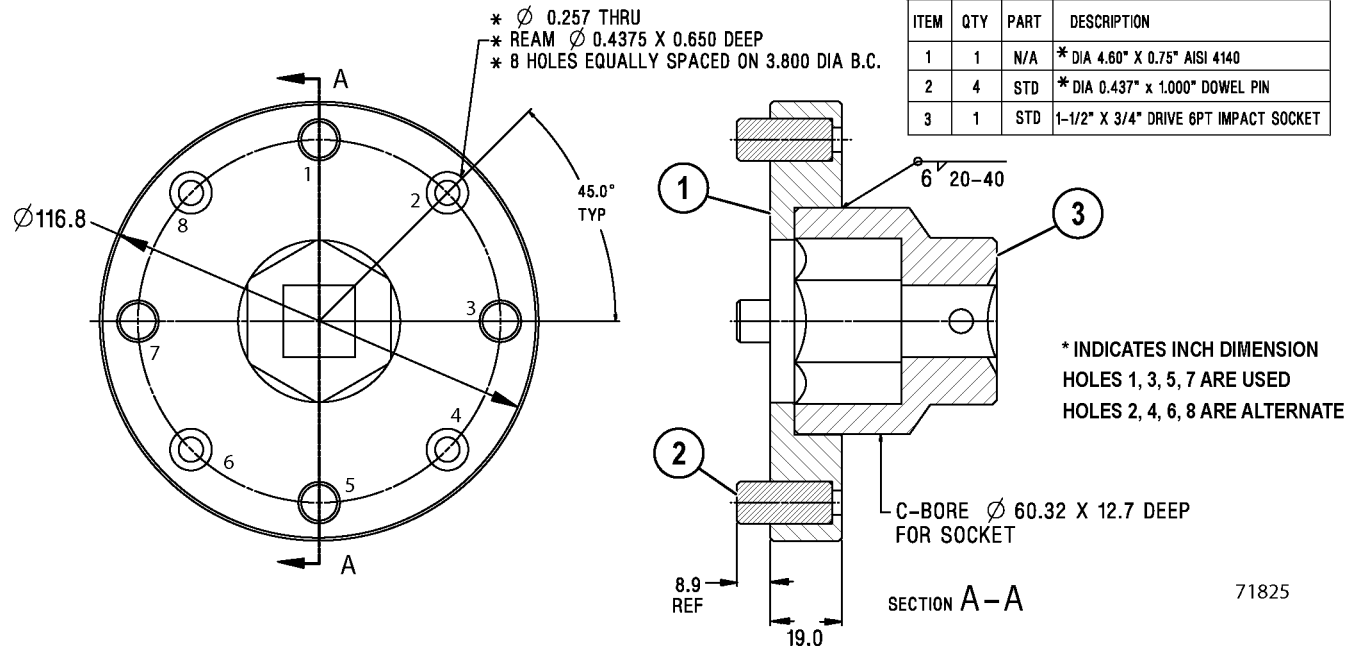
- | | |
|-------------------|-------------------------------|
| 1. Element Cover | 3. Element Retaining Setscrew |
| 2. Heater Element | |

Installation

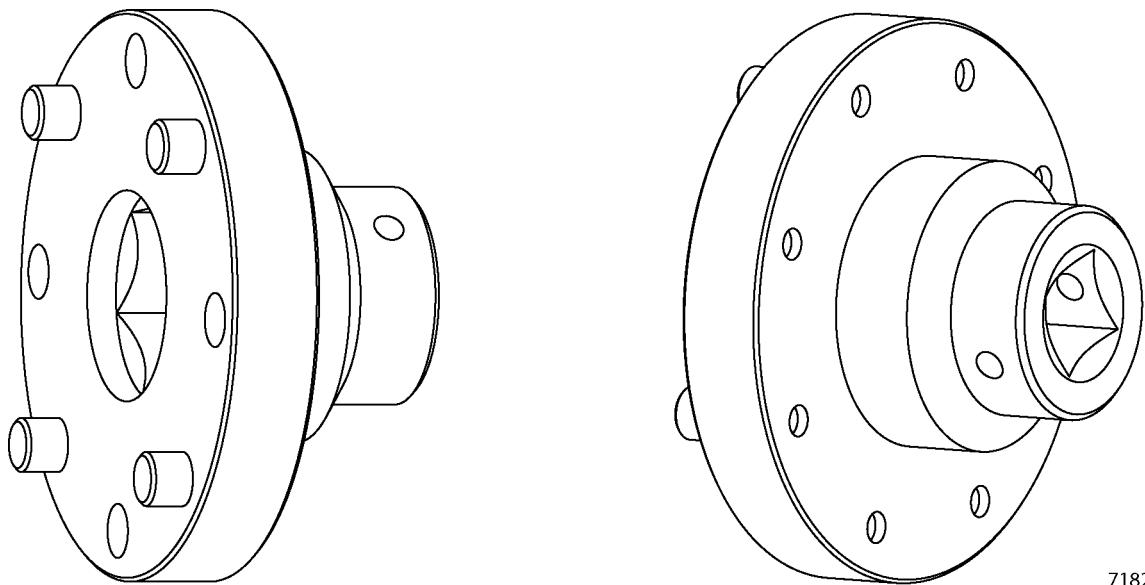
1. Install new heater element (2) and secure it in place with setscrew (3, Figure 7-3).
2. Coat the threads of element cover (6, Figure 7-2) with an anti-seize compound and install housing (5, Figure 7-2).
3. If removed, insert power cord (1), rubber bushing (4), washer (3), and cover (2) into the housing.
4. Twist the wires together and place screw-on wire connector (9) on each pair of wires.
5. Adjust the power cord and tighten the cord grip cover.
6. Replace housing (5).
7. If the engine oil was drained, refill the crankcase with clean, filtered oil.

BRAKE PISTON TOOL

Part Number	Description	Use
XB3579	Special Spanner Wrench	Remove / install rear park brake piston cap



71825



71825

TABLE II. Troubleshooting

1. Testing operation of shutters	With engine at slow idle, connect a 24 VDC power source to solenoid valve (5, Figure 19-1)	Shutters close - GO TO STEP 11 Shutters stay open - GO TO STEP 2
2. Check hydraulic pressure to cylinder rod end	Install tee fittings (6, Figure 19-3) in lines (8 & 9). Connect pressure gauges with a 0-3500 kPa (0-500 psi) range to tee fittings. Disconnect wire harness (5) from solenoid valve. There should be 517 kPa (75 psi) pressure in hose (9), and NO pressure in hose (8).	In Spec - GO TO STEP 3 Out of Spec - GO TO STEP 4
3. Check hydraulic pressure to cylinder head end	Connect 24 VDC power source to solenoid valve. There should be 517 kPa (75 psi) pressure in hose (8), and NO pressure in hose (9).	In Spec - GO TO STEP 11 Out of Spec - GO TO STEP 4 If nothing changed as compared to Step 2 - GO TO STEP 7
4. Check hydraulic pressure between pressure reducing valve (3) and solenoid valve (4)	Install hose with tee fitting between pressure reducing valve (3) and valve (4). Connect pressure gauge with a 0-3500 kPa (0-500 psi) range to tee fitting. Pressure should be 517 kPa (75 psi).	In Spec - GO TO STEP 7 Out of Spec - GO TO STEP 5
5. Check hydraulic pressure between pressure reducing valve (2) and pressure reducing valve (3)	Install hose with tee fitting between pressure reducing valve (2) and pressure reducing valve (3). Connect pressure gauge with a 0-35000 kPa (0-5000 psi) range to tee fitting. Pressure should be 10,342 kPa (1,500 psi).	In Spec - GO TO STEP 6 Out of Spec - GO TO STEP 8
6. Pressure reducing valve (3) is defective	Replace pressure reducing valve (3).	GO TO STEP 5
7. Solenoid Valve (4) is defective	Replace solenoid valve (4).	
8. Check oil supply pressure to pressure reducing valve (2)	Install tee fitting between oil supply hose (1) and pressure reducing valve (2). Connect pressure gauge with a 0-35000 kPa (0-5000 psi) range to tee fitting. Pressure should be 20,684 - 24,131 kPa (3000-3500 psi) the same as steering system standby pressure.	In Spec - GO TO STEP 9 Out of Spec - GO TO STEP 10
9. Pressure reducing valve (2) is defective	Replace pressure reducing valve (2).	GO TO STEP 8
10. Hydraulic supply to shutters is incorrect	Perform troubleshooting procedures in appropriate shop manual to correct truck hydraulic system.	GO TO STEP 8

Operator Switch

The payload operator switch is used to set, view and clear the total load counter and total ton counter. It is also used to enter the operator ID number (0-9999). This switch can also be used to view the suspension pressures and inclinometer. The payload meter operator switch is located on the dashboard. It is a two-way momentary switch. The top position is the SELECT position. The SELECT position is used step through the different displays. The lower position is the SET position. The SET position is used to set the operator ID or clear the load and total ton counters. Normally the inputs from the switch to the payload meter are open circuit. The switch momentarily connects the circuit to ground.

Speed Input

PLMIII uses a speed signal to calculate speed, distance, and other performance data. This input is critical to the proper operation of the system. PLMIII receives this signal from the speedometer/operator display on the dashboard. The same signal displayed to the operator is used by the system. Distance calculations are made based on the rolling radius of the tires for a particular truck.

Body-Up Switch

The body-up input signal is received from a magnetic switch located on the inside of the truck frame, forward the pivot pin of the truck body. This is the same switch typically used for input to the drive system. When the body is down, the switch closes and completes the circuit to 71-control power. 24VDC indicates the body is down. Open circuit indicates that the body is up.

Brake Lock Switch

The brake lock is used to lock the rear brakes on the truck. It is necessary for the accurate calculation of swingloads during the loading process. Without the brake lock applied, the payload meter will not calculate swingloads during the loading process. Without the brake lock, the payload meter will assume that the truck was loaded using a continuous loader and flag the haul cycle record. All other functions will be normal regardless of brake lock usage. The brake lock input comes from the switch located on the dash panel. The brake lock switch connects the circuit to ground. Open circuit indicates brake lock off. Ground indicates brake lock on.

Payload Meter

The payload meter is housed in a black aluminum housing. There is a small window on the face of the unit. Status and active alarm codes can be viewed through the window. During normal operation, a two-digit display flashes 0 back and forth. Active fault codes will be displayed for two seconds. These codes are typically viewed using the laptop computer connected to the serial communications port.

There is one 40-pin connector on the payload meter. A jack-screw is used to hold the payload meter and wire harness connector housings together. This screw requires a 4mm or 5/32 hex wrench. The correct tightening torque for this screw is **3 N·m (25 in. lb)**. Four bolts hold the payload meter housing to its mounting bracket in the cab.

The circuit board inside the payload meter housing is made from multi-layer, dual-sided surface-mount electronics. There are no field serviceable components inside. The electronics are designed to withstand the harsh operating environment of the mining industry. Opening the payload meter housing will result in voiding the warranty.

Communications Ports

The payload meter has two RS232 serial communications ports and two CAN ports. Connections for the two serial ports are available inside the payload meter junction box. The two CAN ports are available for future electronics systems.

Serial port #1 is used to communicate with the dashboard display. It is also used to connect to the laptop computer. The display gauge will remain blank when the PC is using the serial port. This port initially operates with serial settings at 9600,8,N,1. These settings change automatically to increase the communications rate when the PC is using the port. This serial port uses a 3-wire hardware connection.

Serial port #2 is used to communicate to other on-board electronics like Modular Mining's Dispatch® system or the scoreboard from Komatsu. This port uses a 3-wire hardware connection. Connections to this serial port need to be approved by Komatsu. Several protocol options are available and detailed technical information is available depending on licensing.

Fault Code Data

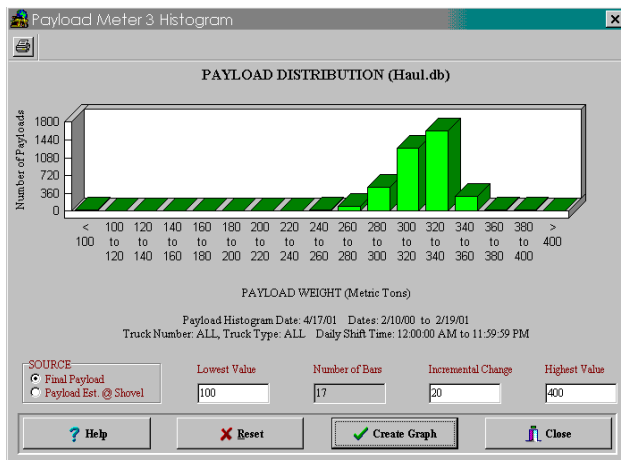
Table 2:		
Fault Code	Name	Description
1	Left front pressure high	Input current > 22 ma
2	Left front pressure low	Input current < 2 ma
3	Right front pressure high	Input current > 22 ma
4	Right front pressure low	Input current < 2 ma
5	Left rear pressure high	Input current > 22 ma
6	Left rear pressure low	Input current < 2 ma
7	Right rear pressure high	Input current > 22 ma
8	Right rear pressure low	Input current < 2 ma
9	Inclinometer high	Input voltage < 0.565 VDC
10	Inclinometer low	Input voltage > 5.08 VDC
11	Speed input failure	Not Used
12	Brake lock input failure	Not Used
13	Body-up input failure	Payload meter detected dumping activity without receiving a body up signal
16	Memory write failure	Indicates possible memory problem at power start up. Cycle power and recheck.
17	Memory read failure	Indicates possible memory problem at power start up. Cycle power and recheck.
18	Rear right suspension flat	Payload meter detected an undercharged suspension condition on the rear right suspension.
19	Rear left suspension flat	Payload meter detected an undercharged suspension condition on the rear left suspension.
20	Time change	Payload meter time was changed by more than 10 minutes. The Alarm Set time indicates original time. The Alarm Clear time indicates the new time.
21	Tare value reset	The user manually forced the payload meter to reset the haul cycle empty (tare) sprung weight. This forced the meter into the tare_zone state and lost all data for the previous haul cycle.
22	Excessive carryback	The payload meter detected an empty carryback load in excess of the user-defined carryback threshold on two consecutive haul cycles.
26	User switch fault - SELECT	Select switch on for more than 2 minutes, may indicate short to ground
27	User switch fault - SET	Set switch on for more than 2 minutes, may indicate short to ground

Creating Graphs

The PLMIII software can generate graphs that quickly summarize payload data. These graphs can be customized for printing. Just like the reports, the graphs are generated from the query displayed on the "Payload Summary" screen. From the "Sorting on Time Range" example, the graph that is printed would only contain data from truck 374 during the month of July 2000, from 8:00 AM to 5:00 PM.

It is important to carefully select the query data and press the "Query Database & Display" button before creating a graph.

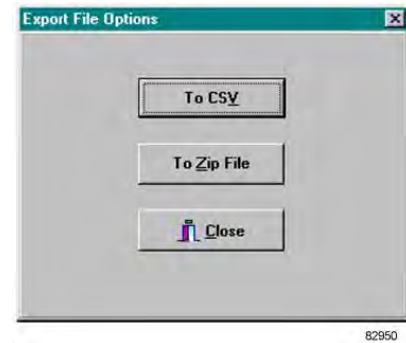
1. From the Payload Summary Screen select the "Graph" button at the bottom. The Histogram Setup screen will display



2. Enter the "Lowest Value". This will be the lowest payload on the graph. Any payloads less than this value will be summed in the first bar.
3. Enter the "Highest Value". This will be the highest value on the graph. Payloads over this value will be summed in the last bar.
4. Enter the "Incremental Change". This will determine the number of bars and the distance between them. The program limits the number of bars to 20. This allows graphs to fit on the screen and print onto 1 page.
5. Press the "Create Graph" button.

The graph will be displayed based on the query settings from the Payload Summary screen. The graph can be customized and printed.

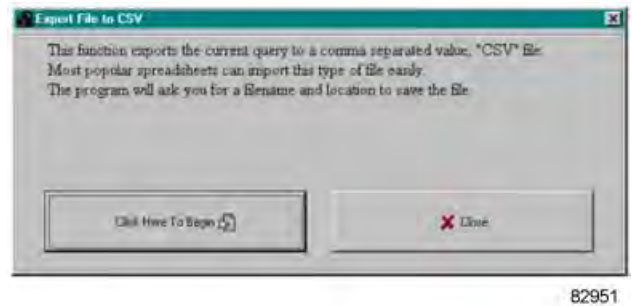
Exporting Data



The data from the database can be exported for use with other software applications. The data is selected from the currently displayed query. The exported data can be put into a ".csv" file or a compressed ".zip" file.

- The ".csv" format allows data to be easily imported into spreadsheet applications and word processing applications.
- The ".zip" format allows data to be transferred from one computer to the PDM Software database on another computer. This offers a compact way to transfer data from one computer to another.

CSV Export



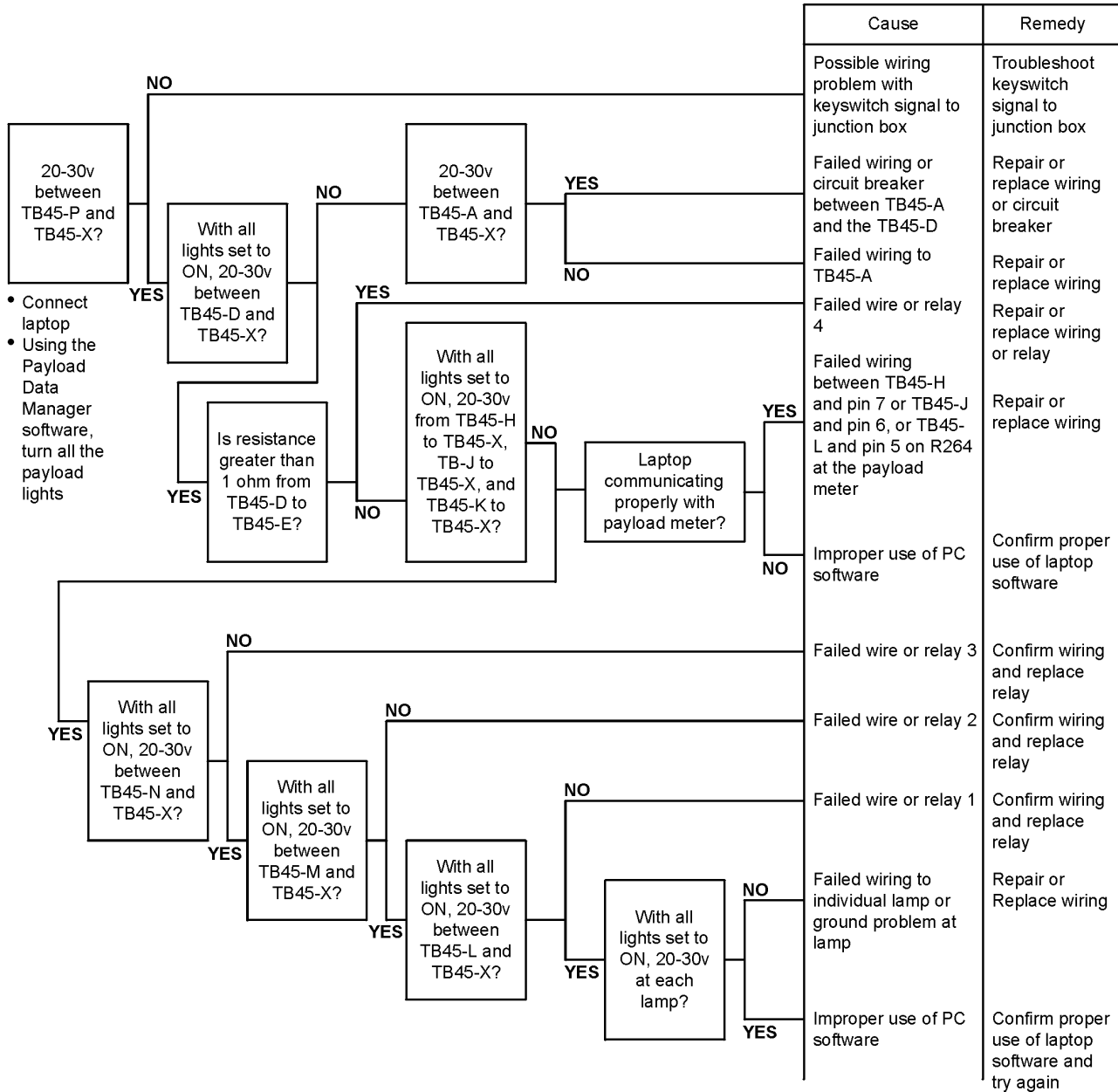
CSV stands for Comma Separated Value. This is an ASCII text file format that allows spreadsheet applications like Excel and Lotus 123 to import data easily. To export the data into a ".csv" file, press the "Export" button at the bottom of the payload summary screen and select "To CSV". The program will request a filename and location for the file.

Load Lights Remain ON

Load Lights Remain ON During Dumping

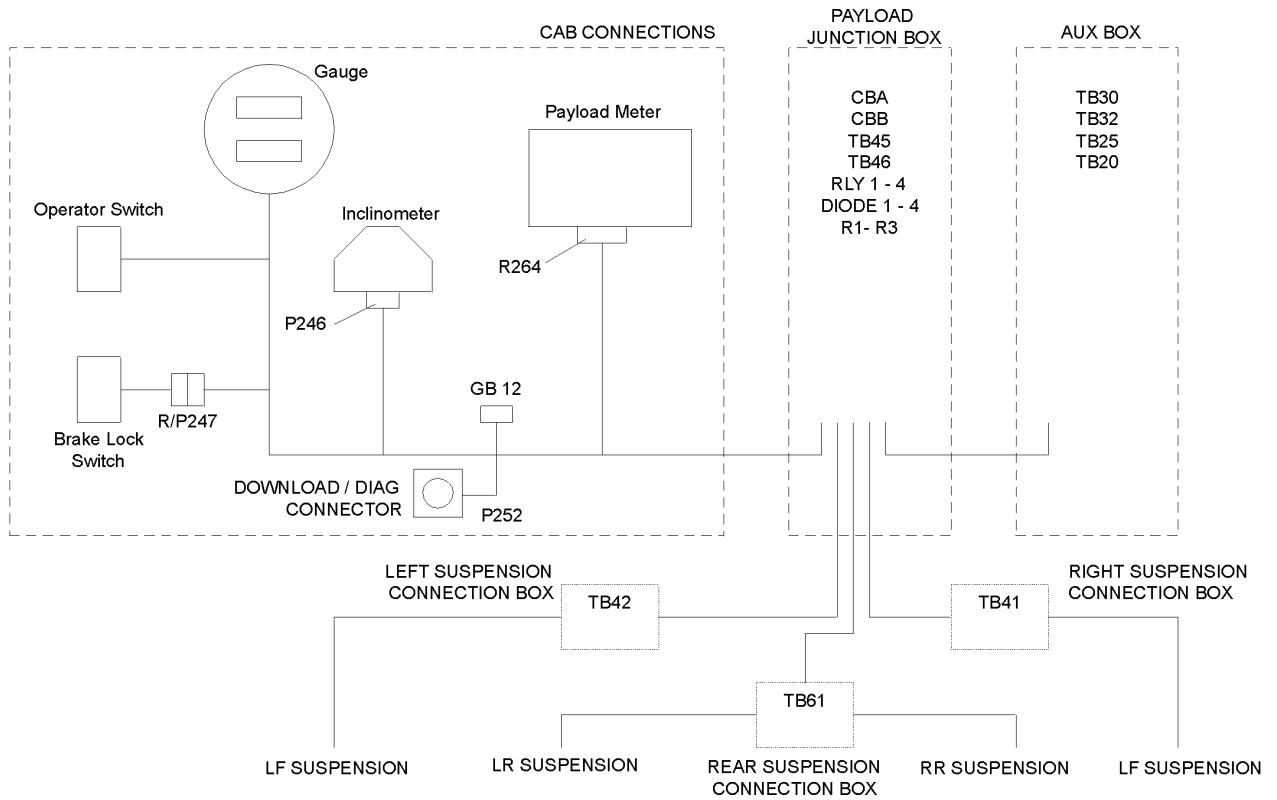
Display Doesn't Clear When The Load Is Dumped

- Confirm the body up switch signal. When the body up signal is not properly received during dumping, the payload meter may maintain the lights after the body is lowered.
- Confirm the payload light wiring using the procedures in "Load Lights Don't Light During Loading".



Connector Map

This diagram shows the general location of connectors, terminal boards and miscellaneous connections.



NOTES

TRUCK CAB AND COMPONENTS

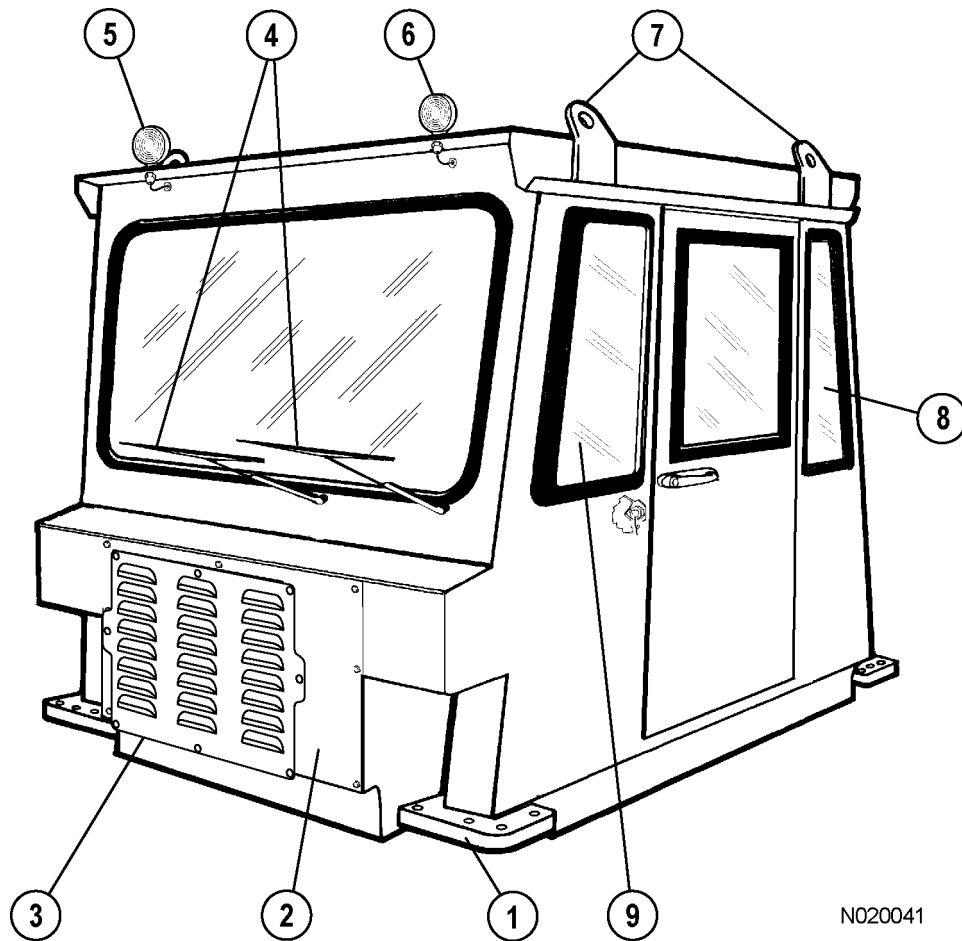
TRUCK CAB

Description

The truck cab is a fully insulated design incorporating an integral ROPS structure for maximum operator comfort and safety. All gauges, switches, and controls have been designed to simplify operation and are placed within easy reach of the operator. Servicing of cab and associated electrical systems is simplified by use of heavy-duty connectors on the various wiring harnesses. Hydraulic components are located outside of the interior and are accessed through covers (2, Figure 2-1) on the front of the cab.

WARNING

DO NOT attempt to modify or repair damage to the ROPS structure without written approval from the manufacturer. Unauthorized repairs to the ROPS structure will void certification. If modification or repairs are required, contact the servicing Komatsu Distributor.



N020041

FIGURE 2-1. CAB ASSEMBLY

- | | |
|--|------------------------------------|
| 1. Mounting Pad | 6. Retard Light (Retarder Applied) |
| 2. Access Covers | 7. Lifting Eye |
| 3. Filter Cover | 8. Rear, Side Glass |
| 4. Windshield Wiper Arms | 9. Front, Side Glass |
| 5. Stop Light (Service Brakes Applied) | |

Replacing the Door Handle or Latch Assembly

The cab doors are equipped with serviceable latch handle assemblies (inner and outer). If they become inoperative, they should be replaced. The outer latch handle assembly on each door has a key-operated lock.

1. Perform Steps 1 through 6 in the procedure "Replacing the Door Glass".
2. Remove cap screw and nut (1, Figure 2-14) from the inside door handle.
3. Remove four mounting screws (2) for the latch. Remove the latch assembly.
4. If replacing the latch assembly, proceed to Step 5.

If replacing the outside door handle, remove three screws (3) that secure the handle to the door panel.

Note: Only one screw is shown. The other two are behind the latch assembly.

5. Install a new latch assembly and align the mounting holes. Install four mounting screws (2, Figure 2-14). Ensure that they are tight.
6. Align the inside door handle and install capscrew and nut (3).
7. Perform Steps 22 through 25 in the procedure "Replacing the Door Glass".

Replacing the Door and Door Hinge Seal

1. The door assembly seal has only three members to it (sides and top) and is glued on the door. This seal can be replaced by peeling the seal away from the door frame. Then use a suitable cleaner to remove the remaining seal and glue material.
2. The area where the door seal mounts should be free of dirt and oil. Spread or spray a glue which is quick drying and waterproof onto the area where the seal is to be installed.
3. Install the seal so that the corners of the seal fit up into the corners of the door frame (3, Figure 2-16).
4. Door hinge seal (2, Figure 2-17) is glued to the hinge. Use the same procedure as above for this seal.

WINDSHIELD WASHER

Operation

The windshield washer, mounted on the right side of the hydraulic components cabinet behind the cab, has a 3.8 liter (1 gal) plastic reservoir (1, Figure 3-4) with a 24 volt electric pump (2).

The washer is controlled by the windshield wiper switch mounted on the turn signal lever. When the switch is activated, washing solution is pumped through the outlet hose (3) and fed to a jet located in each of the windshield wiper arms.

Service

If windshield washer maintenance is required, check the strainer opening for obstructions and inspect the hoses for damage. Check the voltage to the pump from the control switch. If the pump is inoperable, replace it with a new pump assembly.

Note: The pump is only available as an assembly and cannot be repaired.

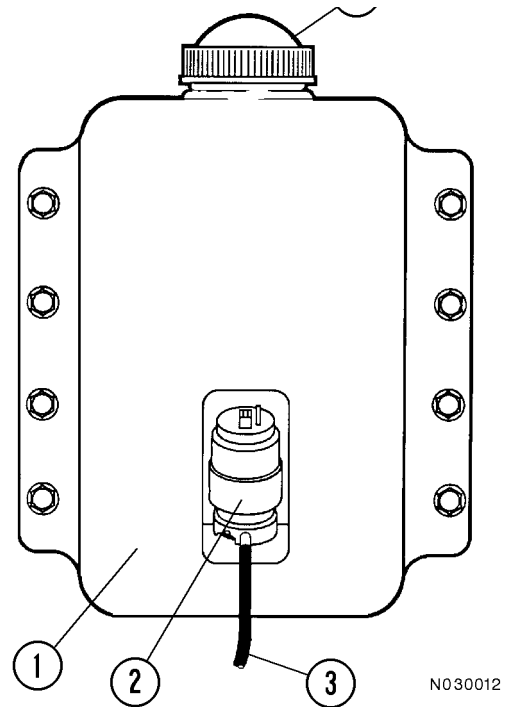


FIGURE 3-4. WINDSHIELD WASHER FLUID RESERVOIR AND PUMP

- | | |
|--------------|----------------|
| 1. Reservoir | 3. Outlet Hose |
| 2. Pump | 4. Filler Cap |

ENVIRONMENTAL IMPACT OF AIR CONDITIONING

Environmental studies have indicated a weakening of the earth's protective Ozone (O₃) layer in the outer stratosphere. Chloro-flouro-carbon compounds (CFC's), such as R-12 refrigerant (Freon), commonly used in mobile equipment air conditioning systems, have been identified as a possible contributing factor of the Ozone depletion.

Consequently, legislative bodies in more than 130 countries have mandated that the production and distribution of R-12 refrigerant be discontinued after 1995. Therefore, a more "environmentally-friendly" hydro-flouro-carbon.

(HFC) refrigerant, commonly identified as HFC-134a or R-134a, is being used in most current mobile air conditioning systems. Additionally, the practice of releasing either refrigerant to the atmosphere during the charging/recharging procedure is prohibited.

These restrictions require the use of equipment and procedures which are significantly different from those traditionally used in air conditioning service techniques. The use of new equipment and techniques allows for complete recovery of refrigerants, which will not only help to protect the environment, but through the "recycling" of the refrigerant will preserve the physical supply, and help to reduce the cost of the refrigerant.

AIR CONDITIONING FOR OFF-HIGHWAY VEHICLES

Mining and construction vehicles have unique characteristics of vibration, shock-loading, operator changes, and climate conditions that present different design and installation problems for air conditioning systems. Off-highway equipment, in general, is unique enough that normal automotive or highway truck engineering is not sufficient to provide the reliability to endure the various work cycles encountered.

The cab tightness, insulation, and isolation from heat sources is very important to the efficiency of the system. It is advisable to close all vents, even the intakes of pressurization systems, when there are high humidity conditions.

The general cleanliness of the system and components is important. Dust or dirt collected in the condenser, evaporator, or air filters decreases the system's cooling capacity.

The compressor, condenser, evaporator units, hoses and fittings must be installed clean and tight and be capable of withstanding the strain and abuse they are subjected to on off-highway vehicles.

Equipment downtime costs are high enough to encourage service areas to perform preventative maintenance at regular intervals on vehicle Air Conditioning (A/C) systems. (Cleaning, checking belt tightness, and operation of electrical components).

PRINCIPLES OF REFRIGERATION

A brief review of the principles of air conditioning is necessary to relate the function of the components, the technique of troubleshooting and the corrective action necessary to put the A/C unit into top operating efficiency.

Too frequently, the operator and the serviceman overlook the primary fact that no A/C system will function properly unless it is operated within a completely controlled cab environment. The circulation of air must be a directed flow. The cab must be sealed against seepage of ambient air. The cab interior must be kept free of dust and dirt which, if picked up in the air system, will clog the intake side of the evaporator coil.

Air Conditioning

Air conditioning is a form of environmental control. As applied to the cab, it refers to the control of temperature, humidity, cleanliness, and circulation of air. In the broad sense, a heating unit is as much an air conditioner as is a cooling unit. The term "air conditioner" is commonly used to identify an air cooling unit. To be consistent with common usage, the term "air conditioner" will refer to the cooling unit utilizing the principles of refrigeration; sometimes referred to as the evaporator unit.

SYSTEM PERFORMANCE TEST

This test is performed to establish the condition of all components in the system. Observe these conditions during testing:

1. Place a fan in front of the condenser to simulate normal ram air flow and allow the system to stabilize.
2. Install a thermometer into the air conditioning vent closest to the evaporator.
3. Start the engine and operate at 1000 rpm.
4. Evaluate the readings obtained from the gauges to see if they match the readings for the ambient temperature.
5. Set air conditioning system at maximum cooling and maximum blower speed operation.
6. Close all windows and doors to the cab.
7. Carefully feel the hoses and components on the high side. All should be warm-hot to the touch. Check the inlet and outlet of receiver-drier for even temperatures, if outlet is cooler than inlet, a restriction is indicated.
8. Feel the hoses and components on the low side. They should be cool to the touch. Check connections near the expansion valve; the inlet side should be warm and the outlet side cold.
9. After a minimum of 10 minutes has elapsed and the system has stabilized, observe the gauge readings. Compare the readings to the specifications in Table 1.

NOTE: Pressures may be slightly higher in very humid conditions and lower in very dry conditions.

Pressures listed in the table are during compressor clutch engagement.

10. Check the cab vents for cool air. Outlet air temperature should be approximately 16 - 22° C (30 - 40° F) below ambient air temperature.
11. If pressures and temperatures are not within the specified ranges, the system is not operating properly. Refer to Preliminary Checks near the end of this chapter for tips on diagnosing poor system performance.



Use extreme caution when placing hands on high side components and hoses. Under most normal conditions these items can be extremely hot.

TABLE 1. NOMINAL R-134a PRESSURE RANGES		
Ambient Air Temperature	High Side Pressure	Low Side Pressure
21° C (70° F)	820 - 1300 kPa (120 - 190 psi)	70 - 138 kPa (10 - 20 psi)
27° C (80° F)	950 - 1450 kPa (140 - 210 psi)	70 - 173 kPa (10 - 25 psi)
32° C (90° F)	1175 - 1650 kPa (170 - 240 psi)	105 - 210 kPa (15 - 30 psi)
38° C (100° F)	1300 - 1850 kPa (190 - 270 psi)	105 - 210 kPa (15 - 30 psi)
43° C (110° F)	1450 - 2075 kPa (210 - 300 psi)	105 - 210 kPa (15 - 30 psi)

NOTE: All pressures in this chart are for reference, only. Weight is the only absolute means of determining proper refrigerant charge.

Servicing the Compressor Clutch

* RECOMMENDED TOOLS FOR COMPRESSOR CLUTCH REMOVAL AND INSTALLATION	
J-9399	Thin Wall Socket
**J-9403	Spanner Wrench
**J-25030	Clutch Hub Holding Tool
J-9401	Clutch Plate and Hub Assembly Remover
J-8433	Pulley Puller
J-9395	Puller Pilot
***J-24092	Puller Legs
J-8092	Universal Handle
J-9481	Pulley and Bearing Installer
J-9480-01	Drive Plate Installer
J-9480-02	Spacer, Drive Plate Installer

*Tools are available through your local Kent-Moore dealer.

** These tools are interchangeable.

***For use on multiple groove pulleys.

CAUTION

Use the proper tools to remove and replace clutch components. Using the recommended tooling helps prevent damage to compressor components during maintenance.

Do not drive or pound on the clutch plate, hub assembly, or shaft. Internal damage to the compressor may result.

1. Remove the belt guard from the front of the air conditioning compressor.

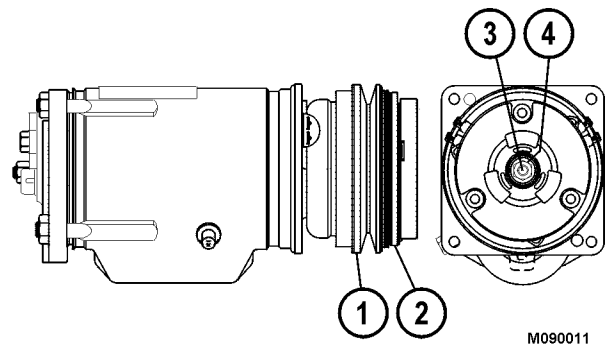


FIGURE 4-17.

- | | |
|---------------------------|------------|
| 1. Belt Pulley | 3. Shaft |
| 2. Clutch Hub/Drive Plate | 4. Locknut |

2. Remove the drive belt from compressor belt pulley.
3. Remove locknut (4, Figure 4-17) using thin wall socket (1, Figure 4-18) or the equivalent.

PROBLEM: Air and/or Moisture in the System

Indications:

Low side pressure - HIGH
High side pressure - HIGH
Discharge air is only slightly cool.

Possible Causes

- Leaks in system.

Suggested Corrective Actions

Test for leaks, especially around the compressor shaft seal area. After leaks are found, recover refrigerant from the system and repair leaks. Replace the receiver-drier. Check the compressor and replace any oil lost due to leakage. Evacuate and recharge the system using a scale to ensure proper quantity. Check A/C operation and performance.

PROBLEM: Expansion Valve Stuck or Plugged

Indications:

Low side pressure - VERY LOW or in a Vacuum
High side pressure - HIGH
Discharge air only slightly cool.
Expansion valve body is frosted or sweaty.

Possible Causes

An expansion valve malfunction could mean the valve is stuck in the closed position, the filter screen is clogged (block expansion valves do not have filter screens), moisture in the system has frozen at the expansion valve orifice, or the sensing bulb is not operating. If the sensing bulb is accessible, perform the following test. If not, proceed to the Repair Procedure.

Suggested Corrective Actions

Test: Warm diaphragm and valve body with your hand, or very carefully with a heat gun. Activate the system and watch to see if the low pressure gauge rises. Next, carefully spray a little nitrogen, or any substance below 32° F, on the capillary coil (bulb) or valve diaphragm. The low side gauge needle should drop and read at a lower (suction) pressure on the gauge. This indicates the valve was partially open and that your action closed it. Repeat the test, but first warm the valve diaphragm or capillary with your hand. If the low side gauge drops again, the valve is not stuck.

Repair Procedure: Inspect the expansion valve screen (except block type valves). To do this, remove all refrigerant from the system. Disconnect the inlet hose fitting from the expansion valve. Remove, clean, and replace the screen. Reconnect the hose and replace the receiver-drier. Evacuate and recharge the system with refrigerant using a scale. Check AC operation and performance. If the expansion valve tests did not cause the low pressure gauge needle to rise and drop, and if the other procedure described did not correct the problem, the expansion valve is defective. Replace the valve.

Note: There is no lower end bearing in this new 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 (7).

6. Without removing cap screws (10) from the holes, move the steering control unit (7) into place and start each of the cap screws.
7. Tighten four cap screws (10).
8. Check for proper steering wheel rotation without binding. Ensure wheel returns to neutral after rotating 1/4 turn left and right.
9. If disconnected, re-connect the hoses to the steering control unit.
10. Connect the steering column wire harness(es) to the harness(es) 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 5-4) 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. A new, more reliable horn contact is available. Some trucks may have the previous horn contact, which is a stick design (1, Figure 5-5). The new horn contact uses a roller (2). Install the new horn contact as shown in Figure 5-6.
2. Place steering wheel (1, Figure 5-4) 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.
3. Install nut (2). Tighten the nut to **81 ± 7 N·m (60 ± 5 ft lb)**.
4. Connect horn wire (3) to horn button (4).
5. Install the horn button onto the steering wheel. Turn on the battery disconnect switch and verify that the horn functions properly.

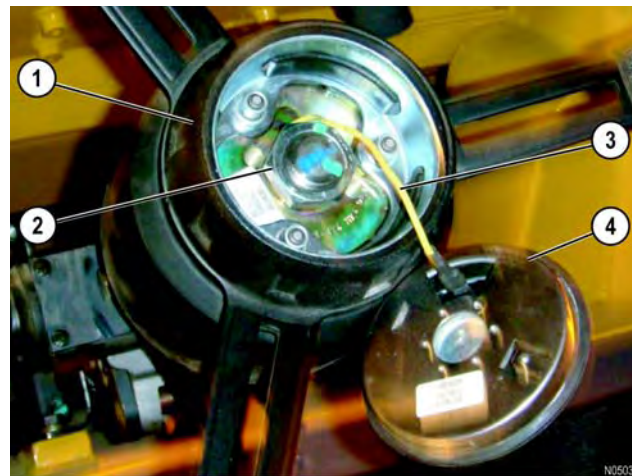
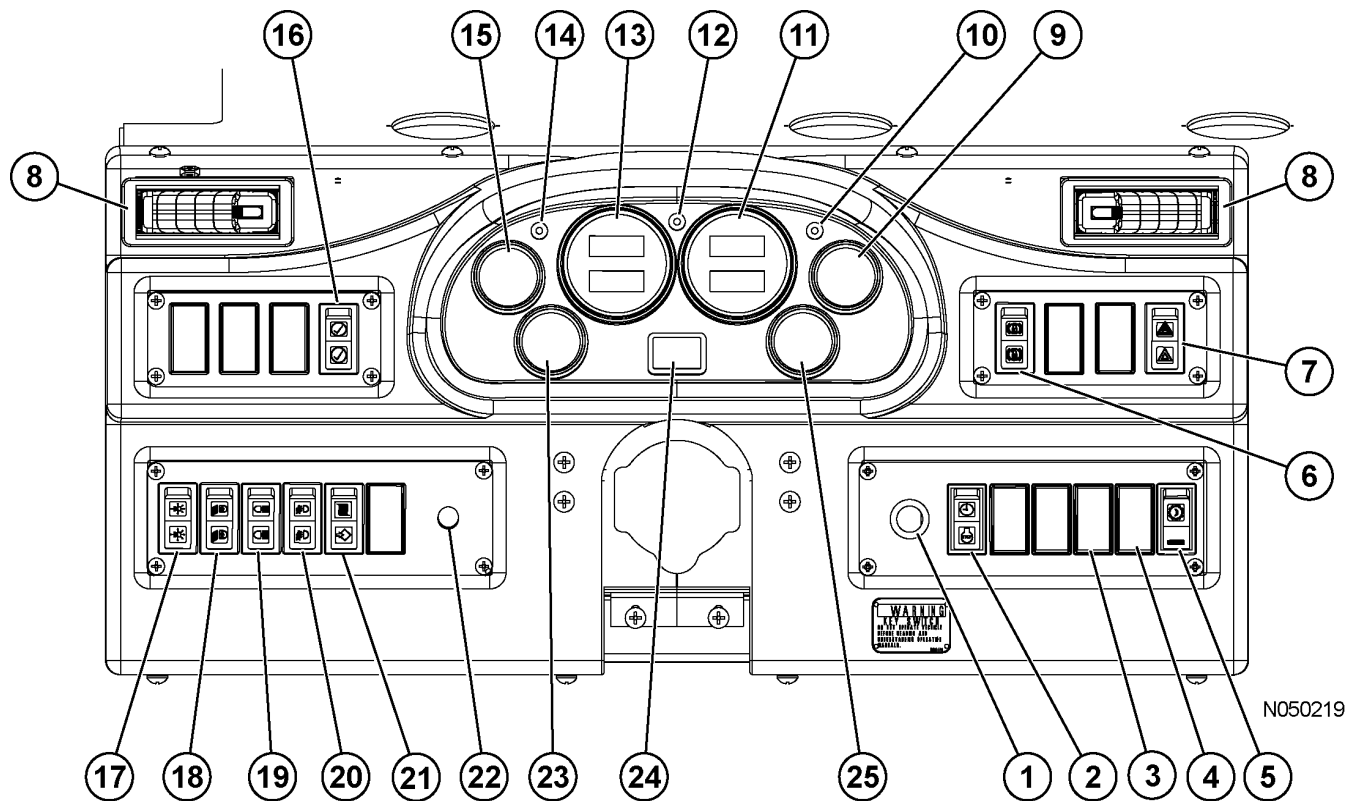


FIGURE 5-4. STEERING WHEEL RETAINER NUT

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



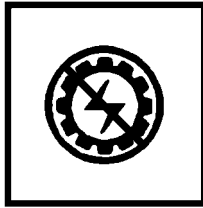
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FIGURE 5-10. PANEL GAUGES, INDICATORS, AND CONTROLS

- | | |
|--|---|
| 1. Key Switch | 14. Left Turn Signal Indicator |
| 2. Engine Stop Switch with Timer Delay | 15. Water Temperature Gauge |
| 3. Rotating Beacon (Optional) | 16. Lamp Check Switch |
| 4. Heated Mirrors (Optional) | 17. Headlight/Panel Illumination Light Switch |
| 5. AC Drive System Rest Switch | 18. Ladder Light Switch (3-Way) |
| 6. Wheel Brake Lock Switch | 19. Backup Light Switch |
| 7. Hazard Lights Switch | 20. Fog Light Switch |
| 8. Heater/Air Conditioner Vents | 21. Payload Meter Mode Switch |
| 9. Engine Oil Pressure Gauge | 22. Panel Illumination Lights Dimmer Control |
| 10. Right Turn Signal Indicator Light | 23. Hydraulic Oil Temperature Gauge |
| 11. Digital Tachometer | 24. Engine Hourmeter |
| 12. High Beam Headlight Indicator | 25. Fuel Level Gauge |
| 13. Speedometer/Payload Meter Display | |

A5. No Power

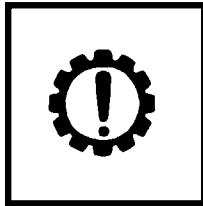
This red “no retard/no propel” indicator light indicates a fault has occurred which has eliminated the retarding and propulsion capability. A warning buzzer will also sound.



If this condition occurs, the operator should safely stop the truck, move directional control lever to PARK, shutdown the engine, and notify maintenance personnel immediately.

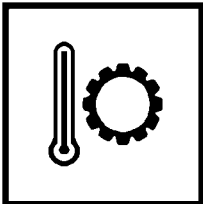
B5. Propulsion System Warning

This amber indicator light indicates a drive system fault has occurred. A speed limit restriction will be applied, which could be as low as 16 kmh (10 mph). The operator must notify maintenance personnel immediately.



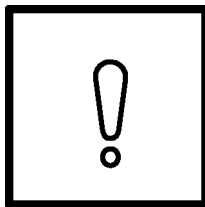
C5. Propulsion System Temperature

This amber AC drive system temperature warning light indicates the drive system temperature is above a certain level. When this condition occurs, the operator should consider modifying truck operation in order to reduce system temperature. The operator is not required to stop the truck at this time.



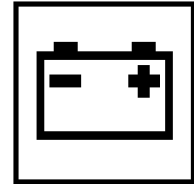
D5. System/Component Failure

This red warning light indicates that the interface module system detected a failure somewhere on the truck. There are many conditions that could trigger the light to illuminate. If this light illuminates, the operator must safely stop the truck, move selector switch to PARK, shut the engine off, and notify maintenance personnel immediately.



E5. Battery Charging System Failure

The red battery charging system light indicates a problem has been detected in the charging system, and system voltage is outside the normal operating range. If this light illuminates, the operator must safely stop the truck, move selector switch to PARK, shut the engine off, and notify maintenance personnel immediately. If truck operation continues, and the battery voltage drops below 20.0 volts, the propulsion system will not operate, but retarding will still be available.

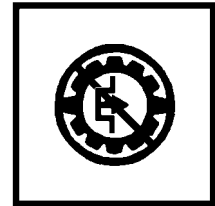


The following conditions will also illuminate this light:

- Battery voltage below 24.5V, engine rpm above 1450. Resets at 26V.
- Battery voltage below 23V with engine off. Resets at 25.5V.
- Battery voltage above 32V with engine operating. Resets at 27.5V.

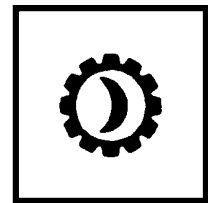
A6. No Propel

The red “no propel” light indicates a fault has occurred which has eliminated the propulsion capability. If this condition occurs, the operator must safely stop the truck, move the directional control lever to PARK, shut down the engine, and notify maintenance personnel, immediately.



B6. Propel System @ Rest

The amber “propel system @ rest” light is used to indicate that the AC drive system is de-energized and propulsion is not available. This light is activated when the instrument panel rest switch is turned ON and the AC drive system is de-energized. The three link energized lights (one on rear of the center console inside the operator cab, and two on the deck-mounted control cabinets) should NOT be illuminated at this time.



RESERVE ENGINE OIL SYSTEM (Optional)

The reserve oil tank for the engine is designed to add more oil capacity to the engine to reduce the frequent servicing of the engine oil. The engine oil level must still be checked every shift using the dipstick. If engine oil level is not correct, check for proper operation of the reserve oil system. Never add oil to the engine unless it has been drained.

If the engine oil has been drained from the oil pan, the new oil must be added to the engine oil pan before starting. DO NOT use the oil in the reserve tank to fill an empty engine with oil. After an oil change, both the engine and reserve tank must be full of oil before starting the engine.

With the engine running, check the operation of the red LED light on the pump.

- **Continuously on** - Pump 1 is withdrawing oil from the engine sump and bringing down the oil level.
- **Regular pulsing** - Pump 2 is returning oil to the engine sump and raising the oil level.
- **Irregular pulsing** - Oil is at the correct running level.

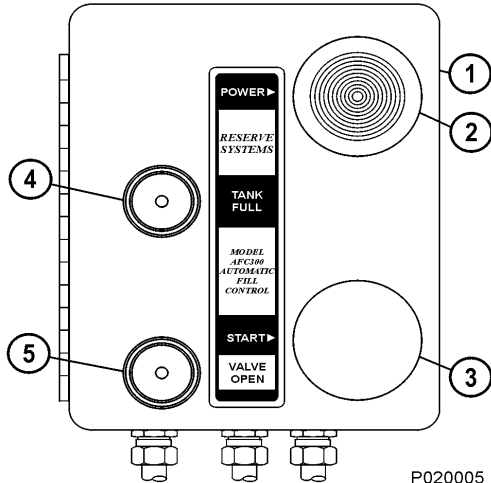


FIGURE 2-3. CONTROL PANEL

- | | |
|-----------------------|-----------------------|
| 1. Remote Control Box | 4. "FULL" Light |
| 2. System Switch | 5. "VALVE OPEN" Light |
| 3. Start Switch | |

Oil should always be visible in the bottom sight gauge. If not, add oil to the reserve oil tank until oil is visible in the top sight gauge.

- Never add oil to the engine unless it has been completely drained.
- If the engine oil has been drained from the oil pan, new oil must be added to the oil pan. **Do not use the oil in the reserve oil tank to fill an empty engine oil pan.**

After an oil change, both the engine and reserve oil tank must be full of oil before starting the engine.

Reserve Oil Tank Filling Procedure (Remote fill)

1. Connect the pressure supply hose from the new oil supply to the quick coupler on the truck. Open valve on supply hose to apply pressure.
2. Pull out on switch (2, Figure 2-3) to turn the system on.
3. Push start switch (3). The VALVE OPEN light (5) should illuminate and the filling process will begin.
4. When tank is full, the VALVE OPEN light will turn off and FULL light (4) will illuminate.
5. Close the oil supply valve in the fill hose.
6. Press and hold start switch (3) for a couple of seconds.
7. Disconnect the new oil supply hose.
8. Push switch (2) in to turn system power OFF.

Inline Screen

There is an inline screen located at the inlet of the fill valve. This screen does not require periodic maintenance, but it can be cleaned by removing the screen and back flushing.

250 HOUR LUBRICATION AND MAINTENANCE (Continued)

	TASK	COMMENTS	CHECKED	INITIALS
18.	AIR INTAKE PIPING - Check all mounting hardware, joints, and connections. Ensure no air leaks exist and all hardware is properly tightened. Figure 2-9.			
19.	G.E. PREFILTER BLOWER (If equipped) - Add one to two applications of grease to the grease fitting. Lube key "D".			
20.	WHEEL MOTOR BLOWER (If equipped) - Grease motor blower shaft bearings. Lube key "D".			

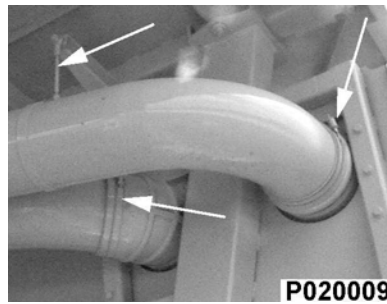


FIGURE 2-9.

GENERAL INSTRUCTIONS

Required Lubricant

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

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

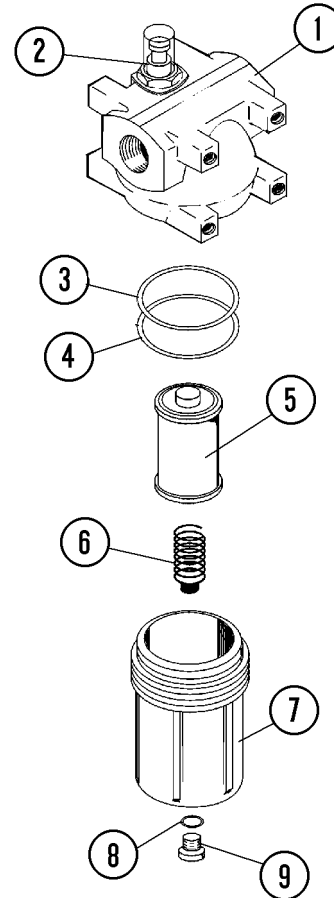
System Priming

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

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

Filter Assembly

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



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FIGURE 3-4. FILTER ASSEMBLY

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

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