

Shop Manual

830E

DUMP TRUCK

SERIAL NUMBERS **A30710 - A30732**
With Full Time Axle Blower

KOMATSU®

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SPECIFICATIONS

These specifications are for the standard Komatsu 830E Truck. Customer Options may change this listing.

ENGINE

Komatsu SDA16V160
(Optional SSSA16V160)
No. of Cylinders 16
Operating Cycle 4-Stroke
Rated Brake HP . . 2500 HP (1865 kW) @ 1900 RPM
Flywheel HP 2360 HP (1761 kW) @ 1900 RPM
Weight* (Dry) 21,182 pounds (9 608 kg)

* Weight does not include Radiator, Sub-frame, or Alternator

ELECTRIC DRIVE SYSTEM - STATEX III

(AC/DC Current)
Alternator General Electric GTA - 26
Dual Impeller, In-Line Blower 9000 cfm (255 m³/min)
Motorized Wheels General Electric 787
Ratio 31.875:1
Maximum Speed* 30.3 MPH (48.8 km/h)
(*w/40.00-57 Tires and 31.875:1 gear train)

DYNAMIC RETARDING

Extended Range Retarding with fully blown grids and reverse retarding standard equipment.
Maximum Rating 4000 HP (2983 kW)

TIRES

Rock Service, Deep Tread (E-4) Tubeless
Standard Tire 40.00 - 57, 68 Ply Rating

(w/787 Wheelmotor)
Separable Tire Rims *
5 Piece New Generation™ Rims *

Rims* are interchangeable with different positions on the truck, but due to improved design for greater load support, rims are not interchangeable with other manufacturer's rims.

Rim Size:

29 in. (737 mm) X 57 in. (1448 mm) X 6 in. (152 mm)

24 VDC ELECTRIC SYSTEM

Batteries . . . Four 12 Volt Batteries in Series/Parallel
. . . 220 Ampere-Hour Capacity w/Disconnect Switch
Alternator 24 Volt, 260 Ampere Output
Lighting 24 Volt
Cranking Motors (2) 24 Volt

SERVICE CAPACITIES

. U.S. Gallons . . . (Liters)
Crankcase * 74.0 280.0
* Includes Lube Oil Filters
Cooling System 130 492
Fuel 1200 4543
Hydraulic System 262 992
Hydraulic Tank 250 946
Wheel Motor Gear Box (each) 10.5 39.7

HYDRAULIC SYSTEMS*

Pumps
Hoist Gear Pump
Rated @ 160 GPM (605 lpm) @ 1900 RPM
Steering Piston, Pressure Compensating
(also Brake) 61 GPM (231 lpm) @ 1900 RPM
Axle Blower 16.5 GPM (62.4 lpm) @ 1900 RPM

System Relief Pressures

Hoist 2500 psi (17 240 MPa)
Brakes/Steering 4000 psi (27 580 MPa)
Hoist Cylinders (2) 3-Stage
Tank (Vertical/Cylindrical) Non-Pressurized
Filtration . Remote-mounted, Replaceable, Elements
Suction Single, Full Flow, 100 Mesh
Hoist & Steering
. Full Flow, Dual In-Line,
. High Pressure Beta 12 Rating =200

*With Quick Disconnects for powering disabled truck and system diagnostics.

STEERING (w / Accumulators)

Turning Circle - Front Wheel Track . . . 93 ft. (28.4 m)
Full Time Power Steering Twin Cylinders
Automatic Emergency Steering Standard

WHEN DUMPING

- Before starting the dumping operation, check that there is no person or object behind the machine.
- Stop the machine in the correct position, and check again that there is no person or object behind the machine. Give the determined signal, then slowly operate the dump body. If necessary, use blocks for the wheels or position a flagman.
- When carrying out dumping operations on slopes, the machine stability will become poor and there is danger that it may tip over. Always carry out such operations extremely carefully.
- Do not travel with the dump body raised.

WORKING ON LOOSE GROUND

- Avoid operating the machine too close to the edge of cliffs, overhangs, and deep ditches. If these areas collapse, the machine could fall or tip over and result in serious injury or death. Remember that the soil after heavy rain or blasting is weakened in these areas.
- Earth laid on the ground and the soil near ditches is loose. It can collapse under the weight or vibration of the machine. Avoid these areas, if possible.

WHEN LOADING

- Check that the surrounding area is safe, stop the machine in the correct loading position, then load the body uniformly.
- Do not leave the operator's seat during the loading operation.

PARKING THE MACHINE

- Choose a horizontal road surface to park the machine. If the machine has to be parked on a slope, always put blocks under all the wheels to prevent the machine from moving.
- When parking on public roads, provide fences and signs, such as flags or lights, on the machine to warn pedestrians and other vehicles. Be sure that the machine, flags, or lights do not obstruct the traffic.
- Before leaving the machine, lower the dump body fully, set the parking lever to the PARKING position, stop the engine, then lock everything. Always take the key with you.

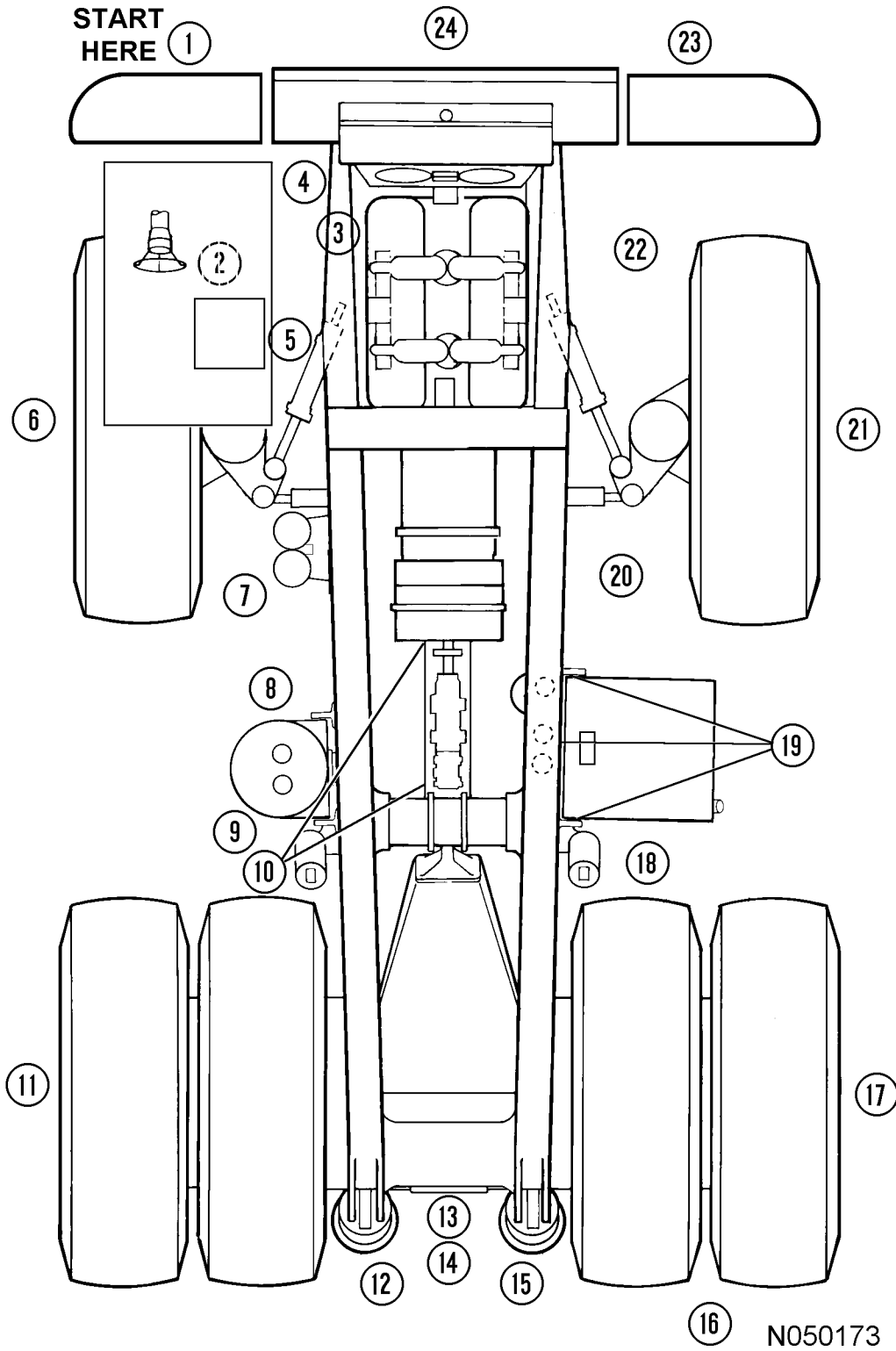
TOWING

WHEN TOWING, FIX WIRE TO HOOK

- Towing in the wrong way may lead to serious personal injury or damage.
- When using another machine to tow this machine, use a towing device with ample strength for the weight of this machine.
- Never tow a machine on a slope.
- Do not use any towing rope that has kinks or is twisted.
- Do not stand astride the towing cable or wire rope.
- When connecting a machine that is to be towed, do not let any one come between the towing machine and the machine that is being towed.
- Set the coupling of the machine being towed in a straight line with the towing portion of the machine, and secure it in position.

(For towing method, see Section A, "Operating Instructions, TOWING".)

PREPARING FOR OPERATION
GROUND LEVEL CHECKS



SUDDEN LOSS OF ENGINE POWER

NOTE: If the engine suddenly stops, there is enough hydraulic pressure stored in the brake and steering accumulators to allow the operation of the steering and brake functions. However, this oil supply is limited so it is important to stop the truck as quickly and safely as possible after the loss of engine power. If the brake supply pressure drops to a pre-determined level, the "Low Brake Pressure" warning light will illuminate and a buzzer will sound. If the brake pressure continues to decrease, the "Auto-Apply" feature will activate and the service brakes will apply automatically to stop the truck. Apply parking brake as soon as the truck comes to a complete stop.

1. Bring the truck to a safe stop as quickly as possible by using the foot pedal to apply the service brakes.



Dynamic retarding will not be available! Do not use the service brakes for continuous retarding purposes.

2. If possible, steer the truck to the side of the road while bringing it to a complete stop. Apply the parking brake as soon as the truck has stopped moving. Turn key switch "Off" and notify maintenance personnel immediately.
3. If safe to do so, place wheel chocks in front or behind the wheels to that truck cannot roll.
4. If the truck becomes disabled where traffic is heavy, mark the truck with warning flags in daylight or flares at night.

RESERVE ENGINE OIL SYSTEM (Optional)

The reserve oil tank for the engine is designed to add more oil capacity to the engine and to make less frequent servicing of the engine oil. The circulation of oil between the engine sump and reserve tank increases the total volume of working oil. This dilutes the effects of contamination and loss of additives and maintains the oil quality over longer periods. A filter in the supply circuit protects the pumping unit and prevents transfer of contaminants to the engine sump which might enter the tank during servicing. It also gives an added level of oil cleanup.

Operation

Engine oil is circulated between the engine sump and the reserve tank by two electrically driven pumps within a single pumping unit (11). The pump unit is mounted on the side of the reserve tank. The pump unit is equipped with an LED monitor light on one side.

Pump 1 (in the pump unit) draws oil from the engine sump at a preset control point (determined by the height of the suction tube). Oil above this point is withdrawn and transferred to the reserve tank (9). This lowers the level in the engine sump until air is drawn.

Air reaching the pumping unit activates Pump 2 (in the pump unit) which returns oil from the reserve tank and raises the engine sump level until air is no longer drawn by Pump 1. Pump 2 then turns off. The running level is continuously adjusted at the control point by alternation between withdrawal and return of oil at the sump.

LED Monitor Light

- Steady - 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 on the correct running level.

STANDARD CHARTS AND TABLES

This manual provides dual dimensioning for most specifications. U.S. standard units are specified first, with metric (SI) units in parentheses. References throughout the manual to standard torques or other standard values will be to one of the following Charts or Tables. For values not shown in any of the charts or tables, standard conversion factors for most commonly used measurements are provided in TABLE XIII, page 1-14.

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EFFECT OF SPECIAL LUBRICANTS On Fasteners and Standard Torque Values

KOMATSU engineering department does NOT recommend the use of special “friction-reducing” lubricants such as, “Copper Coat”, “Never Seize”, and other similar products on the threads of standard fasteners where “standard torque” values are applied.

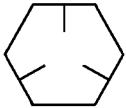
The use of special “friction-reducing” lubricants will significantly alter the clamping force being applied to fasteners during the tightening process.

If special “friction-reducing” lubricants are used with the “Standard Torque” values listed below in Table I (and in Komatsu shop manuals), excessive stress and possible breakage of the fasteners may result.

Where Torque Tables specify “Lubricated Threads” for the Standard Torque values listed, **these standard torque values are to be used with simple lithium base chassis grease (multi-purpose EP NLGI) or a rust- preventive grease (see list, page 1-10) on the threads and seats**, unless specified otherwise.

NOTE: Always be sure threads of fasteners and tapped holes are free of burrs and other imperfections before assembling.

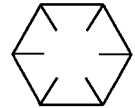
Standard torque values are not to be used when “Turn-of-the-Nut” tightening procedures are recommended.



Grade 5

**TABLE I. -STANDARD TORQUE CHART
SAE HEX HEAD CAPSCREW AND NUT ASSEMBLY
(LUBRICATED THREADS) - TOLERANCES ±10%**

Grade 8



Cap-screw Thread Size	TORQUE - GRADE 5			TORQUE - GRADE 8			Cap-screw Thread Size	TORQUE - GRADE 5			TORQUE - GRADE 8		
	ft. lbs.	kg.m	N.m	ft. lbs.	kg.m	N.m		ft. lbs.	kg.m	N.m	ft. lbs.	kg.m	N.m
1/4-20	7	0.97	9.5	10	1.38	13.6	3/4-16	235	32.5	319	335	46.3	454
1/4-28	8	1.11	10.8	11	1.52	14.9	7/8-9	350	48.4	475	500	69.2	678
5/16-18	15	2.07	20.3	21	2.90	28	7/8-14	375	51.9	508	530	73.3	719
5/16-24	16	2.21	22	22	3.04	30	1.0-8	525	72.6	712	750	103.7	1017
3/8-16	25	3.46	34	35	4.84	47	1.0-12	560	77.4	759	790	109.3	1071
3/8-24	30	4.15	41	40	5.5	54	1.0-14	570	78.8	773	800	110.6	1085
7/16-14	40	5.5	54	58	8.0	79	1 1/8-7	650	89.9	881	1050	145	1424
7/16-20	45	6.2	61	62	8.57	84	1 1/8-12	700	96.8	949	1140	158	1546
1/2-13	65	9	88	90	12.4	122	1 1/4-7	910	125.9	1234	1480	205	2007
1/2-20	70	9.7	95	95	13.1	129	1 1/4-12	975	134.8	1322	1580	219	2142
9/16-12	90	12.4	122	125	17.3	169	1 3/8-6	1200	166	1627	1940	268	2630
9/16-18	95	13.1	129	135	18.7	183	1 3/8-12	1310	181	1776	2120	293	2874
5/8-11	125	17.3	169	175	24.2	237	1 1/2-6	1580	219	2142	2560	354	3471
5/8-18	135	18.7	183	190	26.2	258	1 1/2-12	1700	235	2305	2770	383	3756
3/4-10	220	30.4	298	310	42.8	420							

1 ft. lbs. = 0.138 kg.m = 1.356 N.m

13. Relieve tension from all drive belts. The engine manufacturer recommends insertion of heavy kraft paper between belts and pulleys to prevent sticking.
14. All vandalism covers and locks should be in place and secured.
15. Cab windows should be closed, locked and sealed and the cab door locked to prevent vandalism and weather effects.
16. The vehicle fuel tanks should be completely drained of fuel, fogged with preservative lubricant, ("NOX-RUST" MOTOR STOR., SAE10) and closed tightly. All fuel filters should be replaced.
17. If at all possible, to aid those who will eventually place the unit back in operation, all available service publications (vehicle, engine and transmission) and a current parts catalog should be packaged in a moisture proof package and placed in the vehicle cab.
18. Be certain water drain holes in the body are open.

4. The cooling system should be completely drained, chemically flushed, and refilled with a conditioned water/antifreeze solution suitable for the lowest temperature anticipated. Refer to Fluid Specifications in Section P, Lubrication and Service, for the proper anti-freeze and conditioner concentrations. After refilling the system, always operate the engine until the thermostats open to circulate the solution through the cooling system.
5. Refer to instructions for returning the transmission to operation at the end of this chapter.
6. Thoroughly inspect all drive belts, hydraulic, air and oil lines for evidence of damage, wear or deterioration. Replace any suspected lines. Don't take chances on ruptures or blow-outs.
7. New hydraulic filters should be installed and the hydraulic tank (reservoir) checked and serviced with type C-4 oil as specified in Section P, Lubrication and Service.
8. Drain on fuel tank should be opened to remove any build up of moisture or sediment that may have accumulated while in storage. Close the drain then fill the fuel tank with approved diesel fuel.

REMOVAL FROM STORAGE

If the foregoing preparations were conscientiously followed in placing the vehicle into storage, getting it back to operational status is a simple matter of reversing these steps.

NOTE: Before starting the job or restoring a vehicle to operation, obtain copies of the Operation and Maintenance Manual, Engine and Transmission Manuals and/or the Parts Book and follow all special instructions regarding servicing the vehicle and its components.

In addition to removing the storage materials, the following actions should be performed.

1. Inspect the entire vehicle carefully for rust and corrosion, correct as necessary.
2. Service the engine according to the Engine Manufacturer's Operation and Maintenance Manual.
3. Clean the radiator. Refer to Section C, Cooling System.



Never blend gasoline, gasohol and/or alcohol with diesel fuel. This practice creates an extreme fire hazard and under certain conditions may cause an explosion.

9. Make certain that all hydraulic controls, steering linkage, and throttle linkage points are lubricated and operate freely before engine start-up.
10. All electrical connections must be clean and tight. Check secureness of all ground straps and cables.

Periodic Inspections

It is important that periodic inspections (every three months) of stored equipment be performed to insure the continued serviceability of all protective measures initially taken when the storage period began. Items which should be checked at each inspection interval are listed as follows:

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

Placing Equipment Into Service After Storage

When taking equipment out of storage, perform the following procedures:

When A Truck Is Operational

If a truck has been operated weekly throughout the storage period, perform a complete visual inspection of the Motorized Wheels, blowers, alternator and control compartments. Repair any defects found, then place the truck directly into service.

When A Truck Is Not Operational

If the truck was not operated weekly throughout the storage period, perform the following procedures:

1. Remove all weatherproofing tape from control compartment doors and ductworks.
2. Remove all screening material from ductwork.
3. Remove all heat sources from Motorized Wheels, control compartments and the alternator.
4. Fill with recommended oil. Refer to the Motorized Wheel Service Manual for the type and

amount oil to be used. This oil should be drained and new oil should be added after 500 hours of operation.

5. Clean all Motorized Wheel grease fittings in the axle box. Insure that all grease lines are completely full of grease. Then add the recommended amount of grease to all fittings.
6. Install brushes in the Motorized Wheels, blowers and the alternator. Make sure that brushes move freely in their carbonways and that they have enough length to serve until the truck's next inspection period. Install new brushes if necessary. Insure that all brush pigtail screws are tight.
7. Perform a megohmmeter test. Refer to the truck's Vehicle Test Instructions for the correct procedure. If Megger readings are less than 2.0 megohms, the problem could be an accumulation of moisture in motor or alternator. If this is the case, the faulty component will have to be isolated and dried out using procedures recommended in the G.E. Service Manual.
8. Perform a thorough inspection of the Motorized Wheels, alternator, blowers and control compartments. Look for:
 - a. Rust or dirt accumulation on machine surfaces
 - b. Damaged insulation
 - c. An accumulation of moisture or debris
 - d. Loose wiring and cables
 - e. Any rust on electrical connectors in the control compartment
 - f. Any loose cards in the card panels
 - g. Any accumulation of moisture or debris in ductwork.

Clean and make repairs as necessary.

9. Check retarding grids and insulators for loose connections and dirt accumulation. Clean and make corrections as necessary.
10. Where applicable, check exciter drive belts for cracks, and deterioration. If acceptable, set belt tension to specification.
11. Before starting engine, turn on control power. Check that contactors and relays pick up and drop out normally.

DUMP BODY

Removal

1. Park truck on a hard, level surface and block all the wheels. Connect cables and lifting device to the dump body and take up the slack as shown in Figure 3-2.

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.

2. Remove mud flaps and rock ejectors from both sides of the body. Remove electrical cables, lubrication hoses etc. attached to the body.
3. Attach chains around upper end of hoist cylinders to support them after the mounting pins are removed.
4. Remove pin retainer capscrew (4, Figure 3-3) from each of the upper hoist cylinder mounting eyes. With adequate means of supporting the hoist cylinders in place, remove each of the mounting pins (2).
5. Remove capscrews (4, Figure 3-1) from each pivot pin.
6. Remove body pivot pins (6) far enough to allow spacer (9) to drop out. Complete removal is not necessary unless a new pin is to be installed.

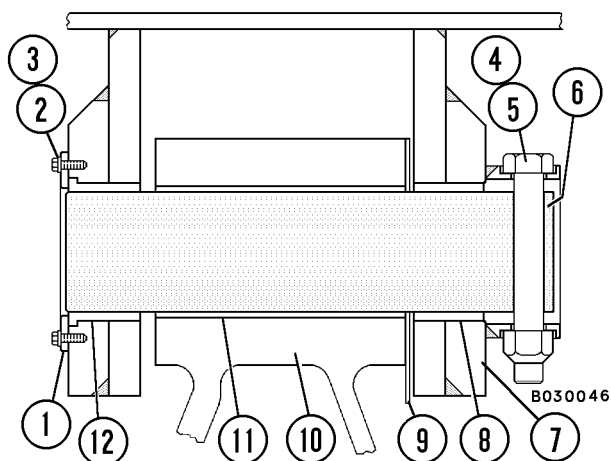


FIGURE 3-1. DUMP BODY PIVOT PIN

- | | |
|-------------------|------------------------|
| 1. Retainer | 7. Body Ear |
| 2. Capscrew - M10 | 8. Body Pivot Bushing |
| 3. Lockwasher | 9. Shim |
| 4. Capscrew - m36 | 10. Frame Pivot |
| 5. Locknut | 11. Pivot Bushing |
| 6. Body Pivot Pin | 12. Body Pivot Bushing |

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.

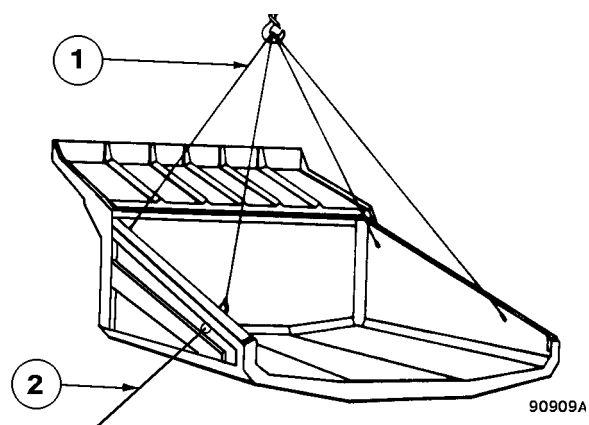


FIGURE 3-2. DUMP BODY REMOVAL

- | | |
|-------------------|---------------|
| 1. Lifting Cables | 2. Guide Rope |
|-------------------|---------------|

Note: Illustration shows engine equipped with two-stage turbochargers. Single stage turbocharger equipped engine ducts and supports are similar.

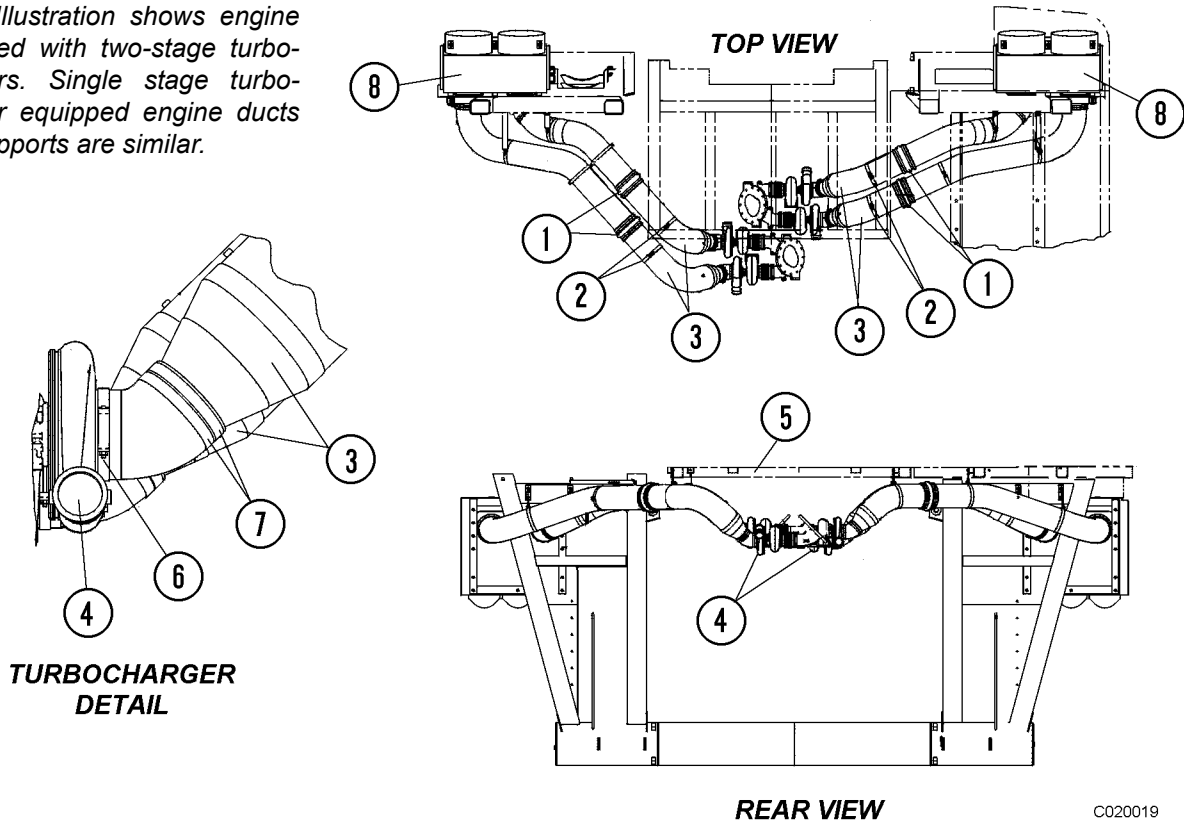


FIGURE 2-3. AIR INTAKE DUCTS

- | | | |
|---------------------|--------------------------|-------------------------|
| 1. Hump Hose | 4. Turbocharger | 7. T-Bolt Clamp |
| 2. Support Rods | 5. Center Deck Structure | 8. Air Cleaner Assembly |
| 3. Air Intake Ducts | 6. Clamp | |

12. Remove upper radiator support struts (12, Figure 2-4).
13. Disconnect grounding strap located near the front subframe mount.
14. Remove capscrews and washers securing cover (10, Figure 2-4) to grille at center of front bumper and remove. Remove capscrews and lockwashers (9) securing front subframe support to main frame.

⚠ WARNING

Install safety chain around the front engine subframe cross member and main frame to prevent the power module from rolling forward when the subframe rollers are installed.

ENGINE/ALTERNATOR MATING

Komatsu SSDA16V160 or SDA16V160 Engine

▲ IMPORTANT ▲

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

General Instructions

- Never pry on the engine crankshaft damper!
- Loosen or remove fan belt prior to measuring crankshaft end-play to insure that the crankshaft moves easily and completely.
- When taking measurements, always take four equally spaced readings and average them.
- Always measure from mating surface to mating surface.
- References to crankshaft rotation; clockwise (CW), or counterclockwise (CCW), is the direction of rotation when looking at the front (damper end) of engine.
- **Crankshaft end-play** for Komatsu SSDA16V160 or SDA16V160
Engine: 0.005 - 0.015 in. (0.13 - 0.38 mm).

SERVICE DATA - Eccentricity & Runout Limits	
Description	T.I.R.
Max. Flywheel Housing Bore Eccentricity	0.026 in. (0.66 mm)
Max. Face Runout, Flywheel Housing	0.010 in. (0.25 mm)
Max. Eccentricity of Flywheel (Coupling Assembly)	0.007 in. (0.18 mm)
Max. Axial Runout of Flywheel Face (Coupling Assembly)	0.010 in. (0.25 mm)

MEASURING PROCEDURE

1. Thoroughly clean the alternator housing mounting surface, rotor drive adapter mounting surface and flywheel housing adapter mounting surfaces.
2. With magnetic base mounted on the front of the engine and the dial indicator on the front of the crankshaft, measure total crankshaft end-play:
 - Verify end play is within 0.005 - 0.015 in. (0.13 - 0.38 mm).

Record Total Crankshaft End-play: _____

3. Refer to Figure 4-5. Move the engine Crankshaft to the rear of its end travel.

- a. Carefully measure Dimension "C" at four locations, 90° apart:

1st measurement: _____

2nd measurement: _____

3rd measurement: _____

4th measurement: _____

Dimension "C": _____ Average

- b. Add 1/2 (one-half) of Total End-play (Step 2).

- c. Record (a + b) as;

"Measurement C": _____

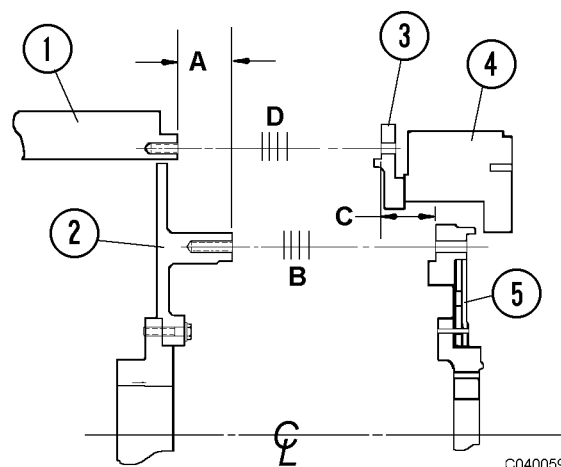
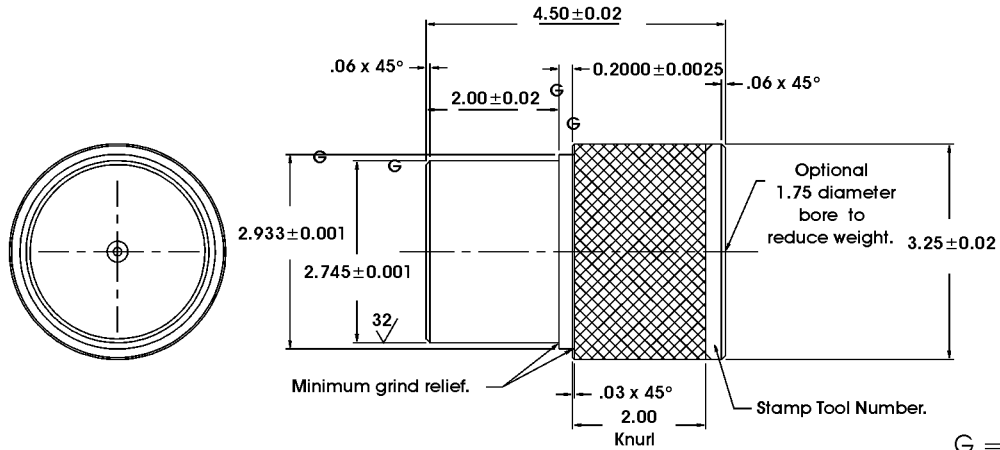


FIGURE 4-5. SHIM LOCATION

1. Alternator Housing "A": Dimension "A"
2. Alternator Rotor "B": Dimension "B"
3. Flywheel Housing Adapter "C": Dimension "C"
4. Flywheel Housing "D": Dimension "D"
5. Engine Drive Ring

FAN CLUTCH

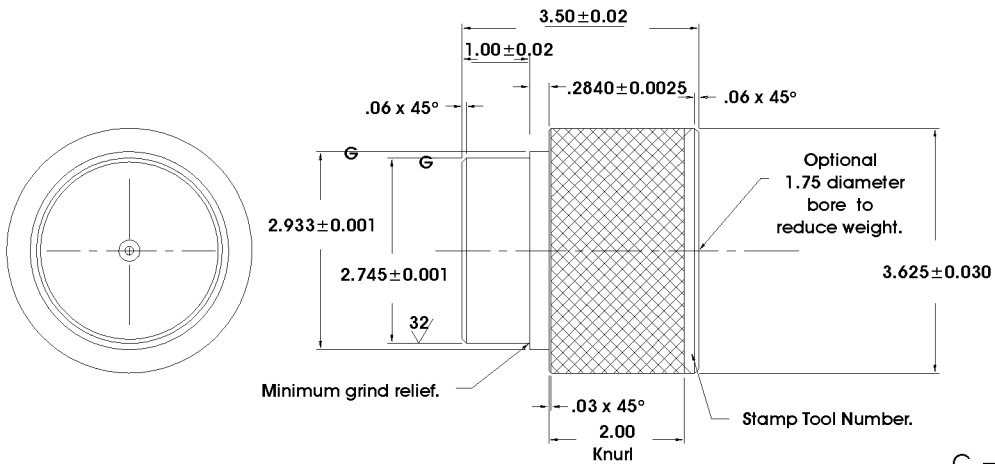
REMOVAL & INSTALLATION TOOLING



G = Grind this surface.
 Dimensions in inches unless otherwise specified.

M060068

TOOL A - FRONT SLEEVE BEARING INSTALLER



G = Grind this surface.
 Dimensions in inches unless otherwise specified.

M060069

TOOL B - REAR SLEEVE BEARING INSTALLER

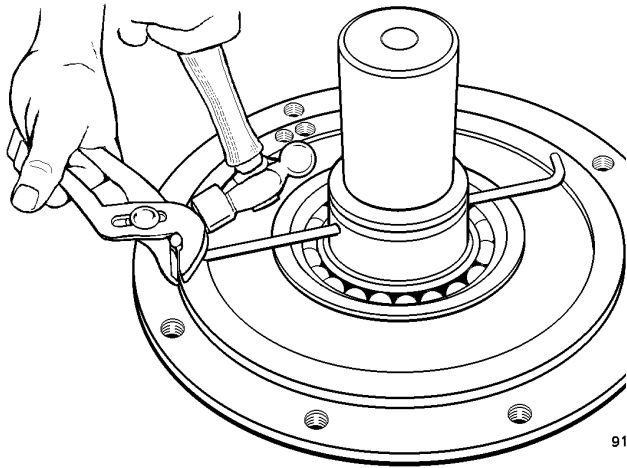


FIGURE 7-23.

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

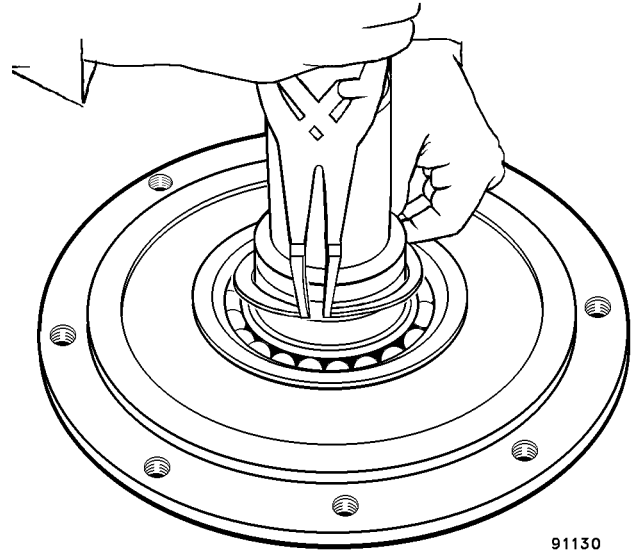


FIGURE 7-25.

22. Remove external snap ring (16).

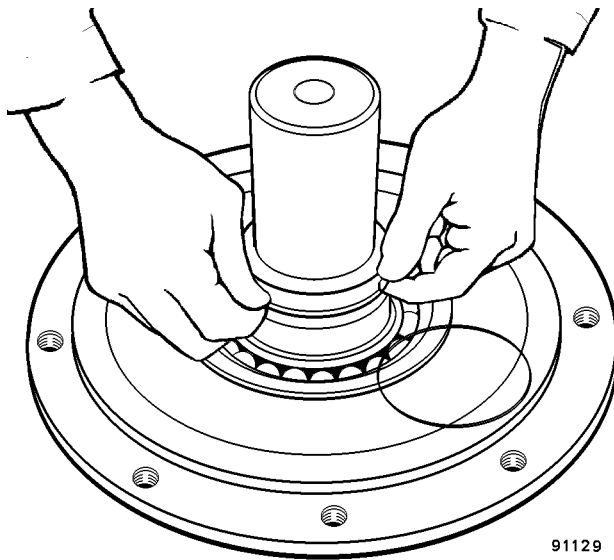


FIGURE 7-24.

21. Remove both seal rings (17).

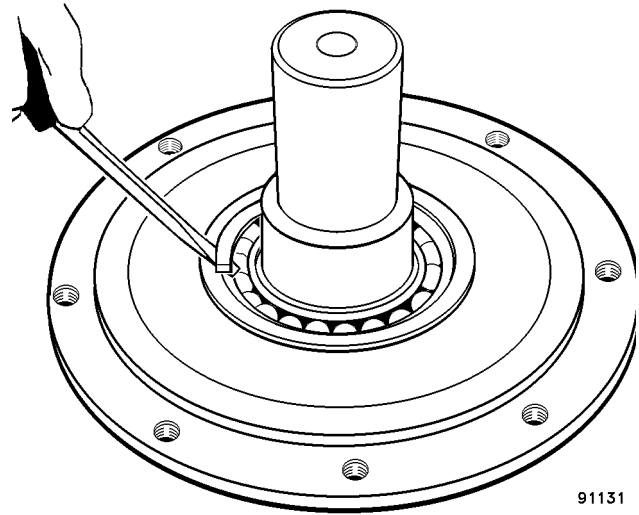


FIGURE 7-26.

23. Remove internal snap ring (15).

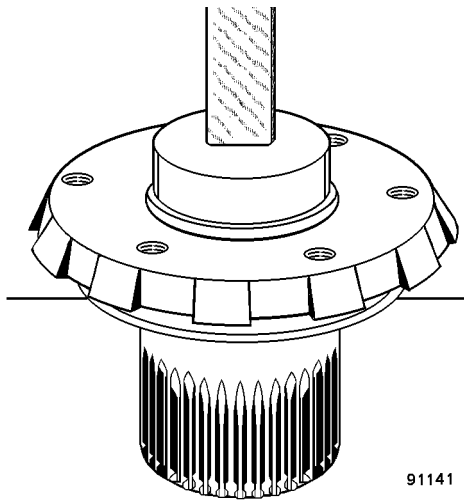


FIGURE 7-47.

7. Coat the bore of the fan mounting hub (42) with a thin coating of Loctite® Primer N and #242.

Remove frozen end cap (45) from the freezer. Do not apply Loctite® to the end cap. Press the end cap into the hub until the cap bottoms out.

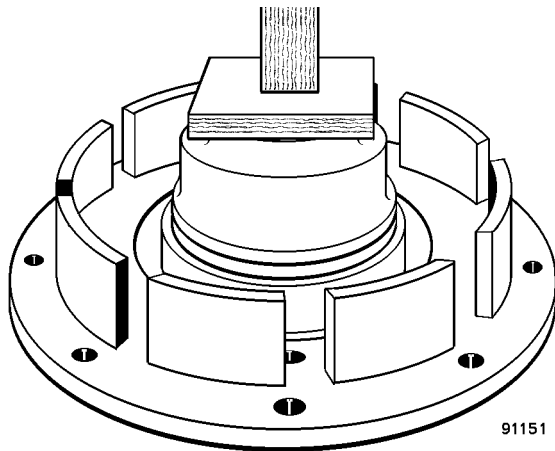


FIGURE 7-48.

8. Apply Loctite® Primer N and #609 to the mating surfaces of front bearing (33) and front bearing retainer (35). Place the bearing into position on the retainer with the notch for the bearing pin facing downward.

Press the front bearing into the bearing retainer using tooling (E) or equivalent. Press **ONLY** on the outer race of the bearing until it seats at the bottom of the bore.

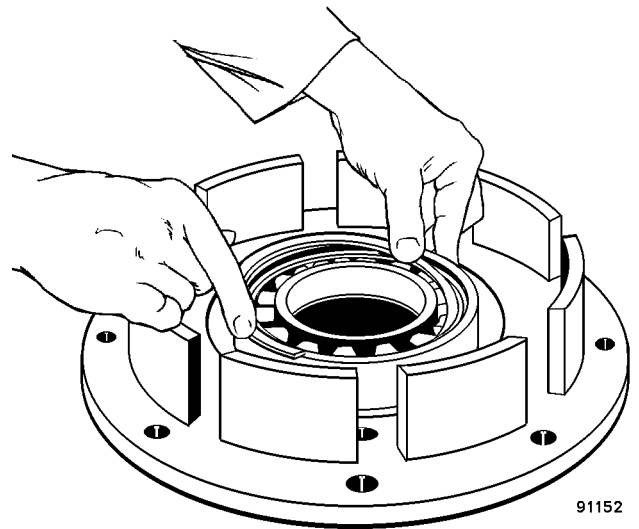


FIGURE 7-49.

9. Install internal snap ring (32).

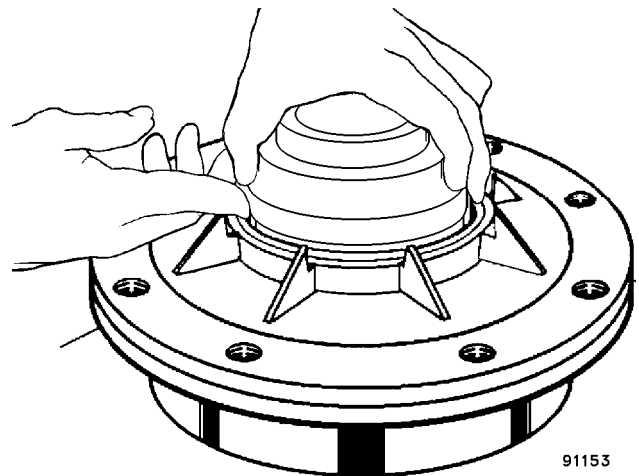


FIGURE 7-50.

10. Turn the retainer over on the press bed. Coat the O.D. of front oil seal (36) and mating surface on the bearing retainer with Loctite® Primer N and #242 (or equivalent). Use tooling (E) to press the oil seal into the front bearing retainer, flush with the front face. **Ensure the lip of the seal is dry.** Wipe any excess Loctite® from the seal area and remove any rubber strings from the seal.

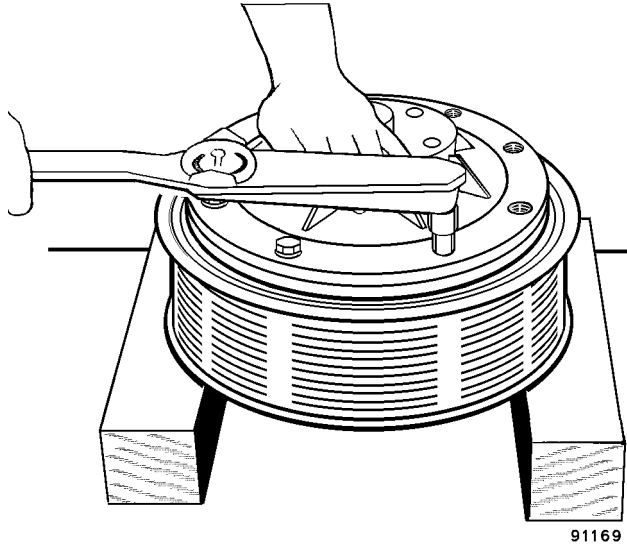


FIGURE 7-79.

38. Turn the assembly over on the bench. Install the remaining bolts (38) and lockwashers (37), and torque all to **36-43 ft. lbs. (49-58 Nm)**.

Maintenance Free types:

- Immediately after engine start, system volts are lower than regulator setpoint with low amps.
- 15-30 minutes into charge cycle, still low volts and low amps.
- 15-30 minutes into charge cycle, volts rise several tenths, amps increase gradually then increase quicker to medium to high amps.
- 20-35 minutes into charge cycle, volts rise to setpoint and amps lower.

High-Cycle Maintenance Free Types:

These types respond much better than standard maintenance free types. The charge acceptance of these batteries may display characteristics similar to standard, maintenance type batteries.

CHARGE VOLT AND AMP VALUES

Voltage and amperage levels are functions of battery state of charge. If the batteries are charged 95% or higher when the engine is cranked, the charge voltage will be near regulator setpoint and the amps will taper quickly from medium to low. True battery voltage is obtained AFTER removing any surface charge from the battery or after 24 hours of non-use.

DEFINITIONS

NOTE: Charge voltage and amp rates vary from battery type to battery type, based on battery construction technology and physical size of battery.

Low amps are the necessary amps that a battery will take continuously over a period of time without damage to the battery when the battery *is in an operating system and is constantly cycling*. Batteries such as the Group-8D may accept rates up to 15 amps over several hours without raising their internal temperature more than a few degrees. Group-31 batteries may accept rates up to 5 amps over several hours with minimal temperature rise.

Medium amps are defined as some multiple of the low amp value, perhaps 30 amps for the Group-8D and 10-15 amps for the Group-31. This rate of amperage will cause a rise in battery temperature over a long period of time (4-8 hrs) and may lead to an overcharge condition if temperature elevates too high.

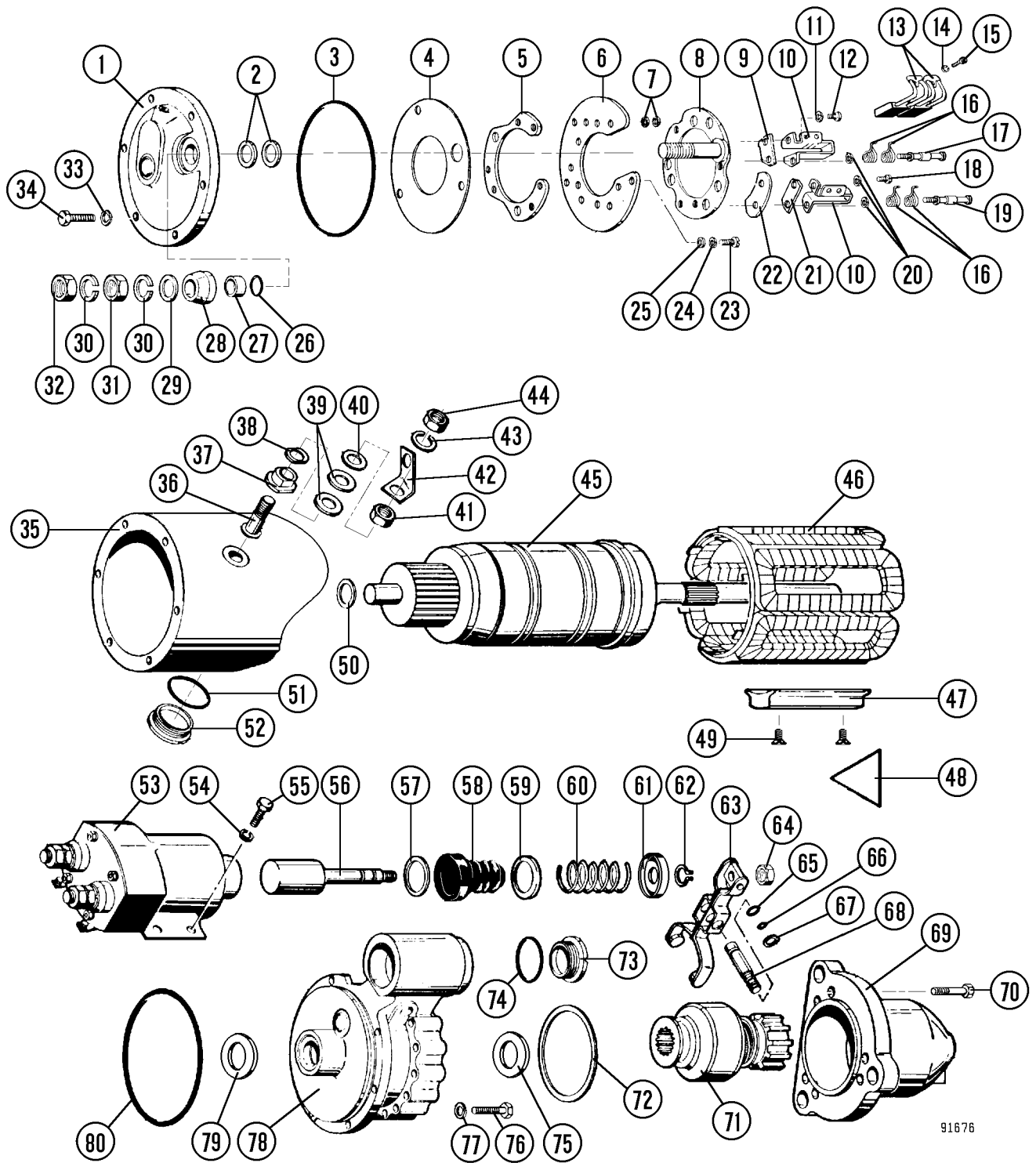
High amps would be 50 to 75 amps for a Group-8D, and 25 to 35 amps for a Group-31 size. High amperage rates over a short period of time (2-3 hrs.) can severely damage any battery by overheating the battery and causing thermal runaway. The battery, in effect, forgets its state of charge and will accept all amps offered. The electrolyte solution is boiled off as the battery moves into an excessive gassing stage.

Charge voltage is the voltage delivered to the battery when the alternator and regulator are operating properly. This charge voltage value is the voltage regulator's setpoint. At times the charge voltage value may be less than the regulator's setpoint but it will never be higher than that setpoint.

Battery voltage is the steady state voltage of the battery. The value of this voltage relates directly to state of charge.

B+ voltage is battery positive voltage, but does not refer to a specific value as does battery voltage.

Surface charge is a higher than normal terminal voltage a battery has when it comes off a charger or after extended time in vehicle operation. The surface charge must be removed to determine true battery voltage.



91676

FIGURE 2-8 CRANKING MOTOR ASSEMBLY

Hot Switch Inverter

The Hot Switch Inverter Card in slot 3 (3, Figure 3-2) is used to operate and test the service brake indicator light. In normal conditions Q4 transistor is off and the Indicator Light is off. When the stoplight switch is activated, 24 volts is sent to pin "E" of the Hot Switch Inverter Card. Transistor Q4 is turned on by this voltage and, in turn, grounds the service brake Indicator Light. There is no alarm horn operation with this card.

A second circuit on this card is used to operate and test the Retard Speed Control indicator light. When RSC is turned Off, transistor Q7 is off and the indicator light is off. When RSC is turned on, 24 volts is sent to pin "J" of the card. This voltage turns on Q7, grounding the indicator light circuit.

Hot Switch Inverter Card (Slot 4) (Not Used)

Temperature

The 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 204°F (96°C). As the temperature goes up the resistance in the probe decreases providing a ground path for the indicator light and alarm horn.

Oil Level

The Oil Level Card is used to turn on the Low Oil Level Indicator Light to warn the operator 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, grounding the indicator light and alarm horn.

Temperature and Latch

The Temperature and Latch Card (5, Figure 3-2) has two circuits to operate two different indicating 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 185°F (85°C) and 500 ohms at 250°F (122°C). Normal setting is 204°F (96°C).

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 Ω resistor is installed to replace the temperature sensor and disable the AID system circuit.

The Latch Circuit monitors the accumulator pre-charge pressure switches. When one of the pressure switches closes, Q5 will be turned off which supplies power to the gate of SCR Q7. 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 (6, Figure 3-2) 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 there being 24 volt positive output on pin "H" of the card and on wire 12F. When a 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, ground the Coolant Level Light through terminal D11, and ground 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 2K Ω resistor is installed to replace the probe and disable the AID system circuit.

Lamp Test

All of the card circuits are connected to the Lamp Test Switch on the overhead display area. In normal operation, these circuits are open and not functional. When the operator pushes the Lamp Test Switch, it activates all the indicator circuits by grounding them. This is used to verify that all lamps are functional.

VEHICLE HEALTH MONITORING SYSTEM (VHMS)

VHMS BASIC FEATURES

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

For instructions on how to use VHMS software programs, refer to VHMS Software elsewhere in this section. For error codes, check-out and troubleshooting procedures, refer to VHMS Troubleshooting and Check-out Procedures elsewhere in this section.

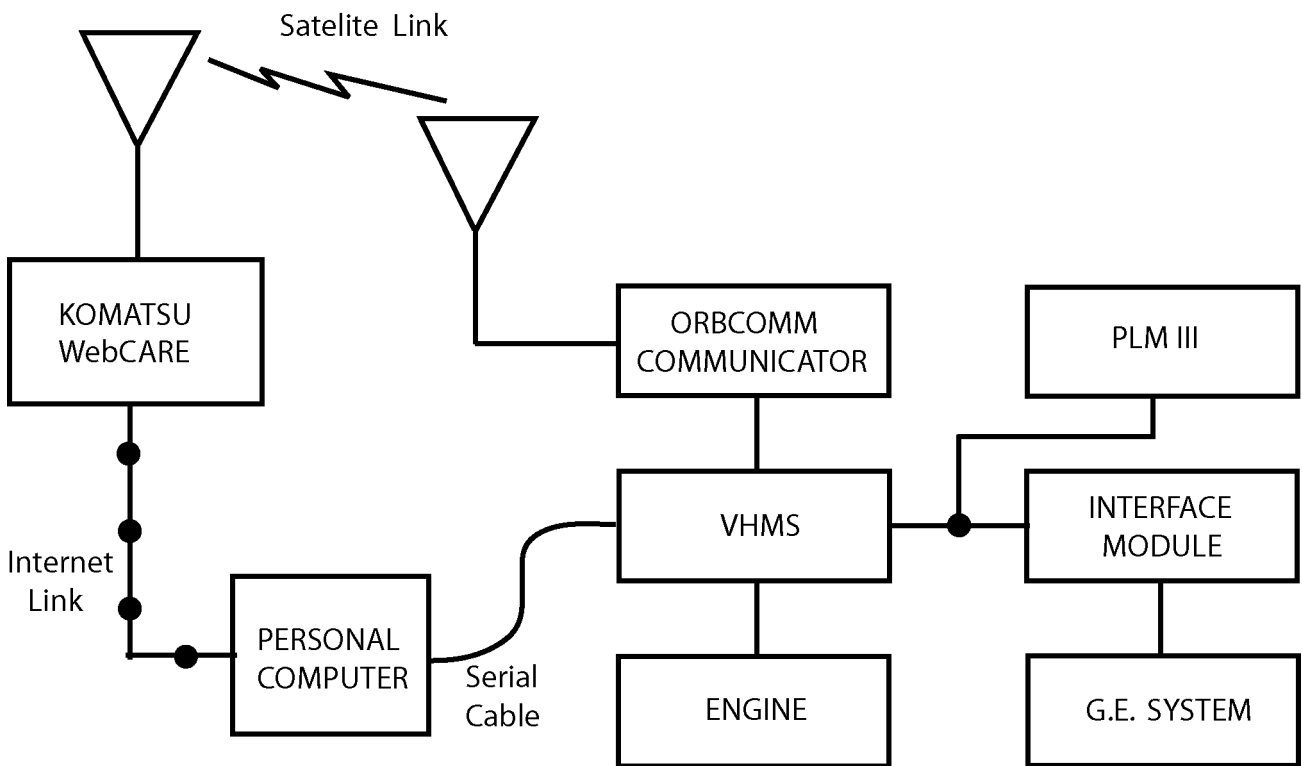
Gather Data

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

The VHMS system performs three primary functions:

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

NOTE: The electric drive system does provide a limited number of faults to the interface module. Refer to VHMS Troubleshooting else where in this section for a complete listing of fault codes generated by the drive system.



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FIGURE 11-1. VHMS SYSTEM

Alarm and Snapshot Triggers

Serious fault conditions will be sent to WebCARE via the OrbComm satellite network, as well as being recorded in permanent memory. Some fault codes are configured to generate a snapshot when they occur.

Table 6 shows which fault codes trigger a snapshot and which fault codes will be sent to WebCARE via satellite.

Table 6: Alarm and Snapshot Triggers					
VHMS Fault Code	VHMS Fault Description	Source	Sent via OrbComm	Snapshot Trigger	Model Notes
#A018	RR Flat Cylinder Warning	PLM III	X		All
#A019	LR Flat Cylinder Warning	PLM III	X		All
#A101	Pump Filter Switches	IM	X		All
#A107	Propel System Caution	IM	X		930E
#A108	Propel System Temp Caution	IM	X		930E
#A109	Propel System Reduced Level	IM	X		930E
#A115	Low Steering Precharge	IM	X		All
#A124	No Propel / Retard	IM	X		930E
#A125	No Propel	IM	X		930E
#A126	Hydraulic Tank Level	IM	X		All
#A127	IM Sensor +5V Low	IM	X		All
#A128	IM Sensor +5V High	IM	X		All
#A190	Auto Lube Switch	IM	X		All
#A193	High Hydraulic Tank Oil Temp	IM	X	X	830E
#A194	High FL Brake Oil Temp	IM	X	X	930E
#A195	High FR Brake Oil Temp	IM	X	X	930E
#A196	High RL Brake Oil Temp	IM	X	X	930E
#A197	High RR Brake Oil Temp	IM	X	X	930E
#A225	Motor Temperature High	IM	X		830E
#A226	Motor Blower Off	IM	X		830E
#A227	Diode Fault	IM	X		830E
#A228	Electric Drive System Fault	IM	X		830E
#A229	Ground Fault	IM	X		830E
MFA0	Manual Trigger	Manual	X	X	All
C00115	Speed Signal Lost	Engine	X	X	All
C00135	Oil Pressure Circuit Failed High	Engine	X	X	All

Continued

VHMS SOFTWARE

To work with the Vehicle Health Monitoring System (VHMS) system, several special tools and software programs are required. Refer to Tables 1 and 2 for detailed information on VHMS software and tools.

Refer to the following pages for detailed information on how to perform certain procedures using VHMS 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.

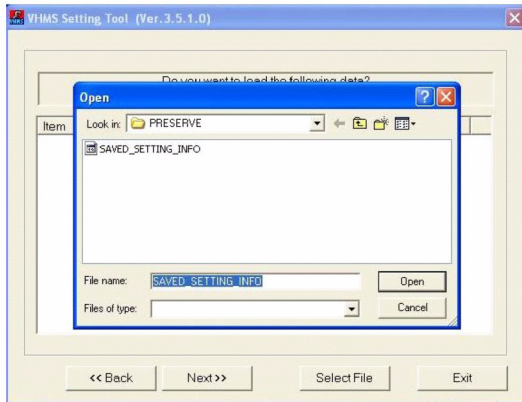
NECESSARY SOFTWARE

Table 1: VHMS Software			
Part Number	Name	Description	Source
799-608-3211 Version 3.04	VHMS Technical Analysis Tool Box	To initialize and maintain VHMS system	Komatsu Parts
VhmsWatcher.exe	VHMS Watcher	Use to watch inputs in interface module	Komatsu Distributor
CGCDat830E.csv	830E Data Files	Use with VHMS Watcher	Komatsu Distributor
CGCDat930E.csv	930E Data Files	Use with VHMS Watcher	Komatsu Distributor
EJ3055-2.exe	Flashburn Software	To install application code in interface module	Komatsu Distributor
EL0335-1.exe	830E Application Code	Application code for interface module	Komatsu Distributor
EJ9098-2.exe	930E Application Code	Application code for interface module	Komatsu Distributor
1.4.7.38	PDM	Payload Meter III Data Manager	Komatsu Distributor
PLM3 03 01 05.kms or higher	PLM III	Software to work with VHMS	Komatsu Distributor

NECESSARY TOOLS

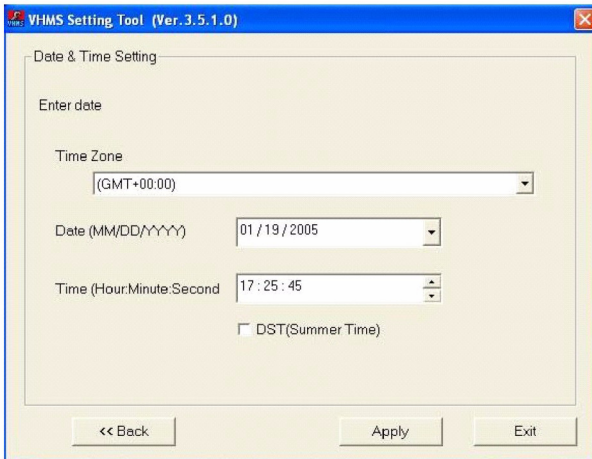
Table 2: VHMS Tools			
Part Number	Name	Description	Source
	Laptop PC	200 MHz or higher 64 MB RAM or more Serial or USB Port CD/DVD -Rom drive Floppy Drive Windows 95/98/2000/ME/XP	Purchased Locally
	Serial cable	(RS232) Purchase locally Male DB9 connector at one end Female DB9 connector at other end	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

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.



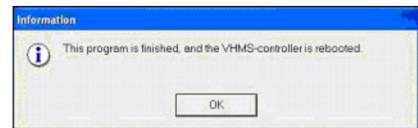
D120057

10. Click the [OK] button.



D120058

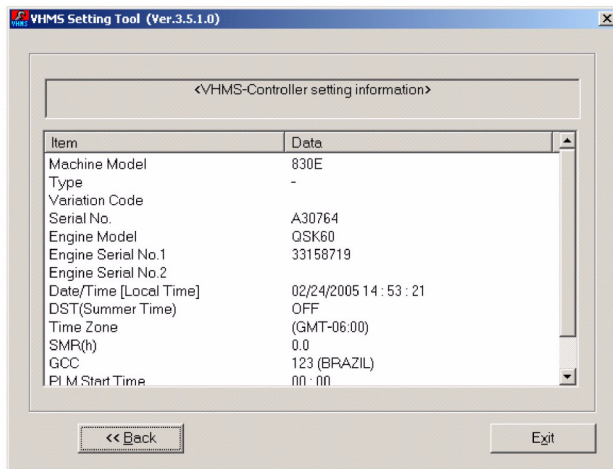
11. Click the [OK] button. The *Setting Tool Program* will close.



D120059

7. Review the settings for accuracy.

- If everything is correct, click the [Exit] button. The checkout procedure is complete.
- If a setting is not correct, click the [Back] button, select the appropriate category and reset the information to the correct settings. Then proceed to the next step.



D120060

8. If any one of the following settings were changed, a new VHMS Initialization Form must be filled out and submitted to Komatsu America Service Systems Support Team.
- VHMS controller replaced
 - Engine or alternator replaced
 - Adjusted time or time zone
9. Select [Apply] and exit the *VHMS Setting Tool* program. Click [YES] when prompted to reset the controller.
10. E-mail or fax the completed VHMS Initialization form to Komatsu America Service Systems Support Team.

TROUBLESHOOTING

The VHMS system basically consists of five communications networks connected to the VHMS and OrbComm modem controllers. Figure 13-1 shows the VHMS system block diagram.

Communications Networks

Each RS232 network uses three wires: transmit, receive, and ground. Both transmit and receive are voltage signals, referenced individually to the ground wire. The shield for the cable is grounded at one end only.

Each CAN network uses two wires: CAN_High & CAN_Low. The communications signal is a voltage differential measured between CAN_High and CAN_Low. The cable shields are connected at each module through a high pass filter and grounded at one point only on the truck. Both ends of each network have termination resistors.

Coaxial Cable

The coaxial cable carries the Radio Frequency (RF) communications signal between the OrbComm modem and the antenna. The coaxial cable consists of an inner conductor and an outer shield (connected to the connector shell) that are separated by a non-conductive dielectric material.

In an RF application such as VHMS, the communications signal sent over coaxial cable is very susceptible to changes in the cable. Physical damage, as well as contaminants such as water, may affect the ability of the cable to properly transmit the RF signal. Bending the coaxial cable into a small loop may also damage the inner conductor.

Table 4: Engine Fault Codes (continued)

VHMS Fault Code	VHMS Fault Description	Source	Sent via OrbComm	Snapshot Trigger	Model Notes
C384	Ether Solenoid Ckt Failed	Engine			All
C422	Coolant Level Signal Invalid	Engine			All
C423	Timing Press Incorrect	Engine			All
C426	J1939 Broadcast Data Missing	Engine			All
C427	J1939 Datalink Can Not Transmit	Engine			All
C431	Idle Validation Invalid	Engine			All
C432	Idle Validation Invalid	Engine			All
C441	Low Battery Voltage	Engine			All
C442	High Battery Voltage	Engine			All
C451	Rail Press Ckt Failed High	Engine			All
C452	Rail Press Ckt Failed Low	Engine			All
C455	Rail Actuator Open Ckt	Engine			All
C467	Desired Timing Not Achieved	Engine			All
C468	Desired Rail Press Not Achieved	Engine			All
C473	Remote Oil Level Signal Invalid	Engine	X	X	All
C487	Ether Bottle Empty	Engine			All
C489	AXG Speed Low Error	Engine			All
C514	Rail Actuator Mech Stuck	Engine			All
C524	Alt Droop SW Val Fault	Engine			All
C527	Dual Output A Shorted High or Open	Engine			All
C528	Alt Torque SW Val Fault	Engine			All
C529	Dual Output B Shorted High or Open	Engine			All
C553	Rail Press OOR High	Engine			All
C554	Rail Press Incorrect	Engine			All
C555	High Blow-by Pressure	Engine	X	X	All
C611	Engine Hot Shutdown	Engine			All
C612	High Oil Filter Rest	Engine			All
C616	High Turbo Comp Inlet Temp LBR	Engine			All
C621	Low Power #1 LB	Engine			All
C622	Low Power #2 LB	Engine			All
C623	Low Power #3 LB	Engine			All
C624	Low Power #4 LB	Engine			All
C625	Low Power #5 LB	Engine			All
C626	Low Power #6 LB	Engine			All
C627	Low Power #7 LB	Engine			All
C628	Low Power #8 LB	Engine			All
C631	Low Power #1 RB	Engine			All
C632	Low Power #2 RB	Engine			All

VHMS FORMS

The preferred method to submit this form is in electronic format. This check list and initialization form are available in PDF format, where the information can be typed into the form. The form should then be saved using the model, serial number and "VHMS Initialization" to create the file name.

Example: 930E-3SE-A30300-VHMS Initialization.pdf.

The following instructions will help insure an accurate and complete form.

When a new machine equipped with the Vehicle Health Monitoring System (VHMS) has been assembled, there are several procedures to perform in order to initialize the VHMS system. Following the procedures in the order listed will ensure a smooth initialization process which should not take longer than one hour to complete. Check off each item on the list below as it is done. It is important to complete the entire procedure at one time. Submitting the download data with a date and service meter reading (SMR) that do not match the rest of the forms will not allow the system to be initialized.

1. ___ VHMS Initialization Check List
2. ___ VHMS Data Download
3. ___ VHMS Initialization Form

Orbcomm terminal activation can take up to two weeks. For this reason, it is important to complete these forms and submit them as early as possible after new machine assembly.

VHMS INITIALIZATION CHECK LIST

This form is used as a check list during the initialization process. Fill in all information. All questions should be answered with a YES. If not, determine the cause and repair as required.

Each machine model will have a different VHMS Initialization Check List. Be sure to use the correct form for the model of machine being setup.

1. With the keyswitch OFF, record all data for item 1.
2. Using a serial cable, connect a laptop PC to the VHMS controller.
3. Turn the keyswitch ON, check operation of the LED lights.
4. Start the *VHMS Setting Tool* program.
 - a. At the Select Operation screen, select the "VHMS Setting" option, then click [Next].
 - b. Select the "Set up & All clear" option, then click [Next].

5. At the Machine Information Setting (1) screen:
 - a. Is Product Group correct?
 - b. Select the correct Machine Model.
 - c. Select the correct Machine Type.
 - d. Select the correct Machine Variation Code.
 - e. Enter the machine serial number.
 - f. Click [Next].
6. At the Machine Information Setting(2) screen:
 - a. Verify information is correct.
 - b. Enter engine serial number.
 - c. Then click [Next].
7. At the Date & Time Setting screen:
 - a. Select the correct time zone.
 - b. Enter the correct date.
 - c. Enter the correct time.
 - d. Select Daylight Savings Time (DST) if necessary.
 - e. Click [Next].
8. At the GCC Setting screen:
 - a. Select the correct country setting.
 - b. Click [Next].
9. At the Verification screen:
 - a. Insure that all information is correct.
 - b. Click on [Apply].
 - c. At the confirmation screen, select [Yes].
 - d. Select [OK].
 - e. Select [OK] to close the program.
10. Start the *VHMS Setting Tool* program.
 - a. Select "VHMS Setting", then click [Next].
 - b. Select "Setup only", then click [Next].
 - c. Select "Payload Meter", then click [Next].
 - d. Set Start Time to "0".
 - e. Set Interval to "1".
 - f. Click [Apply].
 - g. Click [Exit].

FL275 PANEL

The FL275 electronic card panel contains a microprocessor (CPU), a small computer which monitors a variety of input signals and establishes certain controlling output signals which result in the regulation of the propulsion system. If a "laptop" computer, referred to as a Portable Test Unit (PTU) is connected, it can also provide a readout of the "memory" of the operating history of many of the sub-systems which make up the control system. This is useful to technicians looking for problem areas during troubleshooting.

Setting up new trucks or making changes to truck control system parameters requires a PTU and an authorized technician to operate it. The microprocessor in the electronic card panel can only be changed electronically with appropriate commands and programs using the PTU.

Previous control systems provided on Komatsu trucks required system adjustments to be made by removing the plug-in control cards and adjusting potentiometers mounted on the cards. With the FL275 panel, no control card removal is required. The majority of adjustments are made electronically using a menu driven software program installed on the hard disk drive of the "laptop" computer (PTU). The PTU is then connected to a 9 pin connector mounted in the control cabinet or cab of the truck enabling communication with the microprocessor (CPU).

The FL275 panel has five 104-pin connectors mounted above the cards for connecting input and output circuits. They are identified as CNA, CNB, CNC, CND and CNE. Only four connectors are used; connector CNC is not used.

The cards in this panel are protected by a cover which is hinged at the bottom, swings up, and latches at the top.

The card complement of the FL275 panel consists of the following five cards:

- 17FB100 - Power Supply (P1)
- 17FB101/144* - Central Processing Unit (CPU)
- 17FB102/140** - Analog Input/Output (A1)
- 17FB103 - Digital Input/Output (D1)
- 17FB104 - Digital Input/Output (D2)

NOTES:

* *Later model trucks, shipped July 2001 and later are equipped with a 17FB144 card, replacing the 17FB101 card.*

** *Trucks equipped with "Fuel Saver" circuitry require 17FB140 card to replace 17FB102 card.*

The FL275 panel receives input signals from speed sensors on the alternator and wheelmotors, voltage and current feedback signals from various control devices, and command inputs from the operator. Using these inputs, it provides the following:

- Propulsion and dynamic retarding control of the truck.
- Speed restrictions during overspeed and other operating restrictions if faults occur.
- Event data for technicians through the 2-Digit Diagnostic Display panel.
- Statistical data of the history of various component and system function operations, accessible only with a PTU.

It is also capable of receiving inputs from the engine (oil pressure, crankcase pressure, engine coolant pressure, and engine coolant temperature), wheelmotor temperature, and alternator blower pressure to provide warning signals to the driver if malfunctions in these areas occur.

Additionally, on current production trucks (equipped with "Fuel Saver"), the FL275 panel monitors alternator intake temperature and static exciter temperatures to provide:

- Engine low idle speed reduced to 650 RPM.
- Control of engine RPM during propel to obtain the most efficient engine speed for the amount of power requested by the operator.
- Control of engine RPM during retarding ranging from a low of 1250 RPM to a high of 1650 RPM.

TABLE I. 2-DIGIT DISPLAY PANEL CODES (Cont.)

EVENT CODE	EVENT DESCRIPTION	EVENT RESTRICTION	DETECTION INFORMATION	EVENT VALUES			
				Decay Time	Lock Limit	Accept Limit	Window Limit
24	RP8 Contactor	System Event • In ACCEL: No propel and turn on SYSFLT light. • In RETARD: Turn on SYS-FLT light only.	RP8 Contactor command and feedback do not agree. Check for: Same as No. 10.	3600	3	10	2
25	RP9 Contactor	System Event • In ACCEL: No propel and turn on SYSFLT light. • In RETARD: Turn on SYS-FLT light only.	RP9 Contactor command and feedback do not agree. Check for: Same as No. 10.	3600	3	10	2
26	Forward Coil	System Event • In ACCEL: No propel and turn on SYSFLT light. • In RETARD: Turn on SYS-FLT light only.	Forward position of reverser command and feedback do not agree. Check For: Same as No.10.	3600	3	10	2
27	Reverse Coil	System Event • In ACCEL: No propel and turn on SYSFLT light. • In RETARD: Turn on SYS-FLT light only.	Reverse position of reverser command and feedback do not agree. Check For: Same as No.10.	3600	3	10	2
30	Analog Output (See Subcodes)	Recorded in memory only No truck shutdown	Analog input exceeds 10V for .05 seconds. Software error, bad FB101 or FB102/140 card. Check subcodes (Table II) with PTU for more detail.	N/A	N/A	5	0
31	Frequency Output	Recorded in memory only No truck shutdown	Engine RPM signal <500 or >2300.	N/A	N/A	5	0
32	Analog Input (See Subcodes)	Recorded in memory only No truck shutdown	Software error. Bad 101/144 or 102/140 card. Check subcodes (Table II) with PTU for more detail.	N/A	N/A	5	1
33	Frequency Input (See Subcodes)	Recorded in memory only No truck shutdown	Incorrect M1, M2 or engine speed input. Same checks as No. 30. Check subcodes (Table II) with PTU for more detail.	N/A	N/A	5	0
37	Hardware Startup (See Subcodes)	Recorded in memory only No truck shutdown	Check for defective FB101/144 card. Check subcodes (Table II) with PTU for more detail.	1800	3	5	1
45	Diode Fault	System Event • In ACCEL: No propel and turn on SYSFLT light. • In RETARD: Turn on SYS-FLT light only.	Ripple current in alternator field circuit exceeds a pre-set value. Indicates shorted diodes in main rectifier. Check diodes, wiring between FDP and FL275 panel. Defective FDP or FB103 card.	N/A	1	4	2

4. If the floppy disk drive containing the diskette is designated drive "B", type "b:install1" or "b:install2" and press [ENTER] key.
5. When all the diskette files have been copied to the hard drive, a message will appear stating the installation of the desired software version is complete. In addition, the message states that if this is the first time the STATEX III PTU software has been installed on this computer, it may be necessary to modify the AUTOEXEC.BAT and CONFIG.SYS files to ensure proper operation.
 - a. The file C:\CONFIG.SYS must have the FILES variable set to a minimum of 20 and BUFFERS variable set to a minimum of 20.
 - b. The file AUTOEXEC.BAT must have the following directory included in the PATH variable:
Enhanced Version 1.00 -
 C:\GEOHV3E\TOOLS\BATS

Version 14.00 -
 C:\GEOHV\TOOLS\BATS
6. If necessary, edit the above files using DOS to change the minimum FILES and BUFFERS variables and to add the PATH statement as described above.
7. Remove the diskette from the drive and reboot the computer if the changes described in step 5 were required.
8. When using the software, at the DOS C:> prompt, type "geohv3e" to start the Enhanced version 1.00 program or type "geohv" to start the version 14.00 program.

PTU/Truck Communication Problems

Communication problems will occur if the amount of DOS free memory available on the PTU is less than 460K bytes after the software has loaded. If significantly less than 460K is available, it will not be possible to communicate with the truck at all.

In some instances, if the PTU has less than (but very close to) 460K available, the software may appear to function properly until features such as retrieving and saving an event to a file are attempted at which point the program will terminate.

To determine the amount of free memory available, start the software program and on the Main Menu, observe the amount of "free memory:" displayed in the upper right corner of the screen (see Figure 2-2). If the amount shown is less than 460K, it will be necessary to free up memory before using the PTU.

Suggestions for obtaining more free memory:

The following suggestions provide a starting point to provide additional free memory. If necessary, edit the laptop's CONFIG.SYS as follows:

- Load DOS and device drivers into high memory.
- Eliminate any TSR (terminate-stay-ready) programs such as shells or antivirus programs. Do not allow Microsoft Windows™ to load.
- Disable PCMCIA card drivers if the laptop is equipped with PCMCIA slots.
- If DOS version 6.2 or higher is used, it is advisable to create multiple start-up configurations. This will allow the user to choose the appropriate configuration from a menu list for the desired use of the laptop computer. A CONFIG.SYS file can be created for specific use with the GE software, preventing unwanted drivers from loading and using the required free memory. Alternate menu choices will allow the computer to boot and load the necessary drivers for other functions such as Microsoft Windows™.

Note: Consult the laptop computer manufacturer's instructions and the DOS operating system technical manuals for editing the CONFIG.SYS file, creating multiple configuration files, and additional suggestions to obtain maximum free memory.

If Microsoft Windows™ is installed on the computer, be certain to operate in MS-DOS mode, NOT Windows.

```

FNAM: K645131A.100  T_ID: KMS A30645  GE FNAM: x001131a.100
-----
TRUCK SERIAL AND MODEL NUMBERS SCREEN
-----
A30645      830E      : Truck
33149029   QSK60C     : Diesel Engine
EE00020952 5GTA26F2    : Alternator
[default]  : Wheel Motor Right
[default]  : Wheel Motor Left
FM01033455 17FM52802   : Rectifier Panel 1
FB01030030X 17FB103B2   : Rectifier Panel 2
FM01030364 17FM466F1   : Alternator Static Exciter
FM01030259 17FM467D1   : Motor Field Static Exciter
EE01020038 5GY19L5     : Grid Motor Blower 1
FB00030136X 17FB104B2   : Grid Motor Blower 2
FL01040304 17FL275F1   : Control Panel
FB01050144A 17FB100B3   : 17FB100
FB01030042N 17FB144B3   : 17FB144
FB01110014N 17FB140A2   : 17FB140
-----
■ LEAVE TRUCK SERIAL AND MODEL NUMBERS SCREEN
Press ENTER to exit this screen

```

E020102

FIGURE 2-12. TRUCK COMPONENT SERIAL NUMBERS

“3) Change/View Serial and Model Numbers . . .”

1. Use the down arrow key to move the cursor to the menu position “CHANGE/VIEW SERIAL AND MODEL NUMBERS SCREEN”, or press [3]. All of the major component serial numbers will be displayed, or serial number information can be typed in. Refer to the screen shown in Figure 2-12. If a serial number is changed, an asterisk (*) will appear next to it.
2. To insert new serial numbers, move the cursor to the desired location, type in the information, and press [ENTER]. When finished entering serial numbers, exit the screen by moving the cursor to the “leave truck serial numbers screen” selection and press [ENTER].

“4) View Options . . .”

NOTE: The options on this screen can be changed only by the manufacturer.

1. Use the Down arrow to move the cursor to the menu position “VIEW OPTIONS” and press [ENTER], or press [4]. The screen shown in Figure 2-13 will appear.
2. Several codes are used to indicate the status of various options and equipment.

The Y, N and X codes are described as follows:

- Y = OEM has selected YES
- N = OEM has selected NO
- X = Not available to OEM

```

FNAM: K645131A.100  T_ID: KMS A30645  GE FNAM: x001131a.100
STX OEM-ONLY  SETTABLE  OPTIONS  ENTRY  SCREEN
-----
Y GE engine control
Y engine status: Y = 0v trip(DDEC), N = 28v trip
N engine crankcase pressure sensor installed
N engine coolant temperature sensor installed
N engine coolant pressure sensor installed
N engine oil pressure sensor installed
N APS accel inhibit: Y = 28v, N = 0v
Y two speed overspeed system installed
Y motor 1 temperature sensor installed
Y motor 2 temperature sensor installed
Y retard speed control system installed
N spin/stall correction and protection active
Y propulsion contactor/reverser: Y = Elec, N = Air
8.0 AT speed spin-correction active above mph
2.0 mph oem speed option
KMS 830E 2500HP ANTELOPE : Truck manufacturer and make
-----
LEAVE OPTIONS ENTRY SCREEN
-----
- DO NOT HAVE PRIVILEGE TO CHANGE. Press any key to continue

```

*Available with
Enhanced Vers. 1.00
only*

E020103

FIGURE 2-13. OPTIONS ENTRY SCREEN (View Only)

Download Configuration Files

Download configuration files into the CPU on the truck as follows:

1. From the GE STATEX III PTU MAIN MENU (Figure 2-19) use the arrow keys to move the cursor to the "SPECIAL OPERATION WITH ENGINE STOPPED" selection and press [ENTER]. An intermediate screen will appear asking yes or no. With the cursor on "yes" press [ENTER]. The SPECIAL CONTROL ENGINE STOPPED TEST MENU screen appears.
2. Use the arrow keys to move the cursor to the VIEW PROGRAM TRUCK FILE selection and press [ENTER]. The screen will show the CFG and OBJ file to be downloaded.
3. Press [ESC] to return to the previous menu.
4. Use the arrow keys to move the cursor to the "program truck yes/no menu" selection and press [ENTER]. The PROGRAM TRUCK YES/NO MENU screen appears.
5. Use the arrow keys to move the cursor to desired program truck selection.
 - a. "NO, Return to Engine Stopped Test Menu" This selection will take the computer back to the SPECIAL CONTROL ENGINE STOPPED TEST MENU. If, for some reason programming is not desired, select this choice.
 - b. "YES, RELOAD PROGRAM INTO TRUCK" Use whenever the truck CPU has already been programmed and re-programming is desired. This selection is appropriate if, for example, the truck configuration file has been modified. The configuration file must be reloaded for the changes to become effective.
 - c. YES, INSTALL PROGRAM INTO TRUCK Use to install a program into the truck CPU for the first time or into a new or modified FB101 card. For example, if the FB101/144 card EPROM's are updated.
6. Press [ENTER] to begin programming the truck. The programming will take approximately 15 minutes to complete.
7. During the downloading operation, various messages are displayed on the PTU screen as the procedure progresses. At completion, press [SPACE] per instruction on the screen.

TABLE III. STATISTICAL DATA CODES - COUNTERS (Cont.)

PAR No.	DESCRIPTION	UNITS	COUNT CONDITIONS
166	Overspeed	Occurrences	Refer to Table I, TWO DIGIT DISPLAY CODES
167	Speed Retard Exceeded	Occurrences	
168	Retard Overcurrent	Occurrences	
169	Horsepower Low	Occurrences	
170	HP Limit Exceeded	Occurrences	
171	Engine Overspeed Exceeded	Occurrences	
172	Engine Oil Pressure Warning	Occurrences	
173	Engine Oil Pressure Shutdown	Occurrences	
174	Engine Coolant Pressure Warning	Occurrences	
175	Engine Coolant Press Shutdown	Occurrences	
176	Engine Crankcase Pressure	Occurrences	
177	Engine Coolant Temperature	Occurrences	
178	Engine Service	Occurrences	
179	Engine Shutdown	Occurrences	
180	Engine Speed Retard	Occurrences	
181	Motor 1 Voltage Limit	Occurrences	
182	Motor 2 Voltage Limit	Occurrences	
183	Alternator Field Amps	Occurrences	
190	Battery Voltage Low	Occurrences	
191	Battery Voltage High	Occurrences	
192	Engine Speed Sensor	Occurrences	
193	Motor Speed Sensor	Occurrences	
198	Datastore	Occurrences	
199	Software	Occurrences	

Disassembly

1. Remove screws on cable clamps (1, Figure 2-28 or 2-29) and potentiometer cover (6).
2. Remove potentiometer mounting screws (5) and grommet (3). Remove potentiometer (4).

Reassembly

1. Position new potentiometer with the flat side toward the potentiometer cover and install on shaft as follows:
 - a. Align cutouts in shaft with the potentiometer drive tangs.
 - b. Press potentiometer onto shaft until it bottoms against the housing.
2. Install screws (5, Figure 2-28 or 2-29) and lock-washers but do not tighten.

3. Rotate potentiometer counterclockwise until mounting slots contact the mounting screws and tighten screws (5) to **10-20 in lbs. (1.13-2.26 N-m)** torque.
4. Install grommet (3) and potentiometer cover. Tighten screws to **10-20 in lbs. (1.13-2.26 N-m)** torque.
5. Install cable clamps and tighten screws to **35-45 in. lbs. (3.4-5.1 N-m)** torque.
6. Inspect assembly and verify proper wiring clearance during operation of pedal throughout the range of travel.

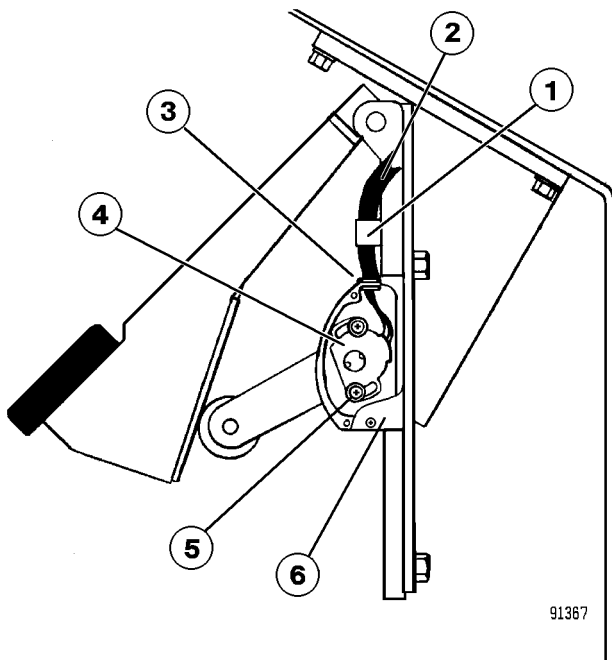


FIGURE 2-29. ELECTRONIC RETARD PEDAL
(Two Pedal System)

- | | |
|---------------------|--------------------|
| 1. Clamp and Screws | 4. Potentiometer |
| 2. Harness | 5. Mounting Screws |
| 3. Grommet | 6. Cover |

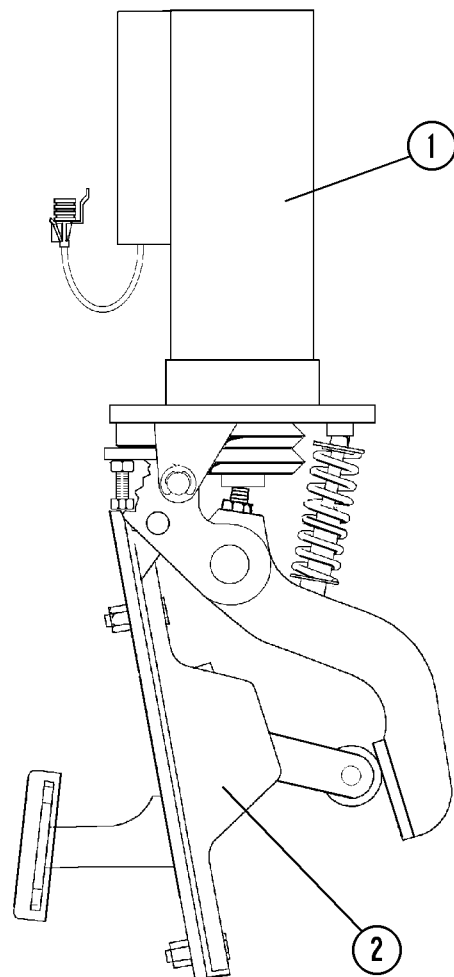


FIGURE 2-30. BRAKE/RETARDER PEDAL
(Single Pedal System)

- | | |
|------------------------|----------------------------|
| 1. Service Brake Valve | 2. Electronic Retard Pedal |
|------------------------|----------------------------|

**STATEX III ELECTRICAL SYSTEM
CHECKOUT PROCEDURE
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d. From 74N to 710:

- Read $.09 \pm .10$ vdc.

3. With retard pedal depressed just until retard contactors pick up, measure the voltage between the following circuits:

a. From 74N to 710:

- Read $0.20 \pm .20$ vdc. If out of tolerance replace RET card.

b. From 54N to 710:

- Read $2.60 \pm .50$ vdc. If out of tolerance, replace retard pedal potentiometer.

c. DDEC equipped trucks only:

- Use the DDR to read PTO counts or measure voltages at circuits 510(+) to 952(-) shown in the following table:

ACC CARD	VOLTS	PTO COUNTS	ACTION IF OUT OF TOLERANCE
TZ6661	2.77 (approx.)	150 \pm 2	Replace ACC card
EB2635	3.63 (approx.)	162 \pm 2	Replace ACC card
EC1806	3.04 (approx.)	162 \pm 2	Adjust Pot P2 on ACC card

4. With retard pedal fully depressed, measure the voltage between the following circuits:

a. From 74N to 710:

- Read $15.50 \pm .25$ vdc. If out of tolerance replace RET card.

b. From 54N to 710:

- Read 12.50 vdc minimum. If out of tolerance replace retard pedal resistor.

c. DDEC equipped trucks only:

- Use the DDR to read PTO counts or measure voltages at circuits 510(+) to 952(-) shown in the following table:

ACC CARD	VOLTS	PTO COUNTS	ACTION IF OUT OF TOLERANCE
TZ6661	2.77 (approx.)	150 \pm 2	Replace ACC card
EB2635	3.63 (approx.)	162 \pm 2	Replace ACC card
EC1806	3.04 (approx.)	162 \pm 2	Adjust Pot P2 on ACC card

5. Depress the throttle pedal fully, and again read the PTO Counts. If values change replace ACC Card. Release throttle and retard pedals.

1.2.2 Electronic Retard Pedal; Fuel Saver Equipped Trucks and Current Production.

- Refer to Section 1.1.2 for both, accelerator and retard pedal setup instructions.

2.2 Digital Input Checks

1. The two digit diagnostic display panel should have a **00** event code to indicate that all previous event codes have been cleared. If not, press reset switch to clear codes.
2. For the digital inputs listed below, do the **PROCEDURE TO ACTIVATE** as specified, and verify that the display status of the digital input name on the **MANUAL DIGITAL OUTPUT TEST SCREEN** changes from false (regular display) to = **true** (inverse display), unless otherwise noted. Restore any switch settings and wiring changes to their original condition before moving on to check the next digital input.
3. All digital inputs have now been checked, except contactor feedback inputs, which will be checked with digital outputs in next section.

DI NAME	DESCRIPTION	PROCEDURE TO ACTIVATE	FUNCTION
FIRSTSRCH	FIRST SEARCH SW	Press Up Arrow Switch on Two Digit Display.	= true (inverse display) = switch depressed
LASTSRCH	LAST SEARCH SW	Press Down Arrow Switch on Two Digit Display.	= true (inverse display) = switch depressed
2DDRESET	LOCAL RESET SW	Press Reset Switch on Two Digit Display.	= true (inverse display) = switch depressed
AS	ACCELSWITCH (Non-Fuel Saver Only)	Accelerator pedal applied.	= true (inverse display) = ACCEL request =28v input
		Pedal released	false (regular display) = no ACCEL request =0v input
RS	RETARD SWITCH (Non-Fuel Saver Only)	Press retard pedal.	= true (inverse display) = retard request = 0v input
		Pedal released	false (regular display) = no request = 28v input
DOS	DUMP OVERRIDE SWITCH	Press override switch.	= true (inverse display) = switch depressed
RSC	RETARD SPEED CONTROL SWITCH	Pull retard speed control switch to On position.	= true (inverse display) = switch depressed
DBUP	DUMP BODY UP SWITCH	Remove wire 71F.	= true (inverse display) = body up = 0v input Verify Body-Up light in cab illuminates.
		Restore circuit 71F.	false (regular display) = body down = 28v input
2SOS	2 SPEED OVERSPEED SYSTEM (LOAD WEIGHT SWITCH)	Disconnect wire 73LS routed to the rear suspension pressure switches and insulate. Jumper from 71 to 73LS.	= true (inverse display) = loaded truck = 0v input
		Remove 71 to 73LS jumper (Reconnect 73LS.)	false (regular display) = empty truck = 28v input
IDLESW	IDLE SWITCH (Non-Fuel Saver only)	Move idle switch from low (turtle) position to high idle position.	= true (inverse display) = high idle = 0v input
		Place switch in low position.	false (regular display) = low idle = 28v input
ACCINH	ACCEL INHIBIT SIGNAL	No signal (0v input)	= true (inverse display) = inhibit = 0v input
		Jumper 73S to 710 to energize park brake failure relay coil. (Leave jumper connected to simulate Park Brake Not Applied)	false (regular display) = not inhibit = 28v input
FAILDIODE	FAILED DIODE PANEL SIGNAL	Remove wire 73A from FDP term D.	= true (inverse display) = failed diode = 0v input Verify that electrical system fault light on instrument panel comes On with wire 73A removed.
		Replace wire 73A.	false (regular display) = ok diode = 28v input

- f. Reverse polarity of input. Jumper circuit 71 to terminal "C" and jumper circuit 710 to terminal "A" at VMM1.
 - Verify negative value of output voltage measured in step e. and negative value on PTU screen.
- g. Remove jumpers and voltmeters. Restore all disconnected wiring.

12. MOTOR M2 ARMATURE VOLTS - VMM2: motor 2 volts = 0.0

- a. Repeat same test procedure used on alt output volts, except substitute VMM2 instead of VMM1.

13. ALTERNATOR FIELD VOLTAGE - VDR3: alt field volts = 0.0

(Screen value volts = 10.6 x input volts).

- a. Disconnect wires from VDR3 terminal "E" and "D".
- b. Connect a 1.5 volt battery (i.e. flashlight battery) to wire removed from "E" (-) and to VDR3 terminal "D" (+).
- c. Measure actual voltage of battery used in above step.
 - PTU screen should read actual test battery voltage x 10.6

Example:

- If test battery voltage measures 1.550 volts, PTU screen should read 16.43 volts.
- d. Remove test battery. Screen should read 0 volts.
- e. Reconnect wires removed in step a.

MOTOR 1 TEMPERATURE motor 1 temp = 0.000 V; 0.0° C

NOTE: Motor Temperature monitoring system is optional.

- a. Disconnect motor 1 temperature sensor wires 722C and 722A routed to wheel motor from terminal board in control cabinet.
- b. Connect a 100 ohm resistor to terminal board in place of wires removed in previous step to simulate 0°C temperature signal into analog input card.
 - Screen value on PTU should read 1.96 ±.04 volts and 0.0° C.
- c. Replace 100 ohm resistor with a 181 ohm resistor. (210°C)
 - Screen value on PTU should read 3.55 ±.07 volts and 210° C.
- d. Remove resistor and replace sensor wires at terminal board.

6.0 LOAD TEST USING TRUCK RETARD GRIDS

NOTE: DO NOT RUN OPEN CIRCUIT TEST.

*NOTE: The single ended grid used on the 772 wheel drive system will be operating at 100% capacity when loaded with a 1200 HP engine. **The grid should be monitored closely on extended horsepower tests to avoid overheating.***

Setup and Preparation

Engines equipped with Rockford Clutch only:

- Disconnect the fan clutch solenoid to fully engage fan.

All trucks:

- Connect swing shunts to load test position:
 - a. Top shunt swings to upper position, bottom shunt swings to bottom position.
 - b. For 830E or 685E trucks, left shunt swings to left position, right shunt swings to right position.



If load test must be run any longer than to just read horsepower, the motor field leads must be disconnected to prevent overheating of the motor fields. Follow disable procedure below:

To disable the motor field:

- Disconnect circuit 716E at “-1” terminal on the GFM on the MFSE.
- Disconnect circuit 716F at “+2” terminal on the GFM on the MFSE.

PTU Setup

- Select the **AUTOMATIC LOAD BOX TEST** screen as follows:
 - a. From the **GEOHV STATEX III MENU**, select “PTU TALK TO TRUCK”, press [ENTER].
 - b. At **PTU LOGON** screen, enter your name and assigned password. Press [ENTER].
 - c. When the **GE STATEX III PTU MAIN MENU** appears, move the cursor to “NORMAL OPERATION” and press [ENTER].
 - d. A screen appears with the message: “Selection of NORMAL OPERATION gives truck control to the driver - Continue?”. With the cursor at the “Yes” option, press [ENTER].
 - e. The **NORMAL OPERATION MENU** will appear. Select “AUTOMATIC LOAD BOX TEST” and press [ENTER].

9.3 Engine Options

CUMMINS ENGINE OPTION CHART				
ENGINE MODEL	RATED ENGINE RPM	TOP NO LOAD RPM	*RETARDING RPM (No Load)	*LOW IDLE RPM
KTA-38	1900	2100 ±75	1675 ±10	750 ±25
KTTA-50-C	1900	2100 ±75	1675 ±10	750 ±25
KTTA-50-C	2000	2200 ±75	1675 ±10	750 ±25
KTTS-50-C	2100	2300 ±75	1675 ±10	750 ±25
K2000E	1900	2100 ±75	1675 ±10	750 ±25
QSK60	1900	2150 ±75	1675 ±10	750 ±25

DETROIT DIESEL ENGINE OPTION CHART				
ENGINE MODEL	RATED ENGINE RPM	TOP NO LOAD RPM	*RETARDING RPM (No Load)	*LOW IDLE RPM
12V149TI (Mechanical Governor)	1900	2040 ±10	1675 ±10	750 ±25
12V149TI (Hydraulic Governor)	1900	2040 ±20	1675 ±10	750 ±25
12V149TI (DDEC II)	1900	1910 ±5	1675 ±25	750 ±25
16V149TI (Mechanical Governor)	1900	2040 ±10	1675 ±10	750 ±25
16V149TI (Hydraulic Governor)	1900	2040 ±20	1675 ±10	750 ±25
16V149TI (DDEC III)	1900	1910 ±5	1675 ±25	750 ±25
12V4000 (DDEC IV)	1900	1920 ±5	See *Notes	600 ±25
16V4000 (DDEC IV)	1900	1920 ±5		600 ±25

MTU ENGINE OPTION CHART				
ENGINE MODEL	RATED ENGINE RPM	TOP NO LOAD RPM	*RETARDING RPM (No Load)	*LOW IDLE RPM
MTU 16V396TE44	1900		1675 ±10	750 ±25

* NOTES: Trucks equipped with "Fuel Saver" system:

Low Idle RPM = 650 RPM

Retarding RPM: Will vary from 1250 to 1605 RPM, dependent on operating conditions. (Controlled by FL275 panel)

2. If valve stem and spud assembly were removed, reinstall in rim. Install valve stem assembly onto rim and install spud assembly to inside of rim. Tighten spud assembly to **35 in. lbs. (4 N.m)** torque.
3. Adjust vinyl clamp and capscrew on valve stem and rim assembly. Tighten capscrew to standard torque.
4. Install inner flange on rim. Coat beads of tire with tire mounting soap solution.



Prying against tire bead may cause damage to tire bead and will cause air leaks.

5. Position tire over rim and work tire on as far as possible without prying against the beads. Any damage to tire bead will destroy air seal and cause air leaks at these points.
6. Install outer flange (5, Figure 2-8) in position and replace bead seat band (2). Push in on bead seat band to expose O-ring groove in rim.
7. Lubricate new O-ring (4) with soap solution and install in groove of rim.

8. Install lockring (6) and tap into place with lead hammer. **Lockring lug must fit into slot of rim.**
9. Remove valve core from valve stem and inflate tire to seat beads of tire and O-ring as specified by tire manufacturer.



Use a safety cage whenever possible. Stand to one side as tire is being inflated. Never start inflating unless lockring is securely in place. DO NOT stand in front of or over lockring when inflating.

10. If beads of tire and O-ring do not seat within one minute, raise tire slightly and tap bead seat band. This will help the air pressure to push the tire bead out into position.
11. As soon as seating has been accomplished, install valve core and inflate tire to recommended tire pressure.
12. Follow tire manufacturers recommendations concerning tire bead seating procedures and final tire pressure setting for each application.

4. Wrap a chain and chain binder (2, Figure 3-10) around the top half of the tire. Secure chain through the frame. Chain should be tightened enough to prevent movement during bearing adjustment when the retainer plate is removed.
5. Install another chain (3) around the bottom half of the tire and tighten enough to prevent movement during bearing adjustment procedure.
6. Drain oil at wheel hub drain plug (24, Figure 3-5). Remove cover (3).
7. Remove capscrews (5), retainer plate (8), and shims (7).
8. Reinstall retainer plate (with the thickness dimension stamp facing toward the outside), capscrews, and hardened washers. **Do not install shims.**
9. Remove tire retaining chains (2 & 3, Figure 3-10).
10. Tighten retainer capscrews alternately using the following procedure:
 - a. Tighten all capscrews to **60 ft. lbs. (81 N.m)** torque while rotating the hub.
 - b. Increase torque on all capscrews to **120 ft. lbs. (163 N.m)** while rotating hub.
 - c. Increase torque on all capscrews to **180 ft. lbs. (244 N.m)** while rotating hub.
 - d. Increase torque on all capscrews to **240 ft. lbs. (325 N.m)** while rotating hub.
 - e. Increase torque on all capscrews to **250 ft. lbs. (339 N.m)** while rotating hub.

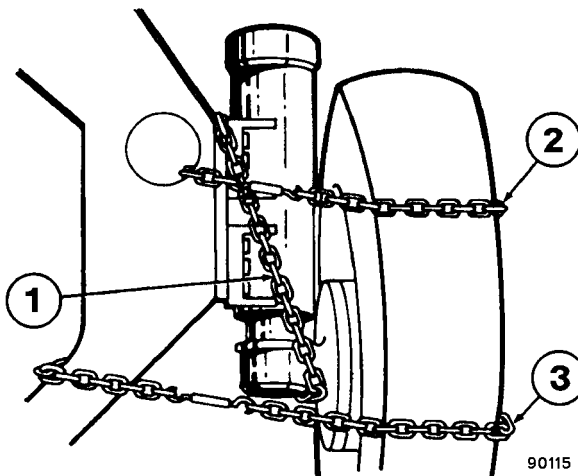


FIGURE 3-10. WHEEL SUPPORT CHAIN INSTALLATION

- | | |
|-----------------------------|-------------------|
| 1. Suspension Support Chain | 2. Chain & Binder |
| | 3. Chain & Binder |

11. Loosen all six capscrews just enough until the flat washers are loose enough to turn (approximately 1/2 turn) to allow some movement of the bearing race to release the preload. Rotate the wheel hub a minimum of three revolutions.
12. Tighten two capscrews 180° apart and adjacent to the 0.50 in. (13 mm) diameter depth measurement holes (3) to **60 ft. lbs. (81 N.m)**. 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.
13. Tighten the same two capscrews to **110 ft. lbs. (149 N.m)** while rotating the hub.
14. 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 capscrews tightened in step 12.
15. 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): _____

16. 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 0.007 in. (0.178 mm) preload for the bearings.

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

NOTE: Shim pack must be compressed when measuring.

18. Reinstall tire support chains (2 & 3, Figure 3-10).
19. Remove capscrews and retainer. Install shim pack and reinstall retainer, capscrews, and hardened washers.
20. Tighten all capscrews alternately to **750 ± 75 ft. lbs. (1017 ± 102 N.m)** torque in several successive increments while rotating the hub.
21. Using a new O-ring (10, Figure 3-5), install cover (3). Install capscrews and washers (2) and tighten to standard torque.

REAR AXLE HOUSING

REAR AXLE HOUSING

Removal

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

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

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

Installation

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

WHEEL MOTOR

Removal

1. Block front wheels to prevent movement. Turn key switch OFF. Wait for 90 seconds to bleed hydraulic pressure from the steering system. Turn the steering wheel to ensure no hydraulic pressure remains. Open the drain valves on the brake accumulators and bleed off hydraulic pressure.
2. Raise the rear of truck, using jack adapter as described in "Wheels and Tires", this Section, until tires clear the ground. Use support stands or cribbing to block under rear housing.
3. Remove the inner and outer wheels from wheel motor. Refer to "Wheels and Tires", this Section, for wheel removal instructions.
4. Drain oil from wheel motor gear case.

NOTE: To aid in assembly tag all lines and electrical connections prior to disassembly.

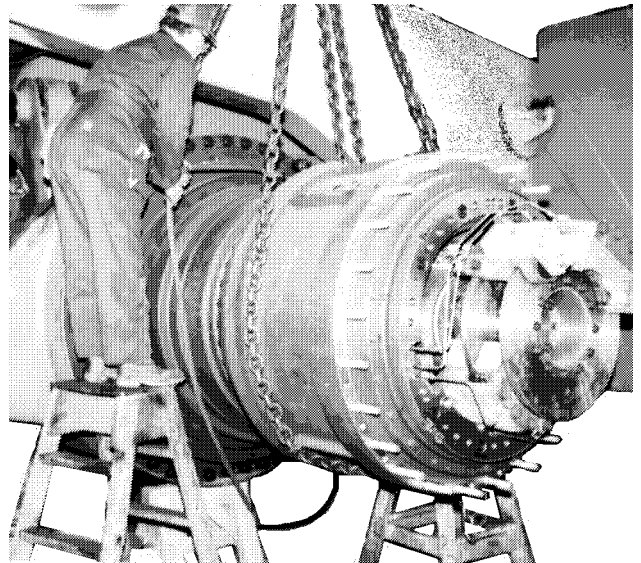


FIGURE 5-1. WHEEL MOTOR REMOVAL AND INSTALLATION

(Shown with the body removed.)

Assembly

NOTE: All parts must be completely dry and free of foreign material. Lubricate all interior parts with clean HYDRAIR® suspension oil (see Oil Specification under "Oiling and Charging Procedure").

▲ IMPORTANT ▲

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

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

1. Install new rod buffer seal (24, Figure 2-8), lip seal (25), and rod wiper (26).
2. Install new O-rings (20) and backup rings (21) in their appropriate grooves in the bearing structure (16).

NOTE: Backup rings must be positioned toward bearing retainer bolt flange as shown in Figure 2-9.

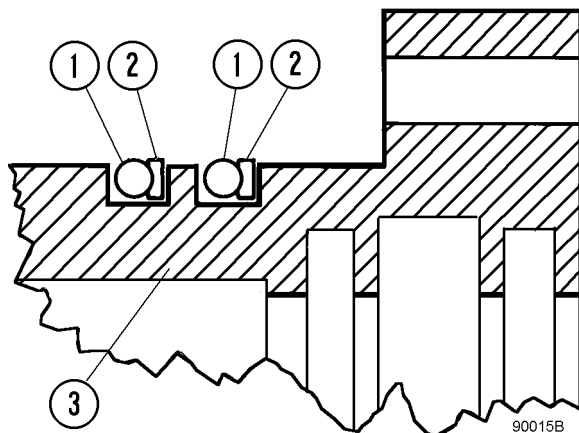


FIGURE 2-9. BACKUP RING PLACEMENT

- | | |
|----------------|----------------------|
| 1. O-Ring | 3. Bearing Structure |
| 2. Backup Ring | |

3. Install lower bearing assembly (16) into lubricated suspension housing. Install capscrews and hardened lockwashers (18 & 19) through retainer flange and into tapped holes in housing. Tighten to **310 ft. lbs. (420 N.m)** torque.

4. Install new backup rings and O-rings (14 & 15, Figure 2-7) in end cap grooves. Backup rings must be positioned toward the flange on the end cap.
5. Slide upper bearing structure (6) over cap structure rod.
6. Install key (13) and piston stop (12) on cap structure rod. Make sure piston stop is fully seated against the rod shoulder. Install locknut (11) against piston stop. Tighten locknut one half turn further, until hole for the roll pin (10) is in alignment. Install roll pin.
7. Attach a lifting device to top side of end cap assembly. Lower assembly down on piston (8). Insert steel balls (9) in holes in piston prior to fully seating bearing on top of piston. A small amount of petroleum jelly will prevent the balls from dropping out during assembly.
8. Install upper bearing structure (6) onto piston rod. Secure bearing in place with NEW capscrews (3) and hardened washers (4). Tighten capscrews to **500 ft. lbs. (678 N.m)** torque.

NOTE: ALWAYS use new capscrews (3, Figure 2-7) during assembly. Used capscrews will be stressed and fatigued because of loads imposed on these capscrews during operation.

9. Apply a light coating of petroleum jelly to the seals, wiper and bearings. With suspension housing in a vertical position, carefully lower the piston rod and end cap assembly into the bore of the cylinder housing to its fully retracted position.
10. Install capscrews and hardened washers (1 & 2) and tighten to **310 ft. lbs. (420 N.m)** torque.
11. Install bottom plug (17, Figure 2-6) and tighten to **13 ft. lbs. (17.5 N.m)** torque.
12. Install charging valve (5, Figure 2-1) using a new flat gasket under the large hex (valve body). Tighten large hex of charging valve to **16.5 ft. lbs. (27.4 N.m)** torque.
13. Install remaining plugs and/or pressure sensor.
14. Pressure test according to instructions on the following page.

FRONT SUSPENSION

1. Park the unloaded truck on a hard, level surface. Apply the parking brake, and chock the wheels.
2. Thoroughly clean area around the charging valve on the suspensions. Remove the protective covers from the charging valves.

⚠ WARNING

All HYDRAIR®II suspensions are charged with compressed nitrogen gas with sufficient pressure to cause injury and/or damage if improperly handled. Follow all the safety notes, cautions and warnings in these procedures to prevent accidents during servicing and charging.

Front Suspension Oiling

⚠ WARNING

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

NOTE: For longer life of suspension components, a Friction Modifier should be added to the suspension oil. See Specifications Chart, Figure 4-5 at the end of this chapter.

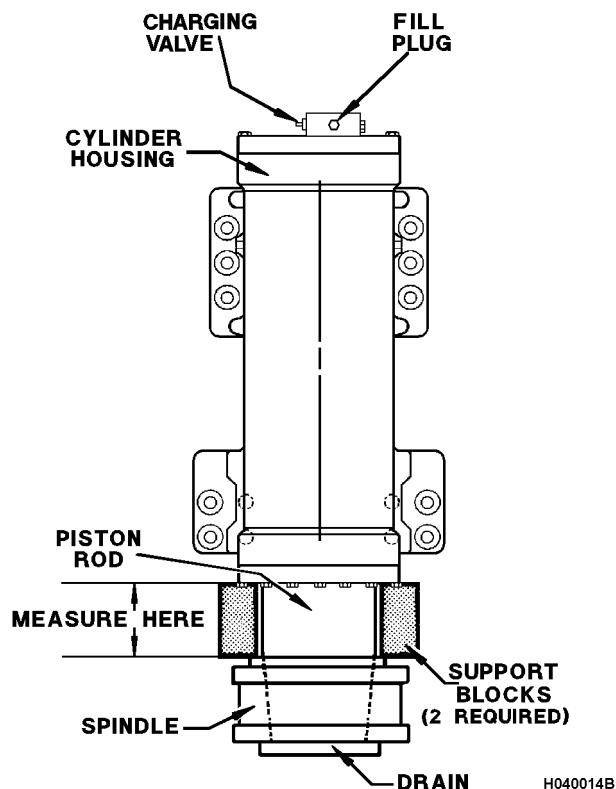
1. Position and secure oiling height dimension blocks in place (Figure 4-2). When nitrogen pressure is released, suspensions will lower to rest on the blocks. Ensure the blocks do not mar or scratch the plated surfaces of the pistons or damage wiper seals in the lower bearing retainer. Support blocks must seat on the spindle and the cylinder housing. The blocks should be positioned 180° apart to provide stability.

⚠ WARNING

Wear a face mask or goggles while relieving nitrogen pressure.

2. Remove charging valve cap. Turn the charging valve swivel nut (small hex) counterclockwise

- three full turns to unseat valve seal. DO NOT TURN LARGE HEX. The charging valve body has a bleeder groove in its mounting threads but for safety of all personnel the valve body MUST NOT be loosened until ALL nitrogen pressure has been vented from the suspension.
3. Depress the charging valve core to release nitrogen pressure from the suspension. When all nitrogen has been vented to the atmosphere, the suspension should have collapsed slowly and be seated solidly on the support blocks. Remove top fill plug next to the charging valve (Figure 4-2).

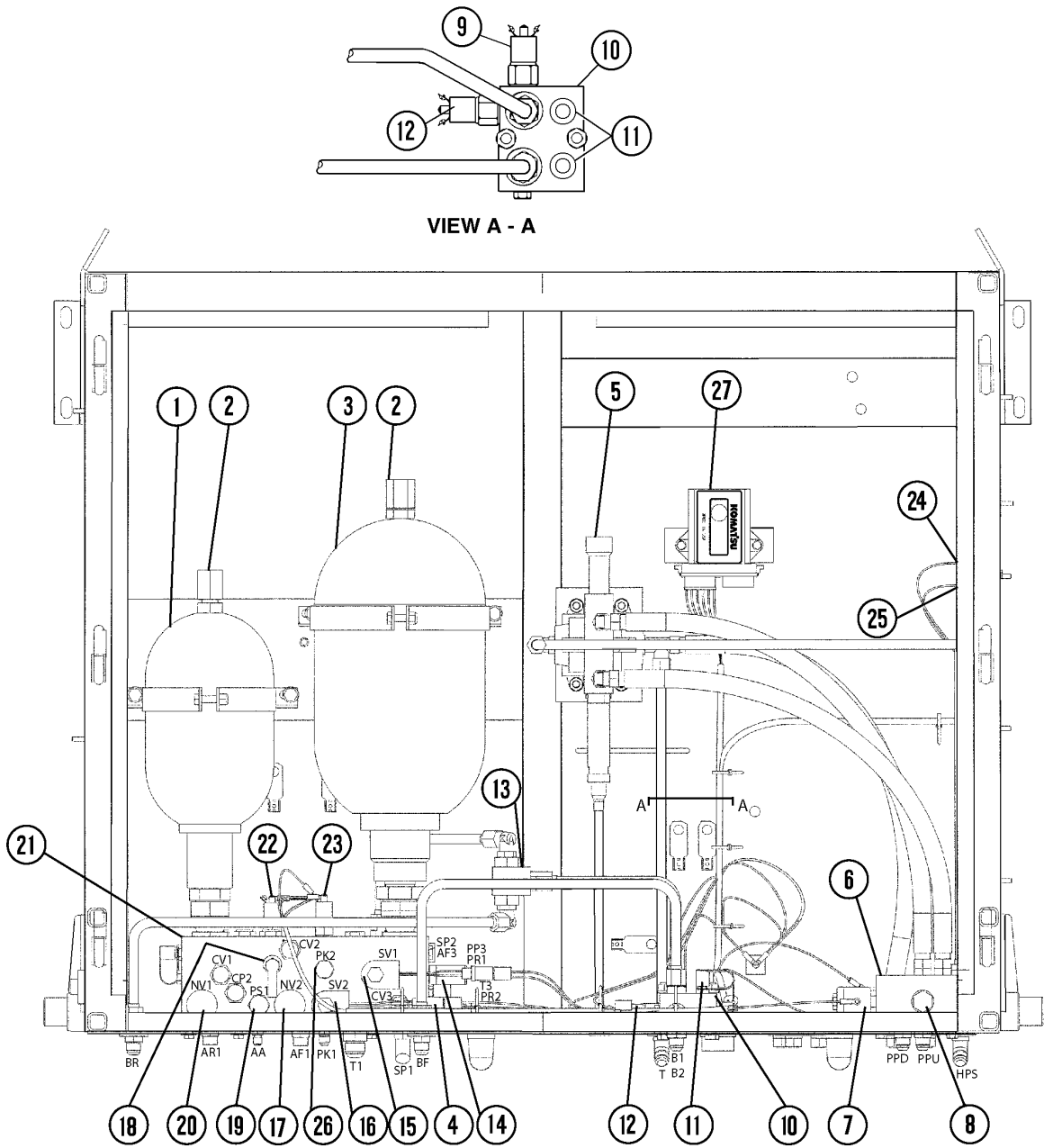


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FIGURE 4-2. FRONT SUSPENSION

FRONT SUSPENSION DIMENSIONS (EMPTY)			
TRUCK MODEL & OPTIONS	OILING HEIGHT IN. (mm)	CHARGING HEIGHT IN. (mm)	CHARGING PRESSURE psi (kPa)
730E*	1.5 (38.1)	9.0 (229)	400 (2758)
830E*	1.0 (25.4)	9.0 (229)	390 (2689)
830E**	1.0 (25.4)	9.0 (229)	410 (2827)
930E*	1.0 (25.4)	9.0 (229)	440 (3034)
930E-2*	1.0 (25.4)	9.0 (229)	425 (2930)

* with standard Rock Body
 ** with Combination Body / Tailgate
 Note: If truck starts to lift off blocks before charging pressure is attained, STOP CHARGING.



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FIGURE 2-1. HYDRAULIC BRAKE CABINET

- | | | |
|--------------------------------------|------------------------------|--------------------------------|
| 1. Rear Brake Accumulator | 11. BF & BR Test Port | 19. Automatic Apply Valve |
| 2. Charging Valve | (Front & Rear Brake) | 10. Bleed Down Valve |
| 3. Front Brake Accumulator | 12. Stop Light Switch | (Rear Brake Accumulator) |
| 4. Park Brake Pressure Reducer Valve | 13. Brake Lock Shuttle Valve | 10. Brake Manifold |
| 5. Hoist Pilot Valve | 14. Brake Lock Pressure | 10. Low Brake Accumulator |
| 6. Hoist Pilot Manifold | Reducing Valve | Pressure Switch |
| 7. Hoist-Up Limit Solenoid | 15. Brake Lock Solenoid | 10. Park Brake Pressure Switch |
| 8. Pilot Operated Check Valve | 16. Park Brake Solenoid | 10. Brake Warning Delay Timer |
| 9. Brake Lock Degradation | 17. Bleed Down Valve | 10. Brake Warning Light Relay |
| Pressure Switch | (Front Brake Accumulator) | 26. Park Brake Test Port |
| 10. Junction Block | 18. Accumulator Test Port | 27. Hoist Controller |

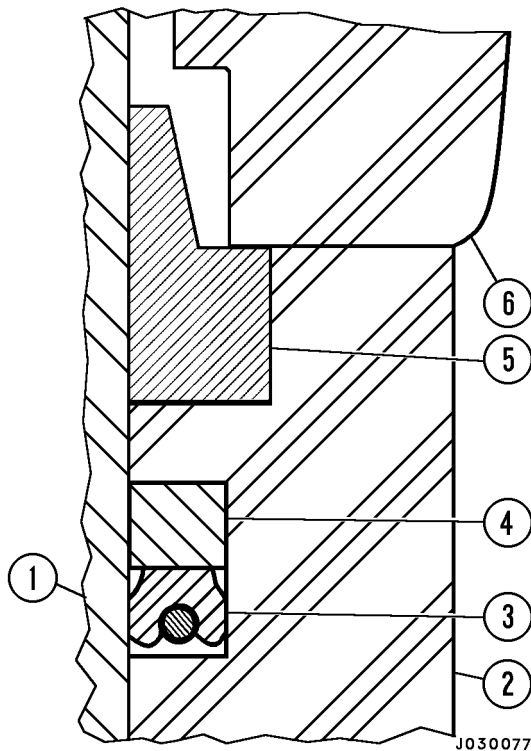


FIGURE 3-6. VALVE BODY SEAL INSTALLATION

- | | |
|---------------------|------------------|
| 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.

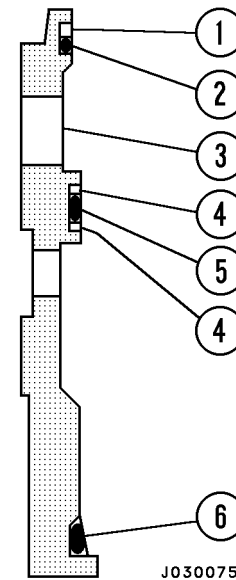


FIGURE 3-7. SLEEVE SEAL PLACEMENT

- | | |
|---------------------|-----------------|
| 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 an 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 the 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.

Actuator Plunger O-ring Installation

1. Install an O-ring (7, Figure 3-5) into the O-ring groove located at the large diameter end of the actuation plunger (3).
2. Install a split Glyde ring over the O-ring. (Twist and squeeze the split Glyde ring into a small circle before installing to insure a tight fit over the O-ring).

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Assembly

1. Replace shell in vise, if removed.
2. Pour a liberal amount of clean C-4 hydraulic oil into shell to serve as a cushion.
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 3-19).
6. Pull bladder pull rod out of shell with one hand while feeding bladder into shell with other hand.

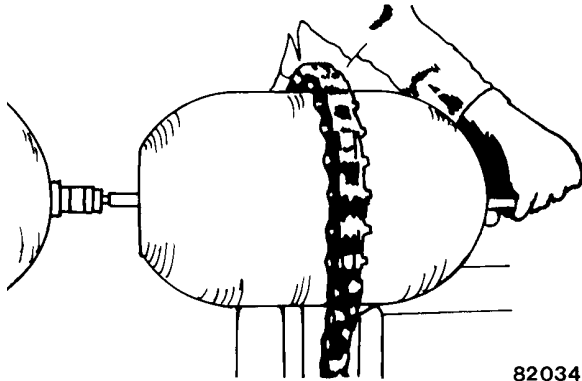


FIGURE 3-19. BLADDER INSTALLATION

7. Position name plate over valve stem and install valve stem nut by hand (Figure 3-20). Remove bladder pull rod.
8. Grasp threaded section of plug and insert poppet end into shell mouth.

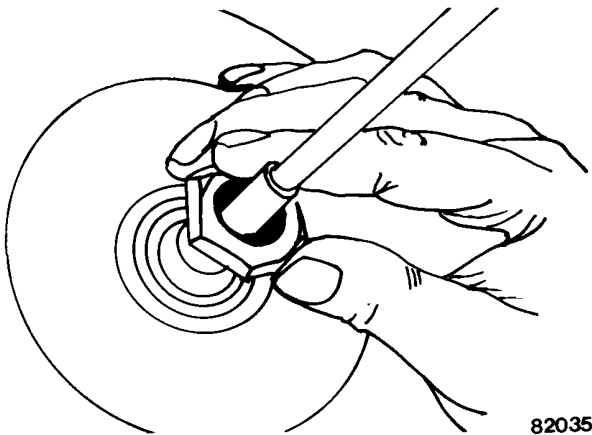


FIGURE 3-20. VALVE STEM INSTALLATION

9. 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.
10. Withdraw threaded end of plug through shell mouth. (Refer to Figure 3-21).
11. Pull plug until seated solidly into position on shell mouth opening.

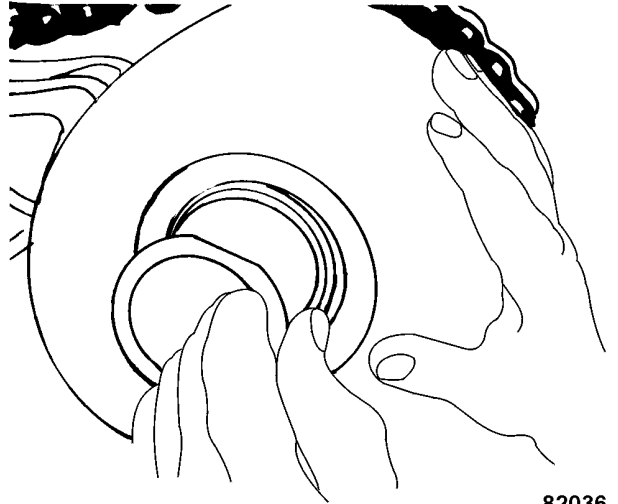


FIGURE 3-21. PLUG ASSEMBLY

12. Install valve core. Using dry nitrogen, slowly pressurize bladder with sufficient pressure [approximately 5 psi (34 kPa)] to hold plug and poppet assembly in place.
13. Install washer onto plug and poppet assembly and push until seated against anti-extrusion ring. (Refer to Figure 3-22).

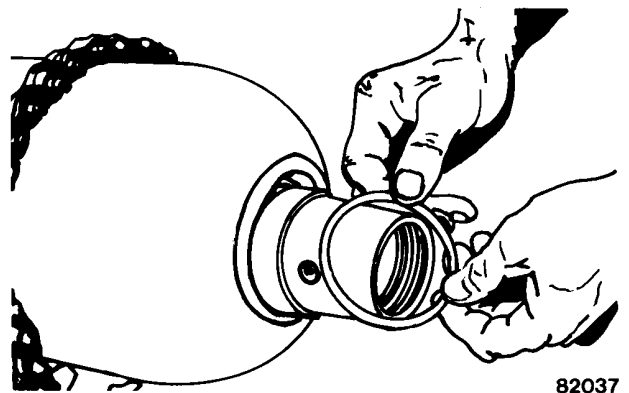


FIGURE 3-22. WASHER INSTALLATION

30. Depress the brake pedal very slowly until the brake differential pressure switch activates the low brake pressure lamp and buzzer.

Verify fault indicators are activated at:

Refer to Table I Pressures.

· Record Pressure on data sheet.

Table 1. - Differential Pressure Switch Adjustment		
Spring Color	Pressure - Switch Contacts Closing	
	"B1" Valve Spool	"B2" Valve Spool
Red	250 ± 30 psi (1 724 ± 207 kPa)	375 ± 50 psi (2 585 ± 345 kPa)
Green	600 ± 50 psi (4 137 ± 345 kPa)	1000 ± 75 psi (6 895 ± 517 kPa)

! WARNING ! DO NOT attempt to adjust a "red" spring to the higher "green" spring pressures. This will cause the spring to "bottom out" and the warning switch will not function properly.

For more specific details regarding Table I, refer to previous chapter: BRAKE CIRCUIT COMPONENT SERVICE, BRAKE VALVE, "Differential Pressure Switch Adjustment".

· Record on data sheet.

31. Turn key switch off and bleed down both brake accumulators by opening the manual bleed down valves on the brake manifold.

32. Outside the brake cabinet, reconnect the hose that connects the front brake accumulator (port AF1) to the brake pedal in the cab. Disconnect the hose that supplies oil from the rear brake accumulator to the brake pedal in the cab for the rear brakes (port AR1) and plug the tube end at the cabinet. Be sure to leave end of hose vented to atmosphere.

33. Slowly depress brake pedal. Differential switch must actuate the low brake pressure buzzer and lamp at 375 ± 50 psi (2586 ± 345 kPa) front brake pressure. Adjust if necessary.

· Record on data sheet.

34. Turn key switch off and bleed down both brake accumulators by opening the manual bleed down valves on the brake manifold.

35. Outside the brake cabinet, reconnect the hose that supplies oil from the rear brake accumulator to the brake pedal in the cab.

36. Install a jumper wire between circuits #33 and #33W at the brake warning timer. Install another jumper wire between circuits #33W and #33T on the brake warning relay. Both circuits are in the brake cabinet.

37. Start engine and build accumulator pressures.

NOTE: With engine running, and service and brake lock released, the low brake pressure warning system should be activated.

38. Slowly depress the service brake pedal until the low brake pressure warnings are deactivated.

39. Slowly release pedal, the low brake pressure warning should activate when the rear brake pressure reaches 1000 ± 25 psi (6895 ± 172 kPa). (Checks brake lock degradation pressure switch.)

40. Remove jumper between circuits #33W and #33.

41. Disconnect one end of the jumper between #33T and #33W.

NOTE: With engine running, there should be no warnings.

42. Reattach jumper between #33T and #33W. The low brake pressure warning should actuate approximately 1.0 second after reconnecting jumper. (Checks delay of timer).

· Record on data sheet.

43. Remove all jumper wires, and gauges. This concludes the brake check out.

NOTE: These bolts are highly stressed and should be replaced whenever their condition appears questionable. A 3/4-16 UNF-28 tap lubricated with a light oil may be used to inspect tapped holes in housings for thread damage and to clean up any minor thread roughness.

10. Brake housings and pistons should be thoroughly cleaned. After cleaning, passages, cavities, and external surfaces should be blown dry with clean, dry, compressed air. Piston should also be cleaned and blown dry.

NOTE: Cleaned and dried parts should not be left exposed for any appreciable time without a protective coating of lubricant; for short term storage, coating all internal cavities, passages, and bosses with hydraulic fluid will be adequate protection; for longer term storage wipe cavities, connector bosses, and threads with a protective grease, such as petroleum jelly.

BRAKE LINING

Replacement

Each front wheel speed disc assembly has three (some trucks may have four) 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.

WARNING

Failure to replace lining when worn to limits will result in loss of braking and possible catastrophic failure.

1. To replace front linings, remove front tire and rims, refer to "Wheel and Tire Installation", Section "G".
2. Remove end plates (7 or 8) Figure 5-3 from either end of caliper.
3. Pry between lining and disc to force pistons to bottom in caliper housing.
4. Remove lining from inboard and outboard sides of disc.
5. Inspect dust seals. Seals should be soft, pliable, and show no evidence of hardening or rupture. If damage is observed, the dust covers must be

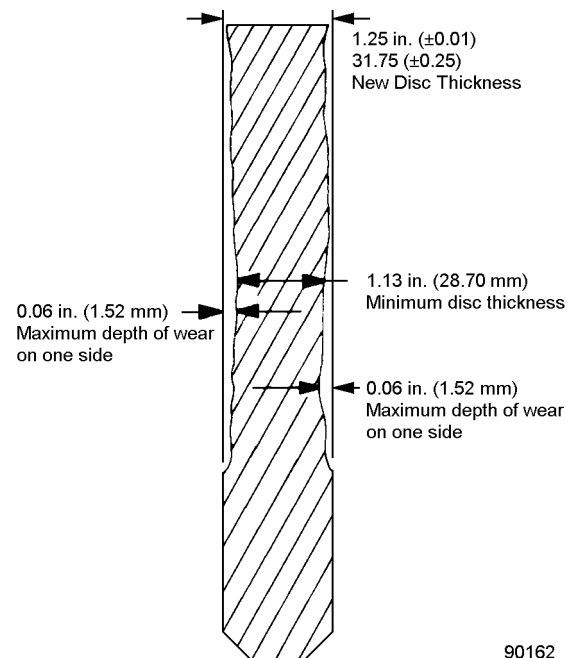
replaced. This will require disassembly of the caliper.

6. Inspect end plates for wear. Replace if grooves will not allow lining back plate to slide freely.
7. Inspect disc for wear limits, Figure 5-4. If disc is worn below the limits shown, the disc must be replaced. Refer to "Wheel and Tire Installation", Section "G".
8. If original linings have sufficient lining material for reuse, inspect lining back plate for cracks or excessive yielding where plate fits into end plates 7 or 8 (Figure 5-3).

CAUTION

When replacing linings, never mix new and used linings in a brake assembly.

9. Slide linings (9) into caliper. It may be necessary to again pry pistons into housing (1).
10. Install end plates (7 & 8), apply Loctite® 271 to threads of end plate capscrews (6). Install capscrews and tighten to **403 ft.lbs. (54.6 N.m)** torque. Check that linings (9) slide freely between end plates.
11. After completing lining replacement, reinstall front wheels. Refer to "Wheel and Tire Installation", Section "G".



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FIGURE 5-4. DISC WEAR LIMITS

NOTE: If desired, installation of brake housing components may be temporarily withheld to perform a "Functional Test".

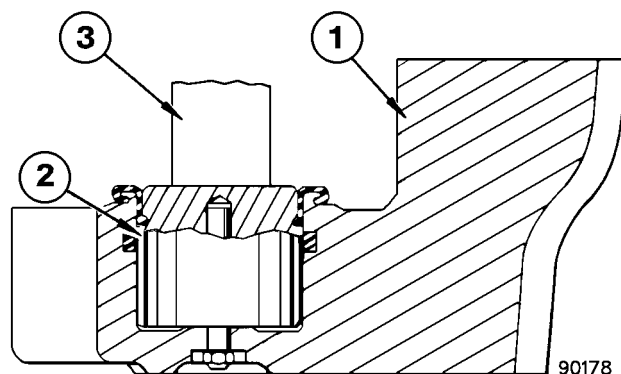


FIGURE 6-5. PISTON INSTALLATION (Retracted Position)

1. Brake Housing
2. Piston Assembly
3. Arbor Press
8. Install all fittings with new packings into correct position in brake housings.
9. For ease of brake caliper installation, do not install linings and retaining plates in calipers. "Bench Test" should be performed on brake calipers before installation.

FUNCTIONAL TEST OF PISTON ASSEMBLY

NOTE: Perform functional test prior to disassembling piston assembly to determine if any components require replacement. To assure proper operation, also perform functional test prior to installing piston assembly in caliper housing, if disassembled.

Return Spring Force

Return spring (14, Figure 6-7) captured between outer spring guide (8) and spring retainer (5), exerts a return force, through spring retainer (5) and threaded retaining ring (4) on piston (11). With brake applied (spring compressed to a minimum height) return spring force should be between 180-250 lb. (800-1112 N).

Built-In Clearance

This is the amount piston will retract when brake pressure is released. Piston is retracted by force of piston return spring (14, Figure 6-7). Required built-in clearance is 0.065-0.073 in. (1.65-1.85 mm), obtained by the setting of threaded retaining ring (4).

1. The piston subassembly can be inspected for required return spring force and built-in clear-

ance adjustment at the same time. Use the set-up on a spring checker as shown in Figure 6-8.

2. Set up dial indicator between arbor of spring checker and table.
3. Place sleeve (A, Figure 6-6) over return pin, lower arbor and fully compress spring (indicator pointer will stop moving).
4. With spring compressed, set indicator dial to zero.

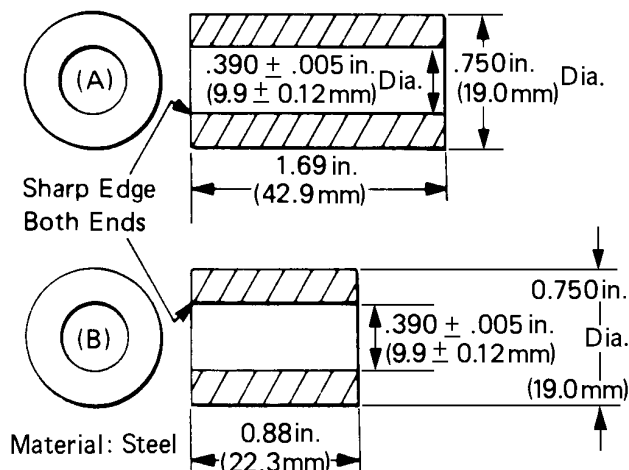


FIGURE 6-6. GRIP SPACE AND INSTALLATION SLEEVES

5. Raise arbor slowly until spring checker force scale reads zero. Reading on indicator dial will be the built-in clearance which should be 0.055-0.073 in. (1.65-1.85 mm).
6. Lower arbor slowly until dial indicator reads zero. Reading on spring checker force scale will now indicate the return spring force which should be 180-250 lbs. (808-1112 N) force.
7. Slowly raise and lower arbor several times to verify both built-in clearance and spring force measurements. If measurements are outside this range, remove lockwire (15, Figure 6-7), lower arbor until spring is fully compressed, screw threaded retaining ring clockwise until bottomed (a spanner wrench is recommended for this) then back off one full turn (minimum), plus any additional amount to reach the next locking position, raise arbor and install lockwire. Recheck for correct built-in clearance adjustment by repeating Steps 3, 4 & 5).

Rear Brake Conditioning

Note: Front brakes will require burnishing independently from rear brakes in order to control disc temperatures.

⚠ WARNING

Extreme safety precautions should be used when making high-energy/high-speed brake stops on any downgrade. Safety berms or adequate run off ramps are necessary for any stopping performance tests.

1. Temporarily disconnect the FRONT brakes using the following procedure:
 - a. Observe safety precautions on the previous page and relieve stored pressure in hydraulic system.
 - b. Disconnect "BF" hydraulic tube (5, Figure 6-19) at both ends inside brake control cabinet. Install a #8, 0.75 x 16UNF-2B, 37° flare Cap Nut (WA2567, or equivalent) on each fitting where tube was removed. Tighten caps to standard torque to prevent leakage. Cap or plug tube to prevent contamination.
NOTE: This will disconnect the hydraulic supply from the operator's brake pedal to the front brakes. There will be a noticeable loss of "braking action" at the pedal. However, this method of temporarily disabling the brakes will still permit the application of Brake Lock, in the event of an emergency.
 - c. Close accumulator bleed valves handles (7).
2. Drive empty truck on level terrain at speeds of 5 to 10 MPH while applying (dragging) the brakes using sufficient pressure to make engine "Work" until the disc temperatures reach or exceed 600°F (316°C).

NOTE: The Override Switch on the instrument panel must be depressed and held by the operator in order to propel the truck with the brakes applied.

⚠ CAUTION

Do not exceed 800°F (427°C) disc temperatures during burnishing.

3. Allow the brake discs to cool to approximately 250°F (121°C) between cycles.
4. Repeat steps 2 and 3.

5. If linings smoke or smell during the second cycle, continue to repeat burnishing cycle until smoke and smell are gone or are significantly reduced.
6. Reconnect front brakes:
 - a. Relieve pressure in hydraulic system according to the previous "WARNING" instructions.
 - b. Remove Cap Nuts and reinstall tube (5). Tighten tube nuts to standard torque.
 - c. Close accumulator bleed valve (7) handles.
7. Start engine and check for leaks. Bleed brakes according to procedure on the following page.
8. Insure all brakes are functioning properly before releasing truck.

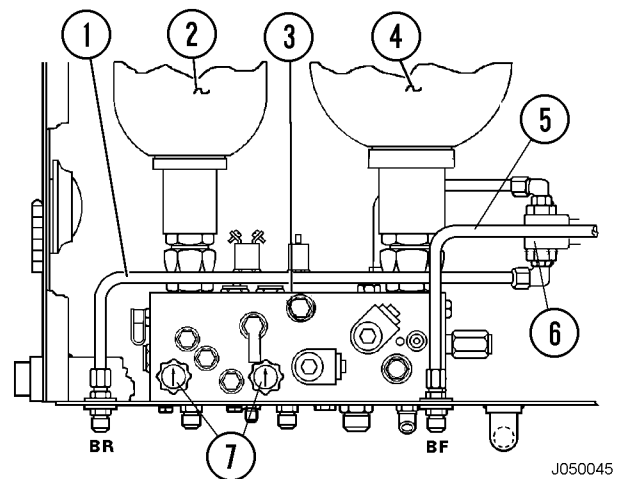


FIGURE 6-19. BRAKE MANIFOLD AND COMPONENTS

- | | |
|----------------------------|-----------------------------------|
| 1. "BR" Hydraulic Tube | 5. "BF" Hydraulic Tube |
| 2. Rear Brake Accumulator | 6. Brake Lock Shuttle Valve |
| 3. Brake Manifold | 7. Brake Accumulator Bleed Valves |
| 4. Front Brake Accumulator | |

HYDRAULIC SYSTEM

HYDRAULIC SYSTEM OPERATION

The following describes the basic hydraulic system operation. Further system description is outlined under different system circuits such as the hoist circuit and steering circuit in this section of the manual. Refer to Section "J" for details regarding the hydraulic brake system.

The hoist, brake/steering and axle blower circuits share a common hydraulic tank (1, Figure 2-1). The tank is located on the left frame rail forward of the rear wheels.

The service capacity of the tank is 250 gal. (946 l). Type C-4 hydraulic oil is recommended for use in the hydraulic system.

NOTE: It is recommended that any hydraulic oil to be used for filling or adding to the hydraulic system is routed through a 3 micron filter device prior to use.

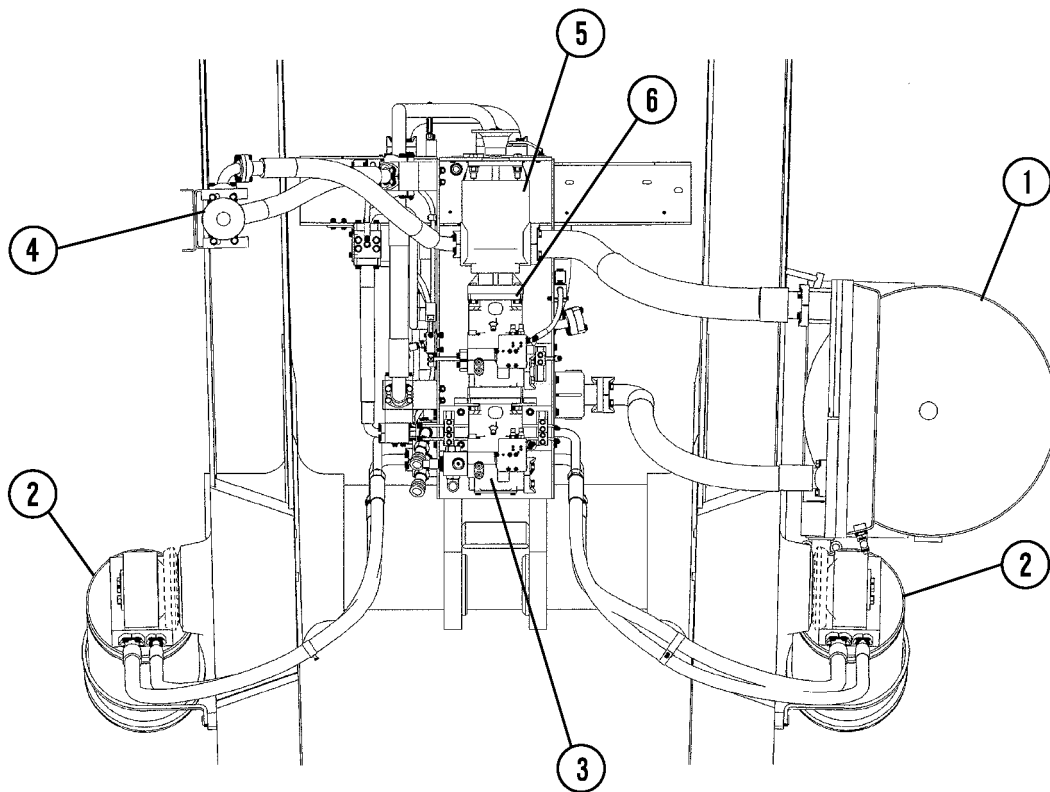


FIGURE 2-1. HOIST CIRCUIT COMPONENTS (VIEWED FROM BELOW TRUCK)

1. Hydraulic Tank
2. Hoist Cylinder

3. Axle Blower Pump
4. Hoist Circuit Filter

5. Hoist Pump
6. Steering/Brake Pump

7. Lubricate the thru stud threads (14, Figure 3-8) with hydraulic oil. Thread the studs into flange until snug. There are 4 long studs (11, Figure 3-9) and 4 short studs (12). Refer to Figure 3-9 for proper stud location.
8. Lubricate and install O-ring (7, Figure 3-8). Install dowel pins (12), if removed. Install gear plate (13) with recess in gear plate facing up or toward the connector plate when gear plate is installed.
9. Install steel rings (5, Figure 3-9). Lubricate and install backup ring (8), O-ring (7) and ring retainer (6).
10. Install the isolation plate (9) on the suction side of the gear plate. The isolation plate has relief area milled on one side, turn that side up or toward the pressure plate.

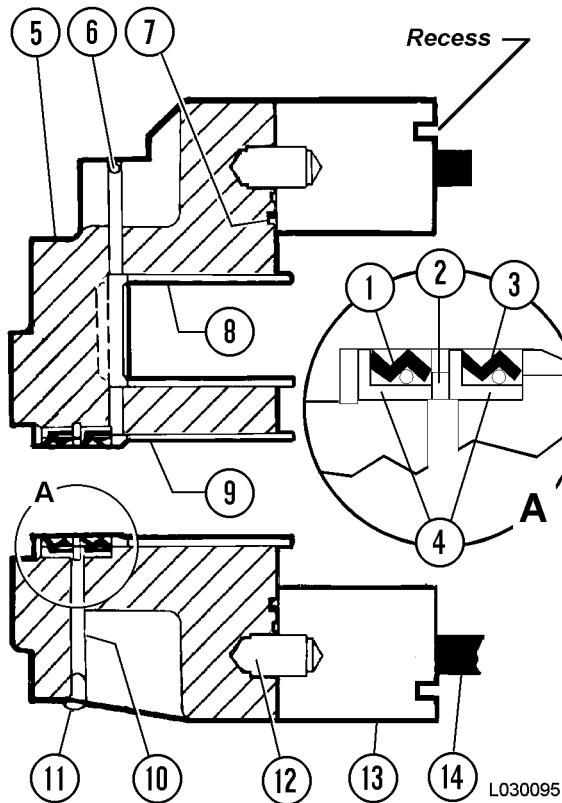


FIGURE 3-8. SHAFT SEAL INSTALLATION

- | | |
|------------------------|----------------|
| 1. Outboard Shaft Seal | 8. Bearing |
| 2. Snap Ring | 9. Bearing |
| 3. Inboard Shaft Seal | 10. Weep Hole |
| 4. Seal, Metal Face | 11. Plug |
| 5. Flange | 12. Dowel |
| 6. Steel Ball | 13. Gear Plate |
| 7. O-ring | 14. Thru Studs |

11. With the bronze side up and the milled slot facing toward the discharge side, slide pressure plate (2, Figure 3-10) down into the gear bores until it rests on the backup ring and O-ring. Do not force the plate down the gear bores. If it hangs up on the way down, work it back and forth until it slides freely into place.
12. Coat the inside of the gear plate and the gears with clean hydraulic oil.
13. With the extension end of the drive gear (1, Figure 3-12) facing toward the shaft seals, install the drive gear. Do not drop the gear in the bore as damage to the bronze face of the pressure plate could result. Use care when pushing the drive gear extension through the shaft seals. Install the idler gear (4).
14. Install the opposite pressure plate with the bronze side down and the milled slot facing toward the discharge side.

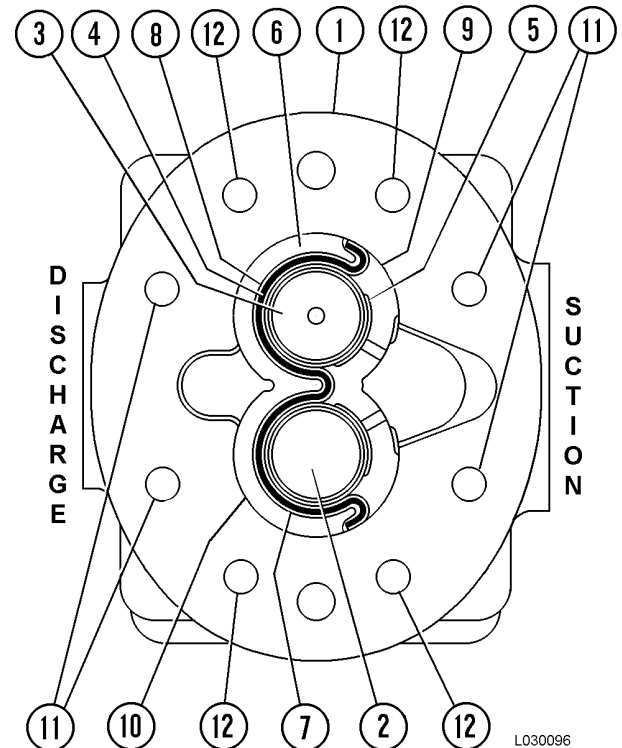
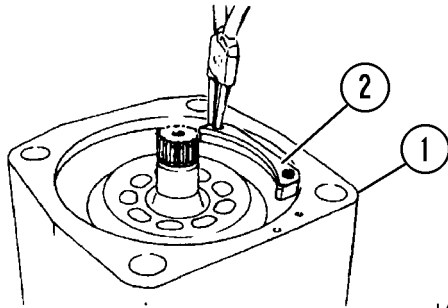


FIGURE 3-9. PUMP REASSEMBLY

- | | |
|---------------|------------------------|
| 1. Gear Plate | 7. O-ring |
| 2. Drive Gear | 8. Backup Ring |
| 3. Idler Gear | 9. Isolation Plate |
| 4. Bearing | 10. Relief Area |
| 5. Steel Ring | 11. Thru Studs (Long) |
| 6. Retainer | 12. Thru Studs (Short) |

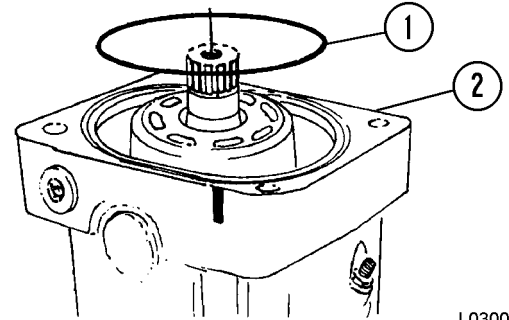
11. Remove screws and retainer segments (2, Figure 3-24).



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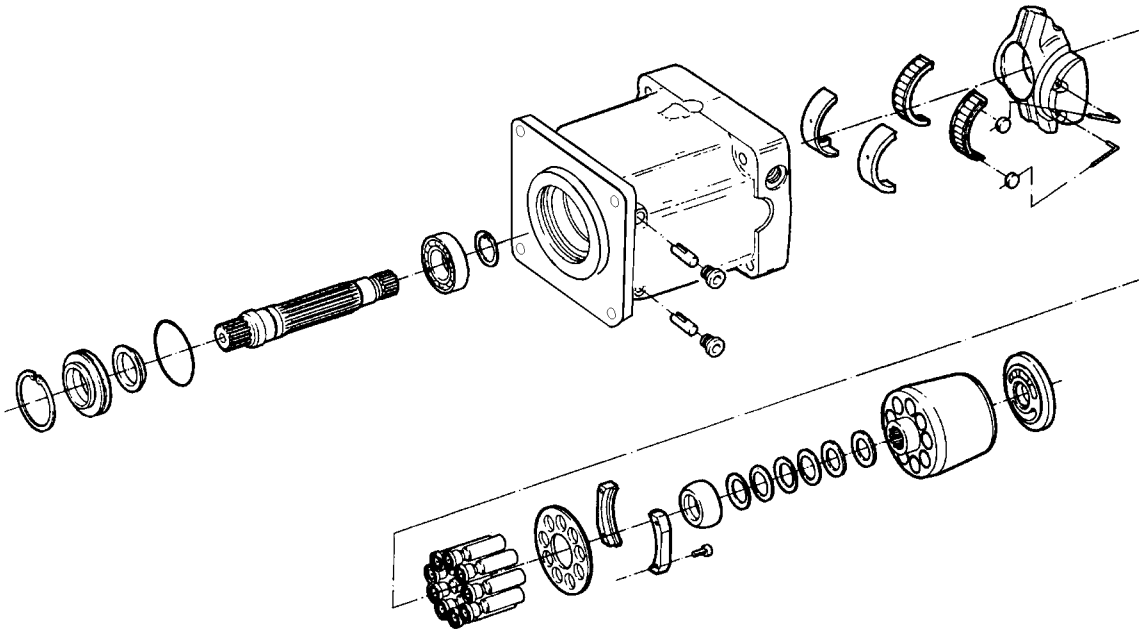
FIGURE 3-24. RETAINER REMOVAL
1. Port Plate 2. Retainer

12. Remove O-ring (1, Figure 3-25).



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FIGURE 3-25. O-RING REMOVAL
1. O-Ring 2. Housing



L030054

FIGURE 3-26. ROTARY GROUP DISASSEMBLY

Disassembly

NOTE: Tag similar parts (particularly screws, plugs and O-rings) during disassembly to be certain they don't become confused with similar parts and to assure they will be returned to original location. Do not remove (locator) roll pins unless they are deformed or otherwise in need of replacement.

When disassembling or assembling unit, choose a work area where no traces of dust, sand or other abrasive particles which could damage the unit are in the air. Do not work near welding, sand-blasting, grinding benches and the like. Place all parts on a CLEAN surface. To clean parts which have been disassembled, it is important CLEAN solvents are used. All tools and gauges should be clean prior to working with these units and new, CLEAN and threadless rags used to handle and dry parts.

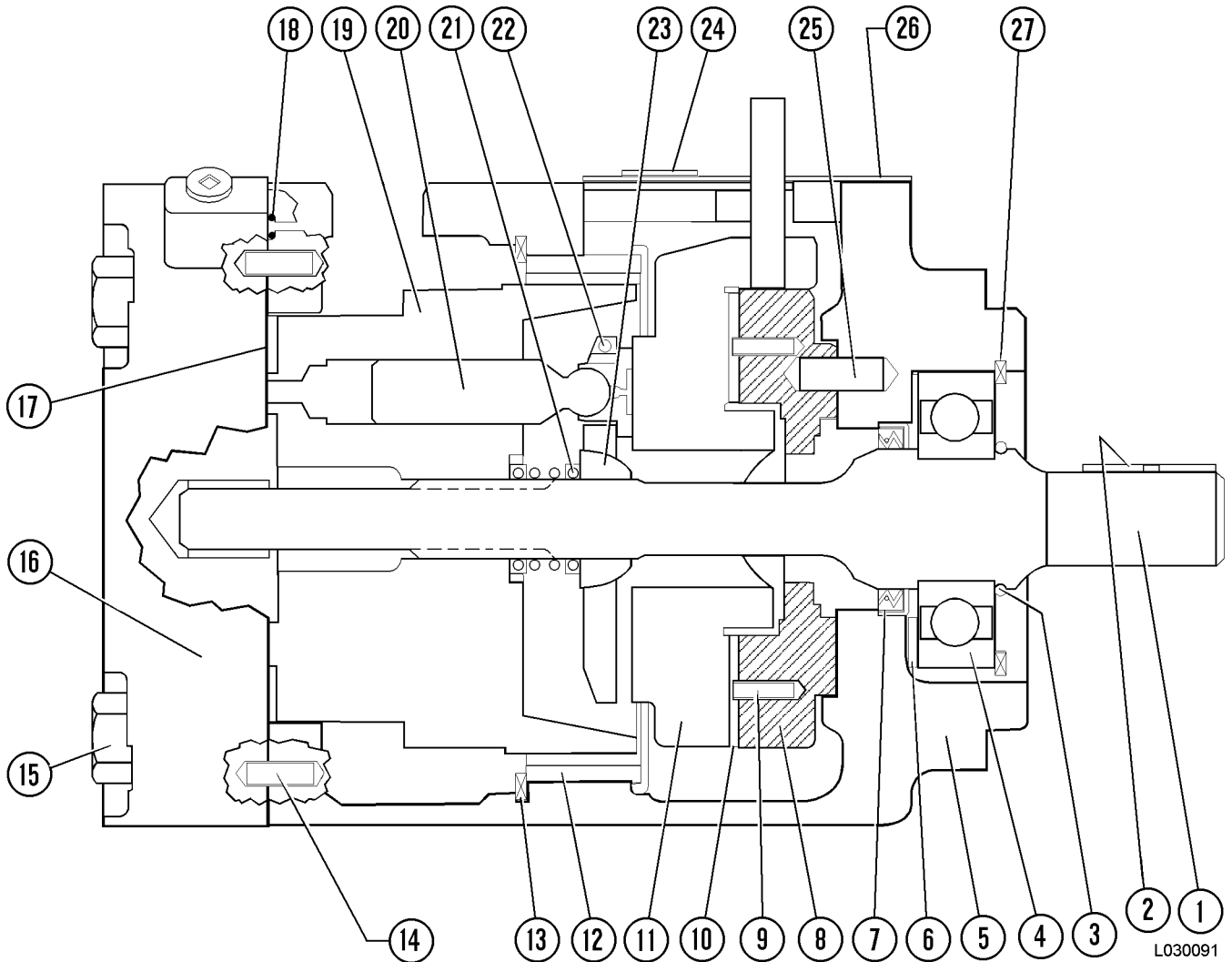


FIGURE 3-65. HYDRAULIC MOTOR

- | | | | |
|------------------|-------------------------|---------------------|----------------------|
| 1. Shaft | 8. Saddle Block | 15. Capscrew | 22. Shoe Retainer |
| 2. Key | 9. Roll Pin | 16. Valve Plate | 23. Fulcrum Ball |
| 3. Retainer Ring | 10. Saddle Bearing | 17. Gasket | 24. O-Ring |
| 4. Front Bearing | 11. Swashblock | 18. O-Ring | 25. Dowel Pin |
| 5. Motor Housing | 12. Bearing with Spacer | 19. Cylinder Barrel | 26. Top Plate Gasket |
| 6. Seal Retainer | 13. Retainer Ring | 20. Piston & Shoe | 27. Retainer Ring |
| 7. Shaft Seal | 14. Roll Pin | 21. Spring | |

STEERING CIRCUIT

STEERING CIRCUIT OPERATION

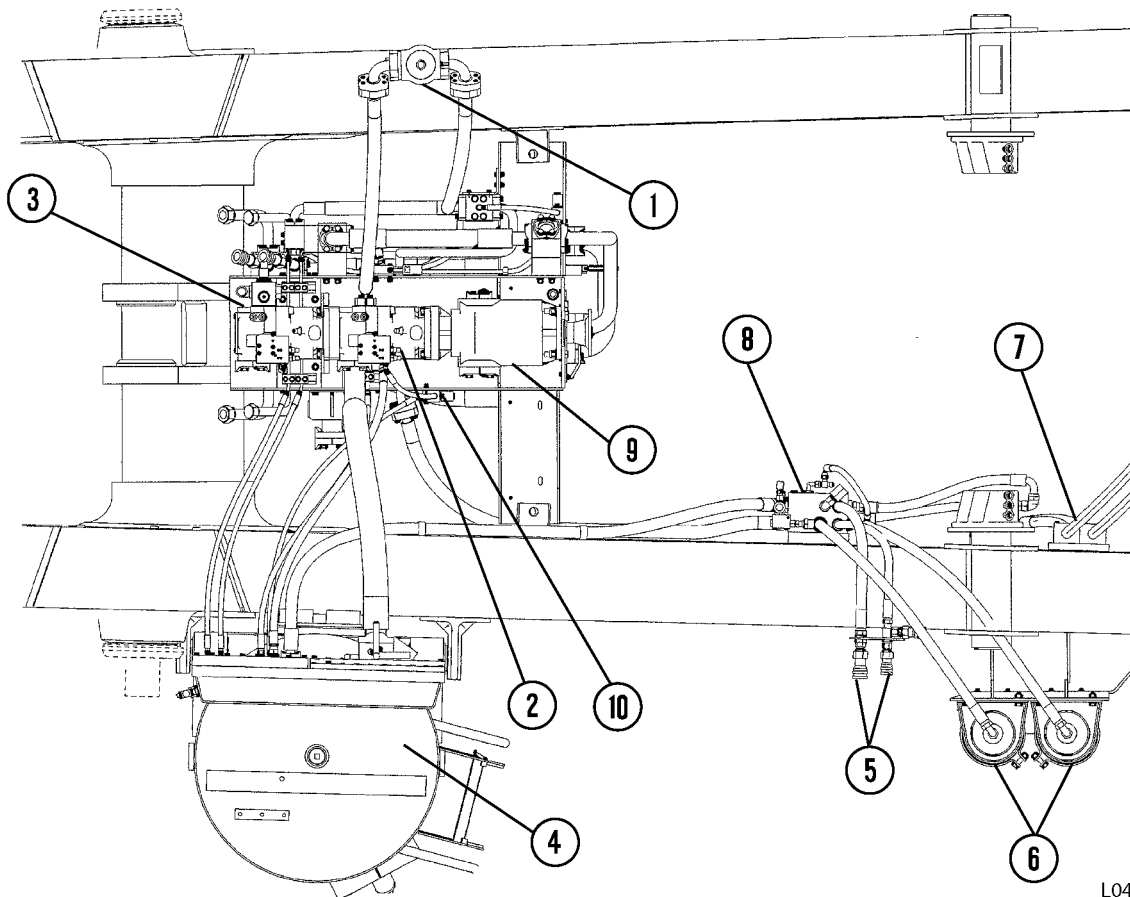
The brake/steering pump (2, Figure 4-1) delivers oil to the high pressure steering filter (1), then to a bleed down manifold valve (8) which is located on the inside left frame rail. The bleed down manifold diverts oil between the steering circuit and brake circuit. The bleed down manifold directs oil to the steering accumulators (6), flow amplifier (7), brake circuit and steering cylinders via the flow amplifier.

Oil entering the accumulator via the bleed down manifold pushes the floating bladder within the accumulator upward, compressing the nitrogen on the opposite side of the bladder. The nitrogen pressure increases directly with steering circuit pressure. The top side of the bladder is pre-charged to 1400 psi (9 653 kPa) with pure dry nitrogen when the piston is at the bottom.

The accumulator oil is supplied constantly to the flow amplifier, via the bleed down manifold. The accumulators also act as a reservoir for pressurized hydraulic oil to be used during an emergency situation should the hydraulic steering oil supply malfunction for any reason.

▲WARNING

If a loss in steering pressure occurs, stop the truck immediately. The pressure in the accumulator allows the operator to steer the truck only for a short period. Do not attempt further operation until the problem is located and corrected.



L040094

FIGURE 4-1. STEERING CIRCUIT (BOTTOM VIEW)

- | | | |
|----------------------------|-------------------------------|--|
| 1. Steering Circuit Filter | 5. Steering Quick Disconnects | 9. Hoist Pump |
| 2. Brake/Steering Pump | 6. Steering Accumulators | 10. Steering Pump Compensator
Vent Solenoid Valve |
| 3. Axle Blower Pump | 7. Flow Amplifier Valve | |
| 4. Hydraulic Tank | 8. Bleeddown Manifold Valve | |

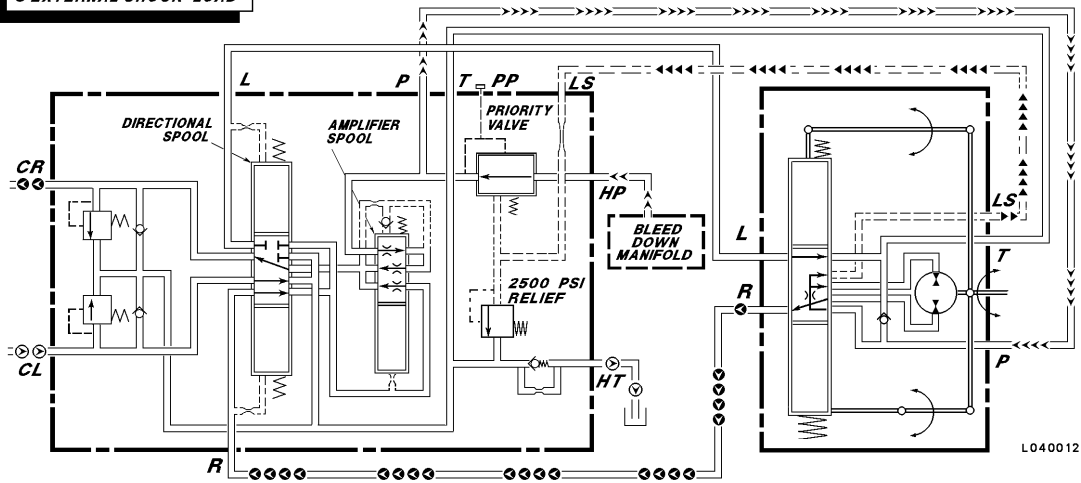
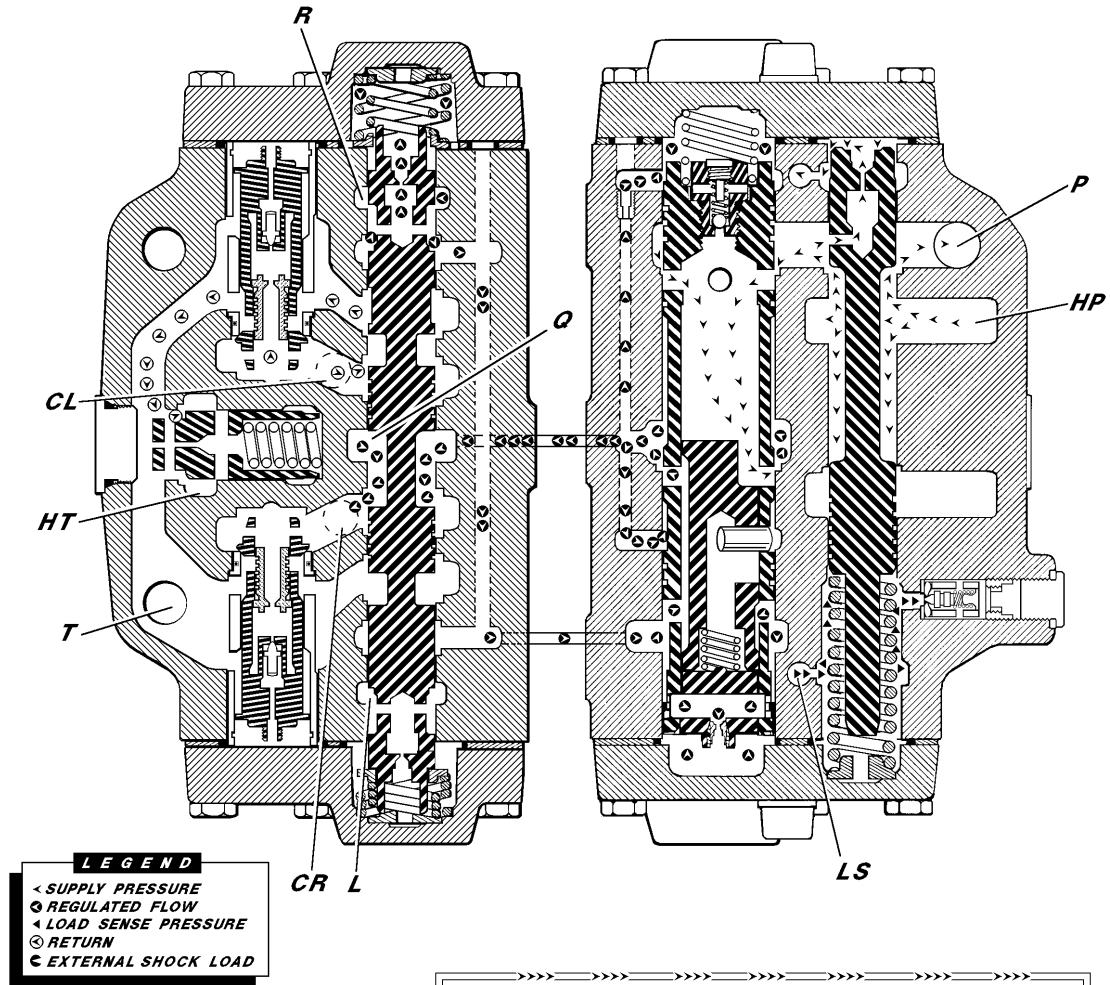


FIGURE 4-7. FLOW AMPLIFIER (Steering Right)

7. Hold bladder valve stem on the flats with a wrench and tighten nut (5) securely.
8. If removed, install pressure switch (15), valve assembly (11) and charging valve onto gas valve manifold (14). Install new O-Ring (16) on gas valve manifold (14). Hold bladder valve stem with wrench and install gas valve manifold (14) and tighten securely.
9. Holding the hydraulic port assembly (2) by the threaded end, insert the poppet end into the shell fluid port. Lay complete assembly in side shell.
10. Fold anti-extrusion ring (3) to enable insertion into the shell. Once the anti-extrusion ring has cleared the fluid port opening, place the anti-extrusion ring on the hydraulic port assembly with the steel collar facing toward the shell fluid port.
11. Pull the threaded end of the port assembly through the shell fluid port until it seats solidly into position on the shell fluid port opening.
12. Connect nitrogen charging kit to charging valve. Refer to "Steering Accumulator Charging Procedure" to charge accumulator. With hydraulic port assembly firmly in place, slowly pressurize the bladder using dry nitrogen with sufficient pressure (first 25 psi (172 kPa), then approximately 50 psi (345 kPa) to hold port assembly in place so both hands are free to continue with assembly.
13. Install the metal O-Ring backup washer (6) over hydraulic port assembly and push into the shell fluid port to bottom it out on anti-extrusion ring.
14. Install O-Ring (7) over hydraulic port assembly and push it into the shell fluid port until it has bottomed out against the metal O-Ring backup washer (6).



Do not twist O-ring.

15. Install O-ring back-up (8) over hydraulic port assembly and push until it bottoms against O-ring
16. Insert spacer (9) with the smaller diameter of the shoulder facing the accumulator shell.

17. Install the lock ring (10) on the hydraulic port assembly and tighten securely. This will squeeze the O-Ring into position. Use appropriate wrench on flats on port assembly to insure the unit does not turn.
18. Install bleed plug (12) into the hydraulic port assembly.
19. Refer to "Steering Accumulator Charging Procedure" for details on how to charge accumulator to 100 - 120 psi (690 - 827 kPa). After precharging, install plastic cover over hydraulic port to prevent contamination. Do not use a screw-in type plug.



Always store bladder accumulators with 100 - 120 psi (690 - 827 kPa) nitrogen precharge pressure. Do not exceed 120 psi (827 kPa). Storing accumulators with more than 120 psi (827 kPa) pressure is not safe in case of leaks.

NOTE: Bladder accumulators should be stored with 100 - 120 psi (690 - 827 kPa) precharge, which fully expands the bladder, and holds oil against the inner walls for lubrication and to prevent rust formation.

LEAK TESTING

To carry out the testing required, it will be necessary to check for internal and external leaks at high pressure. A source of 3500 psi (24132 kPa) hydraulic pressure and nitrogen pressure of 1400 psi (9653 kPa) will be required. A small water tank will be necessary for a portion of the test.

1. Refer to "Steering Accumulator Charging Procedure" to precharge accumulator first to 25 psi (172 kPa), and then to 1400 psi (9653 kPa).
2. After accumulator is charged with nitrogen to 1400 psi (9653 kPa), tighten swivel nut (4, Figure 5-6) to close internal poppet (10-15 in. lb.) (11.5 -17 cm kg).
3. Submerge accumulator assembly under water and observe for 20 minutes. No leakage (bubbles) is permitted. If leakage is present, go to Step 10. If no leaks, go to Step 4.
4. Hold charging valve (6) with a wrench and remove swivel connector and charging hose.
5. Replace cap on charging valve (10-15 in. lb.) (11.5-17 cm kg) and install gas valve guard.

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 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 **4 in. lbs. (.5 N.m)**. Install check valve (54). Tighten check valve to **8 in. lbs. (1 N.m)**. Install orifice screw (53). Tighten orifice screw to **8 in. lbs. (1 N.m)** torque.
4. Install seal (21). Install relief valve assembly (20), seal (5), and plug (20). Tighten plug to **22 in. lbs. (2.5 N.m)** 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).
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 capscrews (3) with lockwashers (4). Tighten capscrews to **2 ft. lbs. (2.5 N.m)**. Install capscrew (1) and lockwasher (2). Tighten capscrew to **6 ft. lbs. (8 N.m)** torque.
10. Lubricate O-rings (40 & 49) with molycote grease and install on cover (47). Install end cover (47). Install capscrews (36) with lockwashers (39). Tighten capscrews to **2 ft. lbs. (2.5 N.m)**. Install capscrew (37) with lockwasher (38). Tighten capscrew to **6 ft. lbs. (8 N.m)** torque.
11. To help prevent contamination during storage or installation, install plastic plugs in each valve port.

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

NOTE: Be prepared to contain approximately 250 gal. (946 L) 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. The steering / brake pump (7, Figure 5-24) will be removed with the axle blower pump (11). Disconnect the suction and discharge lines from both pumps (7 & 11). Also disconnect pump case drain lines. Plug all lines and fittings to prevent oil contamination.

⚠ WARNING

The piston pumps (7 & 11) together weighs approximately 290 lbs. (132 kgs). The hoist, piston, and brake / steering pumps together weigh approximately 467 lbs. (212 kgs). Use a suitable lifting or support device that can handle the load safely.

4. Attach a suitable lifting or support device to the steering/brake pump and axle blower pump capable of handling approximately 290 lbs. (132 kg).
5. Loosen (but do not remove) the four capscrews (12 & 13, Figure 5-24) securing support bracket (14). Loosen (but do not remove) the two lower capscrews (10).
6. Make sure the lifting and support devices are in place on pumps (7 & 11). Remove capscrews (6). Remove the two lower capscrews (10).
7. Swing brackets (14) out of the way and move pump (7) away from hoist pump until splined shaft is disengaged from hoist pump shaft. Lower the pumps down from the truck.
8. Move pump to a clean work area for disassembly.
9. Remove the top two capscrews (10) and separate axle blower pump (11) from steering / brake pump.

Installation

NOTE: The hoist pump is already in position on the truck.

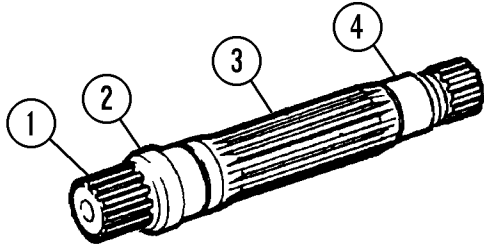
⚠ WARNING

The piston pumps (7 & 11) each weigh approximately 145 lbs. (66 kgs). Use a suitable lifting or support device that can handle the load safely.

1. Lubricate and install new O-ring (9, Figure 5-24) to mounting flange on pump (11). The pump weighs approximately 145 lbs. (66 kgs). Use a suitable lifting device capable of handling the load safely. With coupling (8) in place, join pump (11) to pump (16). Install only the top two capscrews (10) with washers, then tighten capscrews securely.
2. Make sure spline coupler (4) is in place (inside hoist pump) prior to pump installation. Lubricate all the pump splines.
3. Lubricate and install new O-ring (5) to mounting flange on pump (7)
4. The pumps (7 & 11) together weigh approximately 290 lbs. (132 kgs). Use a suitable lifting device capable of handling the load safely. Move the pumps into position. Engage pump shaft with hoist pump spline coupler (4).
5. After pump (7) is fully engaged with hoist pump, install capscrews (6) with washers, and tighten to standard torque.
6. If removed, install support brackets (14) with capscrews (12 & 13). Install capscrews (10) with washers through brackets (14). Tighten capscrews (10, 12 & 13) to standard torque.
7. Remove lifting device from pumps.
8. Remove plugs from inlet and outlet hoses and install to pumps using new O-rings. Tighten capscrews securely. Connect all other hoses to both pumps.
9. Remove plug (16) from both pumps (7 & 11). Add clean C-4 oil to pump through opening until each piston pump housing is full. This may require 2-3 quarts (2-3 l) of oil for each pump.
10. Replace hydraulic filter elements. Refer to "Hydraulic Filters" elsewhere in this section.

NOTE: Use only Komatsu filter elements.

Inspection of Parts

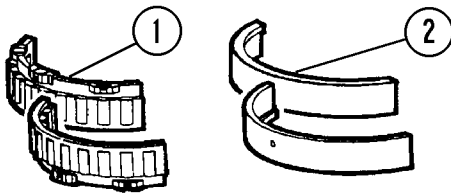


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FIGURE 5-46. DRIVE SHAFT

- | | |
|----------------------|----------------------|
| 1. Splines | 3. Spline |
| 2. Seal Contact Area | 4. Bearing Seat Area |

1. Inspect splines (1 and 3, Figure 5-46) for deformity, pits, chips, or excessive wear. Seal contact area (2) and bearing seat (4) should not be scored or rough.

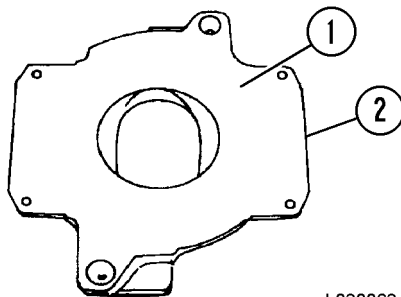


L030062

FIGURE 5-47. BEARINGS

- | | |
|-------------|-----------------|
| 1. Bearings | 2. Bearing Cups |
|-------------|-----------------|

2. Inspect bearings for scoring and severe wear.

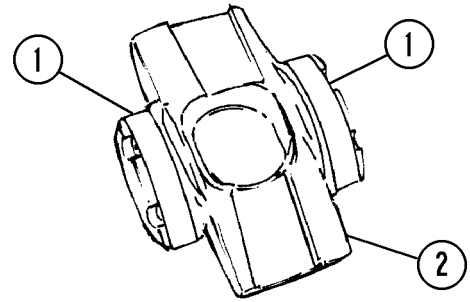


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FIGURE 5-48. SWASH PLATE

- | | |
|-----------------|----------------|
| 1. Contact Area | 2. Swash Plate |
|-----------------|----------------|

3. Inspect contact area (1, Figure 5-48) for roughness or erosion. Inspect regulator socket for erosion.

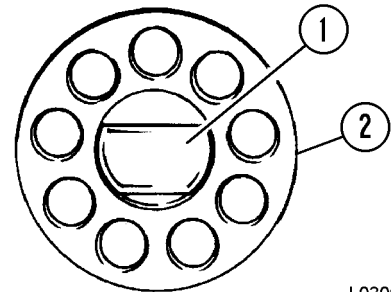


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FIGURE 5-49. CRADLE

- | | |
|-----------------|-----------|
| 1. Bearing Area | 2. Cradle |
|-----------------|-----------|

4. Inspect bearing area (1, Figure 5-49) for smoothness, scoring, and severe wear.

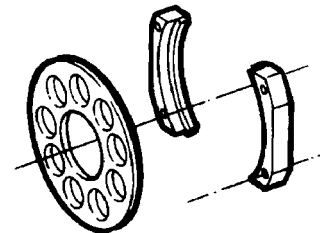


L030065

FIGURE 5-50. RETAINING PLATE

- | | |
|--------------------|--------------------|
| 1. Retaining Plate | 2. Retaining Plate |
|--------------------|--------------------|

5. Inspect the retaining ball (1, Figure 5-50) and retaining plate surface (2).



L030066

FIGURE 5-51. RETAINING SEGMENTS

6. Inspect retaining segments for damage.

Hoist Pilot Valve

The hoist pilot valve (1, Figure 7-5) is located in the hydraulic component cabinet directly behind the operators cab. The hoist pilot valve spool is spring centered to the hold position. The valve is controlled directly by the operator through a lever and cable arrangement. The control lever is located between the operator and center console. When the operator moves the lever, the pilot valve spool moves and directs pilot flow to the appropriate pilot port on the hoist valve causing the main spools to direct working pump flow to the hoist cylinders.

The hoist pilot valve is equipped with a one way load check valve which allows free flow from the center passage to bridge core and prevents reverse flow. The hoist pilot valve is also equipped with a power down relief valve (8). The power down relief valve is located between the power down control port and return galley. The power down relief valve limits power down pressure at 1500 psi (10.5 MPa).

Hoist-Up Limit Solenoid

The Hoist-up Limit Solenoid (2, Figure 7-5) is used in the hydraulic circuit to prevent maximum hoist cylinder extension.

This solenoid valve is “normally open” between the hoist pilot valve raise port and the hoist valve raise pilot port. The return-to-tank port is “normally closed”. The solenoid is controlled by the proximity switch (hoist limit switch) located inside the rear frame rail near the body pivot and above the right rear suspension. When the solenoid is signaled by the proximity switch, the raise pilot port on the hoist valve is closed. The hoist pilot valve raise port is opened to return to tank.

Pilot Operated Check Valve

The Pilot Operated Check Valve (7, Figure 7-5) is opened by power down pilot pressure to allow oil in the raise port to bypass the hoist up limit solenoid for initial power down operation while the solenoid is activated by the hoist limit switch.

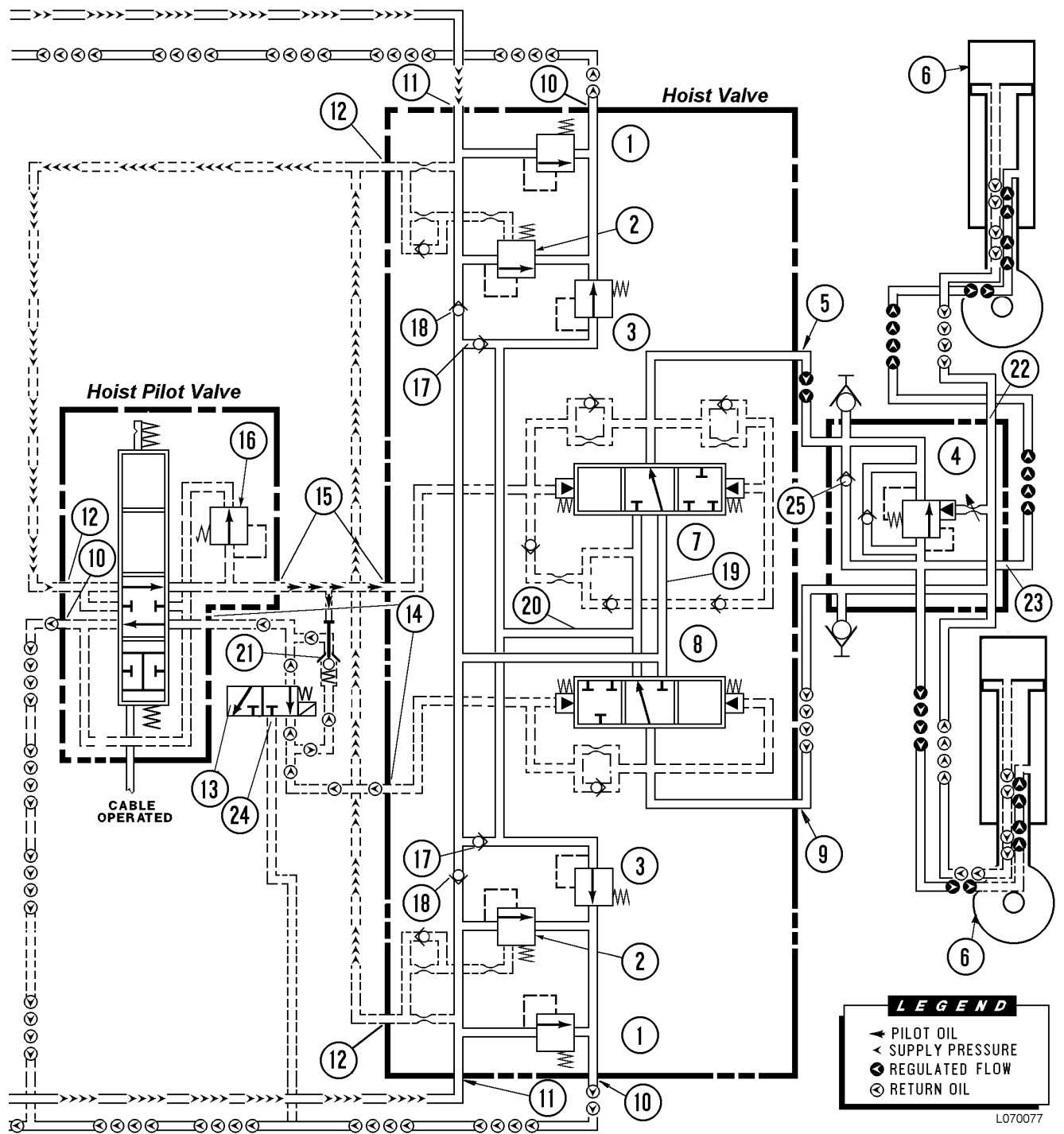


FIGURE 7-10. POWER DOWN

HOIST PILOT VALVE

Removal

1. Place the hoist control lever in the body down position. Make sure the body is in the full down position. Release the hoist control lever to return the hoist valve spool to the FLOAT position.
2. Disconnect hydraulic lines at the hoist pilot valve (1, Figure 8-11). Remove capscrews (4).
3. Loosen and unthread jam nut (7). Unthread sleeve (6) until cotter pin (5) and pin (9) are exposed.
4. Remove cotter pin (5) and pin (9).
5. Remove the hoist pilot valve mounting hardware (10). Remove hoist pilot valve. Refer to hoist pilot valve disassembly for repair instructions.

Installation

1. Place the hoist pilot valve into position on the mounting bracket. Secure valve in place with capscrews (10, Figure 8-11).

2. Position hydraulic lines (2, 13, 14 and 15) over valve ports and assemble fittings. Tighten hydraulic line connections securely.
3. Place hoist control lever in spring-centered position. Adjust pilot valve spool until center-line of cable attachment hole extends 1.16 in. (29.5 mm) from the face of the valve body.
4. Align control cable eye with pilot valve spool hole and insert pin (9). Secure pin in place with cotter key (5).
5. Thread sleeve (6) upward until contact is made with valve body. Move flange (3) into position and secure in place with capscrews (4).
6. Thread jam nut (7) against sleeve (6). Tighten jam nut securely.
7. Start the engine and check for proper hoist operation. Observe for leaks.

Disassembly

1. Thoroughly clean the exterior of the valve. Place the valve in a clean work area for disassembly.
2. Remove machine screw (15, Figure 8-12) seal plate (16), wiper (13) and O-ring (12).

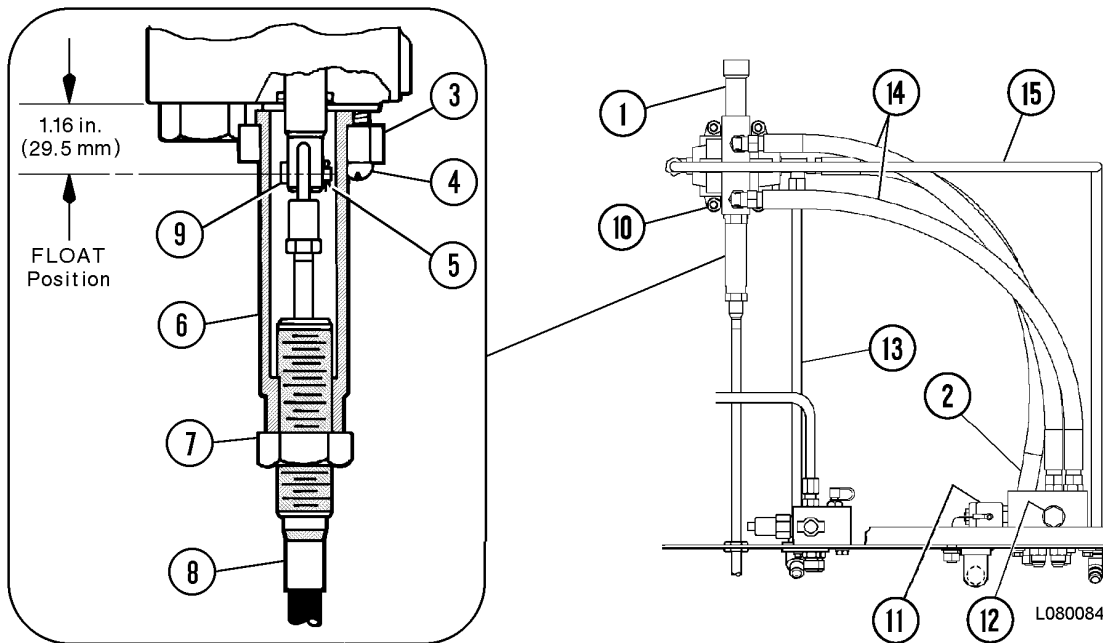


FIGURE 8-11. HOIST PILOT VALVE REMOVAL

- | | | | |
|----------------------|------------------|------------------------------------|--------------------------------------|
| 1. Hoist Pilot Valve | 6. Sleeve | 11. Solenoid Valve (Body Up Limit) | 14. Pilot Pressure to Hoist Valve |
| 2. Hydraulic Lines | 7. Jam Nut | 12. Pilot Operated Check Valve | 15. Supply Pressure From Hoist Valve |
| 3. Flange | 8. Control Cable | 13. Return Line | |
| 4. Capscrew | 9. Pin | | |
| 5. Cotter Pin | 10. Capscrews | | |

Installation of Check Balls and Plugs in Quill

The check balls (4, Figure 8-20) in the side of the quill assembly (2) are held in place with threaded plugs (3).

If a plug is missing and the check ball is not found in the cylinder, the opposite side hoist cylinder and the plumbing leading to the hoist valve should be examined for damage. The hoist valve itself should also be checked to see if the ball or plug has caused internal damage to the spool. Peening of the necked down sections of the spool may result. Spool sticking may also occur under these circumstances.

Refer to Figure 8-21 for SS1158 tool that can be made for installing or removing the check ball plugs.

Plugs should be checked during any cylinder repair to be sure they are tight. If found to have any movement, they should be removed and the ball seat in the quill checked to see if it is deformed.

- If deformation of the ball seat has occurred, the quill should be replaced.
- If the ball seat area is not deformed, measure the plug thickness as shown in Figure 8-20:
Older Plug is 0.25 ±0.02 in. thick.
Newer plug is 0.38 ±0.02 in. thick.

1. Use the newer plugs and make certain threads in quill tube and on plugs are clean and dry (free of oil and solvent).
2. Use Loctite "LOCQUIC" Primer "T" (TL8753, or equivalent), and spray mating threads of both plugs (3, Figure 8-20) and quill assembly (2). Allow primer to dry 3 to 5 minutes.
3. Apply Loctite Sealant #277 (VJ6863, or equivalent) to mating threads of both plugs and quill assembly.
4. Place check balls (4) in quill tube (2) and install plugs (3) with concave side facing ball. Using SS1158 tool, tighten plugs to **70 ft. lbs. (95 N.m)** torque. Allow parts to cure for 2* hours before exposing threaded areas to oil.

* Note: If "LOCQUIC" primer "T" (TL8753) was not used, the cure time will require 24 hours instead of 2 hours.

5. Stake plug threads in two places (between holes) as shown in Figure 8-20 to prevent loosening of plug.

If removal of the plug is necessary in a later rebuild, it will be necessary to carefully drill out the stake marks and destroy the plug. A new plug should be installed and staked as previously detailed.

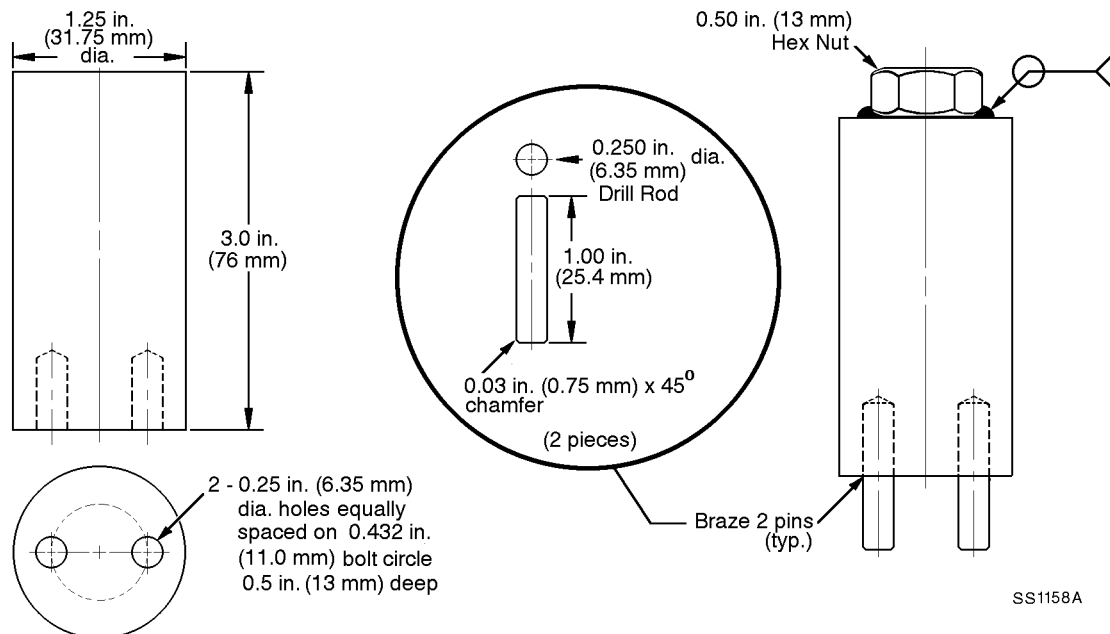


FIGURE 8-21. SS1158 PLUG INSTALLATION/REMOVAL TOOL

ACCUMULATOR BLEED DOWN PROCEDURE

To safely relieve hydraulic pressure in the accumulators while performing leakage tests, follow these steps.

Parts required:

- a. Hose - 1/4" SAE 100R2 (rated at 5,000 psi)
or - 3/8" SAE100R2 (rated at 4,000 psi)
 - b. Two needle valves (rated at 4,000 psi)
 - c. One Tee connector
 - d. One fitting to connect hose to hydraulic tank filler tube.
1. Perform all Preliminary Set-Up steps.
 2. Before performing any tests, with engine OFF and accumulators bled down, attach a hose and needle valve assembly to each accumulator bleed port.
 3. Connect the two hoses (one from each needle valve) together using a tee connector, then connect the remaining hose end to a fitting that screws into the hydraulic tank filler tube (in place of the filler cap).
 4. By opening the needle valves, both accumulators can be bled down and the oil discharged back into the hydraulic tank.

LOW STEERING PRESSURE SWITCH

1. Shut down engine and turn key switch OFF. Wait 90 seconds for steering accumulator to bleed down. Turn steering wheel to be sure no pressure remains.
2. Connect a calibrated 5000 psi (35,000 kPa) pressure gauge to the rear accumulator stem.
3. Start truck and observe at least 3150 psi (21 718 kPa) on gauge before stopping engine. Verify switch closes between pin "b" (COM) and pin "c" (N.O.) when pressure is rising and is between approximately 2239 - 2661 psi (15 437 - 18 347 kPa). If outside this range, replace pressure switch.
4. Observe at least 3150 psi (21 718 kPa) on gauge. Shut engine down using kill switch on center console (not key switch).
5. Slowly bleed off accumulator pressure by opening needle valves in brake cabinet. Observe the pressure value when the Low Steering Pressure warning light and buzzer are activated. Activation range must be within 2300 ± 61 psi (15 858 ± 420 kPa) falling. If outside this range, replace pressure switch.

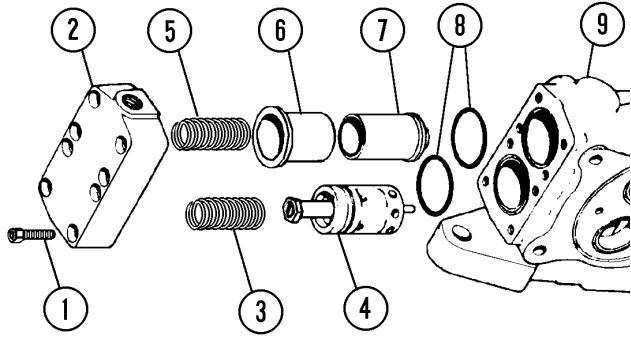


FIGURE 10-11. HOIST RELIEF VALVE

- | | |
|----------------------|------------------------|
| 1. Capscrew | 6. Sleeve |
| 2. Inlet Cover | 7. Low Pressure Relief |
| 3. Spring | 8. O-Rings |
| 4. Main Relief Valve | 9. Inlet Section |
| 5. Spring | |

7. Confirm that the steering/brake pump compensator vent solenoid (4, Figure 10-4) and the steering circuit depressurization solenoid (3, Figure 10-3) were both energized for two seconds then de-energized by watching the gauges connected to steering/brake pump test port "M" and bleeddown manifold test port marked "TEST" (or bleeddown manifold port marked "SWITCH"). When hoist control lever is placed in power up, gauges should show pressure dropping from 3350 psi (23 097 kPa) to below 500 psi (3447 kPa) within 2 seconds, indicating solenoids are energized. Pressure at both gauges should then rise to 2500 ± 100 psi ($17\ 237 \pm 689$), indicating solenoids are de-energized and that steering/brake pump is opened into hoist circuit.
8. If steering/brake pump test port "M" is not at 2500 ± 100 psi ($17\ 237 \pm 689$), the steering/brake pump was not opened into the hoist circuit. Verify correct operation of solenoid valves, and check controller wiring to/from all switches and solenoids. Verify pressure at test port (4, Figure 10-3) for steering-into-hoist solenoid valve controlling pilot-to-open check valve between steering and hoist circuits is between 2400 and 2750 psi (16 547 and 18 961 kPa), which will be the pressure of the oil going into the axle box hydraulic motor. If a problem with the hoist controller is suspected, refer to "Hoist Controller Troubleshooting Procedure".

9. When hoist control lever is released from power up and returned back to hold or float, confirm that the steering/brake pump compensator vent solenoid and the steering circuit depressurization solenoid were both energized for two seconds then de-energized by watching the gauges connected to steering/brake pump test port "M" and bleeddown manifold test port marked "TEST" (or bleeddown manifold port marked "SWITCH"). When hoist control lever is released from power up and returned to hold or float, gauges should show pressure dropping from 2500 psi (17 237 kPa) to below 500 psi (3447 kPa) within 2 seconds, indicating solenoids are energized. Pressure at both gauges should then rise to approximately 3350 psi (23 097 kPa), indicating solenoids are de-energized and that steering/brake pump is blocked from hoist circuit and returned back to steering circuit.

10. Repeat step b, but apply park brake switch instead of brake lock switch.

Steps a, b, c, and d below confirm that the steering/brake pump compensator vent solenoid, steering circuit depressurization solenoid, and steering-into-hoist solenoid (controlling the pilot-to-open check valve) are not energized. Each step below simulates conditions when the steering/brake pump must remain blocked from hoist system and stay dedicated to the steering circuit. These conditions may indicate truck possibly moving (step a), or steering system pressure is too low (step b), or possible switch/wiring failure (steps b, c, d, and e).

- a. Apply neither the brake lock nor the park brake switch. Place hoist control lever in power up, and confirm that the pressure at the hoist filter is 2500 ± 100 psi ($17\ 237 \pm 689$) but the pressure at the steering/brake pump test port "M" remains at 3350 psi (23 097 kPa).
- b. Disconnect the steering pressure switch input to the hoist controller and apply the brake lock switch. Place hoist control lever in power up. Confirm that the pressure at the hoist filter is 2500 ± 100 psi ($17\ 237 \pm 689$) but the pressure at the steering/brake pump test port "M" remains at 3350 psi (23 097 kPa).

SECTION M

OPTIONS AND SPECIAL TOOLS

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ENGINE COOLANT HEATER

To aid in cold weather starting, the truck can be equipped with cooling system heaters. Two high capacity coolant heating units are mounted under the engine on the power module subframe. The system includes:

- Heaters
- Thermostats
- Coolant Shutoff Valves and Hoses
- 220 volt Receptacle
- Power Cables, Thermostat Wiring, and Junction Box

Heater operation is controlled by a thermostat mounted on the intake end of the heating units. The thermostat turns the heater ON at 120°F (48°C) and OFF at 140°F (60°C). Shutoff valves allow heater element or thermostat sensor replacement without loss of engine coolant.

CAUTION

Do not operate engine while the cooling system heater is plugged in. The flow check valve eliminates coolant flow through the heater while the engine is running. This will cause a lack of circulation in the heater and burn out the heating elements.

Maintenance

To check for operation of the heating units, the outlet water hoses should feel warm to the touch.

1. Check all electrical connections to insure proper connections are made.
2. Check for a burned out heating element. (Do not remove heating unit from the truck.)
 - a. Remove the two Phillips head screws and slide end cover out of the way.
 - b. Connect a voltmeter at the two electrical terminals and check for operating voltage (220 to 230 volts) while coolant temperature is below 120°F (48°C). If correct voltage is present, the heating element is defective and should be replaced.
3. If correct voltage (measured above) is not read at heating element terminals, the thermostat is defective and should be replaced.

HEATING ELEMENT

Removal

1. Disconnect the external power source at the plug-in receptacle.
2. Close the shut-off valves located at the inlet and outlet ports.
3. Remove heating element.
 - a. Remove the two Phillips head screws from cover at power cable entry. Slide cover out of the way.
 - b. Disconnect the two electrical leads and remove heating element from the cartridge.

Installation

1. Install new heating element.
 - a. Cover the new heating element threads with an anti-seize thread compound.

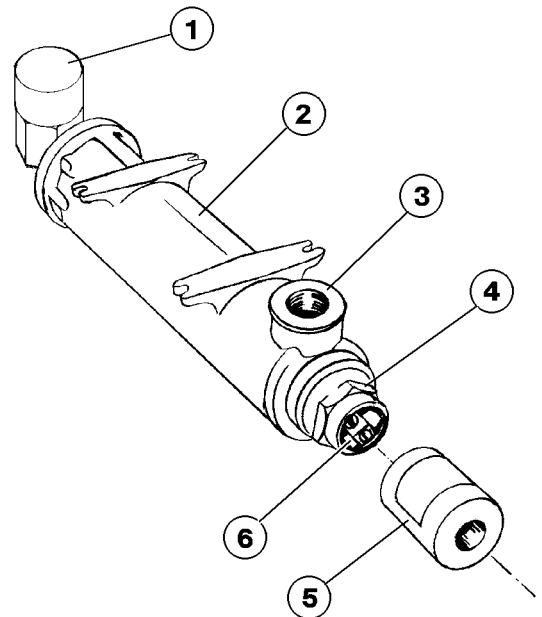


FIGURE 7-1. COOLANT HEATER

- | | |
|----------------------|--------------------|
| 1. Thermostat | 4. Heating Element |
| 2. Heater Assembly | 5. Cover |
| 3. Water Outlet Port | 6. Terminals |

Refrigeration - The Act Of Cooling

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

The Refrigeration Cycle

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

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

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

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

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

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

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

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

Manifold Gauge Set

A typical manifold gauge set (Figure 9-7) has two screw type hand valves to control access to the system, two gauges and three hoses. The gauges are used to read system pressure or vacuum. The manifold and hoses are for access to the inside of an air conditioner, to remove air and moisture, and to put in, or remove, refrigerant from the system. Shutoff valves are required within 12 inches of the hose end(s) to minimize refrigerant loss.

A gauge set for R-134a will have a blue hose with a black stripe for the low side, a red hose with a black stripe for the high side, and a yellow hose with a black stripe for the utility (center) hose. The hoses use a 1/2 in. ACME female nut on the gauge end. Special quick disconnect couplings are normally combined with a shutoff valve on the high and low side hoses. The free end of the center hose contains a 1/2 in. ACME female nut and a shutoff device within 12 inches of the hose end. These special hoses and fittings are designed to minimize refrigerant loss and to preclude putting the wrong refrigerant in a system.

NOTE: When hose replacement becomes necessary, the new hoses must be marked "SAE J2916 R-134a".

Functions of the manifold gauge set are included in many of the commercially available recovery or recovery/recycle stations.

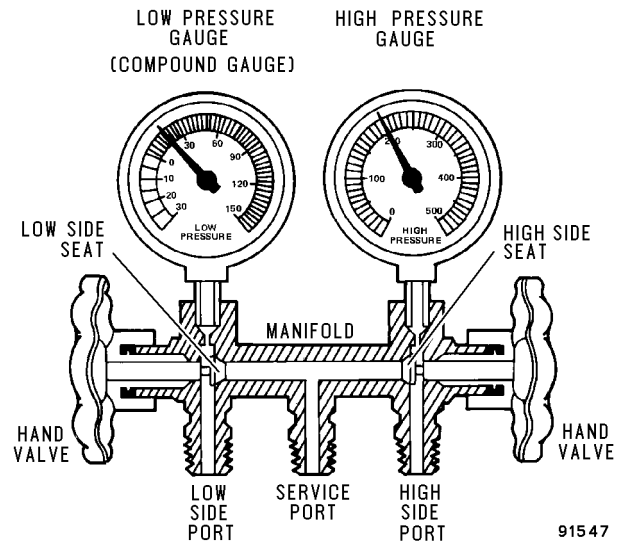


FIGURE 9-7. MANIFOLD GAUGE SET

Low Side Gauge

The Low Side Gauge, registers both vacuum and pressure. The vacuum side of the scale is calibrated from 0 to 30 inches of mercury (in. Hg). The pressure side of the scale is calibrated to 150 psi.



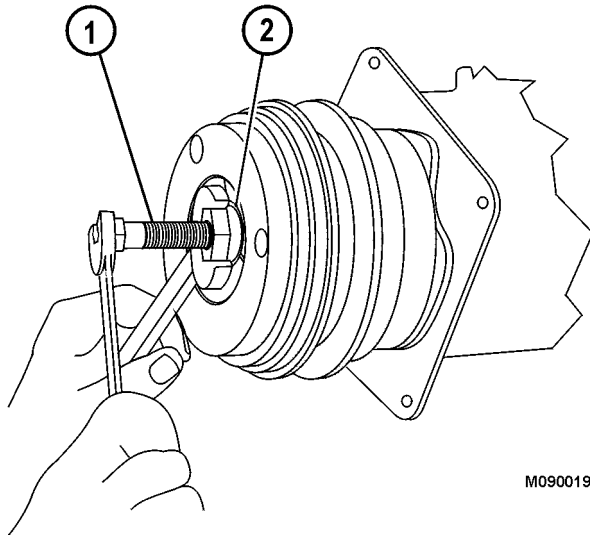
Never open the hand valve to the high side at anytime when the air conditioning system is operating. High side pressure, if allowed, may rupture charging containers and potentially cause personal injury.

High Side Gauge

The High Side Gauge is used to measure pressure only on the discharge side of the compressor. The scale is calibrated from 0 to 500 psi.

Clutch Assembly Installation

1. Insert square key (1, Figure 9-13) into the key-way in the clutch hub. Allow the key to protrude about 4.5 mm (0.18 in.) from the outer edge of the hub. Use petroleum jelly to hold the key in place.



M090019

FIGURE 9-18.

1. Thin Wall Socket
 2. Clutch Hub Holding Tool
 3. Clutch Hub
2. Place the clutch assembly into position on the compressor. Align the square key with the key-way on the shaft.

3. Thread drive plate installer (1, Figure 9-18) onto the shaft of the compressor. Spacer (2) should be in place under the hex nut on the tool.

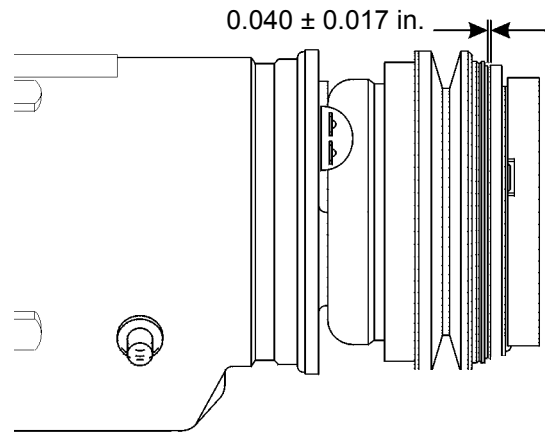


FIGURE 9-19. CLUTCH GAP

4. Press the clutch onto the compressor using installer (1). Continue to press the clutch plate until a 2 mm (0.079 in.) gap remains between the clutch friction surface and the pulley friction surface. Refer to Figure 9-19.

NOTE: The outer threads of installer (J-9480-01) are left handed threads.

5. Install locknut (4, Figure 9-10) and tighten the nut until it seats. The gap should now measure 1.02 ± 0.043 mm (0.040 ± 0.017 in.). If the gap is not within the specification, check for proper installation of the square key.
6. Install the drive belt onto the compressor. Ensure that the proper tension on the belt is attained. Refer to the belt tension chart in the appropriate engine manual for the proper specifications.
7. After assembly is complete, burnish the mating parts of the clutch by operating the air conditioning system at maximum load conditions with the engine at high idle. Turn the air conditioning control ON and OFF at least 15 times for one second intervals.
8. Install the belt guard if no further servicing is required.

PROBLEM: Compressor Malfunction

Indications:

Low side pressure - HIGH
High side pressure - LOW
Compressor operates noisily.

Possible Causes

- Defective reed valves or other internal components.

Suggested Corrective Actions

Repair Procedure: If the belt is worn or loose, replace or tighten it and recheck system performance and gauge readings. If inspection of the compressor is required, all of the refrigerant must be recovered and the compressor disassembled to the point that inspection can be performed. Replace defective components or replace the compressor. If particles of desiccant are found in the compressor, flushing of the system will be required. It will also be necessary to replace the receiver-drier. Always check the oil level in the compressor, even if a new unit has been installed. Rotary compressors have a limited oil reservoir. Extra oil must be added for all truck installations. Tighten all connections and evacuate the system. Recharge the system with refrigerant using a scale. Check system operation and performance.

PROBLEM: Thermostatic Switch Malfunction

Indications:

Low side pressure - Normal
High side pressure - Normal
Low side pressure may cycle within a smaller range as the compressor clutch cycles more frequently than normal. This may indicate the thermostat is set too high.

Possible Causes

- Thermostat malfunctioning possibly due to incorrect installation.

Suggested Corrective Actions

Replace the thermostatic switch. When removing the old thermostat, replace it with one of the same type. Take care in removing and handling the thermostat and the capillary tube that is attached to it. Use care not to kink or break the tube.

Position the new thermostat capillary tube at or close to the same location and seating depth between the evaporator coil fins as the old one. Connect the electrical leads

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Load Calculation

The final load calculation is different from the last swingload calculation. The accuracy of the swingload calculation depends on loading conditions and the position of the truck during loading. The last swingload calculation is not the value recorded in memory as the final load. The final load is determined by a series of calculations made while the truck is traveling to the dump site.

Carry Back

Carry back is calculated as the difference between the current truck tare and the clean truck tare. The clean truck tare is calculated using the PC software. When the suspensions are serviced or changes are made that may affect the sprung weight of the truck, a new clean truck tare should be calculated.

Measurement Accuracy

Payload measurements are typically repeatable within 1%. Accuracy for a particular scale test depends on specific combinations of pressure sensors and payload meters as well as the specifics of each scale test. Comparisons from different scale tests are often made without considering the differences introduced by the specific installation and operation of the scales for each test. In addition, each pressure sensor and payload meter introduces its own non-linearity. Each truck becomes an individual combination of sensors and payload meter. Errors from these sources can introduce up to a $\pm 7\%$ bias in the payload meter calculations for a specific scale test, for an individual truck.

Because the PLMIII calculates a new empty tare for each payload, a detailed scale test must weigh the trucks empty and loaded for each haul cycle. Using a simple average of 2 or 3 empty truck weights as an empty tare for the entire scale test will introduce significant error when comparing scale weights to PLMIII weights.

SOURCES FOR PAYLOAD ERROR

Payload Error

The number one source of error in payload calculation is improperly serviced suspensions. The payload meter calculates payload by measuring differences in the sprung weight of the truck when it is empty and when it is loaded. The sprung weight is the weight of the truck supported by the suspensions. The only method for determining sprung weight is by measuring the pressure of the nitrogen gas in the suspensions. If the suspensions are not properly maintained, the payload meter cannot determine an accurate value for payload. The two critical factors are proper oil height and proper nitrogen charge.

If the suspensions are overcharged, the payload meter will not be able to determine the empty sprung weight of the truck. The suspension cylinder must be able to travel up and down as the truck drives empty. The pressure in an overcharged suspension can push the suspension rod to full extension. In this case, the pressure inside the cylinder does not accurately represent the force necessary to support that portion of the truck.

If the suspensions are undercharged, the payload meter will not be able to determine the loaded sprung weight of the truck. The suspension cylinder must be able to travel up and down as the truck drives loaded. If the pressure in an undercharged suspension cannot support the load, the suspension will collapse and make metal-to-metal contact. In this case, the pressure inside the cylinder does not accurately represent the force necessary to support that portion of the truck.

Low oil height can also introduce errors by not correctly supporting a loaded truck. This is why the correct oil height and nitrogen charge are the most critical factors in the measurement of payload. If the suspensions are not properly maintained, accurate payload measurement is not possible. In addition, suspension maintenance is very important to the life of the truck.

Setting the Truck Type



A screenshot of a software interface showing a dropdown menu labeled "Truck Type". The menu is open, and the selected option is "930E".

1. From the Truck Configuration screen, use the pull-down menu to select the truck type that the payload meter is installed on.
2. Press the "Save Changes" button to program the change into the meter.

Setting the Gauge Display Units

The payload meter speedometer / display gauge displays the speed on the upper display. The units for the speed display are selected using a jumper on the rear of the case.

The payload units on the lower display can be changed from metric to short tons or long tons using the Truck Configuration screen. This selection also switches between metric (kg/cm^2) and psi (lbs/in^2) for the live display of pressure on the gauge.

1. From the Truck Configuration screen, select the payload units to be used on the lower display of the speedometer/display gauge.
2. Press the "Save Changes" button to program the change into the payload meter.

Setting the Frame Serial Number

Frame Serial Number	A950010
Truck Number	T3444
KMS Distributor	RMS
KMS Customer	Pit Mine

The frame serial number is located on the plate mounted to the truck frame. The plate is outboard on the lower right rail facing the right front tire. It is very important to enter the correct frame serial number. This number is one of the key fields used within the haul cycle database. The field will hold 20 alpha-numeric characters.

1. On the Truck Configuration screen, enter the truck frame serial number in the appropriate field.
2. Press the "Save Changes" button to program the change into the payload meter.

Setting the Truck Number

Most mining operations assign a number to each piece of equipment for quick identification. This number or name can be entered in the Truck Number field. It is very important to enter a unique truck number for each truck using the PLMIII system. This number is one of the key fields used within the haul cycle database. The field will hold 20 alpha-numeric characters.

1. On the Truck Configuration screen, enter the truck number in the appropriate field.
2. Press the "Save Changes" button to program the change into the payload meter.

Setting the Komatsu Distributor

This field in the haul cycle record can hold the name of the Komatsu distributor that helped install the system. Komatsu also assigns a distributor number to each distributor. This number is used on all warranty claims. This Komatsu distributor number can also be put into this field. The field will hold 20 alpha-numeric characters.

1. On the Truck Configuration screen, enter the distributor name or number in the appropriate field.
2. Press the "Save Changes" button to program the change into the payload meter.

Setting the Komatsu Customer

This field in the haul cycle record can hold the name of the mine or operation where the truck is in service. Komatsu also assigns a customer number to each customer. This number is used on all warranty claims. This Komatsu customer number can also be put into this field. The field will hold 20 alpha-numeric characters.

1. On the Truck Configuration screen, enter the customer name or number in the appropriate field.
2. Press the "Save Changes" button to program the change into the payload meter.

TROUBLESHOOTING SECTION

TROUBLESHOOTING

Troubleshooting the PLMIII system is done through the PC software you can:

- View active alarms.
- View the sensor inputs using the Real-Time Data Display.
- Test the payload lights.
- Create log files of sensor inputs for further analysis.
- These activities require a connection to the PLMIII system.

Viewing Active Alarms

Active alarms are alarms that have been set, but not yet cleared. Each alarm is set when the conditions for activation are held for 5 seconds. Each alarm is cleared when the condition has been returned to normal range for 5 seconds. For example, 5 seconds after the left-rear pressure sensor is disconnected, the LR-Pressure Lo alarm will be activated. This can be viewed using to the "Connect to Payload Meter" screen. 5 seconds after the pressure sensor is re-connected, the alarm will clear and be recorded in memory.

Active alarms are recorded in memory as "cleared" when the keyswitch is turned off. When power is restored to the payload meter, the alarms will be re-activated if the conditions still exist for 5 seconds.

To view active alarms:

1. Connect to the payload meter and start the PC software.
2. From the main menu, select "Connect to Payload Meter". The PC will request the latest status information from the payload meter.
3. If there are active alarms, the "Display Active Alarms" button in the lower left corner will be available. If the button is not available, there are no active alarms at the time of connection. The screen does not automatically refresh. If a condition changes to cause an alarm, the user must exit and re-enter the "Connect to Payload Meter" screen.

Real-Time Data Display

Pressure	PSI	Truck Status	
Left Front	304	Inclinometer	0.5
Right Front	287	Body Up	No
Left Rear	299	Brake Lock	Off
Right Rear	293	Haul Cycle State	Tare Zone

Speed	MPH	Weight	Short Tons
Truck	20.0	Sprung Weight	107

Lights			
<input type="checkbox"/>	Green Light	<input type="checkbox"/>	Amber Light
<input type="checkbox"/>		<input type="checkbox"/>	Red Light

Buttons: Set FileName, Start Log, Stop Log, Set Lights, Close

The PC software can be used to view the 'live' input readings from the payload meter. The numbers displayed are 1-second averages.

1. Connect to the payload meter and start the PC software.
2. From the main menu, select "Connect to Payload Meter". The PC will request the latest status information from the payload meter.
3. Select the "Real Time Data" button. The data screen will pop up. The PC will request the payload meter to begin transmitting data.
4. To exit, press the "Close" button.

The units for each measurement are determined by the setting in the Program Options for the PC software. The four suspension pressures and inclinometer are shown. The status of the Body-Up and Brake-Lock inputs is also shown. The haul cycle state and speed is displayed. The current sprung weight is displayed. This differs from pure payload. The sprung weight is a measurement of the weight of the truck above the suspension. It does not include the tires, spindles, wheel motors, drive case, or anything below the suspensions.

Testing the Payload Lights

The real time data display also allows the user to individually power the payload lights. This can be useful for testing the lights. To turn on a particular color payload light:

1. Click the check box beside the color light to power.
2. Press the "Set Lights" button to turn on the light.
3. Uncheck the box and press "Set Lights" to turn off the light.

The lights will return to their normal state when the real time data display is closed.

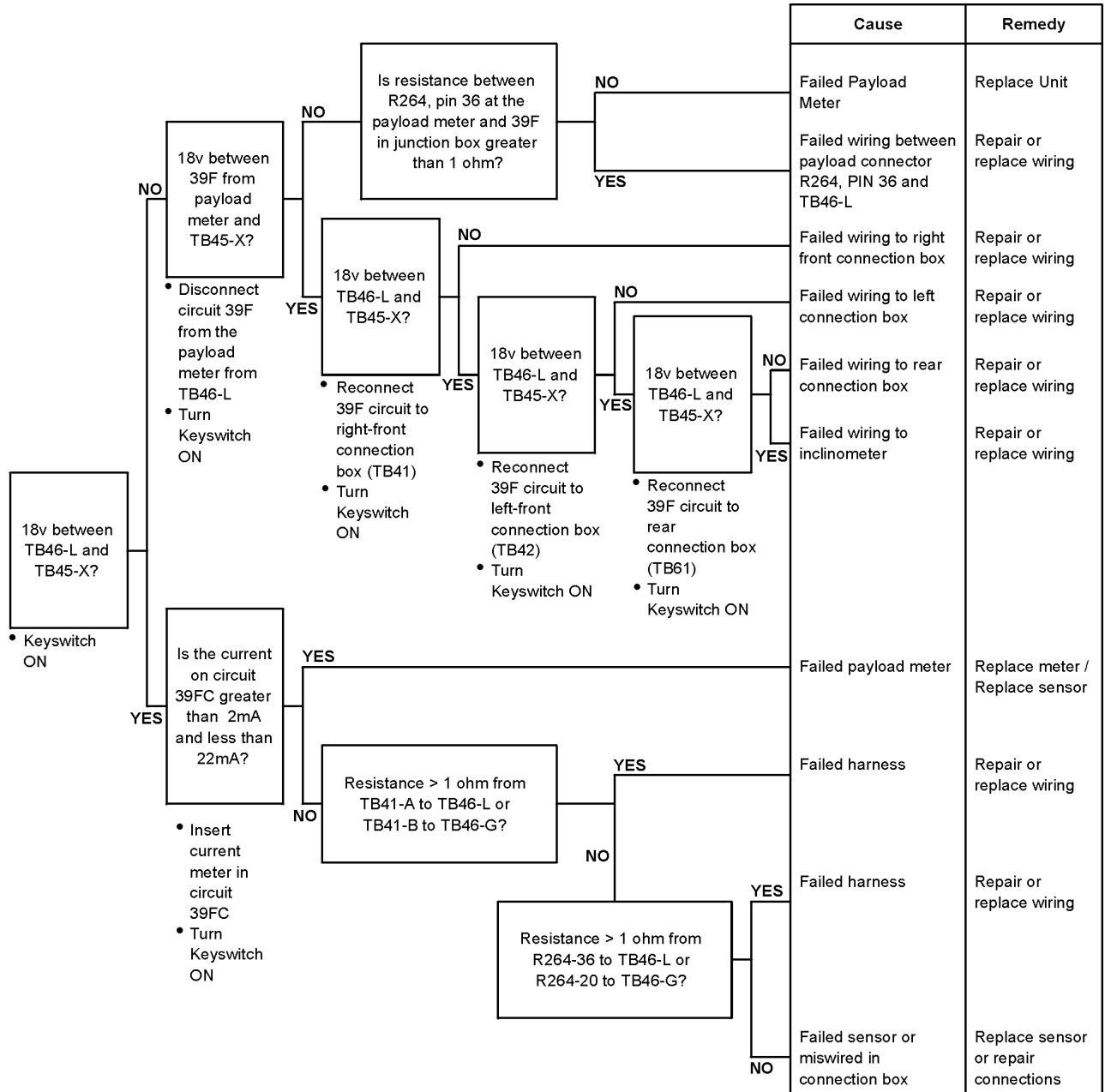
Alarm 3 - Right Front Pressure High

Alarm 4 - Right Front Pressure Low

Troubleshoot Wiring to Right Front Suspension

These alarms indicate that the current being read by the payload meter is higher than 22ma or lower than 2ma. The pressure sensor is designed to output 4-20ma over a pressure range of 4000 psi.

- Confirm 18v sensor supply at TB46-L in payload junction box.
- Confirm proper connection of signal circuit 39FC from right suspension connection box, TB41-B to payload junction box TB46-G to payload meter connector R264, pin 20.



PLMIII CHECK OUT PROCEDURE

General Description

The process consists of attaching dummy loads in place of the suspension pressure sensors and checking the pressures indicated by the payload meter. In addition, connecting to the payload meter using a laptop PC in order to confirm the latest software version and the rest of the inputs and outputs of the system.

Tools Required

- Payload Data Manager software
- EF9160 - Download Harness
- EJ3057 - Harness Str, PLMIII test (4 needed).

Checkout Procedure

1. Attach one EJ3057 harness to the left-front suspension connection box. The red alligator clip attaches to the 39F circuit at TB42-A. The white alligator clip attaches to the 39FD circuit at TB42-B. The EJ3057 acts as a dummy load to simulate a suspension pressure sensor for the payload system.
2. Attach one EJ3057 harness to the right-front suspension connection box. The red alligator clip attaches to the 39F circuit at TB41-A. The white alligator clip attaches to the 39FC circuit at TB41-B.
3. Attach one EJ3057 harness to the left-rear suspension connection in the rear suspension connection box. The red alligator clip attaches to the 39F circuit at TB61-A. The white alligator clip attaches to the 39FB circuit at TB61-C.
4. Attach one EJ3057 harness to the right-rear suspension connection in the rear suspension connection box. The red alligator clip attaches to the 39F circuit at TB61-A. The white alligator clip attaches to the 39FA circuit at TB61-B.
5. In the PLMIII junction box, check the input voltage on circuit 39G between TB45-B and TB45-X. This voltage should be 24vdc from the batteries.
6. Turn the keyswitch ON. The speedometer/display gauge on the dashboard will scroll the truck type across the lower display. The payload meter defaults to 930E.
7. In the PLMIII junction box, check the sensor supply voltage on circuit 39F between TB46-L and TB45-X. This voltage should be 18vdc ± 1 vdc.
8. Return to the cab and check the speedometer/display gauge. The gauge will display the current payload. With the EJ3057 harnesses attached at the sensor locations, the payload should be 0.

NOTE: The display can be used to quickly show the current readings from the four suspension pressure sensors and the inclinometer. This can be used during regularly scheduled service periods to check the state of the suspensions. These displays are live and will update as the values change. The display is changed by pressing the 'SELECT' button on the dashboard. The sequence of displays is:

- PL = Payload
- Id = Operator ID
- TL = Total Shift Tons
- LC = Shift Load Counter
- LF = Left Front Suspension Pressure
- rF = Right Front Suspension Pressure
- Lr = Left Rear Suspension Pressure
- rR = Right Rear Suspension Pressure
- In = Inclinometer

NOTE: The live displays cannot be cleared and the SET button will have no effect.

NOTE: The units for the display are controlled by the configuration of the payload meter. The payload meter defaults to display metric units, the pressures will be displayed in tenths of kg/cm^2 . For example, if the display shows 202 the actual value is $20.2 kg/cm^2$. If the payload meter is set to display short tons, the pressures will be displayed in psi (lbs/in^2). To convert from kg/cm^2 to psi, multiply by 14.2233. $14.2233 psi (lbs/in^2) = 1 kg/cm^2$.

NOTE: The inclinometer displays whole degrees of incline. Positive incline is when front of truck is pointing up.

Tank Fill Control (Optional)

With the reserve oil system the engine oil level is held constant, with only the reserve tank needing routine filling. The fill system automatically controls the filling of remote tank from a convenient ground level position. Filling of the tank to the proper "FULL" level is fast and accurate and accomplished in 2 to 3 minutes.

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 the engine oil has been drained from the engine oil pan, the new oil must be added through the engine fill tube. After an oil change, both engine and reserve tank must be full of oil before starting the engine.

NOTE: DO NOT use the oil in the reserve tank to fill the engine pan.

The system switch (2, Figure 31-3) is an illuminated push-pull POWER ON switch that powers the fill system. The start switch (3) is a momentary push button switch that opens the fill valve mounted on the reserve tank to begin the automatic filling of the reserve tank. Supply oil under pressure flows through the fill valve and into the tank.

Filling Procedure (Remote fill feature)

NOTE: This procedure adds oil to the reserve tank.

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 system switch (2, Figure 31-3) to turn the fill system ON.
3. Push the 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 the FULL light (4) will illuminate.
5. Close the oil supply valve in the fill hose.
6. Press and hold the start switch (3) for a couple of seconds to relieve oil pressure in the line.
7. Disconnect the new oil supply hose.
8. Push switch (2) in to turn fill system power OFF.

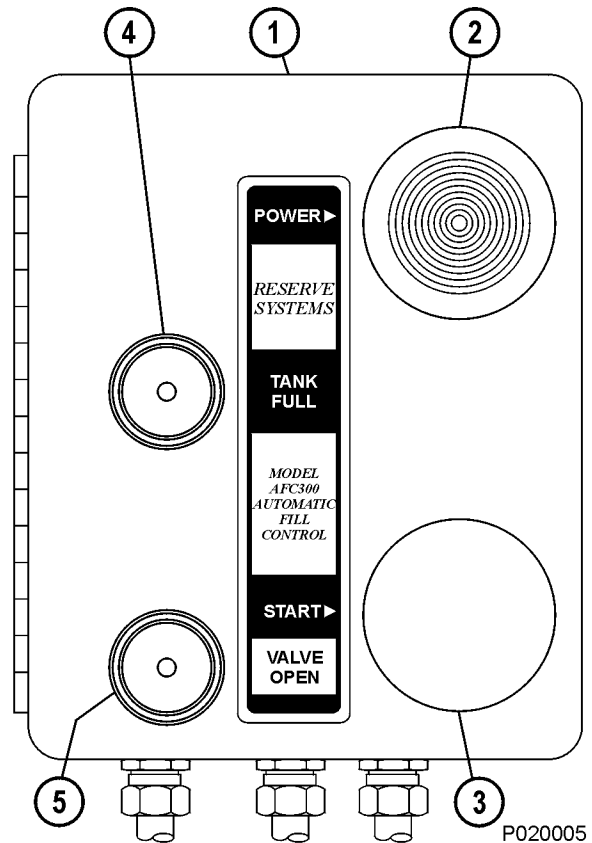


FIGURE 31-3. RESERVE OIL TANK REMOTE FILL

- | | |
|-----------------------|-----------------------|
| 1. Remote Control Box | 4. "Full" Light |
| 2. System Switch | 5. "Valve Open" Light |
| 3. Start Switch | |

3. Hold a piece of paper such as a dollar bill between where the door seal (4) will hit the skin of the cab and firmly close the door ensuring that it latches on the second catch. (The door latch mechanism has a double catch mechanism.)
4. The door seal should firmly grip the paper all along the top, front, and bottom edge of the door. If the paper is loose all around, REPEAT STEP 2. If the paper is firmly gripped, but can be removed without tearing it, open door and tighten the jamb bolt completely without affecting the adjustment.
5. If the paper slips out from the door seal easily along the top and not at the bottom, the door itself will have to be "adjusted". Or if the paper slips out easier at the bottom than at the top, the door will have to be "adjusted".

- If seals are tight at bottom of door, but not at top, place a 4 x 4 block of wood at the bottom edge of the door, below the handle. Close the door on the wood block and press firmly inward on the top corner of the door. Press in one or two times, then remove the wood block and check seal tension again using the paper method. Seal compression should be equal all the way around the door. If seal is still loose at the top, repeat procedure again until seal compression is the same all the way around.
- If seal compression is greater at the top than at the bottom of the door, place a 4 x 4 block of wood at the top corner of the cab door. Then press firmly inward on the lower corner of the door. Press in one or two times, then remove the wood block and check seal compression again. Seal compression should be equal all the way around the door. If seal is still loose at the bottom, repeat procedure again until seal compression is uniform all the way around.

Step B. If the door bucks back when trying to close it, the striker bolt (2, Figure 2-4) has probably loosened and slipped down from where the catch can engage with the bolt.

1. Open the door and close both claws (3 & 5, Figure 2-4) on the catch until they are both fully closed.
2. Transfer the center of this opening onto the skin of the cab nearest where the door jamb bolt is located. Use a T-square or other measuring equipment and mark on the cab with a pencil.

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

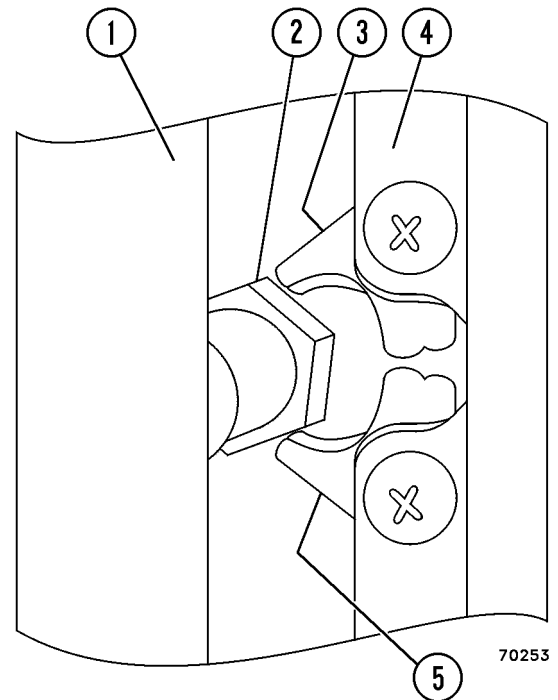


FIGURE 2-4. DOOR JAMB BOLT ADJUSTMENT

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

3. Loosen and vertically align (center) the door jamb bolt with this mark and tighten it firmly enough to hold it in place but still allow some slippage.
4. Carefully try to close the door (4) and determine if this has helped the "bucking" problem. If the door latches but not firmly enough, follow procedures listed previously in "Step A". If the door latch does not catch, move the bolt outwards and try again. When corrected, follow adjustment procedures listed in "Step A" to ensure a good seal. By design, if both seals are in good condition, proper adjustment of the outside seal will ensure good contact on the inside seal to prevent dust and moisture from entering the cab.

Installation

1. If the weatherstrip material previously removed is broken, weathered, or damaged in any way, use new rubber weatherstrip material.

NOTE: Using a non-oily rubber lubricant on the weatherstrip material and cab opening will make the following installation easier:

- a. Install the weatherstrip around the opening in the cab for the glass. Start with one end of the weatherstrip at the center, lower part of the window opening and press the weatherstrip over the edge of the opening.
- b. Continue installing weatherstrip while going all the way around the opening. When the ends of the weatherstrip meet at the starting point at the lower, center area of the window opening, there must be 0.5 in. (12.7 mm) of overlapping material.

NOTE: The ends of the weatherstrip material need to be square-cut to assure a proper fit.

- c. Lift both ends so that they meet squarely, then while holding ends together, force them back over the lip of the opening.
2. Lubricate the groove of the weatherstrip where the glass is to be seated.
 - a. Lower the glass into the groove along the bottom of the opening.
 - b. Two people should be used for glass installation. Have one person on the outside of the cab and push in on glass against opening, while the person inside uses a soft flat tool (plastic knife) and goes around the glass to work the weatherstrip over the edge of the glass.

3. After the glass is in place, go around the weatherstrip and push in on the locking lip (2, Figure 2-18 or 2-19) to secure the glass in the weatherstrip.

4. If windshield was being replaced, lower windshield wiper arms/blades back to the glass.

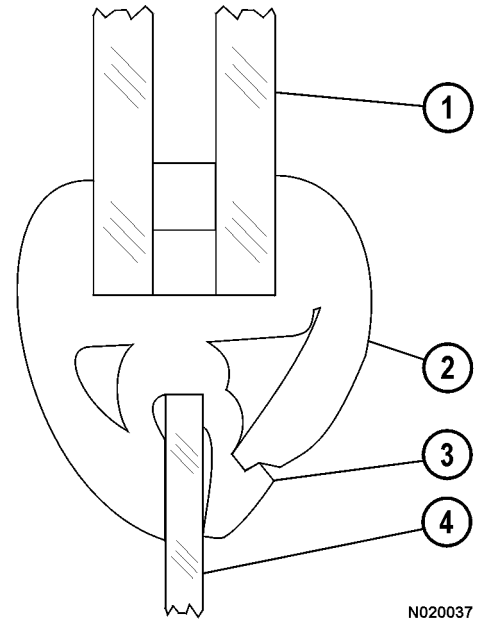
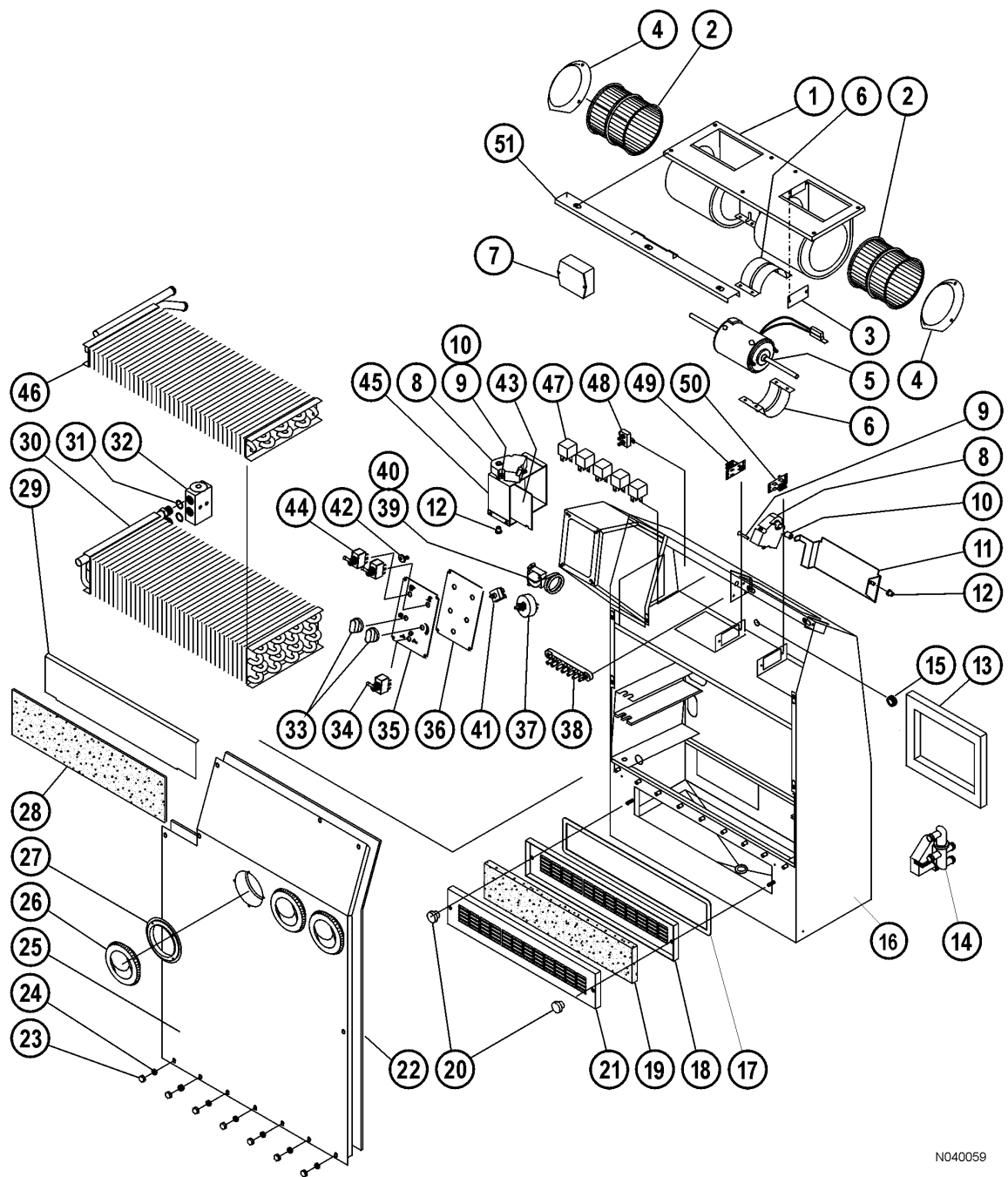


FIGURE 2-19. Rear Window

- | | |
|----------------|--------------------------|
| 1. Glass | 3. Weatherstrip Material |
| 2. Locking Lip | 4. Sheet Metal |



N040059

FIGURE 4-4. HEATER/AIR CONDITIONER ASSEMBLY

- | | | | |
|------------------------|---------------------|----------------------------|----------------------------|
| 1. Blower Housing | 13. Foam | 26. Louver | 39. Thermostat |
| 2. Blower Wheel | 14. Heater Valve | 27. Louver Adapter | 40. Hose |
| 3. Cover Plate | 15. Grommet | 28. Foam | 41. Switch, Blower |
| 4. Venturi | 16. Casing | 29. Plate, Coil | 42. Screw |
| 5. Motor, 24V | 17. Gasket | 30. Evaporator Core | 43. Discharge Flapper |
| 6. Motor Mount | 18. Filter Holder | 31. O-Ring | 44. Toggle Switch (2 pos.) |
| 7. Converter (24V-12V) | 19. Air Filter | 32. Expansion Valve | 45. Bracket, Flapper |
| 8. Actuator Motor | 20. Knob | 33. Knob | 46. Heater Core |
| 9. Screw | 21. Filter Holder | 34. Toggle Switch (3 pos.) | 47. Relay (12V) |
| 10. Spacer | 22. Foam Insulation | 35. Overlay | 48. Circuit Breaker |
| 11. Defrost Flapper | 23. Nut | 36. Plate, Control | 49. Resistor (12 Volt) |
| 12. Snap Bushing | 24. Flatwasher | 37. Potentiometer | 50. Resistor (24 Volt) |
| | 25. Cover | 38. Block, Junction | 51. Retainer, Blower |

When the throttle pedal is released and the RSC switch is ON, dynamic retarding will activate at, or above, the RSC dialed speed and will adjust truck speed to maintain, the dialed speed.

With the RSC switch ON and the dial adjusted, the truck will operate as follows:

As truck speed increases to the “set” speed and throttle pedal released, dynamic retarding will apply. As truck speed tries to increase, the amount of retarding effort will automatically adjust to keep the selected speed. When truck speed decreases, the retarding effort is reduced to maintain the selected speed. If truck speed continues to decrease to approximately 3 mph (4.8 kph) below “set” speed, Dynamic Retarding will turn off automatically. If truck speed must be reduced further, the operator can turn the Adjust Dial to a new setting or depress the foot operated retard pedal.

If the operator depresses the foot operated retard pedal and the retard effort called for is greater than that from the automatic system, the foot pedal retard will override RSC.

RSC Control Adjustment

While operating truck at desired maximum speed:

1. Rotate RSC dial (12) clockwise to fastest speed.
2. Pull RSC switch (11) out to engage system.
3. Reduce throttle, allowing truck to coast.
4. Rotate RSC dial counterclockwise until dynamic retarding is activated.

Dynamic retarding will now be activated automatically whenever the “set” speed adjusted in the above steps is reached, provided the RSC switch is ON and the throttle pedal is released.

STATEX III PROPULSION SYSTEM DIAGNOSTIC CONNECTOR

This 9-pin connector (13, Figure 5-5) is for use by qualified personnel to access G.E. STATEX III electric propulsion diagnostic information and data. Refer to Section “E” for additional information.

MODULAR MINING PORT CONECTOR

This connector (15, Figure 5-5) location is used if the optional Modular Mining System is installed on the truck.

UNUSED CONNECTOR

This connector (18, Figure 5-5) location is not used for this model truck.

KOMATSU ENGINE QUANTUM CONNECTOR

This connector (17, Figure 5-5) is for use by qualified personnel to access engine diagnostic information for the QUANTUM system. Refer to engine manufacturer’s publications for troubleshooting information.

KOMATSU ENGINE CENSE CONNECTOR

This 3-pin connector (14, Figure 5-5) is for use by qualified personnel to access engine diagnostic information for the CENSE system. Refer to engine manufacturer’s service publications for troubleshooting information.

DATA STORE BUTTON

This button (19, Figure 5-5) is for use by qualified maintenance personnel to record in memory a “snapshot” of the Statex III drive system.

PASSENGER SEAT

The passenger seat (16, Figure 5-5) is mounted on top of the right hand portion of the Center Console structure.

The area beneath the passenger seat provides a cabinet for various 24 VDC electrical components. Refer to Section “D” for service involving any of these components.

SERVICE ENGINE LIGHT (Blue)

The service engine light (20, Figure 5-5) will illuminate if a problem is detected by the electronic engine monitoring system. Electric propulsion and dynamic retarding will still be available.



If this light is on, notify maintenance personnel so they can diagnose and repair the problem the next time the truck is in the shop for repairs or at the next PM (Preventative Maintenance) interval.

PAYLOAD METER (NOT SHOWN)

The Payload Meter and Download Connector (located on the back wall behind the passenger seat) is used to provide management with operational data such as tonnage hauled and cycle times. Refer “Optional Equipment”, for a more complete description of the payload meter and its functions.

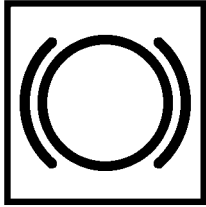
A3. Parking Brake

The AMBER parking brake indicator will illuminate when the parking brake is applied. Do not attempt to drive the truck with the parking brake applied.



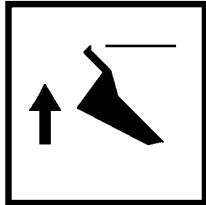
B3. Service Brake

The AMBER service brake indicator light will illuminate when the service brake pedal is applied or when the wheel brake lock or emergency brake is applied. Do not attempt to drive truck from stopped position with service brakes applied.



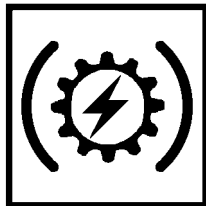
C3. Body Up

The AMBER body up indicator, when illuminated, shows that the body is not completely down on the frame. The truck should not be driven until body is down and the light is off.



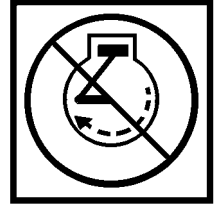
D3. Dynamic Retarding

The AMBER dynamic retarding indicator light illuminates when the retarder pedal is operated, RSC (Retard Speed Control) is activated, or the automatic overspeed retarding circuit is energized, indicating the dynamic retarding function of the truck is operating.



E3. Stop Engine

The RED engine monitor warning light will illuminate if a serious engine malfunction is detected in the electronic engine control system.



- Electric propulsion to the wheel motors will be discontinued and maximum engine speed will be reduced to 1250 RPM.
- Dynamic retarding will still be available to slow the truck.

⚠ WARNING

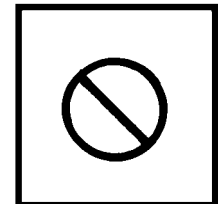
If this lamp illuminates, the operator should stop the truck as quickly as possible in a safe area, apply the parking brake.

SHUT DOWN THE ENGINE IMMEDIATELY. Additional engine damage is likely to occur if operation is continued.

Listed below are a few conditions that could cause the Stop Engine light to illuminate:

- Low Oil Pressure - red warning light will illuminate, but engine does not shut down.
- Low Coolant Level - red warning light will illuminate, but engine does not shut down.
- Low Coolant Pressure - red warning light will illuminate, but engine does not shut down.
- High Coolant Temperature - red warning light will illuminate, but engine does not shut down.

A4. Blank (Reserved for future use)



AUTOMATIC LUBRICATION SYSTEM

GENERAL DESCRIPTION

The Lincoln Automatic Lubrication System is a pressurized lubricant delivery system which delivers a controlled amount of lubricant to designated lube points. The system is controlled by an electric timer which signals a solenoid valve to operate a hydraulic motor powered grease pump. Hydraulic oil for pump operation is supplied by the truck steering circuit.

Grease output is proportional to the hydraulic motor input flow. A pump control manifold mounted on top of the hydraulic motor (3, Figure 3-1), controls input flow and pressure. A 24VDC Solenoid (5) mounted on the manifold turns the pump on and off.

The pump is driven by the rotary motion of the hydraulic motor, which is then converted to reciprocating motion through an eccentric crank mechanism. The reciprocating action causes the pump cylinder to move up and down. The pump is a positive displacement, double-acting type as grease output occurs on both the up and the down stroke.

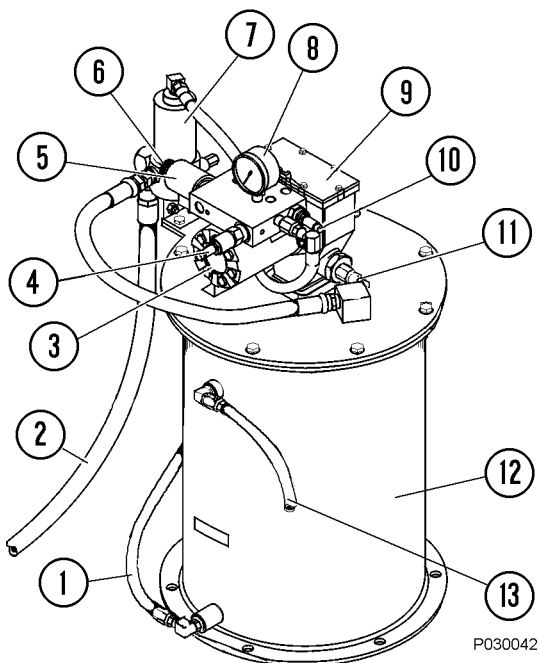


FIGURE 3-1. PUMP COMPONENTS

- | | |
|----------------------------|------------------------|
| 1. Hose From Filter | 7. Vent Valve |
| 2. Outlet to Injectors | 8. Pressure Gauge |
| 3. Hydraulic Motor | 9. Pump Assembly |
| 4. Pressure Reducing Valve | 10. Flow Control Valve |
| 5. Solenoid Valve | 11. Pressure Switch |
| 6. Manual Override | 12. Grease Reservoir |
| | 13. Vent Hose |

During the down stroke, the pump cylinder is extended into the grease. Through the combination of shovel action and vacuum generated in the pump cylinder chamber, the grease is forced into the pump cylinder. Simultaneously, grease is discharged through the outlet of the pump. The volume of grease during intake is twice the amount of grease output during one cycle. During the upstroke, the inlet check valve closes, and one half the grease taken in during the previous stroke is transferred through the outlet check and discharged to the outlet port.

WARNING

Over-pressurizing of the system, modifying parts, using incompatible chemicals and fluids, or using worn or damaged parts, may result in equipment damage and/or serious personal injury.

- * **DO NOT exceed the stated maximum working pressure of the pump, or of the lowest rated component in the system.**
- * **Do not alter or modify any part of this system unless approved by factory authorization.**
- * **Do not attempt to repair or disassemble the equipment while the system is pressurized.**
- * **Make sure all fluid connections are securely tightened before using this equipment.**
- * **Always read and follow the fluid manufacturer's recommendations regarding fluid compatibility, and the use of protective clothing and equipment.**
- * **Check all equipment regularly and repair, or replace, worn or damaged parts immediately.**

This equipment generates very high grease pressure. Extreme caution should be used when operating this equipment as material leaks from loose or ruptured components can inject fluid through the skin and into the body causing serious bodily injury including possible need for amputation. Adequate protection is recommended to prevent splashing of material onto the skin or into the eyes.

If any fluid appears to penetrate the skin, get emergency medical care immediately! Do not treat as a simple cut. Tell attending physician exactly what fluid was injected.

PUMP REBUILD



Be certain to bleed steering accumulators to relieve hydraulic pressure and to relieve pump outlet grease pressure before removing any hoses or fittings.

Disassembly

1. Remove the four socket head screws (33, Figure 3-9) and separate the manifold (37) from the hydraulic motor (42).
2. Remove pipe plug (45) and drain the crankcase oil from pump housing (46).
3. Remove the six screws (29) and remove the housing cover (30) and cover gasket (31).
4. Remove retaining ring (57) and pull the shovel plug (56) from the housing tube (55).
5. Remove two socket head screws (44) and separate hydraulic motor (42) from the pump housing (46).
6. Remove two outlet pin nuts (50) from pump housing.
7. Remove the pump subassembly (1 through 28) from the pump housing. Pushing the subassembly up with a 0.75 in. (19 mm) diameter wooden or plastic rod against the check seat housing (28) is helpful.
8. Remove the housing tube (55) from the pump housing by inserting a 0.75 in. (19 mm) diameter rod through the inlet holes at the bottom of the housing tube and unscrewing it.
9. Remove the bronze bearing (51), O-ring (52), backup washer (53), and O-ring (54) from the housing tube.
10. Remove the crankrod assembly (1 through 8) from the pump by unscrewing the button head screws (12) and then pulling out the wrist pin bushings (13).
11. Remove the check seat housing (28) from the reciprocating tube (21).

Note: There is a 3/8 in. allen head socket in the throat of the check seat housing to facilitate removal.

12. Unscrew the wrist pin anchor (14) from the reciprocating tube (21) and pull the plunger assembly (9 through 20) from the tube.

13. Using a 0.50 in. (13 mm) diameter wooden or plastic rod, push the cup seal (22) and the pump cylinder (24) from the reciprocating tube.
14. Remove the pump plunger (20) from the plunger link rod (17). (A spanner wrench, which uses the holes in the pump plunger, is required.)
15. Unscrew the plunger link rod (17) from the plunger tube (11) and slide off the cup seal (16) backup washer (15) and wrist pin anchor (14).
16. Unscrew the plunger tube (11) from the outlet pin (9).
17. To dismantle the crankrod assembly (1 through 8), remove flat head screws (1) and the inner and outer weights (2 & 3).
18. Remove the small retaining rings (6) and press the crank eccentric (7) out of the ball bearing (8). Be sure to support the ball bearing on the inner race.

Cleaning and Inspection

1. Discard all seals and gaskets. Repair kits are available containing all the necessary seals and gaskets for reassembly. Refer to the appropriate truck parts book.
2. Clean and inspect the following parts. Replace if excessive wear is evident:
 - Ball bearing (8)
 - Crank eccentric (7)
 - Crankrod (5)
 - Wrist pin bushings (13)
 - Plunger tube (11)
 - Pump plunger & upper check parts (20, 19 & 18)
 - Pump cylinder (24)
 - Check seat housing/lower check ball (28, 26)
 - Upper bronze bushing (51)
 - Housing tube (55)
 - Shovel plug (56)
 - Reciprocating tube (21)

MOTOTIZED WHEEL MAINTENANCE SCHEDULE

GENERATOR / ALTERNATOR

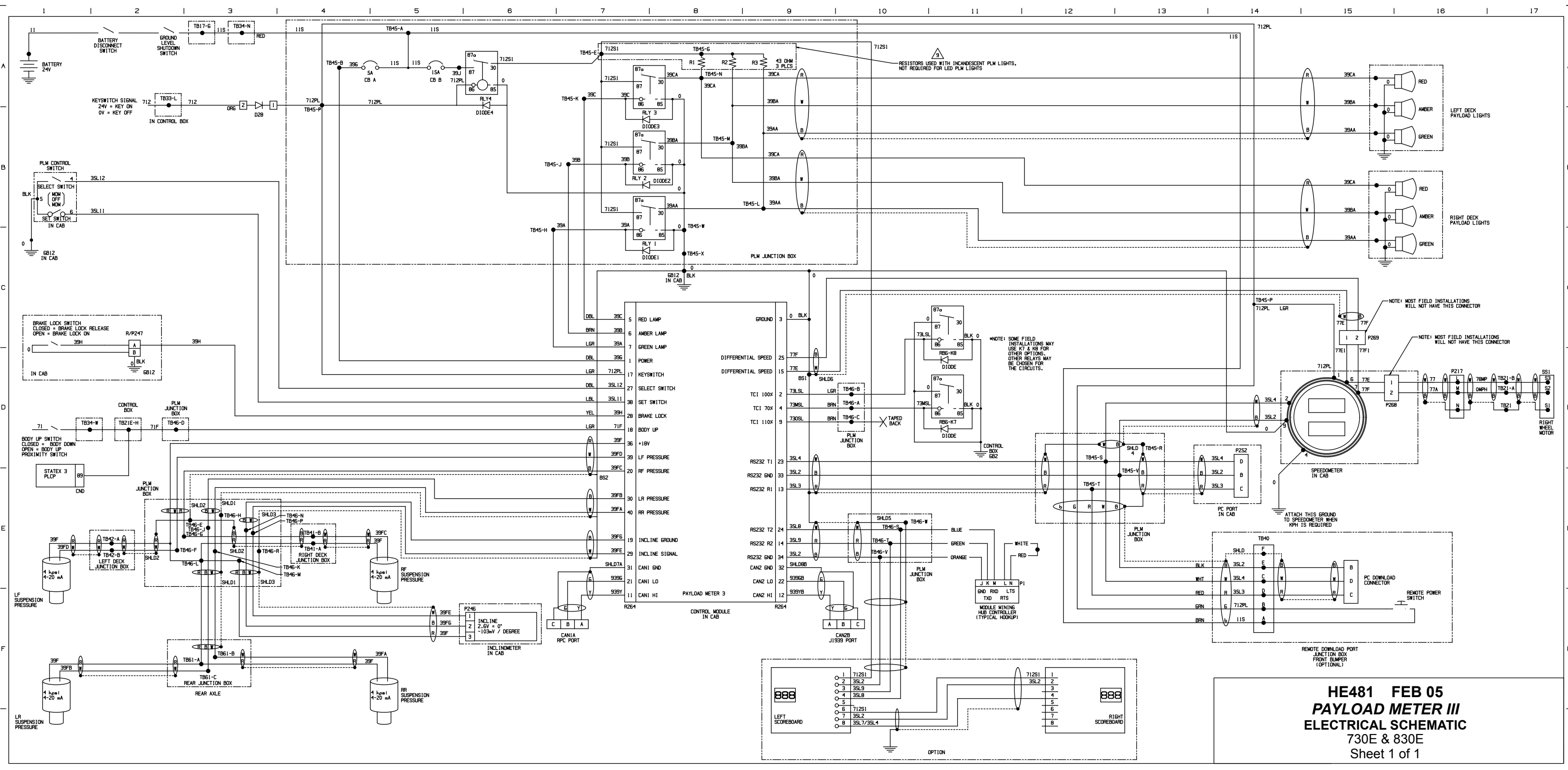
CONTROL MAINTENANCE SCHEDULE	P.M. HOURS	
	250	500
WORK TO BE DONE		
Brush length, condition, free moving.	X	X
Brushholder condition, spacing tension	X	X
Commutator / slip ring condition, film, etc.	X	X
Clean string / Teflon band.	X	X
Check all connections; tightness, burning, etc.	X	X
Blow out commutator.	X	X

GRID BLOWER MOTOR

CONTROL MAINTENANCE SCHEDULE	P.M. HOURS	
	250	500
WORK TO BE DONE		
Brush length, condition, free moving.		X
Brushholder condition, spacing tension		X
Commutator condition, film, etc.		X
Clean string / Teflon band.		X
Check all connections; tightness, burning, etc.		X
Check cables for abrasion and burning		X
Blow out commutator area with clean dry air, 70 psi (482 KPa) maximum.		X
		X

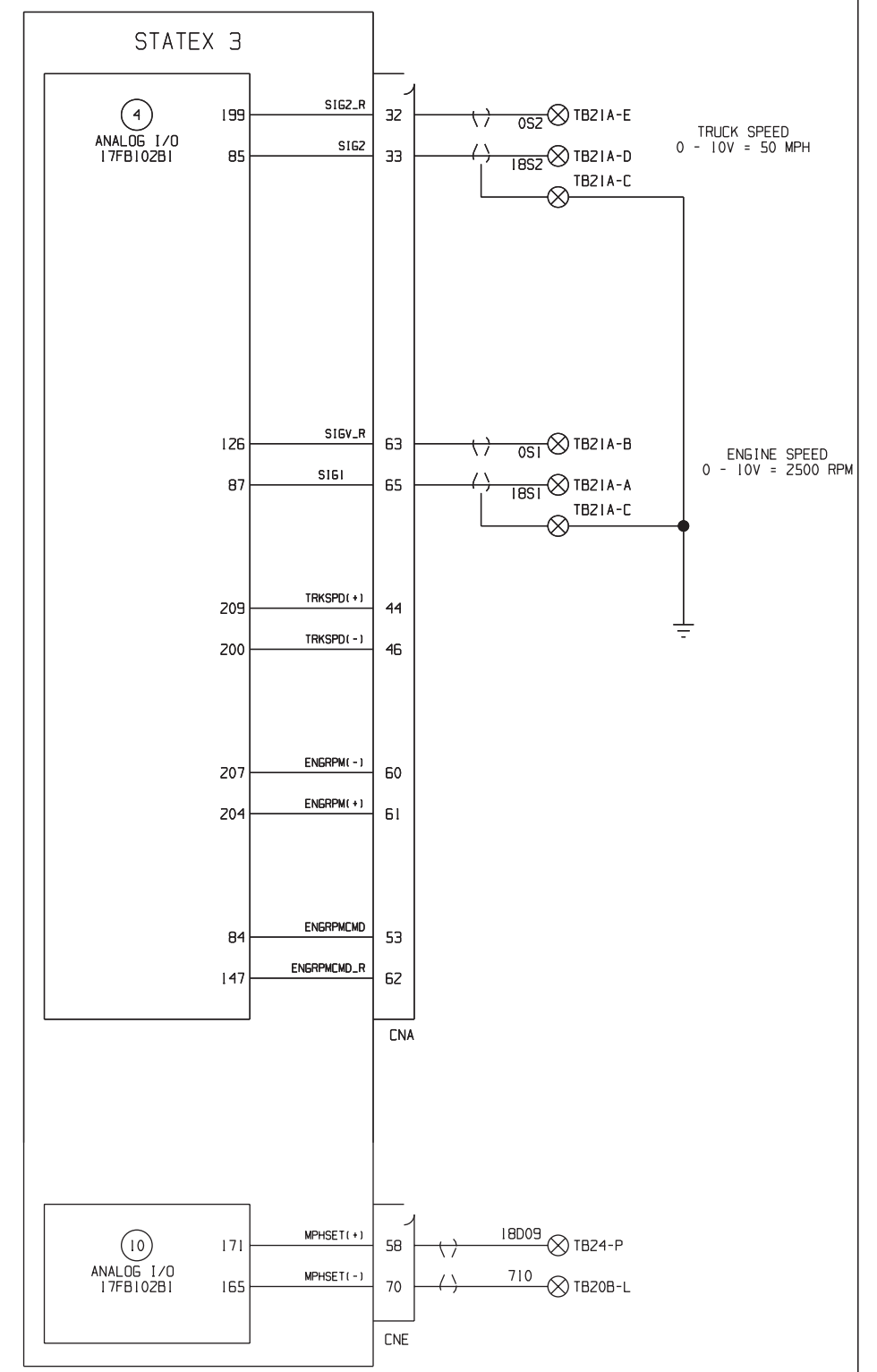
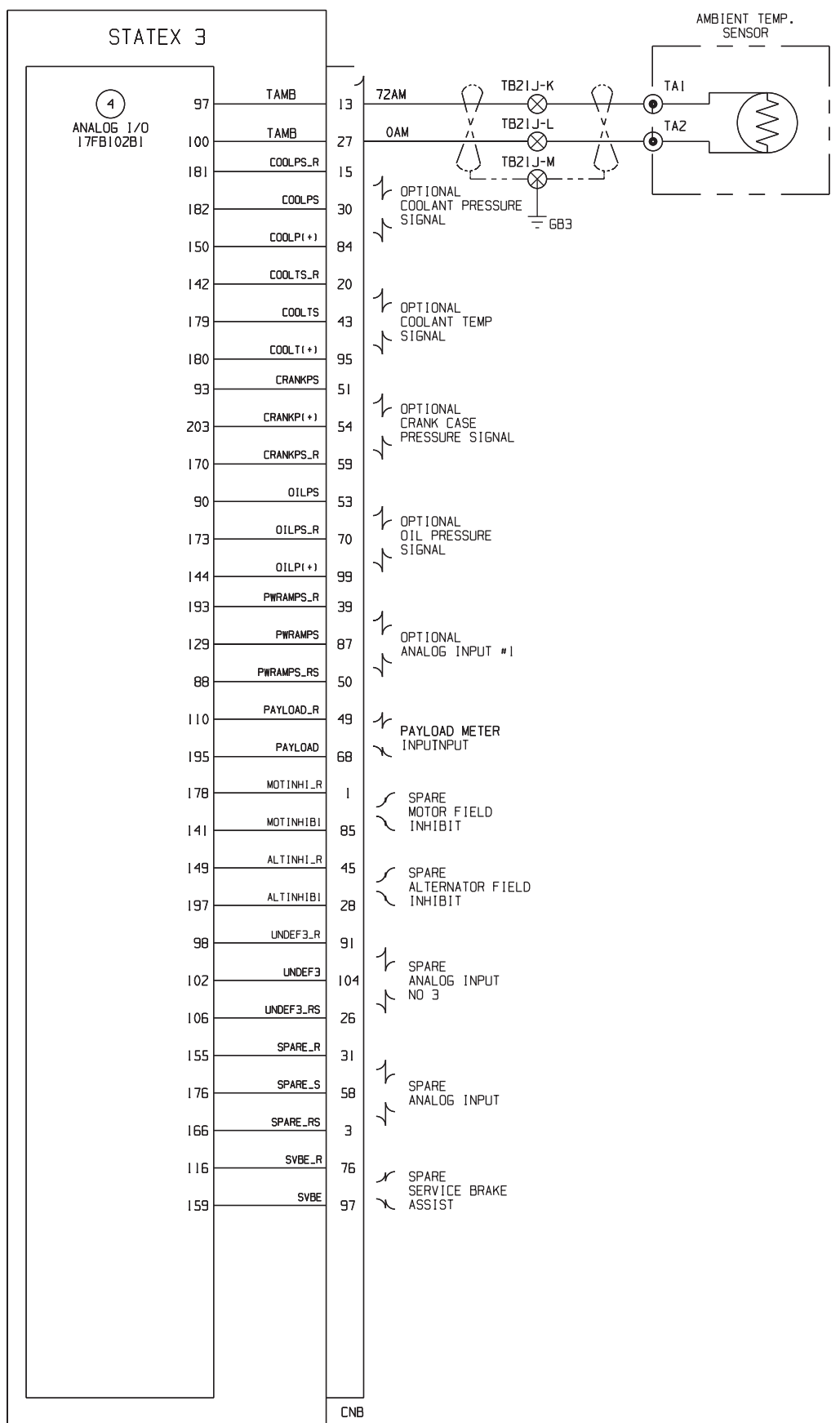
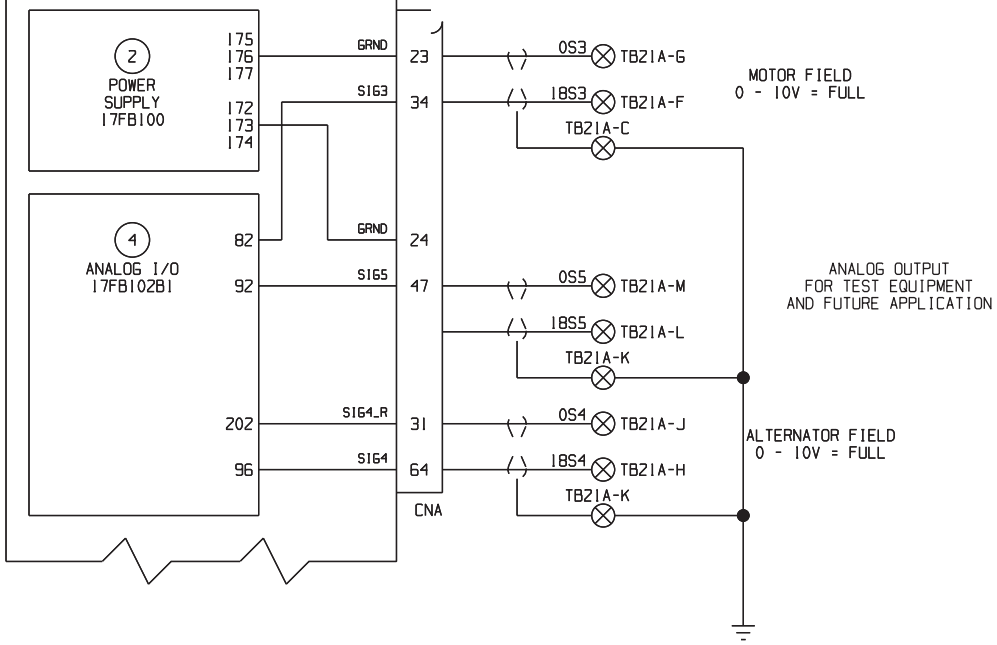
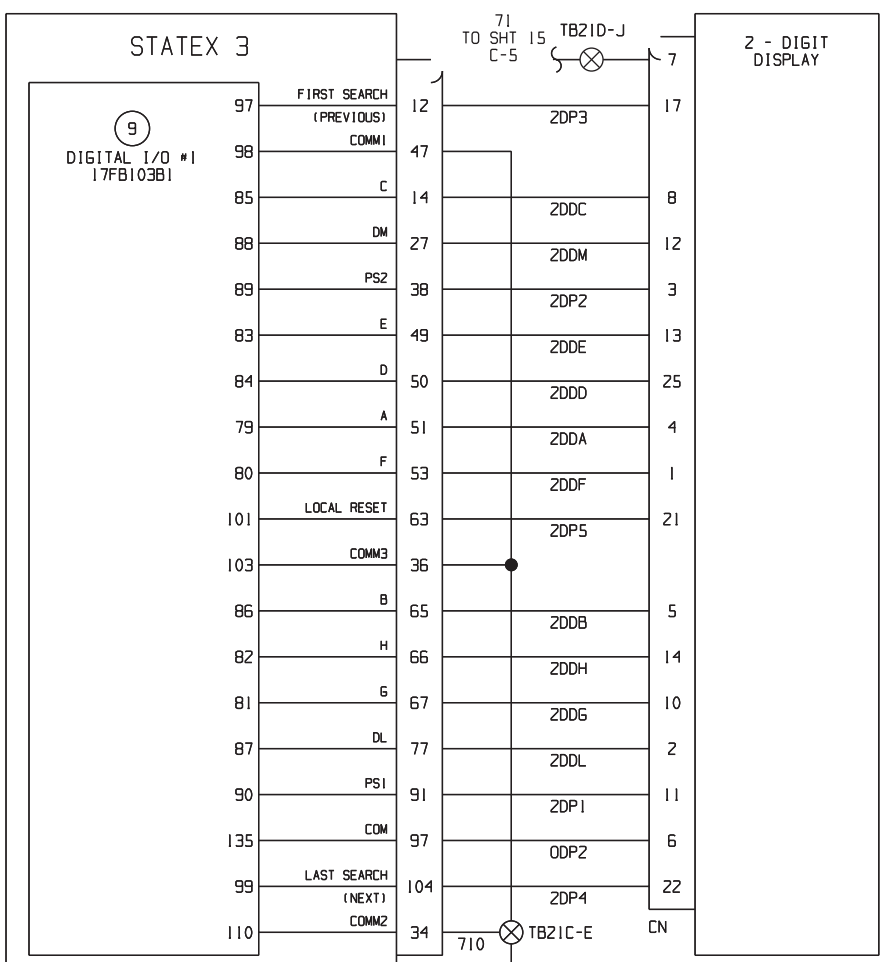
CONTROL EQUIPMENT CHECKS

CONTROL MAINTENANCE SCHEDULE	P.M. HOURS	
	250	500
WORK TO BE DONE		
Vacuum the control cabinet.	X	X
Check all electrical connections for tightness.	X	X
Check current shunts for tightness, discoloration.	X	X
Check insulators, terminal strips, springs, etc. for breaks or cracks.	X	X
Check reverser contactors, interlocks and relays for top wear, burning, tip break, overtravel, tip pressure and frayed, broken or discolored shunts.	X	X
Check magnet valves for leaks.	X	X
Check condition of arc chutes.	X	X
Check door seal and latch.	X	X



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