

Shop Manual

830E

DUMP TRUCK

SERIAL NUMBERS **A30607 - A30624**

KOMATSU®

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SPECIFICATIONS

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

ENGINES -

MTU/DDC 16V4000 Series

Number of Cylinders	16
Operating Cycle	4- Stroke
Rated Brake HP	2500 HP (1887 kW) @ 1900 RPM
Flywheel HP	2409 HP (1818 kW) @ 1900 RPM
Weight* (Dry)	15,835 pounds (7183 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 m ³ /min)
Motorized Wheels	General Electric 787
Ratio	28.125:1
Maximum Speed*	35.3 MPH (56.9 km/h)
(*w/40.00-57 Tires and 28.125:1 gear train)	

DYNAMIC RETARDING

Extended Range Retarding With Fully Blown 18-Resistor Grids and Reverse Retarding Standard	
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	
Battery Charging Alternator	
. 24 Volt, 240 Ampere Output	
Lighting	24 Volt
Starters	(2) Delco-Remy 24 Volt

SERVICE CAPACITIES

	U.S. Gallons (Liters)	
Crankcase *	66.0	250.0
* Includes Lube Oil Filters		
Cooling System	150	568
Fuel	1200	4543
Hydraulic System	250	947
Hydraulic Tank	238	901
Wheel Motor Gear Box (each)	10.5	39.7

HYDRAULIC SYSTEMS*

Pumps

Hoist	Tandem Gear Pumps
Rated @	230 GPM (870 l/min.) @ 1900 RPM
Steering	Radial Piston-Pressure Compensating
(also Brake)	65 GPM (246 l/min.) @ 1900 RPM
System Relief Pressures	
Hoist/Steering	2500 psi (17.2 MPa)
Brakes	3500 psi (24.1 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

WORK UNDER THE MACHINE

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

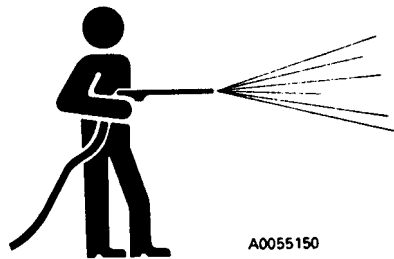


RADIATOR WATER LEVEL

- If it is necessary to add water to the radiator, stop the engine and allow the engine and radiator to cool down before adding the water.
- Slowly loosen the cap to relieve pressure before removing the cap.



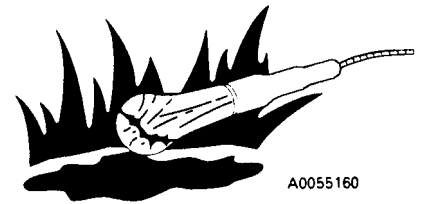
KEEP THE MACHINE CLEAN



- Spilled oil or grease, or scattered tools or broken pieces are dangerous because they may cause you to slip or trip. Always keep your machine clean and tidy.
- If water gets into the electrical system, there is danger that the machine may not move or may move unexpectedly. Do not use water or steam to clean the sensors, connectors, or the inside of the operator's compartment.

USE OF LIGHTING

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

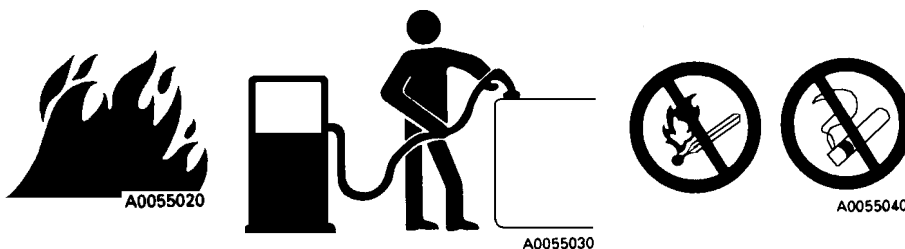
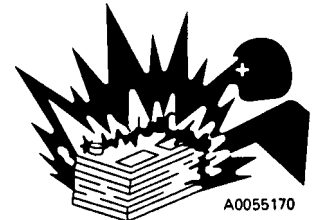


RULES TO FOLLOW WHEN ADDING FUEL OR OIL

- Spilled fuel and oil may cause you to slip, so always wipe it up immediately.
- Always tighten the cap of the fuel and oil fillers securely.
- Never use fuel for washing any parts.
- Always add fuel and oil in a well-ventilated place.

PRECAUTIONS WITH BATTERY

- When repairing the electrical system or when carrying out electrical welding, remove the negative (-) terminal of the battery to stop the flow of current.



DUMPING

1. Pull into dump area with extreme caution. Make sure area is clear of persons and obstructions, including overhead utility lines. Carefully maneuver truck into dump position. Obey signals directed by the spotter, if present.
2. Avoid unstable areas. Stay a safe distance from edge of dump area.
Position truck on a solid, level surface before dumping.

⚠ DANGER

As body raises, the truck Center of Gravity (CG) will move. Truck must be on level surface to prevent tipping / rolling!

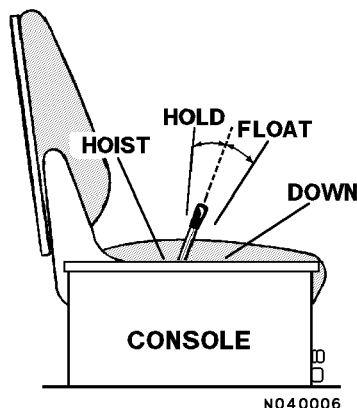
3. When in dump position, apply Brake Lock and move Selector Switch to the "Neutral" position.

To Raise dump body:

⚠ WARNING

The dumping of very large rocks (10% of payload, or greater) or sticky material (loads that do not flow freely from the body) may allow the material to move too fast and cause the dump body to move RAPIDLY and SUDDENLY. This sudden movement may jolt the truck violently and cause possible injury to the operator, and/or damage to the hoist cylinders, frame, and/or body hinge pins. If it is necessary to dump this kind of material, refer to the CAUTION in the following procedure:

4. Pull the lever to the rear to actuate hoist circuit.
(Releasing the lever anywhere during "hoist up" will place the body in "hold" at that position.)



5. Raise engine RPM to accelerate hoist speed.
Refer to the CAUTION below.

⚠ CAUTION

If dumping very large rocks, or sticky materials, as described in the previous WARNING, slowly accelerate engine RPM to raise body. When the material starts to move, release hoist lever to "HOLD" position. If material does not continue moving and clear body, repeat this procedure until material has cleared body.

6. Reduce engine RPM as last stage of hoist cylinder begins to extend and let engine go to low idle as last stage reaches half-extension.
7. Release hoist lever as last stage of hoist cylinder reaches full extension.
8. After material being dumped clears body, lower body to frame.

To Lower Body

(When dumping over a berm or into a crusher):

8. Move hoist lever forward to "down" position and release. Releasing the lever places hoist control valve in the "float" position allowing the body to return to frame.

NOTE: If dumped material builds up at the rear of the body and the body cannot be lowered, perform steps "a" & "b" below:

- a. Move hoist lever back to the "hoist" position to fully raise the dump body. Then release the hoist lever so it returns to the "hold" position.

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

- b. Shift Selector Switch to "Forward", release Brake Lock, depress Override button and drive forward to clear the material. Stop, shift Selector Switch to "Neutral", apply Brake Lock and lower body again.

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

STANDARD TORQUE CHARTS AND CONVERSION TABLES

This manual provides U.S. standard and metric (SI) units for most specifications.

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 these charts or tables, standard conversion factors for most commonly used measurements are provided in Table XIII.

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

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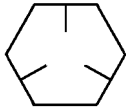
EFFECT OF SPECIAL LUBRICANTS On Fasteners and Standard Torque Values

Komatsu does not recommend the use of special friction-reducing lubricants, such as Copper Coat, Never-Seez®, 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 during the tightening process.

If special friction-reducing lubricants are used, excessive stress and possible breakage of the fasteners may result.

When the 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 A5-2) on the threads and seats unless specified otherwise.

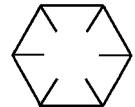
Verify threads and tapped holes are free of burrs and other imperfections before installing hardware.



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

RECONDITIONING AN IDLE VEHICLE

⚠ WARNING

NEVER attempt operation of a vehicle which has been standing idle for a long period until all systems which affect steering, brakes, engine, transmission and running gear have been completely reconditioned. An unsafe vehicle can cause serious injuries and/or major property damage - DON'T TAKE CHANCES!

At times a vehicle is subjected to long idle periods without being properly serviced for storage - merely shut down and left to the elements for an extended period. Reconditioning of this vehicle can and does present a major expenditure of time and money when it is to be put into operating condition.

1. Remove all trash and thoroughly clean the vehicle before starting any inspection or maintenance.

POISON ⚠ DANGER
CAUSES SEVERE BURNS

CONTAINS SULFURIC ACID. BATTERIES PRODUCE EXPLOSIVE GASES. KEEP SPARKS, FLAMES, CIGARETTES AWAY. VENTILATE WHEN CHARGING OR USING IN ENCLOSED SPACE. WHEN USING A CHARGER—TO AVOID SPARKS NEVER CONNECT OR DISCONNECT CHARGER CLIPS TO BATTERY WHILE CHARGER IS TURNED ON. ALWAYS SHIELD EYES. PROTECT SKIN AND CLOTHING WHEN WORKING NEAR BATTERIES. ANTIDOTE: EXTERNAL—FLUSH WITH WATER. EYES—FLUSH WITH WATER 15 MINUTES AND GET PROPER MEDICAL ATTENTION. INTERNAL—DRINK LARGE QUANTITIES WATER OR MILK. FOLLOW WITH MILK OF MAGNESIA, BEATEN EGG OR VEGETABLE OIL. CALL PHYSICIAN IMMEDIATELY.

WA3101

2. Remove vehicle batteries and move to battery shop for service and charging or replacement as necessary.

⚠ WARNING

Do not disassemble an inflated tire. Remove valve core slowly, and allow pressure to bleed off, before attempting to remove lockring. Also, eye protection should be worn during tire deflation to protect against any foreign object being projected into the eyes.

3. Inspect tires thoroughly for tread and side wall condition, weathering, cuts and cracks.
 - a. Any tire suspected of being unserviceable should be dismantled and thoroughly inspected inside and out before being inflated.

⚠ WARNING

Do not mix rim parts of different rim manufacturers. Rim parts may resemble those of a different manufacturer, but the required tolerances may be wrong. Use of mismatched rim parts is hazardous.

- b. If tires are dismantled, all wheel components must be cleaned, inspected, all rust and corrosion removed and parts repainted as applicable before remounting the tires. Follow the safety rules when mounting and inflating tires.
 - c. Mount and inflate tires as shown in Operation and Maintenance Manual or service manual.
4. Inspect vehicle service brakes carefully.

⚠ WARNING

Before disabling the brake circuit, block all wheels to prevent possible movement of the vehicle.

- a. If dust covers are installed on the inboard side of the wheels, remove the covers to allow for inspection of brake calipers/shoes and/or brake discs/drums.

⚠ WARNING

The use of vapor degreasing or steam cleaning is not recommended, either for brake assemblies or the component parts. Corrosion and rusting may occur.

- b. All brake lines, connections and pressure converters must be clean, serviced and free of rust and corrosion.
- c. Check condition of brake fluid; fill or replace fluid as necessary.

ELECTRIC DRIVE TRUCKS

Storage Instructions and Procedures

This instruction provides the recommended procedures for protecting equipment from damage during both short-term and long-term storage periods and for maintaining adequate protection while in storage. Also included are instructions for placing this equipment into service after having been stored.

For the purposes of this instruction, a short-term storage period is considered to be less than three months; a long-term storage period is considered to be three months or longer.

General Electric recommends a maximum storage period of three years, with these storage procedures being repeated after each year. After a storage period of three years or more, the Motorized Wheels should be removed and sent to an overhaul facility for teardown and inspection of seals and bearings. These should be replaced if necessary.

Periodic (every three months) inspections should be made to determine the lasting qualities of long-term storage protection measures. Such inspections will indicate the need for renewing protective measures when necessary to prevent equipment deterioration.

Proper storage of this equipment is vital to equipment life. Bearings, gears, and insulation may deteriorate unless adequate protective measures are taken to protect against the elements. For example, bearings and gears in the Motorized Wheel gear case are susceptible to the formation of rust; insulation in rotating electrical equipment can accumulate moisture; and bearings may become pitted.



NEVER APPLY ANY SPRAY, COATING OR OTHER PROTECTIVE MATERIALS TO AREAS NOT SPECIFICALLY RECOMMENDED.

It is also important to note that these instructions cannot possibly anticipate every type of storage condition and, therefore, cannot prevent all equipment deterioration problems caused by inadequate storage. However, these instructions should be considered as a minimum procedure to achieve the best possible equipment life and the lowest operating cost when the equipment is returned to service.

NOTE: Local conditions and/or experience may require ADDITIONAL procedures and/or additional storage precautions.

Placing Equipment Into Storage

Perform the following instructions when preparing General Electric equipment for storage. There are three main equipment categories to consider:

1. When storing a truck that is operational.
2. When storing a truck that is not operational.
3. When storing major components (Motorized Wheel, alternator, etc.).

These three major categories are the basis for determining required protective measures.

NOTE: In addition to these instructions, refer to truck storage instructions.

When Storing A Truck That Is Operational

When a fully operational truck is being placed into storage for less than three months, the best protective measure which can be taken is to drive the truck once a week for at least 30 minutes. Prior to driving the truck, the rotating equipment should be Meggered and:

1. If greater than 2 megohms, run normally.
2. If less than 2 megohms, isolate condition and correct before running.

Driving the truck circulates oil in the gear case to keep gears and bearings lubricated and free from rust. It also prevents deterioration of the brushes, commutators and slip rings.

When a fully operational truck is being placed into storage for three months or longer, and the truck **cannot** be operated weekly throughout the storage period as indicated above, perform the following instructions:

1. Drain oil from the gear case and install rust preventive 4161 (product of Van Straaten Chemical Co.) or equivalent. Fill per General Electric Motorized Wheel Service Manual.
2. Megger the wheels as indicated in the instructions above. Operate the truck for at least 30 minutes to insure that the rust preventive compound has been thoroughly circulated throughout the gear case. Stop the truck and drain the rust preventive compound.

NOTE: Do not run a LOADED truck with rust preventive compound in Motorized Wheel gear cases.

CENTER AND LEFT HAND DECK COMPONENTS

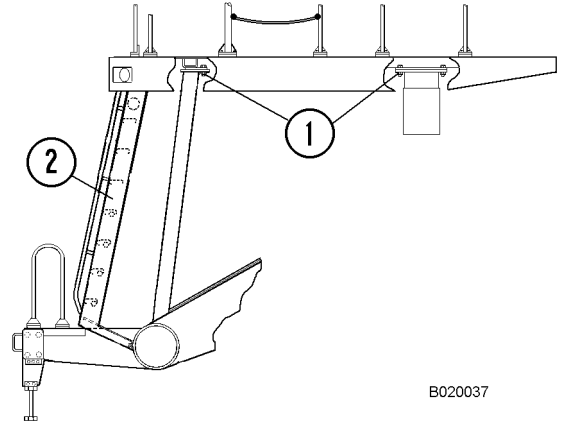
The center deck and left hand deck utilize several individual structures mounted on the main deck supports. Refer to Figure 2-2 for the location of individual sections. Figure 2-4 shows the location of the left deck supports and attachment points. If cab removal is required, refer to Section "N" for removal instructions.

⚠ WARNING

Before performing deck removal or repairs, be certain the battery disconnect switch is open and all hydraulic pressure has been released prior to removing any hoses, electrical harness connectors, etc.

⚠ CAUTION

The decks are covered with anti-slip surfaces. These surfaces must be kept clean and replaced as they become worn.



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FIGURE 2-4. LEFT DECK MOUNTING
1. Mounting Hardware 2. Vertical Ladder

POWER MODULE

The radiator, engine and alternator/blower assemblies are mounted on a roller equipped subframe which is contained within the truck's main frame and is referred to as a "Power Module". This arrangement permits removal and installation of these components with a minimum amount of disconnect being made and by utilizing the unique "Roll In/Roll Out" feature.

Although the instructions in this section are primarily based upon the "Rollout" method for major component removal, the radiator and fan may be removed as separate items. Instructions for radiator and fan removal are contained later in this section.

General Information

WARNING

The complete power module weighs approximately 32,000 lbs. (14,528 kg). Make sure lifting device to be used is of an adequate capacity.

1. Position the truck in a work area with a flat, level surface and adequate overhead clearance to permit raising the dump body.
2. Apply parking brake and block wheels to prevent truck movement. Raise body and install safety lock pin and body cable.

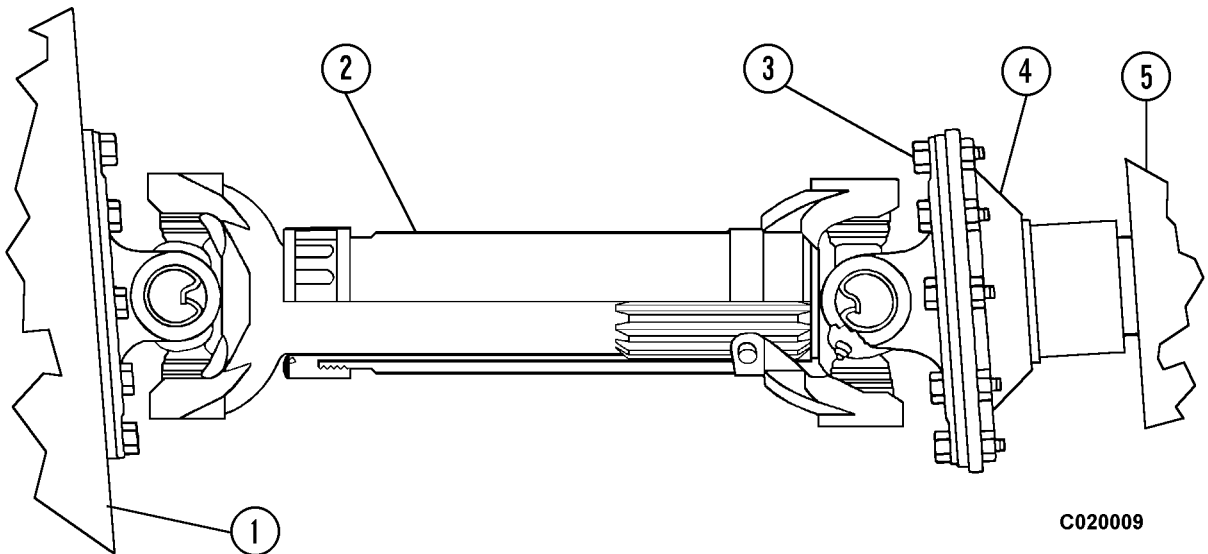
WARNING

Do not work under raised body without first making sure the body lock pin and body cable is installed.

3. Tag or mark all air lines, oil lines, fuel lines and electrical connections to assure correct hookup at time of power module installation. Plug all ports and cover all hose fittings or connections when disconnected to prevent dirt or foreign material from entering.
4. It is not necessary to remove the radiator prior to the removal of the power module. If radiator removal is desired or if only radiator repair is necessary, refer to "Cooling System" in this section.

Removal

1. Disconnect batteries using the following procedure *in this order*:
 - a. Open battery disconnect switch located on battery equalizer box on deck of truck.
 - b. Remove battery equalizer GND (-) terminal.
 - c. Remove +12V (output) terminal at equalizer.
 - d. Remove +24V (input) terminal at equalizer.
 - e. Disconnect battery negative (-) terminal at battery box.
 - f. Disconnect battery positive (+) terminal.



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FIGURE 2-1. HYDRAULIC PUMP DRIVE SHAFT

1. Alternator/Blower
2. Pump Drive Shaft

3. Capscrews, Lockwashers, Nuts
4. Companion Flange

5. Hoist Pump

8. If belt tension is incorrect, repeat steps 1 through 5.

NOTE: Keep belt free from lubricating oil, paint and/or grease. If necessary, the belt can be cleaned by scrubbing with a detergent soap and water. Never use belt dressing on Poly-V belts!

Fan Belt Replacement



Unguarded rotating and moving engine components can cause injury. Disable engine start before working in fan belt area.

1. Loosen fan coupling capscrews (2, Figure 3-6).
2. Loosen bearing cap stud (1) and remove the belt.
3. Check belt pulleys on the fan coupling and crankshaft for cleanliness and replace if necessary.
4. Install new belt.
5. Secure the new belt with the adjusting screw (1) and adjust belt as described under "Fan Belt Adjustment".
6. Tighten fan coupling capscrews (2) to **74 ft. lbs. (100 N.m)**.
7. Operate engine for 30 minutes with a low load and recheck belt tension. If belt tension is incorrect, repeat belt tension adjustment procedure.

NOTE: After running the engine for 8 hours with a load, recheck the belt tension and adjust as necessary.

AIR FILTRATION SYSTEM

AIR CLEANER

Operation

Intake air, required by the diesel engine and by the truck air system, passes through the air cleaner assemblies mounted on each side of the radiator. These air cleaners discharge heavy particles of dust and dirt by centrifugal action and then remove finer particles by passing air through filter cartridges. The air compressor inlet line is connected to the engine filtered air supply.

The engine demand for air creates a vacuum in the air cleaners and causes outside air to be drawn in through air inlets on the air cleaners. Dirty air entering here is drawn through a series of tubes that are designed to produce a cyclonic action. As the air passes through the outer portion of the tubes, a circular motion is set up causing dust and dirt particles to be thrown from the air stream into dust collector cups. At the same time, the air stream turns and is directed up through the center of the tubes into the filter chamber. Here the air passes through the main filter element and safety filter element and out the clean air outlet to the engine's air intake system.

General Service Information

1. Inspect dust collector cups (1, Figure 5-1) at regular intervals - daily inspection is recommended. Never allow dust level build up to the tube chamber.

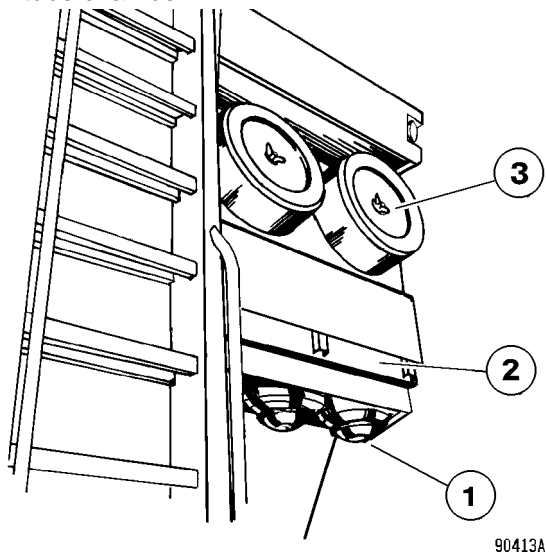


FIGURE 5-1. AIR CLEANERS

- | | |
|------------------------|------------------|
| 1. Dust Collector | 3. Element Cover |
| 2. Pre-cleaner Section | |

2. Check filter restriction gauges, during operation. The filters should be cleaned or replaced when the gauges read between 20 and 25 inches H₂O vacuum or when a warning message is presented on the overhead display by the HMS system. Refer to Filter Service Procedure for maintenance and cleaning instructions.
3. Check to insure air inlet is not obstructed, plugged or damaged.
4. Check all connections between air cleaner outlet and engine intake manifold to insure they are tight and make a positive seal.
5. Check all air cleaner housing capscrews to insure they are tight.

MAIN FILTER ELEMENT

Removal

Remove and inspect the main filter element as outlined below.



The truck engine must be shut down before servicing the air cleaner assemblies or opening the engine air intake system.

1. Shut down engine. Clean dirt and dust off air cleaner assembly exterior surfaces.
2. Loosen large wing nut (5, Figure 5-2) on air cleaner cover to free main element assembly (10). Pull main element clear of assembly.
3. Inspect filter element carefully for possible damage, holes, breaks, etc., which might affect reuse of element. If element appears serviceable other than being dirty, proceed with the cleaning procedure. If defects are found in filter element, wing nut assembly (5) must be removed from element assembly and installed on the new filter element.
4. Check safety filter element indicator nut (7). If solid red area is showing, safety filter service is required. If center is green, safety element does not require replacement.

BATTERY CHARGING SYSTEM (Niehoff)

General Description

The Niehoff model N1227 or C609 (Figure 2-1) is a heavy duty, 24 VDC unit rated at 220 amps. A solid state voltage regulator (6) mounted externally on the end housing assembly provides voltage control during operation. A single output connection (5) is located on the face of the control unit (4) for connection to the truck battery positive circuit. The ground circuit cable can be attached to either of two terminals (10) located on the front housing. A fan guard (7) protects maintenance personnel from the rotating fan when the engine is operating.

TROUBLESHOOTING PROCEDURES (On-Truck)

Most 24 volt charging system problems can be diagnosed with the alternator installed on the truck, operating under normal conditions. Many problems can be attributed to loose or corroded cable connectors. It is essential that all battery charging circuit cables are in satisfactory condition and all connections are clean and securely tightened.

Equipment Required:

- Belt tension scale
- Voltmeter, 0 - 40 volt range
- Ammeter, 0 - 400 amp range

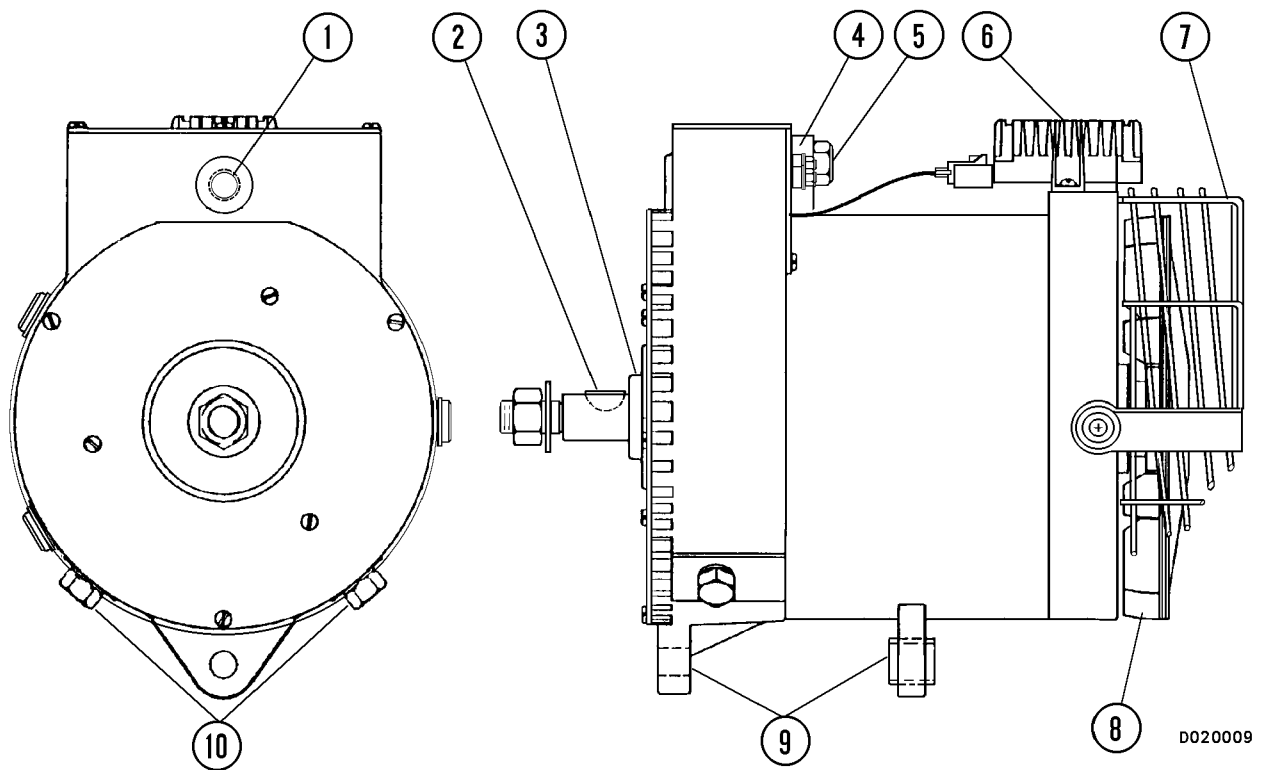


FIGURE 2-1. ALTERNATOR ASSEMBLY

- | | |
|----------------------------------------|-------------------------|
| 1. Belt tension Adjustment
Capscrew | 6. Voltage Regulator |
| 2. Shaft Key | 7. Fan Guard |
| 3. Pulley Bushing | 8. Cooling Fan Assembly |
| 4. Control Unit | 9. Mounting Lugs |
| 5. Battery Positive Terminal | 10. Ground Terminals |

BODY-UP SWITCH

The body-up switch is designed to prevent propulsion in "Reverse" with dump body raised up. This switch also prevents forward propulsion unless the override button is depressed and held.

The body-up switch, located on the right frame rail ahead of the body guide, must be adjusted to within limits. Improper adjustment or loose mounting bolts may cause false signals or damage to the body-up switch assembly.

The body-up switch should be checked daily and the sensing area cleaned of any dirt or metallic dust accumulation.

Adjustment

Adjust the proximity switch bracket to maintain an air gap (Dimension "A", Figure 3-2) between the sensing area and actuator bracket, of between 0.50 in. (12.7 mm) minimum and 0.62 in. (15.7 mm) maximum. Set up measurement "B" should be approximately 1.00 in. (25.4 mm).

Service

Keep sensing area clean, free of metallic dust and other debris that may damage or inhibit operation of the proximity switch. If the switch is not functioning or damaged the unit must be replaced.

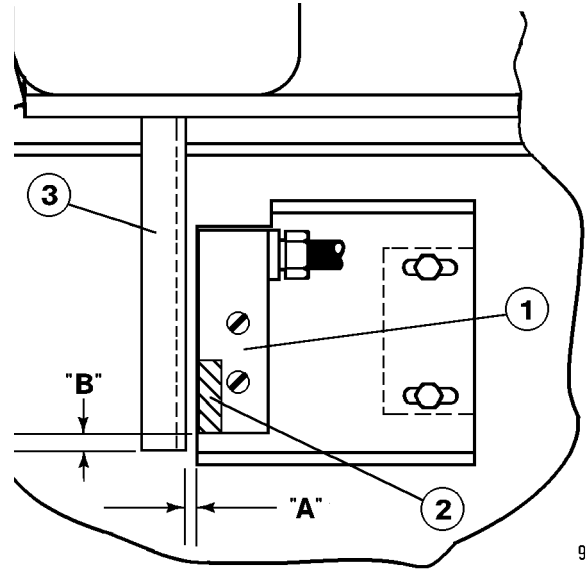


FIGURE 3-2. BODY-UP SWITCH ADJUSTMENT

1. Proximity Switch
2. Sensing Area
3. Actuator

GROUND LEVEL SHUTDOWN

The Ground Level Shutdown switch is located on the left side of the truck near the bottom of the ladder. This switch is intended for emergency use.

The normal engine shutdown procedure is to turn the key switch on the instrument panel to the "Off" position.

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SECTION E2
ELECTRICAL PROPULSION COMPONENTS
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Propulsion

As part of the total software package, a particular group of regulatory software commands is included called a state machine. The state machine controls the various operating functions of truck operation.

The software implements the state machine by keeping track of which state the truck is in, and which state the truck is allowed to move into if the operator requests a different mode of operation.

For example, assume the operator has turned the key switch ON to start the control system software, and then starts the engine. When the accelerator pedal is pressed to request contactor sequence and excitation, the state machine enforces a sequence of actions.

First, the software initializes the system. This includes ensuring that the contactors are all positioned correctly. Initialization takes about eight seconds after control power has been applied to the FL275 panel.

Then, when the initialization is completed, the state becomes the nomo, or no motion, state. No propulsion or braking contactors are picked up.

Next, the state machine enters the into accelerate state. This state can only be entered if there are no restriction flags set in the software such as brake (service or park), ACCINH, DUMPBS, NAFLT, or GNDFLT. In this state, contactor sequence is initiated. If all contactors necessary for acceleration are in their correct positions, then the state machine enters the accelerate state. If the contactor sequence does not complete successfully, then a fault, NAFLT, prohibiting acceleration is tripped.

When the state machine enters the accelerate state, firing commands can be issued. Firing commands are based on operator request and truck volt and amp feedbacks. They are used to generate a pulse burst firing signal from the CPU. The alternator is thus excited, generating electrical power (horsepower) to the wheel motors which will drive the truck forward or backward, depending on the position of the selector switch.

Retarding

When the operator presses the retard pedal, acceleration is canceled and the propulsion contactors are dropped out. The state machine enters the coast state and then the into retarding state. It remains in this state until all of the contactors necessary for retarding are in the correct position.

The state machine then enters the retard state. Firing pulses are issued to the static exciters based on operator request and on various system feedbacks.

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

EVENT CODE	EVENT DESCRIPTION	EVENT RESTRICTION	DETECTION INFORMATION	EVENT VALUES			
				Decay Time	Lock Limit	Accept Limit	Window Limit
83	Alternator Field Current Level	Recorded in memory only.	Alternator field current slow to decay. Check for: Defective shunt, iso-amp, or FB102/140 card.	N/A	N/A	10	1
88	Lamp Test	None.	Lamp test in progress. • Not a true event. • Not logged.				
90	Battery Volts Low	System Event • In ACCEL: No propel and turn on SYSFLT light. • In RETARD: Turn on SYSFLT light only.	Battery volts low. Less than 21 volts for 4 seconds and engine speed greater than 600 rpm. Check for: Check 24V alternator or batteries.	3600	3	10	2
91	Battery Volts High	Recorded in memory only.	Battery volts high. Greater than 32 volts for 4 seconds. Check 24V alternator regulator.	N/A	N/A	10	1
92	Bad Engine Sensor	Recorded in memory only.	Engine sensor output outside normal range. Check sensor and wiring.	N/A	N/A	10	3
98	Data Store	Recorded in memory.	Indicates a data snapshot has been initiated by manual means.	N/A	N/A	11	10
99	Software	Recorded in memory.	Software problem. The allocated fault registers in memory are full, insufficient space exists. Reset event list, erase events.	1800	3	5	1

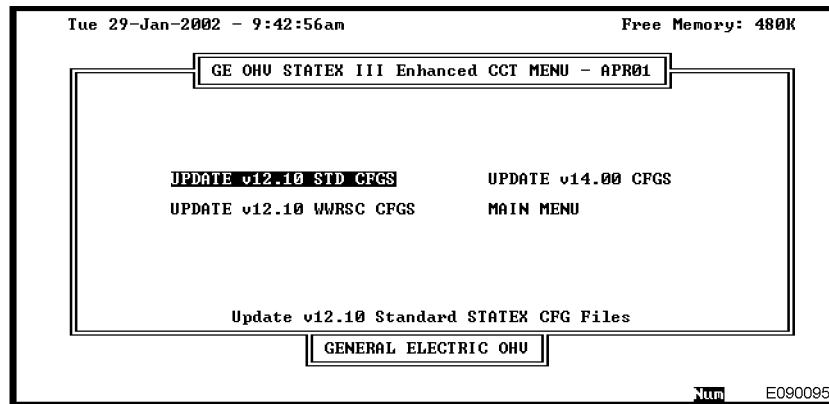


FIGURE 2-6. CONFIGURATION FILE CONVERTER MENU (Enhanced Vers. 1.00 Shown)

4. Exit back to the GEOHV STATEX III menu, use the arrow keys to highlight Quit Menu and press [ENTER] to return to DOS.
5. Open the main menu for the current software release by typing "gemenu3e" and press [ENTER]. The main menu (Figure 2-2) will appear. Note the software release date in the menu title.

Convert Old CFG files for New software

6. Select UPDATE CFG VERSION by typing [u] or move the cursor with the arrow keys and press [ENTER]. The screen shown in Figure 2-6 will appear.
7. Note there are four selections available. The version 14 screen will not display UPDATE v14.00 CFGS. Cursor to the desired operation and press [ENTER].
 - a. Select UPDATE v12.10 STD CFGS if using enhanced version 1.00 to convert from version 12.10 on a truck without wet weather retard speed control.
 - b. Select UPDATE v12.10 WWRSC CFGS if using enhanced version 1.00 to convert from version 12.10 on a truck with wet weather retard speed control.
 - c. Select UPDATE v14.00 CFGS to convert from version 14.00 software to enhanced version 1.00.
 - d. Select Main Menu if not converting files.

For the following example, UPDATE v12.10 STD CFGS was selected and the screen in Figure 2-7 appears.

8. Note the screen shows a series of options labelled F1 through F9, referring to the function keys [F1] through [F9] and provides a description of each.

[F1] provides a help screen to assist you directly on the screen.

[F2] names the new configuration file in column NEWCFG with the old configuration file name in column OLDCFG, only at the line where the cursor is.

[F3] names the new configuration file with no configuration file name.

[F4] creates a new configuration file with a new configuration file name, only at the line where the cursor is.

[F5] creates multiple configuration files with new configuration file names for all files in the NEWCFG column.

[F6] resets all new file names to their original OLDCFG names.

[F7] sorts the old configuration files in the NEWCFG column by file names.

[F8] sorts the old configuration files by their extensions.

NOTE: The description of [F7] or [F8] will be capitalized, depending on which sort has been used.

[F9] exits the configuration converter tool and returns to the GEOHV main menu.

6) Change/View Overspeeds . . .

The Overspeeds Entry Screen is used to enter the desired speed settings for overspeed pickup, overspeed dropout, speed override, and the maximum retard speed control speed.

1. Use the down arrow key to move the cursor to the menu position Change/View Overspeeds and press [ENTER], or press [6].
2. The Overspeeds Entry Screen, Figure 2-15, will be displayed. Using the up and down arrows, move the cursor to the line where a change is desired. Note that the empty or loaded values are selected in the control system only based on the input from the two-speed overspeed switch where 0 Volts selects loaded value and +28 Volts selects empty values. Move the cursor to the proper line and enter the desired value as a permanent value in the truck code. Type the number and press [ENTER].

General guidelines for picking entry speeds:

- Loaded values must be less than or equal to empty values
- Overspeed dropout must be less than or equal to 0.95 of detect speed
- Speed override must be set at 1.0 mph, or more, below the overspeed detect point

NOTE: As the cursor is moved from one selection to another, a variety of instructions appears at the bottom of the screen, one for each selection.

- a. Empty overspeed overshoot . . .mph
Overspeed overshoot speed setting (to be set above the empty overspeed retarding mph) in miles per hour for an empty truck.
- b. Empty overspeed detect . . . mph
Overspeed retarding pickup setting in miles per hour for an empty truck.

- c. Empty overspeed dropout . . . mph
Speed at which overspeed retarding is released in miles per hour for an empty truck.
- d. Empty speed override . . . mph
Speed override value in miles per hour for an empty truck. It must be at least 1 mph lower than the empty overspeed detect value.
- e. Empty maximum retard pot . . . mph
Maximum retarding speed for the retard speed control system when the pot is set at maximum on an empty truck.
- f. Loaded overspeed overshoot . . . mph
Overspeed overshoot speed setting (to be set above the loaded overspeed retarding mph) in miles per hour for a loaded truck.
- g. Loaded overspeed detect . . . mph
Overspeed retarding pickup setting in miles per hour for a loaded truck.
- h. Loaded overspeed dropout . . . mph
Speed at which overspeed retarding is released in miles per hour for a loaded truck.
- i. Loaded speed override . . . mph
Speed override value in miles per hour for a loaded truck. It must be at least 1 mph lower than the loaded overspeed detect value.
- j. Loaded maximum retard pot . . . mph
Maximum retarding speed for the retard speed control system when the pot is set at maximum on a loaded truck.

3. Move the cursor to the leave overspeeds entry screen when finished entering values and press [ENTER]. This automatically returns the program to the Truck Setup Configuration Mine Menu. If you have made an inconsistent entry for the speeds, you will not be able to exit the screen. A note will appear at the bottom to guide you in correcting the error.

```
FNAM: K645131A.100  T_ID: KMS A30645  GE FNAM: x001131a.100
-----
O U E R S P E E D S   E N T R Y   S C R E E N
-----
30.0 : empty overspeed overshoot mph
29.0 : empty overspeed detect    mph
27.0 : empty overspeed dropout   mph
28.0 : empty   speed override    mph
27.0 : empty maximum retard pot  mph

21.0 : loaded overspeed overshoot mph
20.0 : loaded overspeed detect    mph
18.0 : loaded overspeed dropout   mph
18.0 : loaded   speed override    mph
18.0 : loaded maximum retard pot  mph

LEAVE OUEERSPEEDS ENTRY SCREEM
Press ENTER to exit this screen
```

E020105

FIGURE 2-15. OVERSPEEDS ENTRY SCREEN

Statistical Data

The statistical data collector uses the memory capability of the computer to record and store hundreds of system parameters unique to each individual truck. These parameters are divided into two types: counters and profiles.

Detailed information concerning the statistical data collector is discussed on the following pages. Tables III and IV list parameter code numbers, descriptions, units of measure, count conditions, etc. The information below outlines the procedures required to view Statistical Data on the PTU and save the information to a file.



Selecting Special Operation in the following procedure may present a safety hazard if the engine is on. Control of the propulsion system may transfer to the PTU operator from the truck driver with this software operation. Refer to Step 1. below:

1. Use the arrow keys to move the cursor to the “SPECIAL OPERATION” selection on the GE STATEX III PTU MAIN MENU and press [ENTER]. The screen, shown in Figure 2-21, will be displayed to alert the operator about the state of the truck software. This warning notifies the operator when control of the truck is being transferred from the truck driver to the PTU, based on the PTU selection of “SPECIAL OPERATION”. When finished and the PTU is returned to the GE STATEX III PTU MAIN MENU, control of the propulsion system is returned to the truck driver. Before activating this command, the screen, shown in Figure 2-22, will be displayed. The PTU user must keep the truck driver informed of this control.
2. Select “YES” on the caution screen, Figure 2-21, and press [ENTER]. The SPECIAL OPERATION MENU will be displayed.
3. Use the arrow keys to move the cursor to the “STATISTICAL DATA MENU” selection and press [ENTER]. The STATISTICAL DATA MENU screen will be displayed. Selections available on this menu are as follows:

View Counters

The Statistical Counters screen displays the number of times various operations have occurred in the history of the truck operation or in how many seconds or miles the event has lasted. Refer to Table III for a listing of all active counters.

1. While the STATISTICAL DATA MENU is displayed, use the arrow keys to move the cursor to the “VIEW COUNTERS” selection and press [ENTER]. The STATISTICAL COUNTERS SCREEN will be displayed.
2. Use the up and down arrow keys to scroll through the counters. Press [ESC] to return to the exit choice.
3. When finished viewing the information, press [ENTER] again to exit this screen.

View Profiles

This screen displays currents, voltages, and speeds as a history of truck operation. Each profile is broken into a number of bins and each bin has a range of values. In this manner, the entire range of the parameter from minimum to maximum is covered. The result is a histogram for each parameter covered by a profile. Refer to Table IV for a listing of all active profiles.

1. Use the arrow keys to move the cursor to the “VIEW PARAMETER PROFILES” selection and press [ENTER]. The PROFILE screen will be displayed. Use [F3] and [F4] to move through all profiles.
2. When finished viewing this screen, press [ENTER] again to exit this screen.

Upload Statistical Data To A File

Use the arrow keys to move the cursor to the “UPLOAD STATISTICAL DATA TO A FILE” selection and press [ENTER]. The Upload Statistical Data Menu screen will be displayed. Use the directions on this screen to upload data from the truck CPU to your PTU.

TABLE IV. STATISTICAL DATA CODES - PROFILES (Cont.)

PAR No.	DESCRIPTION	COUNT CONDITIONS	BUCKET No.	TEMP RANGE (°C)
98	AFSE Temp °C (in seconds)	<p>This is a histogram of Alternator Field Static Exciter temperature. Sample time is 60.0 seconds The clock will start whenever control power (CPR) is on.</p> <p>The histogram breaks the temperature spectrum into 17 buckets defined at right, and displays the time spent in each bucket.</p>	1	20 & below
			2	21 to 40
			3	41 to 50
			4	51 to 60
			5	61 to 70
			6	71 to 80
			7	81 to 90
			8	91 to 100
99	MFSE Temp °C (in seconds)	<p>This is a histogram of Motor Field Static Exciter temperature. Sample time is 60.0 seconds The clock will start whenever control power (CPR) is on.</p> <p>The histogram breaks the temperature spectrum into 17 buckets defined at right, and displays the time spent in each bucket.</p>	9	101 to 105
			10	106 to 110
			11	111 to 120
			12	121 to 125
			13	126 to 130
			14	131 to 135
			15	136 to 140
			16	141 to 145
			17	146 & above

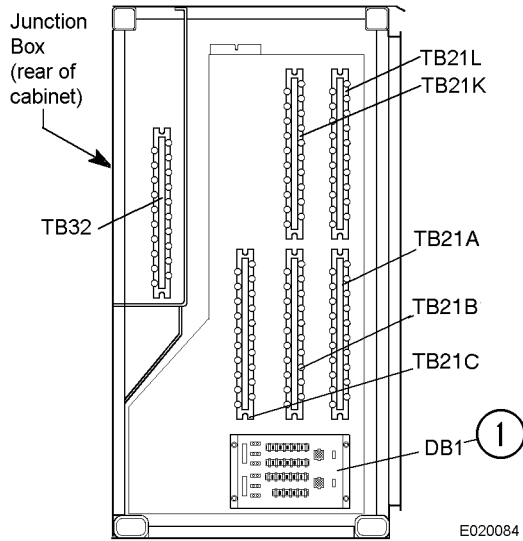


FIGURE 2-32. CONTROL CABINET, VIEW A

1. Diode Board DB1

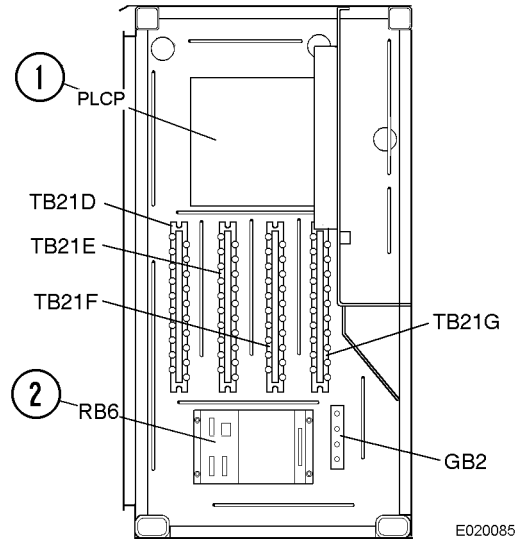


FIGURE 2-34. CONTROL CABINET, VIEW B

1. Propulsion Load Control Panel (PLCP)
2. Relay Board RB6

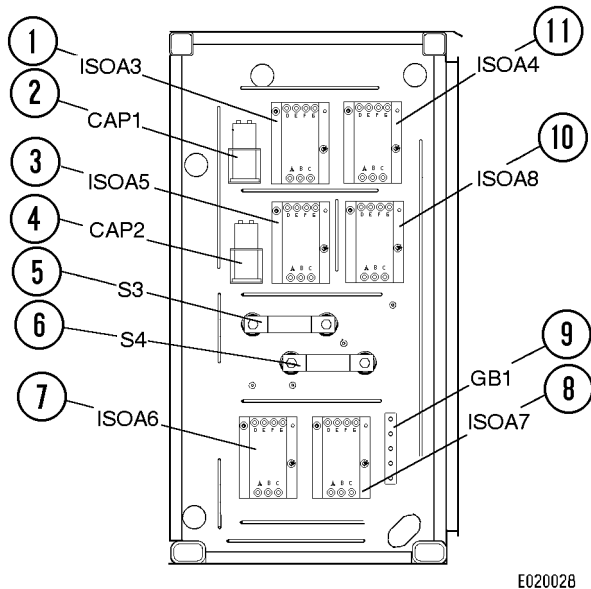


FIGURE 2-33. CONTROL CABINET, VIEW C

1. Isolation Amplifier #3	6. Alt. Field Current Shunt
2. Capacitor #1	7. Isolation Amplifier #6
3. Isolation Amplifier #5	8. Isolation Amplifier #7
4. Capacitor #2	9. Ground Bus #1
5. Motor Field Current Shunt	10. Isolation Amplifier #8
	11. Isolation Amplifier #4

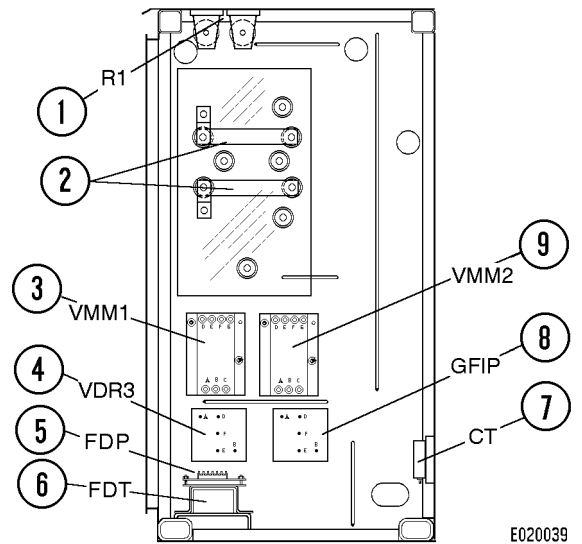


FIGURE 2-35. CONTROL CABINET, VIEW D

1. Alt. Field Current Limit Resistor Panel	6. Diode Fault Detection Transformer
2. Load Test Links	7. Current Transformer Panel
3. Voltage Measuring Module #1	8. Ground Fault Interrupt Panel
4. Voltage Divider Resistor Panel #3	9. Voltage Measuring Module #2
5. Fault Detection Panel	

STATEX III ELECTRICAL SYSTEM CHECKOUT PROCEDURE

GENERAL INFORMATION

This checkout procedure describes test and adjustment procedures for the GE STATEX III Electric Wheel Drive Systems used on Model 445E, 510E, 630E, 685E, 730E, and 830E electric drive trucks with the following alternator and wheel motor combinations.

TRUCK MODEL	ALTERNATOR	WHEEL MOTOR
445E, 510E	GTA-25	GE772, GE776, GE791
630E, 685E, 730E	GTA-22	GE776, GE788
630E, 685E, 830E	GTA-26	GE788, GE787

WARNING

This system is capable of developing high voltage. Use caution when working with the system.

IMPORTANT

The test and adjustment procedures list standard and optional equipment which may be installed. It is the responsibility of the personnel using this Electrical Checkout procedure to determine what equipment is installed on the truck being serviced and to select the applicable test and adjustment procedure.

If any of the cards in the FL275 panel must be removed, a wrist ground strap must be worn to ground personnel to the truck chassis to prevent static discharge damage to the circuit boards. After the board has been removed from the panel, it must immediately be placed in a static-free protective bag.

Sample PTU screens illustrated in the following pages show menus and data screens as they appear in the April, 2001 STATEX III enhanced version 1.00 software release. Instructions are also applicable to the April 2000, version 14.00 software release. Later versions of the software may differ.

NOTE: It is necessary to exit back to this menu before turning off control power to avoid lock up of PTU computer screen.

6. Turn control power switch off.
7. Turn key switch off.

5.0 DIGITAL INPUT/OUTPUT SIGNALS TEST - FL275 CARD PANEL

- Connect PTU at control cabinet as described previously.
- Turn PTU on and type "gemenu3e" (or "gemenu", for version 14.00) at the C:> prompt. Press [ENTER].

5.1 SETUP MANUAL DIGITAL INPUT/OUTPUT TEST ON PTU

1. With control power on, select "PTU TALK TO TRUCK" on GE OHV STATEX III MENU. Press [ENTER] key.
2. At "Enter your name:" type your name. Press [ENTER] key.
3. At "Enter your password:" type your password. Press [ENTER] key.
4. The GE STATEX III PTU MAIN MENU will appear on the screen.

5. Select "SPECIAL OPERATION WITH ENGINE STOPPED". Press [ENTER] key.
 - a. A screen will appear that states: "Selection of SPECIAL OPERATION will override truck driver controls until you exit to the PTU main menu. Continue?"
 - b. With the cursor next to "Yes", press [ENTER].
6. The SPECIAL CONTROL ENGINE STOPPED TEST MENU will appear on the screen.
7. Select "MANUAL DIGITAL OUTPUT TEST". Press [ENTER] key.
8. The MANUAL DIGITAL OUTPUT TEST SCREEN (Figure 3-9.) will appear on the PTU screen. This screen is divided into four sections:
 - a. ENGINE PARA - the functions displayed are not active.
 - b. ANALOG - the functions displayed are not active.
 - c. DIGITAL INPUT - this section monitors 38 digital inputs. The status of the input functions will be shown by displaying the name of the input as follows (unless otherwise noted): = true inverse display = input energized (28 Volts) false regular display = input not energized (0 Volts)
 - d. DIGITAL OUTPUT - this section monitors 35 digital outputs. = on inverse display = output energized

PTUSTX:1.3.1 MANUAL DIGITAL OUTPUT TEST SCREEN < > EXIT																						
Only Digital Inputs and Outputs are Updated										<> trolley												
ENGINE PARA	COOL-PRES 0 PSI	COOL-TEMP 0 C	CRANK-PRES 0 "H2O	OIL-PRES 0 PSI	BattU = 0.0	+15U = 0.0	potref = 0.0	-15U = 0.0														
ANALOG	GFAULT 0 ma	MF-I 0A	M1-I 0A	ENGCMD 0rpm	AF-CMD 0.0	REQUEST 0	RSC-MPH 0.0mph	M1-SPD 0.0mph	M1DEG 0 C													
DIGITAL INPUT	FIRSTSRCH	LASTSRCH	2DDRESET	AS RS	DOS RSC	DBUP 2SOS	IDLESW ACCINH	FAILDIODE SRUBRKPSW	FORIN REUIN	DSTORE BLOWP	PARKBRKSW											
<input checked="" type="checkbox"/> true <input type="checkbox"/> false	P1FB	GFFB	RP1FB	MFFB	RP4FB	RP6FB	RP8FB	FORFB	KEYSW	ENGSRU	P2FB	GFRFB	RP2FB	RP3FB	RP5FB	RP7FB	RP9FB	REUFB	CPSFB	ENGSDWN		
DIGITAL OUTPUT	P1	GF	RP1	RP2	MF	RP4	RP6	RP8	FOR	AFSE	ENGSRU-LT	P2	GFR	RP11	RP22	RP3	RP5	RP7	RP9	REV	MPSE	ENGSDM-LT
<input checked="" type="checkbox"/> on <input type="checkbox"/> off	P11	TS	RETARD	CPRL	FDIODE-LT	SYSFAULT	PRKBRKOFF	LIS	OURS	BLOWFAULT	GNDFAULT	SPEEDEUNT	MOTOR-TEMP									

ENTR=Sel. F1=Help F2=Files ESC=Abort ←↑↓→=Navigate

E030072

FIGURE 3-9. MANUAL DIGITAL OUTPUT TEST SCREEN

15. MOTOR 2 TEMPERATURE

motor 2 temp = 0.000 V; 0.0° C

- a. Disconnect motor 2 temperature sensor wires 722F and 722H 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 will 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 will read 3.55 ±.07 volts and 210° C.
- d. Remove resistor and replace sensor wires at terminal board.

NOTE: Sensors for functions 16 through 19 are not installed on all trucks. To verify installation, select the proper truck configuration file, then select View OEM Options from the TRUCK SETUP CONFIGURATION MINE MENU screen.

16. COOLANT TEMPERATURE

eng coolant temp = 0.00 V; 0.0C

- a. Connect a 1.5 Volt battery to circuit 31CT (+) and circuit 0CT (-) at control cabinet terminal board.
 - Screen value on PTU will read +1.5 Volts; 0°C.
- b. Remove battery from terminal board.

17. COOLANT PRESSURE

eng coolant pres = 0.00 V; 0.0 PSI

- a. Connect a 1.5 Volt battery to circuit 31ECP (+) and circuit 0ECP (-) at control cabinet terminal board.
 - Screen value on PTU will read +1.5 Volts; 25 psi.
- b. Remove battery from terminal board.

18. CRANKCASE PRESSURE

eng crankc pres = 0.00 V; 0.0 PSI

- a. Connect a 1.5 Volt battery to circuit 31CKP (+) and circuit 0CKP (-) at control cabinet terminal board.
 - Screen value on PTU will read +1.5 Volts; 8 psi.
- b. Remove battery from terminal board.

19. OIL PRESSURE

eng oil pressure = 0.00 V; 0.0 PSI

- a. Connect a 1.5 Volt battery to circuit 310P (+) and circuit 00P (-) at control cabinet terminal board.
 - Screen value on PTU will read +1.5 Volts; 25 psi.
- b. Remove battery from terminal board.

20. +15 VOLT SUPPLY

15 v positive = 0.0

- Screen will read +15.0 ±0.3 Volts.

21. -15 VOLT SUPPLY

15 v negative = 0.0

- Screen will read -15.0 ±0.3 Volts.

22. BATTERY VOLTAGE

battery voltage = 0.0

- Screen will be approximately +28.0 Volts, dependent on battery condition.

23. POT REFERENCE

pot reference = 0.0

- Screen will be +19.0 ±0.5 Volts for non-fuel saver truck.
- Screen will be +10 ±0.5 Volts for fuel saver truck.

1. Connect a voltmeter between terminal D (+) and terminal F (-) of the iso-amp to be tested.
2. Turn the control power on.
 - Verify the voltage at D is less than 0.030 Volts.
3. Turn the control power switch off. Disconnect the terminal B input for each iso-amp:
 - 75A for ISOA3
 - 75C for ISOA4
 - 717S for ISOA5
 - 72T for ISOA6
 - 72W for ISOA7
 - 73Y for ISOA8
4. Connect a jumper wire from terminal C to terminal F and another from terminal A to terminal G.
5. Turn the control power switch on.
 - Verify the voltage at terminal D is 1.00 ±0.05 volt.
6. Turn the control power switch off. Remove the jumper wires and meter.
7. Reconnect 75A, 75C, 717S, 72T, 72W, and 73Y wires disconnected at ISOA3, ISOA4, ISOA5, ISOA6, ISOA7, and ISOA8.
8. Reconnect 74C at GFR.

11.7 MOTOR ROTATION TEST

NOTE: If wheel motors were not installed on truck during factory check-out, this test must be performed during truck check-out at mine site.

If rear wheels are raised off ground:

1. Start the engine and place the selector switch in FORWARD.
2. Depress the accelerator pedal just far enough to enter propel state and the wheel motors begin to rotate.
 - Verify both wheel motors turn forward.

If rear wheels and tires are installed and resting on the ground:

- Check each wheel motor individually with the following cable hookup:

1. Place a jumper across the left wheel motor armature (from cable 7GA1 (7G10 on the 830E) to 7J1) to check the right wheel motor rotation.
2. Depress the accelerator pedal just far enough to enter propel state and the wheels begin to rotate.
 - Verify the right wheel motor is turning forward.
3. Place a jumper across the right wheel motor armature (from cable 7J1 to 7J2) to check the left wheel motor rotation.
4. Depress the accelerator pedal just far enough to enter propel state and the wheels begin to rotate.
 - Verify the left wheel motor is turning forward.
5. Shut the engine off and remove the jumper cables.

11.8 GROUND FAULT CHECKS

If a ground fault occurs during operation, the electrical system fault light will turn on and the amount of leakage to ground will be displayed on the MONITOR ANALOG INPUT CHANNELS screen of the PTU. To isolate a ground fault problem, the following procedures must be followed:

1. Visually inspect the truck for obvious causes of the fault.
 - a. Remove the rear wheel covers and inspect wheel motor armature commutators for evidence of flashover. Inspect brushes for length and damage. Inspect field coils for evidence of moisture, oil, or other contaminants which may accumulate in the armature cavity. If flashover is severe or field coils are damaged by contaminants, the wheel motor must be removed for repair. If moisture is present, it may be possible to dry the wheel motor without removal.
 - b. Remove inspection covers on main alternator to inspect slip rings, brushes and check for moisture or other contamination.
 - c. Inspect cables for damaged insulation.
 - d. Inspect exposed connections for possible short circuit to nearby metallic objects.
 - e. Inspect retarding grids for damage and dirt accumulation.

REAR TIRES AND RIMS

If the studs in the rear wheel motor require replacement, use a special tool and tighten studs to **540 ft.lbs. (732 N.m)** torque.

Removal

1. Park truck on level ground and block front wheels. Position a jack in recess of rear suspension mount casting as shown in Figure 2-3.
2. Raise rear axle housing of truck until tires clear ground. Securely block up rear axle housing near the wheel motor mounting flange.
3. Disconnect inner wheel valve stem extension from outer wheel valve stem vinyl clamp by loosening capscrews. Lift valve extension out of vinyl clamp.
4. Using a tire handler (or hoist and sling if body has been removed as shown in Figure 2-4) to grasp outer wheel assembly. Remove wheel nuts (10, Figure 2-4) and wedges (11) securing outer wheel to the wheel motor hub.



Use a strap or other means, to secure inner wheel before removing outer wheel assembly. This will prevent the accidental slipping of inner wheel during this operation.

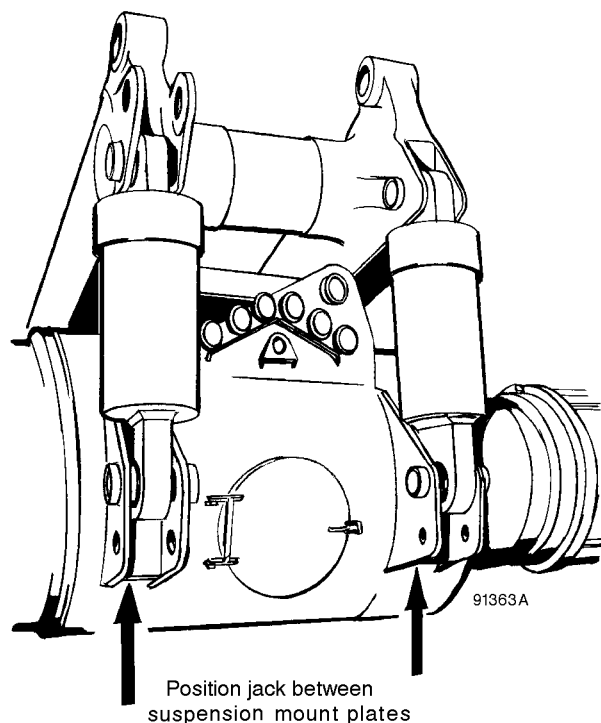


FIGURE 2-3. TIRE LIFTING SLING
(BODY REMOVED)

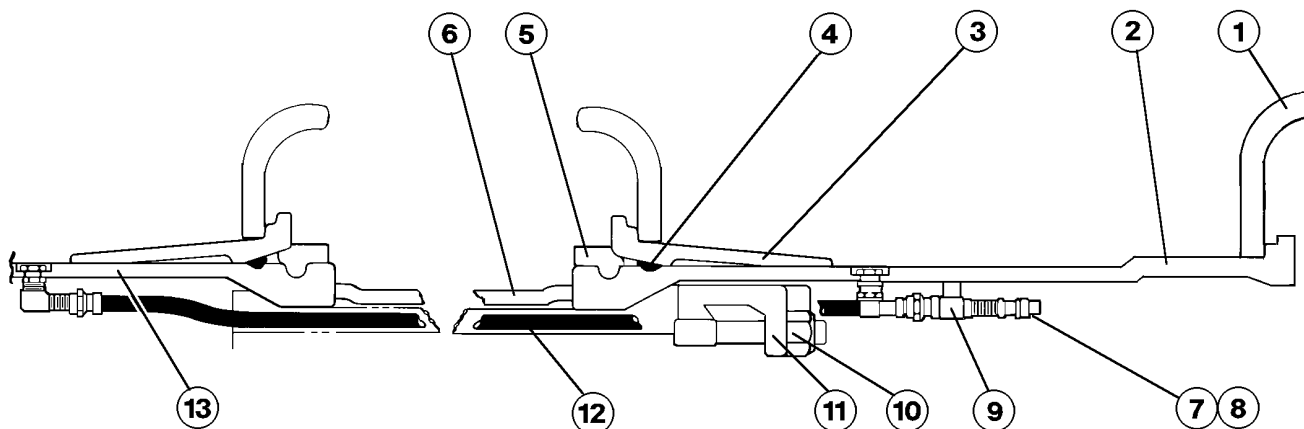


FIGURE 2-4. REAR WHEEL ASSEMBLY

- | | | | |
|--------------------|--------------|--------------------------|---------------------|
| 1. Side Flange | 5. Lock Ring | 9. Clamp | 13. Inner Wheel Rim |
| 2. Outer Wheel Rim | 6. Spacer | 10. Nut | |
| 3. Bead Seat Band | 7. Valve Cap | 11. Wheel Retainer Wedge | |
| 4. O-Ring | 8. Core | 12. Valve Extension Tube | |

Disassembly

Note: The preferred method for rebuilding the front wheel hub and spindle assembly is to remove these components as a complete unit, then support the assemblies in a fabricated rebuild fixture, allowing disassembly and reassembly with the axis of the spindle positioned vertically. If repairs are made with spindle installed on truck, be certain to observe CAUTION statement below.

1. Remove wheel hub and spindle as a complete assembly as covered in "Removal".
2. To aid in complete disassembly of wheel hub and spindle assembly, support assembly in a vertical position using a fabricated spindle stand.
3. Remove brake calipers from support as outlined in Section "J", Brakes.
4. Remove capscrews & lockwashers (2, Figure 3-5) and cover (3).
5. Remove O-ring (10) from cover.
6. Remove capscrews & flat washers (5), bearing retainer plate (8), and shims (7).
7. Attach a lifting device to the wheel hub and carefully lift it straight up and off the spindle. Remove outboard bearing cup (10) and cone (9).

CAUTION

If disassembly of the wheel hub is accomplished while on the truck, the outboard bearing cone should be supported during wheel hub removal to prevent cone from dropping and being damaged.

NOTE: Half of the face seal (16) will remain in the bore of the hub. Do not remove seal unless replacement is required. Use extreme caution when handling face seals. Seals must be replaced in a matched set. If one seal is damaged, both seals must be replaced.

8. Remove face seal, bearing cone (19), and spacer (18) from spindle.

9. If brake disc replacement is required, attach a lifting device to the brake disc (1, Figure 3-6), remove capscrews (2), and lift and brake disc from hub (3).
10. If brake support replacement is necessary, remove capscrews and flatwashers (21, Figure 3-5) and remove support (13).

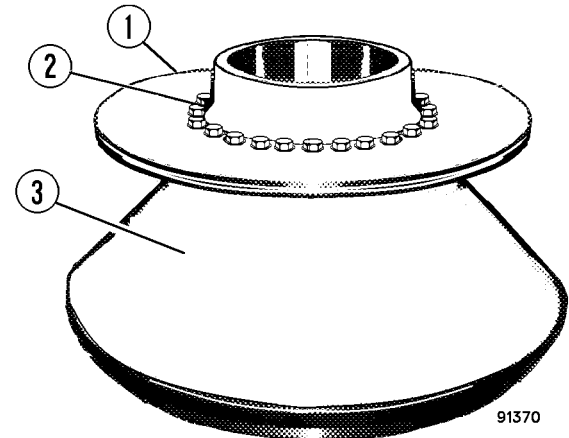


FIGURE 3-6. BRAKE DISC REMOVAL

- | | |
|-----------------------------|--------------|
| 1. Brake Disc | 3. Wheel Hub |
| 2. Capscrews & Flat-washers | |

Cleaning and Inspection

1. Clean all metal parts in fresh cleaning solvent.
2. Replace any worn or damaged parts.
3. Replace O-rings and face seals if worn or damaged.
4. Inspect wheel hub and spindle for damage.
5. Check all lips and cavities in spindle and wheel hub for nicks or tool marks that may damage the rubber seal ring on the face seals.

REAR AXLE HOUSING ATTACHMENT

PIVOT PIN

Removal

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

⚠ WARNING

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

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

⚠ WARNING

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

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

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

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

Installation

1. Raise pivot eye into position.
2. Be certain spherical bearing inner race (7) is aligned. Install spacers (5, Figure 4-1), cover rings (10), and pin (6).
3. Line up cap screw holes in pin with cap screw holes in retainer plate (2). Install cap screws (4).
4. Rotate pin and retainer plate to align cap screw holes in frame mounting structure.
 - a. Install cap screws and lockwashers (3).
 - b. Tighten cap screws (3) to **125 ft. lbs. (170 N.m)** torque.
 - c. Tighten cap screws (4) to **1715 ft. lbs. (2325 N.m)** torque.
5. Install clamps (14) on cover rings (10). Tighten clamps just enough to hold covers in place.
6. Install ground wire and lubrication line. Pressurize lube line to assure bearing receives grease.

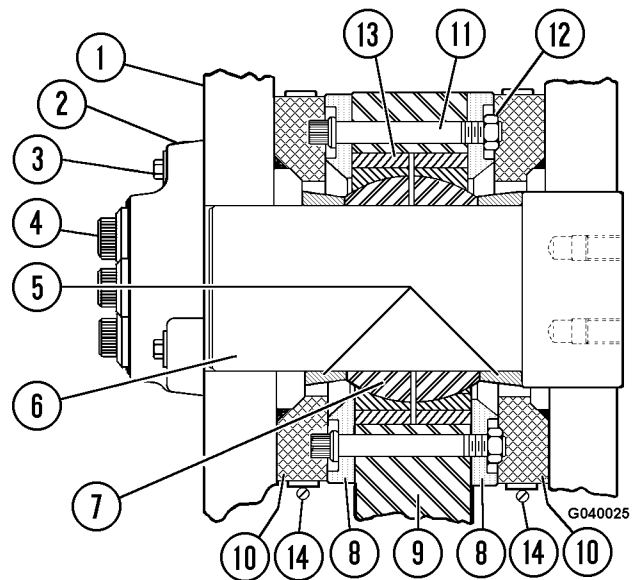


FIGURE 4-1. PIVOT PIN INSTALLATION

- | | |
|--------------------------------------------------|----------------------------|
| 1. Mounting Structure | 7. Bearing |
| 2. Retainer Plate | 8. Bearing Retainer |
| 3. Retainer Cap Screw & Lockwasher | 9. Pivot Eye Structure |
| 4. Cap Screw (12pt. - G9) & Hardened Flat-washer | 10. Cover Ring |
| 5. Bearing Spacer | 11. Cap Screw (12pt. - G9) |
| 6. Pivot Pin | 12. Locknut |
| | 13. Bearing Carrier |
| | 14. Clamp |

4. Lubricate capscrew threads, capscrew head seats, washer face, and nut seats with a rust preventive compound. Approved sources are:

- AMERICAN ANTI-RUST GREASE # 3-X from Standard Oil Company, also American Oil Company.
- RUSTOLENE D grease from Sinclair Oil Company.
- GULF NORUST # 3 from Gulf Oil Company.
- RUST BAN 326 from Humble Oil Company.
- 1973 RUSTPROOF from the Texas Company.
- RUST PREVENTIVE GREASE-CODE 312 from the Southwest Grease and Oil Company.

NOTE: If none of the rust preventive greases listed above are available for field assembly, use one of the following lubricants:

- SAE 30 weight oil.
- 3% Molybdenum - Disulphide Grease



High tightening force is required to load front suspension mounting capscrews. Repeated tightening operations will cause capscrew material to fatigue and break. DO NOT reuse mounting hardware (capscrews, hardened washers, and nuts) more than twice after original installation (3 total – see NOTE below). Replace capscrews, washers and nuts after third use.

NOTE: The following method is suggested to control the "3 - Use" maximum:

Punch mark the capscrew heads with a center punch after each tightening as follows:

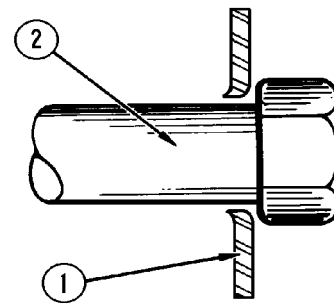
- Initial Installation - No (0) marks.
- Second Installation - One (1) punch mark.
- Third Installation - Two (2) punch marks.

Suspension mounting capscrews are specially hardened bolts to meet or exceed Grade 8 specifications. Replace only with bolts of correct hardness. Refer to Haulpak Parts Catalog for correct part number. Before installation, inspect each capscrew for any defects and number of punch marks. Replace capscrew and related hardware if two punch marks are evident; do not reuse if any defect is suspected. Hardware showing signs of rust, corrosion, galling or local yielding on any seat or thread surfaces should be replaced. Replace all suspension mounting hardware,

if the truck was operated with the suspension mounting in a loose joint condition.

5. Attach fork truck or lifting device to suspension and mount suspension to the truck frame making sure shear bar (5, Figure 2-4) is in place. Install fourteen capscrews (1, 6, 8) with hardened washers and nuts. *Four bottom holes tapped into suspension housing require capscrews (6) with hardened washers, and spacers (9) only.*
6. The capscrews are now ready for the first step of preloading using "TURN-OF-THE-NUT" Tightening Procedure.

NOTE: The "Turn-of-the-Nut" tightening procedure was developed for high strength 1 1/2" UNC capscrews (grade 8 or better). Do not use this tightening method for capscrews of lesser grade/size.



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INSTALLATION OF HARDENED FLAT WASHER

1. Hardened Flat Washer
2. Capscrew

NOTE: Special hardened flat washers are punched during the manufacturing process, therefore when used under the capscrew head they must be assembled with the inside diameter radius of the hole toward the head (punch lip away from head) to prevent damage to the fillet between capscrew head and shank. See illustration above.

OILING AND CHARGING PROCEDURE

GENERAL

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

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

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

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 safety instructions, cautions, and warnings provided in the following procedures to prevent any accidents during Oiling and Charging.

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

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

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

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

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

EQUIPMENT LIST

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

HYDRAIR® CHARGING KIT

Assemble service kit as shown in Figure 4-1 and attach to container of pure dry nitrogen (8).

Installation of Charging Kit

1. Remove protective covers and charging valve caps from suspensions to be charged.
2. Turn "T" handles (1, Figure 4-1) of adapters (2) completely counterclockwise.

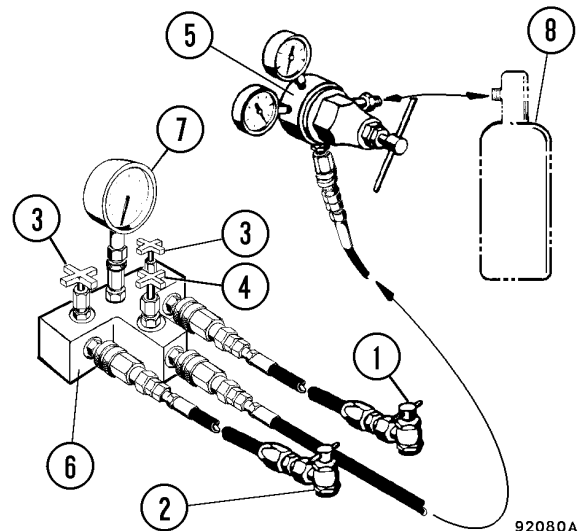


FIGURE 4-1. HYDRAIR® CHARGING KIT

NOTE: Arrangement of parts may vary from illustration above, depending on Charging Kit P/N.

1. "T" Handle Valve
2. Charging Valve Adapter
3. Manifold Outlet Valves (from gauge)
4. Inlet Valve (from regulator)
5. Regulator Valve (Nitrogen Pressure)
6. Manifold
7. Charging Pressure Gauge (Suspensions)
8. Dry Nitrogen Gas (Specifications Figure 4-5)

BRAKE CIRCUIT

The 830E truck is equipped with hydraulic actuated disc brakes. The front brakes have three calipers applying braking effort to a single disc on each wheel. The rear brakes have two (armature-speed) discs with one caliper per disc. Each rear outboard disc also contains a parking brake caliper.

The fundamental function of the brake system is to provide an operator the control he needs to stop the truck in either a slow modulating fashion or in as short a distance as reasonably possible.

Outlined below are the functions that are necessary for safe truck operation:

1. Warn the operator as soon as practical of a serious or potentially serious loss of brake pressure so proper action can be taken to stop the truck before the secondary system is exhausted of power.
2. Provide secondary brake circuits such that any single failure leaves the truck with sufficient stopping power.
3. Automatically apply service brakes if low pressure warnings are ignored and pressures continue to decrease.
4. Wheel brake lock to relieve the operator from holding the brake pedal while at the dump or shovel.
5. Spring applied park brake for **holding, not stopping**, the truck during periods other than loading or dumping.
6. Brake system that is easy to diagnose and perform necessary service.

The following brake circuit description should be used in conjunction with the hydraulic brake system schematic, refer to Section "R".

The brake system consists of two major valve components; the dual circuit treadle valve (heart of the system) and brake manifold. The dual circuit treadle valve is the only component located in the operator's cab.

The remainder of the system, including the brake manifold, circuit accumulators, and electrical components, are located in a weatherproof cabinet behind the cab. This cabinet is accessible for diagnostic and service work.

The brake manifold contains dual circuit isolation check valves, accumulator bleed down valves, and valves for brake lock, park brake and automatic apply functions. All of these components are screw-in cartridge type valves.

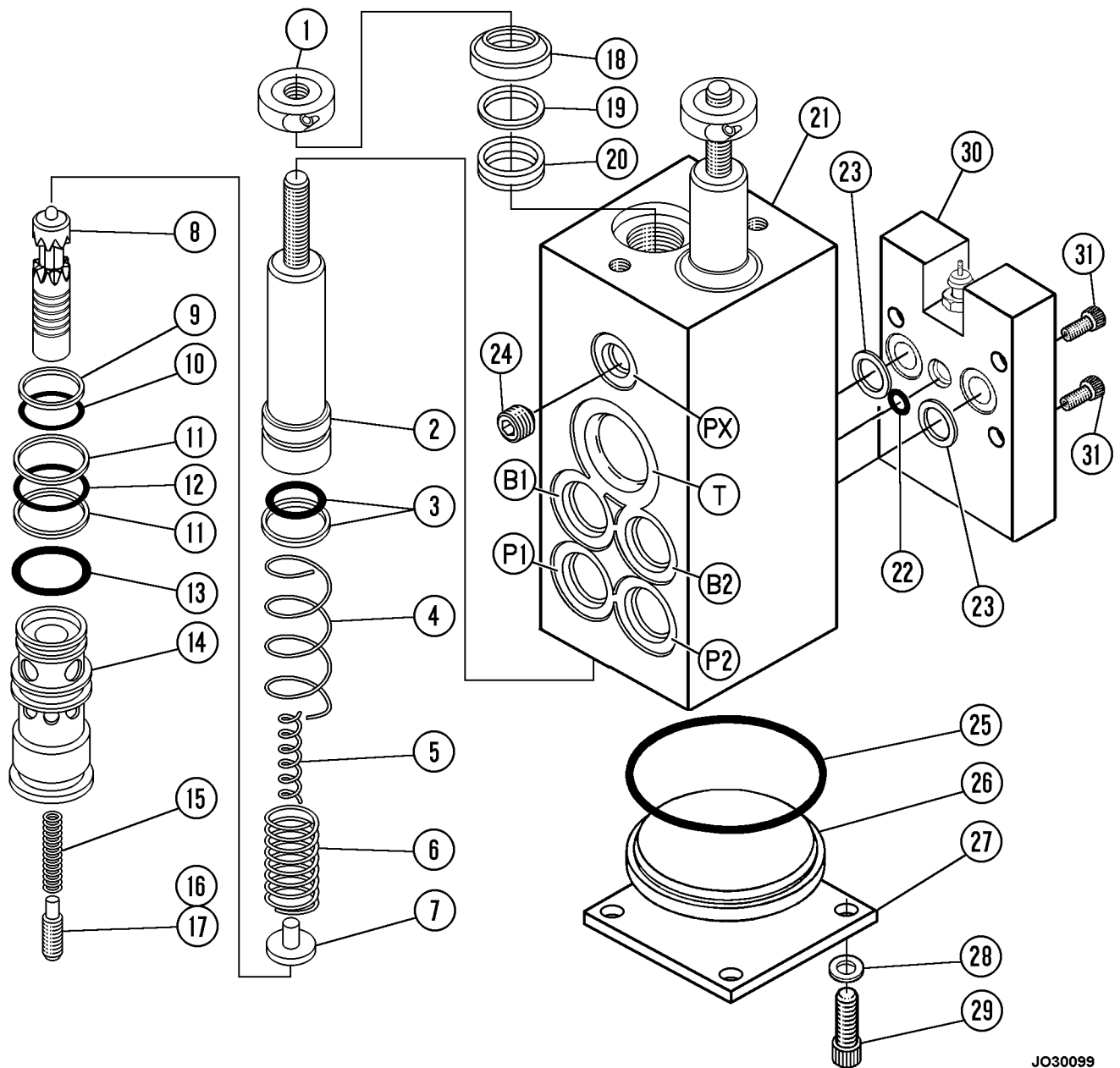
In the 830E truck, there are two independent means of brake actuation, the service brake pedal and brake lock switch.

SERVICE BRAKE CIRCUIT OPERATION

This portion of the system provides the operator the precise control he needs to modulate (feather) brake pressure to slowly stop the truck or develop full brake effort to stop as quickly as possible. The heart of this circuit is the treadle operated dual circuit brake valve. This valve enables the operator to control the relatively high pressure energy within the brake accumulators directly to the brakes. The only element between the operators foot and the actual brake fluid is the dual circuit treadle valve.

As the pedal is depressed, each valve within the dual circuit treadle valve simultaneously delivers fluid from its respective accumulator to the wheel brakes at a pressure proportional to both pedal position and force. The further the pedal is depressed, the higher the brake force, giving a very positive feel of control.

Brake accumulators have two functions; storing energy for reserve braking in the event of a failure and, provide rapid oil flow for good brake response. Depression of the brake pedal actuates the stop light pressure switch, which in turn actuates stop and service brake indicator lights and propulsion interlock. The stop light switch (12, Figure 2-1) is located on the junction block (10) inside the brake cabinet.



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FIGURE 3-5. BRAKE VALVE

- | | | | |
|--------------------------|---------------------------|----------------------------|----------------------------------|
| 1. Adjustment Collar | 9. Back-up Ring | 17. Reaction Plunger (B2) | 25. O-Ring |
| 2. Actuator Plunger | 10. O-Ring | 18. Wiper Seal | 26. Retaining Plug |
| 3. Glyde Ring Assembly | 11. Back-up Ring | 19. Back-up Ring | 27. Base Plate |
| 4. Plunger Return Spring | 12. O-Ring | 20. Poly-Pak Seal | 28. Washer |
| 5. Regulator Springs | 13. O-Ring | 21. Valve Body | 29. Capscrew |
| 6. Regulator Springs | 14. Regulator Sleeve | 22. O-Ring | 30. Differential Pressure Switch |
| 7. Spring Seats | 15. Spool Return Spring | 23. Face Seals | 31. Capscrew |
| 8. Regulator Spool | 16. Reaction Plunger (B1) | 24. Set Screw Orifice Plug | |

HYDRAULIC BRAKE ACCUMULATORS

There are two hydraulic brake accumulators located on the brake manifold in the brake control cabinet behind the operator's cab. The larger accumulator [2.5 gal. (9.51 l) capacity] supplies the pressure necessary for actuation of the front service brakes. The small accumulator [1 gal. (3.79 l) capacity] supplies pressure to activate the rear service brakes.



Accumulators maintain high pressure. DO NOT disconnect any hydraulic line from the accumulators or brake system until all hydraulic pressure has been manually drained from accumulators. Open manual drain valves located on the brake manifold in the brake cabinet to drain pressurized oil. The manual bleddown valve for the rear accumulator is identified as "NV1". The manual bleddown valve for the front accumulator is identified as "NV2".

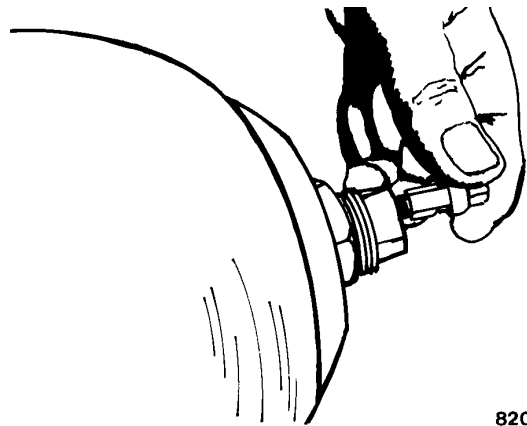
Brake Accumulator Bleed Down Procedure

The brake accumulators can be bled down by rotating the manual bleddown valves (NV1 and NV2) counterclockwise. The valves are located on the brake manifold in the hydraulic brake cabinet.

1. Turn handles counterclockwise to open valves.
2. Confirm accumulators are bled down by applying the "Brake Lock" switch (key switch ON, engine shut down) and applying service brake pedal. The service brake light should not come on.
3. Close the bleddown valves by rotating clockwise.

Removal

1. Shut down engine and exhaust all hydraulic pressure from the system by opening accumulator manual drain valves.
2. Remove the valve guard and "Dyna-seal" from top of accumulators.
3. Depress valve core to release gas precharge pressure from accumulator bladder. (Refer to Figure 3-13).
4. Remove accumulator mounting bracket. Loosen and remove accumulator from the brake manifold. Plug opening on brake manifold to prevent contamination.
5. Transfer accumulator to work area.



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FIGURE 3-13. VALVE CORE REMOVAL

Installation

1. After service repairs or bench test has been completed, move the accumulators to the brake control cabinet. DO NOT precharge accumulators on the bench test.
2. Position the accumulators on the brake manifold. Tighten fittings securely. Install mounting brackets. Secure mounting brackets in place with capscrews and lockwashers. Tighten capscrews to standard torque.
3. Refer to "Charging Procedure" in this section.
4. Replace "Dyna-seal" and valve guard on top of accumulators.

Disassembly

1. Securely clamp accumulator (preferably in a chain vise). Make sure accumulator shell is suitably protected by strips of padding or soft metal on vise base.
2. Remove core from gas valve using valve core tool. (Refer to Figure 3-13).
3. Remove pipe plug from plug & poppet.
4. Remove locknut from plug and poppet assembly using a spanner wrench and an adjustable wrench. One for torque and one for counter-torque. (Refer to Figure 3-14).
5. Remove spacer, Figure 3-15.
6. With palm of hand, push plug and poppet assembly into the shell.
7. Insert hand into shell and remove O-ring, washer and anti-extrusion ring from plug. Fold anti-extrusion ring to enable removal. (Refer to Figure 3-16).
8. Remove plug and poppet assembly from shell. (Refer to Figure 3-17.)

14. Release pedal, assure that each circuit's pressure is zero.
 - Record on data sheet.
15. To check pedal free play, refer to the procedure "Additional Testing and Adjustment (With brake pedal installed)" in this "Section J" of the service manual.

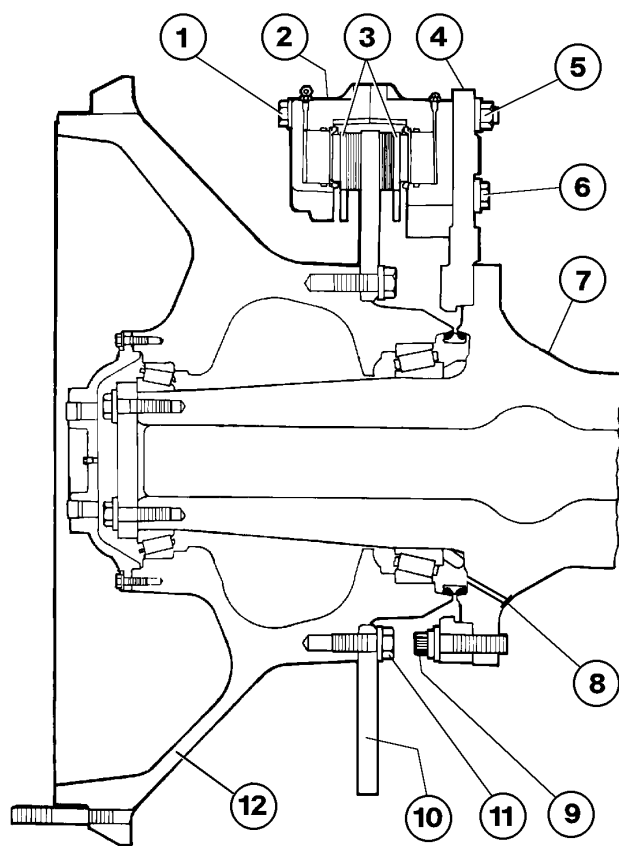
NOTE: Free play is defined by the gap between the setscrew (in the pedal structure) and the actuator cap. There must be a gap to prevent brake drag.

16. Cycle brake lock several times to assure crisp shift of solenoid valve and release of oil pressure.
17. Apply brake lock and read brake pressures. Front pressure should be zero and rear pressure should be 1500 ± 100 psi (10343 ± 690 kPa).
 - Record on data sheet.

Failure Modes Check-Out

18. Allow engine to run until low brake accumulator pressure stabilizes at or above 3200 psi (22,064 kPa).
19. Shut engine down. Allow 90 seconds for the steering accumulator to bleed completely down. Disable steering pressure switch from the brake warning circuit by unplugging the diode between circuits 33 and 33F. (This is diode 22 on diode board 1) Turn key switch on. After two minutes, record the low accumulator pressure (LAP1 port). If LAP1 pressure is below 2600 psi (17,927 kPa), then leakage in the system is excessive and the source of the leakage needs to be identified.
 - Record on data sheet.
20. Crack the front brake accumulator bleed down valve and observe LAP1 pressure. The Low Brake Pressure lamp and buzzer must actuate at 2300 ± 75 psi ($15,859 \pm 517$ kPa).
 - Record on data sheet.
21. Brake pressures should begin to rise (Auto Apply) when LAP1 reaches 2000 ± 100 psi. Close front brake accumulator bleed down valve.
 - Record on data sheet.

22. Start engine to recharge hydraulic system. Allow engine to run until low brake accumulator pressure stabilizes at or above 3200 psi (22,064 kPa).
23. Shut engine down. Allow the steering accumulator to bleed completely down. Turn Key Switch on. Crack the rear brake accumulator bleed down valve and observe LAP1 pressure. Verify that the Low Brake Pressure lamp and buzzer, and Auto Apply set points are within a 100 psi (690 kPa) of those recorded in step 20. Record Auto Apply brake pressures. Close the rear brake accumulator bleed down valve.
 - Record on data sheet.
24. Enable the steering pressure switch by plugging in the diode removed between circuits 33 and 33F.
25. Start the engine to recharge hydraulic system. Allow engine to run until low brake accumulator pressure stabilizes at or above 3200 psi (22,064 kPa).
26. Shut engine down. Do not allow steering accumulator to bleed down. Make repeated slow, complete brake applications with pedal until auto apply comes on. Record the number of brake applications prior to auto apply.
 - Record on data sheet.
27. Bleed down both brake accumulators by fully opening the manual bleed down valves on the brake manifold.
28. Outside the brake cabinet, disconnect the hose that supplies oil from the front brake accumulator to the brake pedal in the cab for the front brakes (port AF1) and plug the tube end at the cabinet. Be sure to leave end of hose vented to atmosphere.
29. Start engine and allow low brake accumulator pressure (LAP1) to stabilize at 3200 psi (22064 kPa) before proceeding.



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FIGURE 5-3. SPINDLE AND HUB ASSEMBLY

- | | |
|------------------------|-------------------------|
| 1. Capscrew/Flatwasher | 7. Spindle |
| 2. Brake Caliper | 8. Oil Drain |
| 3. Lining | 9. Capscrew/Flatwasher |
| 4. Adapter | 10. Brake Disc |
| 5. Nut & Flatwasher | 11. Capscrew/Flatwasher |
| 6. Capscrew/Flatwasher | 12. Wheel Hub |

Piston Removal

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

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

3. Carefully remove the piston dust shields (10) from behind the groove lip in the housing and from the grooved lips on the piston.
4. Mark each piston and corresponding brake caliper housing position and pull piston out of the housing. Do not interchange parts.

5. Remove O-ring seals (12) and backup ring (13) from the piston cavity using small flat non-metallic tool having smooth round edges.

NOTE: Prior to assembly, refer to "Cleaning and Inspection" procedure.

Installation

At assembly of the piston (11, Figure 5-2) into the housings (1), lubricate all cylinder walls, threads, seals, piston seal surfaces, etc., with clean C-4 hydraulic oil.

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

NOTE: Keep these parts as free of lubricant as possible.

4. Install all fittings (4 & 5) and bleeder (2) in correct position in housings.
5. Apply Loctite 271 to threads of capscrew (6). Install linings (9) and end caps (7 & 8) with bolts (6) and tighten to **403 ft. lbs. (546 N.m)** torque.
6. Refer to this section for "Caliper Installation" onto brake adapter.

NOTE: "Bench Test" should be performed before installing calipers. Use same "Bench Test" procedure as used in "Rear Disc Brake" section.

7. Make sure all brake lines are securely connected.
8. Bleed brakes as described in "Bleeding Procedure", this section.
9. Install front tires. Refer to Section "G".

Caliper Cleaning and Inspection

1. Preliminary cleaning can be more effective if linings are first removed. However, retaining plates should be temporarily reinstalled in order to stay with brake assembly through overhaul cycle.

Caliper, Disc, And Parking Brake Installation

1. If removed, install adapter (2, Figure 6-3A) and secure in place with capscrews and flatwashers (3). Tighten capscrews to standard torque.
2. Install two 7/8 - 9 UNC - 14 in. studs in two center caliper mounting capscrew holes (in place of capscrews 13). Install spacer (15) and secure in place with two 0.875 - 9 UNC - 2.5 in. capscrews and two flat washers. Tighten capscrews securely, but not to standard torque.
3. Install inboard disc (12) with four equally spaced capscrews with flatwashers. Tighten capscrews, but do not tighten to final torque at this time.
4. Measure and record distance from inner caliper mount surface (on spacer 15) to inside face of inner brake disc (12), Dimension "A", Figure 6-3A.

NOTE: All measurements in the following references are inches, unless otherwise stated.

5. Subtract dimension "A" from 4.375 in. The difference is shim pack thickness to be placed between inner disc (12) and one-piece disc adapter (16).
6. Refer to "Shim Pack Chart" and select shim pack as follows:

Example: If result found in Step 5 is 0.051", then 0.051 is between 0.045 - 0.055 in **Shim Pack Chart**. This range indicates one 0.010 in. shim and one 0.040 in. shim is required to provide correct shim pack thickness.

7. Remove disc mounting capscrews (11) and inner disc (12).
8. Remove the two 0.875 - 9 UNC - 2.5 in. capscrews securing spacer (15).
9. Install inner brake caliper half (14) over the two studs and spacer (15).
10. Install shim pack (7), determined in Step 5, on inner one-piece disc adapter (16) and install inner disc (12) with bushing (8).
11. Install all capscrews and flatwashers (11) to inner disc. Tighten capscrews (11) to standard torque.
12. Install outer brake caliper half (14) and two capscrews and flatwashers (13).

13. Remove the two studs in the center and install two capscrews (13) and hardened flatwashers. Tighten all capscrews (13) to standard torque.
14. Install outer disc adapter (10). Install capscrews and flat washers (9). Tighten 12 point head capscrews (9) to standard torque.
15. Install two 7/8 UNC-14 in. studs in the two center caliper mounting capscrew holes for the upper brake caliper (5).
16. Install park brake bracket (4) over the two studs and secure in place with two 0.875 - 9 UNC - 2.5 in. capscrews and two flat washers. Tighten capscrews securely, but not to standard torque.
17. Install outboard disc (12) with four equally spaced mounting capscrews (11). Tighten, but do not tighten to final torque at this time.
18. Measure distance from outer face of park brake bracket (4) [caliper mounting surface] to inner face of outboard disc (Dimension "B", Figure 6-3A).
19. Subtract distance determined in Step 18 from 4.375 in (11.113 cm). This difference is the shim pack thickness to be placed between adapter (10) and outer brake disc (12).
20. Make up shim pack from Shim Pack Chart.
21. Remove capscrews (11) and outer disc (12).
22. Install the shim pack (7) determined in Step 19 between outboard disc (12) and adapter (10).
23. Install outboard disc (12) with bushing (8). Install capscrews and flatwashers (11). Tighten capscrews (11) to standard torque.
24. Install outboard caliper half (5) and secure in place with the outer capscrews and flatwashers (6). Remove the two studs in the center holes and install the remaining two capscrews (6) with washers. Tighten capscrews (6) to standard torque.
25. Install linings (Refer to "Lining Replacement").
26. Install bleeders in both calipers. Install crossover tubes and brake lines.
27. Install park brake caliper, refer to "Park Brake Caliper Installation".
28. Brakes must be bled and burnished before truck is returned to production. Refer to "Bleeding" and "Service Brake Conditioning" procedure.

Brake Pad Conditioning (Burnishing) Procedure

General

These procedures apply **ONLY** to the brake lining assemblies obtained from Komatsu Parts Dept. for use on Komatsu Electric Drive Trucks equipped with Rockwell/Goodyear disc brakes.

Conditioning and burnishing of service brake linings must be performed each time a new set of brake linings are installed, or before a new Komatsu Truck is put into operational service. A surface pyrometer is required to measure brake disc temperatures during the conditioning procedures.

If "Brake Certification" type tests are to be run, all linings and discs should be new and the factory should be notified. For in-service testing of service brakes, new linings or discs are not necessary.

Front discs should be in serviceable condition with no metal smearing or metal buildup from previous use and not extensively rough or grooved. Inspect discs for wear limits.

Rear discs will operate at higher temperatures and can be dark blue in color and show periodic spots [approximately 1.5 in. (3.8 cm) in size] and still be serviceable. A disc that is extremely heat-checked with radial cracks open to show a gap should not be used.

IMPORTANT! To prevent lining damage during burnishing, as well as for stop distance tests, release the brakes as quickly as possible at the end of each cycle or stop.

The burnish procedure consists of:

1. Alternately applying and releasing the service brakes until the recommended brake disc surface temperature is reached: then allow brakes to cool. Cool brakes, if necessary, by driving machine. (Rear brakes will normally cool faster than fronts.) Repeat cycle 3 - 4 more times.
2. To expedite the burnishing cycles of heating and cooling, operate the brakes on only one axle at a time, so that the other system will be cooling (operate front brakes with rear brakes disconnected, or rear brakes with front brakes disconnected).
3. The recommended order for burnishing is: Front, Rear, Front, Rear, Front, Rear and Front.

NOTE: Heavy smoke, flames, and foul odor from brake linings is normal during burnishing procedures.

Conditioning (Burnishing) Rear Brakes



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. Refer to **Temporary Disconnect Procedures** on the following pages.

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

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.



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 (refer to **Temporary Disconnect Procedures** on the following pages).
7. Insure all brakes are functioning properly.

Park Brake Caliper Assembly

1. Using all new seal assemblies, lubricate seals (6 & 12, Figure 7-2) with clean hydraulic oil as used in brake circuit. Lubricate cylinder walls with Dow Corning # 4 (or equivalent).
2. Install lubricated seals and backup ring (12 & 13, Figure 2) or O-ring & backup ring (12 & 13, Figure 2A) in housing.
3. Install lubricated seals and backup ring (6 & 7, Figure 2) or O-rings & backup ring (6 & 7, Figure 2A) on pistons.
4. Attach lining (5) to pistons with screws (14). (Refer to "Lining Replacement" Procedure).
5. Install piston in housing.
6. Lubricate spring washers (9) with anti-seize compound.
7. Place spring retainers (15) on a flat surface with the largest diameter on the bottom. Install piston dust boots (8) in groove of spring retainer (15). Place lubricated spring washers (9) on spring retainer so that the concave surface of each pair of springs face one another.
8. Install spring retainers (15) with spring washers on pistons.
9. Install the outer edge of dust boot (8) in grooves of housing.
10. Place yoke (1) over housing (2) and align hole in yoke with the hole in housing.
11. Place washer (4) on clamping bolt (3) and install bolt and washer loosely. Attach yoke to housing.
12. Screw jam nut (17) all the way on adjustment bolt (16) and apply anti-seize compound to threads and end of bolt. Screw bolt in yoke part way, approximately five (5) turns.
13. Install bleeder valves (11) on housing.

PARK BRAKE LINING REPLACEMENT

Inspect park brake linings periodically for wear. Linings must be replaced before lining material has been worn to the top of the retaining screws. Use of linings beyond this wear limit will result in decrease of braking action, and possible damage to disc.

1. Change linings. Refer to "Park Brake Caliper Removal" and "Disassembly" procedure.
2. Remove screws (14, Figure 7-2) releasing the lining (5) from the piston (10).
3. Install new lining and secure lining to piston with screws (14).

NOTE: If lining mounts screws are reused, use Loctite® No. 242 (or equivalent) on threads.

4. After lining replacement, refer to "Park Brake Caliper Installation, Bleeding, Adjustment and Conditioning".

PARK BRAKE BURNISH PROCEDURE

Lining Conditioning

1. Preheat brake disc with service brakes to clean and heat rear discs to between 350°F - 500°F (177°C - 260°C).
2. Park on hot disc (3 to 5 minutes) to clean and heat parking brake linings.

NOTE: Parking capabilities can be tested by parking loaded truck (Do NOT exceed rated GVW shown on Grade/Speed decal in cab) on steepest hauling grade in mine (not to exceed 15% grade).

If parking brake does not hold on grade, allow vehicle to start to roll down grade for approximately 15 ft. (4.6 m), then stop truck with service brakes. While holding truck with service brakes, release park brake. Reapply park brake and release service brakes.

If park brake still does not hold truck, refer to "Parking Brake Adjustment" and repeat procedure.

BRAKE BLEEDING PROCEDURE

1. Bleed parking brake after starting engine.
2. Move parking brake switch on instrument panel to "Off" position. Connect bleeder hose to bleeder valve, open bleeder valve until clear air-free oil (no bubbles) runs from hose. Close bleeder valve.
3. Repeat for each bleeder.

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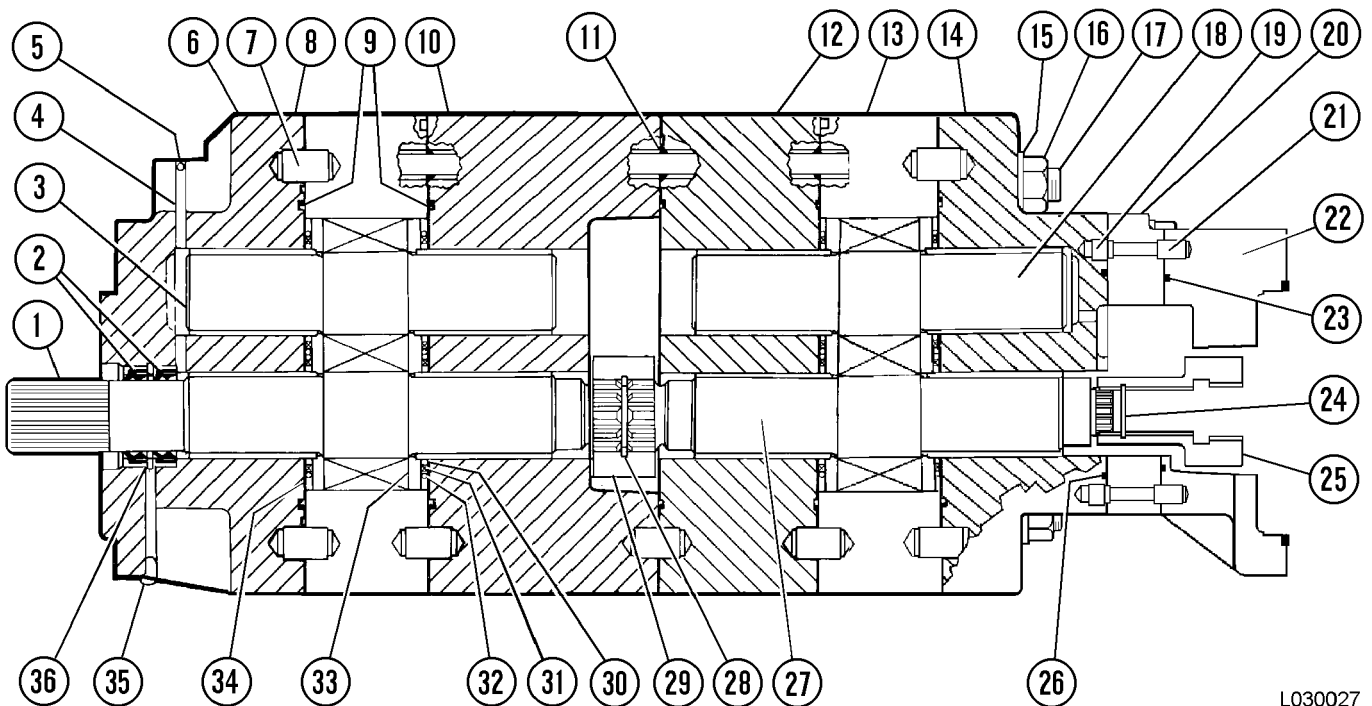
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3. Lubricate the steering pump spline shaft and align with coupling (9). Install hoist pump to steering pump and install capscrews (10) with hardened washers and tighten to standard torque. Raise pumps up into position.
4. Attach front support bracket to the "T" bracket and to the pump with capscrews, lockwashers and nuts. Tighten capscrews to standard torque.
5. Connect hoist pump drive flange with drive shaft with capscrews, lockwashers and nuts. Tighten to standard torque.
6. Tighten support bracket capscrew (on rear of steering pump) to standard torque.
7. Uncap inlet and outlet hoses and install to pumps using new O-rings. Tighten capscrews securely.

8. Service the hydraulic tank with C-4 type hydraulic fluid. Refer to Hydraulic Tank this section for filling instructions.
9. Open the three suction line shut-off valves (13 & 18, Figure 3-1). Loosen capscrews (at the pump) on suction hoses (12 & 16) to bleed trapped air. Then loosen capscrews (at the pump) on pressure hoses to bleed any trapped air. Tighten all capscrews securely.
10. Reconnect blower tube and install blower tube support strap.

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



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FIGURE 3-3. HOIST PUMP

- | | | | |
|-----------------------|---------------------|-----------------------|---------------------|
| 1. Drive Gear & Shaft | 10. Connector Plate | 19. Dowel | 28. Snap Ring |
| 2. Seal | 11. O-ring | 20. Bearing Plate | 29. Coupler |
| 3. Idler Gear | 12. Bearing Plate | 21. Dowel | 30. Steel Ring |
| 4. Stud | 13. Gear Plate | 22. Transition Plate | 31. Backup Ring |
| 5. Steel Ball | 14. Connector Plate | 23. O-ring | 32. O-ring |
| 6. Flange | 15. Washer | 24. Snap Ring | 33. Pressure Plate |
| 7. Dowel | 16. Nut | 25. Coupler | 34. Isolation Plate |
| 8. Gear Plate | 17. Stud | 26. O-ring | 35. Plug |
| 9. O-ring | 18. Idler Gear | 27. Drive Gear (Rear) | 36. Snap Ring |

Installation

1. Install hydraulic tank and secure with capscrews and lockwashers. Tighten to standard torque.
2. Uncap hydraulic lines and attach to the proper connections.
3. Replace breather filters if required.
4. Fill the hydraulic tank with clean, filtered C-4 hydraulic oil. Refer to "Filling Instructions".
5. Bleed all air from hydraulic lines.
6. Bleed trapped air inside steering pump. Refer to "Pump Pressure Setting", Section "L" for air bleeding procedure.

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

HYDRAULIC TANK STRAINERS

Removal



Prior to opening the hydraulic tank, allow at least 90 seconds for the accumulator to bleed down after engine shutdown with the key switch "Off".

1. Shut down the engine and the key switch "Off" for at least 90 seconds.

NOTE: If the oil is to be reused, clean containers must be used with a filtering (3-micron) system available for refill.

2. Be prepared to contain approximately 238 gal. (901 l) of hydraulic oil. Drain hydraulic oil from tank.
3. Disconnect pump suction hoses. (4, Figure 3-18).
4. Remove capscrews and lockwashers (2) securing cover (5) to the hydraulic tank. Remove and discard gasket.
5. Remove capscrews and lockwashers securing suction strainers. Remove suction strainers.

Inspect and Clean

NOTE: Inspect the strainers thoroughly for metallic particles and varnish build up (if oil has been overheated). The quantity and size of any particles may be an indication of excessive wear of components in the hydraulic system.

1. Clean the strainers with fresh cleaning solvent from the inside out.
2. Inspect the strainers for cracks or wear. Replace, if necessary.
3. Clean any sediment from bottom of hydraulic tank.

Installation

1. Install suction strainers and secure in place with capscrews and lockwashers. Tighten capscrews to standard torque.
2. Using new cover gasket move cover into place and install capscrews and lockwashers. Tighten capscrews to standard torque.
3. Fill the hydraulic tank, refer to Hydraulic Tank Filling Instructions. Open both suction line shut-off valves.
5. Loosen suction line connections at both pumps to bleed any trapped air. Tighten hose connections.
6. Bleed trapped air inside steering pump. Refer to "Pump Pressure Setting", Section "L" for air bleeding procedure.

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

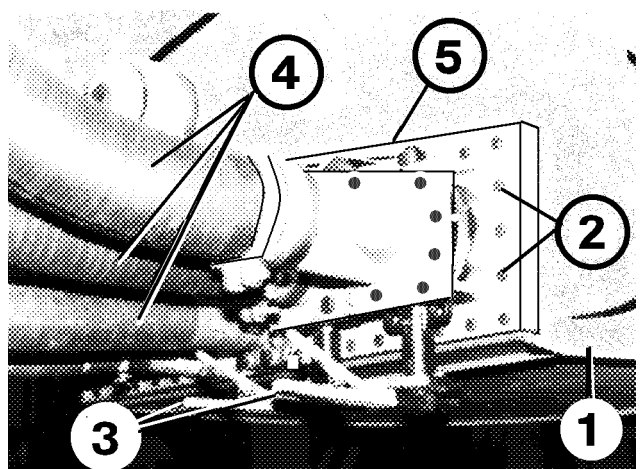


FIGURE 3-18. STRAINER REMOVAL ⁹¹²¹⁸

- | | |
|----------------------------|---------------------|
| 1. Hydraulic Tank | 3. Shutoff Valve |
| 2. Capscrews & Lockwashers | 4. Pump Inlet Lines |
| | 5. Cover |

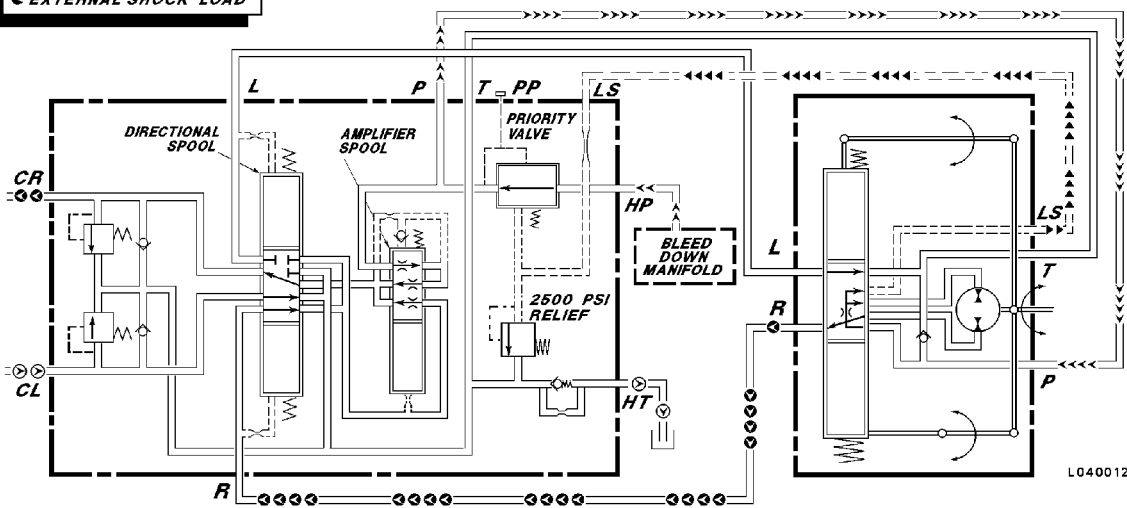
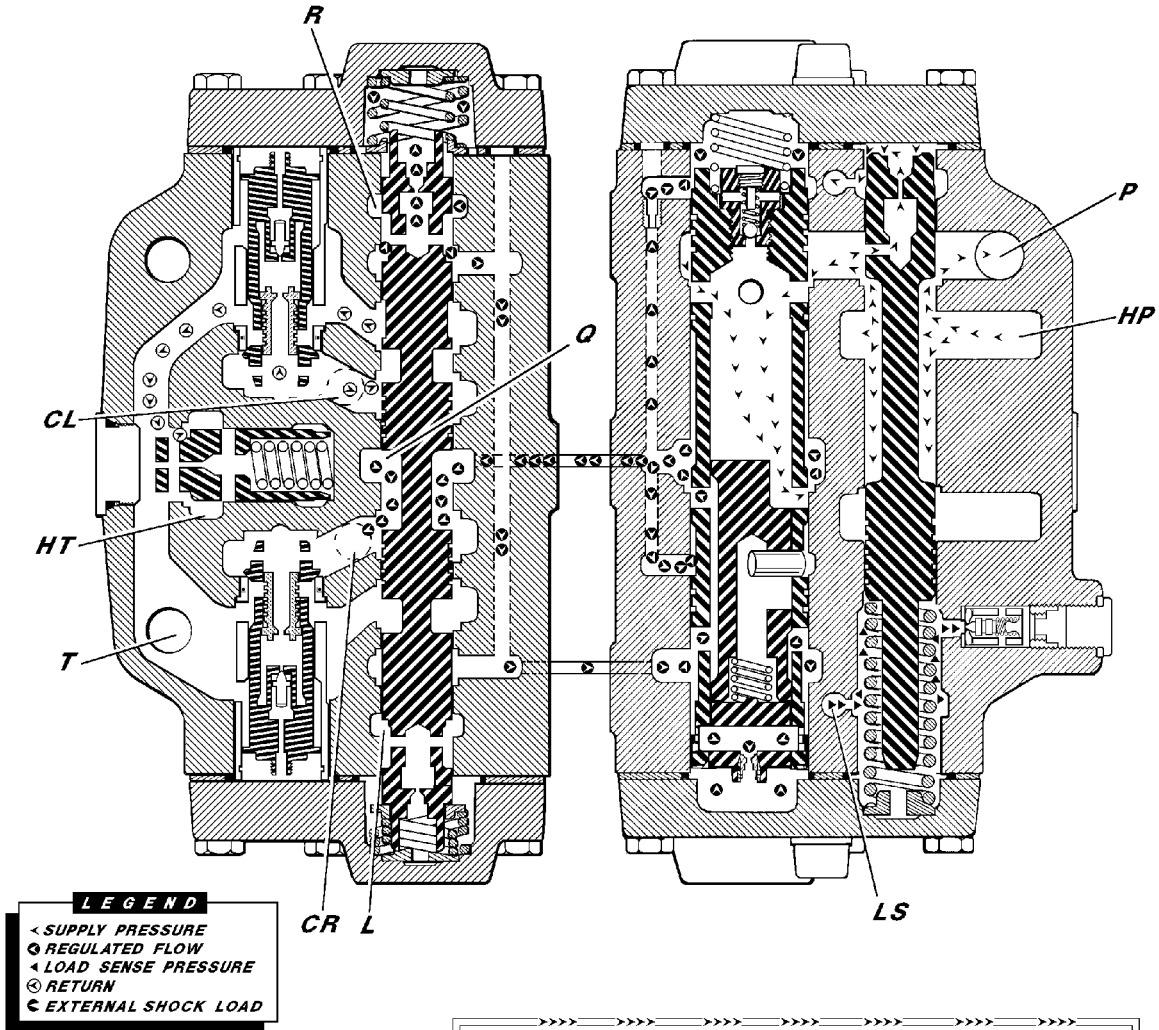


FIGURE 4-5. FLOW AMPLIFIER
(Steering Right)

WARNING

Make certain only the small swivel hex nut turns. Turning the complete charging valve assembly may result in the valve assembly being forced out of the accumulator by the nitrogen pressure inside.

Wear protective face mask when discharging nitrogen gas.

3. Loosen small hex nut (4, Figure 5-2) three complete turns. Remove valve cap (1). Depress the valve stem until all nitrogen pressure has been relieved.
4. Disconnect electrical leads at the pressure switch located on top of the accumulator (15, Figure 5-3).
5. Disconnect and plug the hydraulic line at the bottom of the accumulator.
6. Connect a lifting device to the top section of the accumulator and take up slack.

WARNING

The accumulator weighs approximately 1,300 lbs. (590 Kg). Use a suitable lifting device that can handle the load safely.

7. Remove the capscrews, nuts and lockwashers on the clamps securing the accumulator to the mounting bracket.
8. Lift accumulator clear of the mounting bracket and move to a clean work area for disassembly.
9. Clean exterior of accumulator before starting disassembly.

Installation

New or rebuilt accumulators have three pints of oil in the gas end to prevent rusting of the accumulator walls and to provide for piston seal lubrication.

NOTE: If accumulator has just been rebuilt and three pints of oil have already been added to the gas end of accumulator, do not add any additional oil. Proceed to Step 2.

1. Add three pints of oil.
 - a. Remove charging valve (3) if not already removed.
 - b. Add three pints of either rust preventative oil or C-4 hydraulic oil to gas end of accumulator to provide enough oil above top of piston for seal lubrication.
2. With new O-ring (9, Figure 5-2), install charging valve and tighten to **16.5 ft.lbs. (22 N.m) torque.**

WARNING

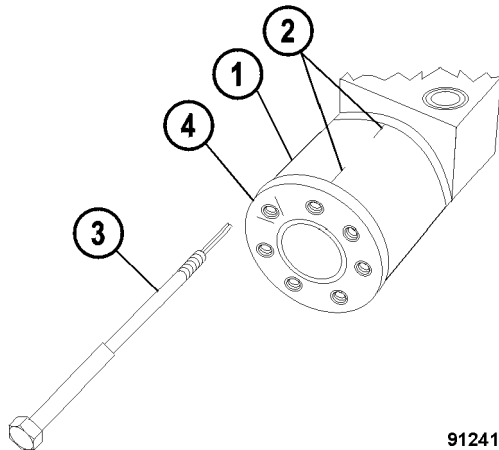
The accumulator weighs approximately 1,300 lbs. (590 Kg). Use a suitable lifting device that can handle the load safely.

3. Keep the accumulator upright and attach a lifting device to the top section of the accumulator. Lift into position, allowing the accumulator to rest on the lower mounting surface.
4. Install mounting clamps and secure in place using capscrews, nuts and lockwashers. Tighten capscrews to standard torque.
5. If the pressure switch was removed, install at this time. Connect electrical leads to the pressure switch, and using a new O-ring, unplug and connect the hydraulic line.
6. Precharge the accumulator with pure dry nitrogen as outlined in the "Steering Accumulator Charging Procedure".

Disassembly

NOTE: The steering control valve is a precision unit manufactured to close tolerances, therefore complete cleanliness is a must when handling the steering control unit. Work in a clean area and use lint free wiping materials or dry compressed air. Clean type C-4 hydraulic oil should be used during reassembly to insure initial lubrication.

1. Match mark gear wheel set and end cover to insure proper relocation during reassembly. Refer to Figure 5-10.

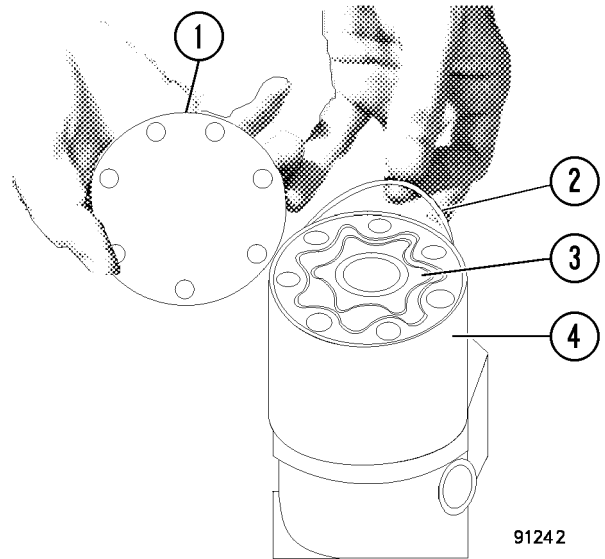


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FIGURE 5-10. STEERING CONTROL VALVE DISASSEMBLY

- | | |
|---------------------------|-----------------------------|
| 1. Steering Control Valve | 3. Capscrew With Rolled Pin |
| 2. Match Marks | 4. Relocation Mark |

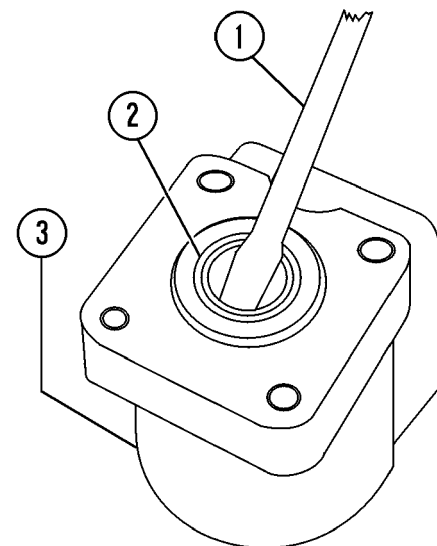
2. Remove end cover capscrews and washers. Remove capscrew with rolled pin (3, Figure 5-10). Mark location of capscrew with rolled pin to facilitate reassembly.
3. Remove end cover (1, Figure 5-11) and O-ring (2). Remove gear wheel set (3) and O-ring.
4. Remove Cardan Shaft (11, Figure 5-13), distribution plate (15) and O-ring (14).
5. Remove threaded bushing (4) and ball (3). Separate the spools from the housing. Remove O-ring (5), kin ring (6) and bearing assembly (7).
6. Remove ring (8) and pin (9) and carefully push inner spool out of outer sleeve.
7. Press the neutral position springs (10) out of their slot in the inner spool.



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FIGURE 5-11. STEERING CONTROL VALVE DISASSEMBLY

- | | |
|--------------|-------------------|
| 1. End Cover | 3. Gear Wheel Set |
| 2. O-ring | 4. Housing |



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FIGURE 5-12. DUST SEAL REMOVAL

- | | |
|----------------|------------|
| 1. Screwdriver | 3. Housing |
| 2. Dust Seal | |
8. Remove the dust seal (2, Figure 5-12) using a screwdriver. Take care not to scratch or damage the dust seal bore.

Disassembly



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.

1. Drain off excess hydraulic oil from pump inlet and discharge ports. It may be necessary to loosen the four valve plate capscrews (20, Figure 5-29) pull back on valve plate to allow fluid to seep out of the case.
2. Thoroughly clean and dry the outside surface of the pump housing.

NOTE: Depending upon what part or parts are to be inspected, it may not be necessary to completely take apart all assemblies.

Control Piston Group

3. Remove the two large plugs (23, Figure 5-27) with O-rings (15) from both sides of pump.
4. Control piston (11, Figure 5-28) must be in the "neutral" position. Control link pin (16) should be centered in the plug opening. If pin is not centered in opening, turn adjusting screw (12, Figure 5-27) clockwise until control link pin (16, Figure 5-28) is centered in opening.
5. Using appropriate snap ring pliers, remove retaining rings (14, Figure 5-28) from both sides of the pin and remove control link washers (15).
6. For handling purposes, insert a 1/4"-20UNC cap-screw into the threaded end of the control link pin (16).
7. Using a brass rod and hammer, tap on end opposite the capscrew to remove control link pin (16).



Maximum volume stop gland (14, Figure 5-27) MUST be removed BEFORE further disassembly of control piston.

8. Without disturbing jam nut (16, Figure 5-27), unscrew gland (14) and remove stroke adjuster as a complete assembly.
9. Back out four capscrews (3, Figure 5-29), then remove cap (24).
10. Remove bias control spring (1, Figure 5-28).

Valve Plate Group

NOTE: Valve plate (17, Figure 5-29) is a slight press fit in the pump housing (20, Figure 5-27).

11. Support valve plate (17, Figure 5-29) from an overhead crane (lifting lug holes are provided) and remove four capscrews (20) from valve plate.
12. Remove valve plate (17) from pump housing (20, Figure 5-27) by tapping away from the housing with a mallet until valve plate pilot diameter disengages from the case 0.25 in (6.35 mm).
13. With the weight of the valve plate still suspended from the overhead crane, slide valve plate back until it disengages from driveshaft and set valve plate aside. Care must be taken not to damage the "wear face" of valve plate (17).
14. To further disassemble control piston assembly, move control piston (11, Figure 5-28) into sleeve (4) until control piston maximum stop pin (8) contacts the sleeve. Use a large mallet to drive piston and sleeve assembly outward from the valve plate.
15. When all sleeve seals (5, 6, & 7) are clear of the valve plate, re-extend control piston (11). While tipping the assembly enough to clear the hole, pull the assembly from the valve plate.
16. Remove pin (18) from control piston by pressing or tapping it out through the hole on opposite side. Control stop pin (8) can be removed and control piston (11) slipped out of sleeve (4).
17. Remove capscrews (9, Figure 5-29) and remove compensator block (13).
18. Remove capscrews (21) and cover plate (19).

HOIST CIRCUIT

HOIST CIRCUIT OPERATION

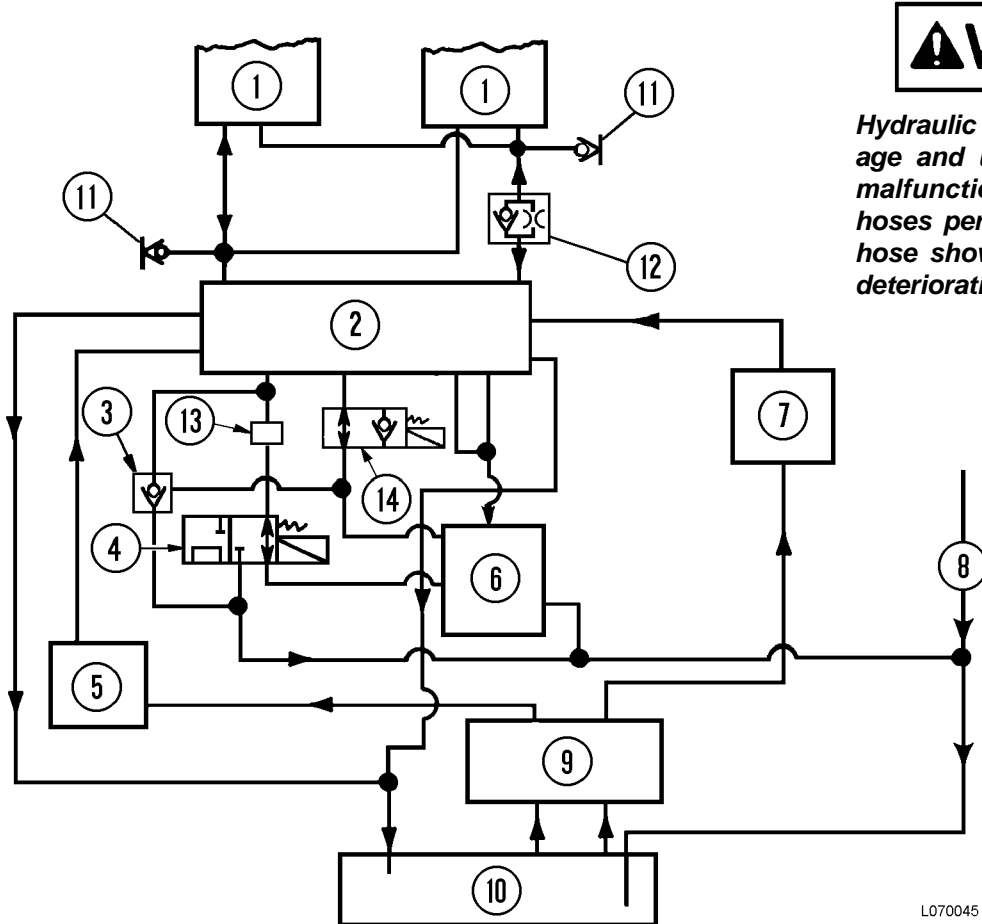
The following hoist circuit operation description describes the basic hoist circuit. Further circuit description is outlined under the individual component descriptions.

Hydraulic fluid is supplied by a tank located on the left frame rail. The tank's service capacity is approximately 238 gal. (901 L). Refer to (10, Figure 7-1), Hoist Circuit Schematic. Hydraulic oil is routed to a tandem gear type pump, (9). The pump is driven by an accessory drive at the end of the traction alternator.

Pump output is directed to two, high pressure filters (5 & 7) mounted on the side of the fuel tank.

Hydraulic oil from the filters is directed to the hoist valve (2) which is mounted above the hoist and steering pumps.

The hoist valve directs oil to the body hoist cylinders (1) for raising and lowering of the dump body. The hoist valve functions are controlled by the operator through a flexible cable to the hoist pilot valve (6) in the hydraulic component cabinet located behind the operator's cab. Also in the hydraulic cabinet is the hoist-up limit solenoid (4). (Reference Figure 7-3.) The hoist-up limit solenoid prevents the hoist cylinders from extending to maximum physical limit. A solenoid valve (14) and switch (13) prevent cylinder extension due to material build-up on the tail of the body.



WARNING

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

FIGURE 7-1. HOIST CIRCUIT SCHEMATIC

- | | | | |
|-------------------------------|----------------------------|-------------------------------------|---------------------|
| 1. Hoist Cylinder | 4. Hoist Up Limit Solenoid | 8. Return From Flow Amplifier Valve | 12. Snubber Valve |
| 2. Hoist Valve | 5. Filter | 9. Pump | 13. Pressure Switch |
| 3. Pilot Operated Check Valve | 6. Hoist Pilot Valve | 10. Hydraulic Tank | 14. Solenoid Valve |
| | 7. Filter | 11. Quick Disconnect | |

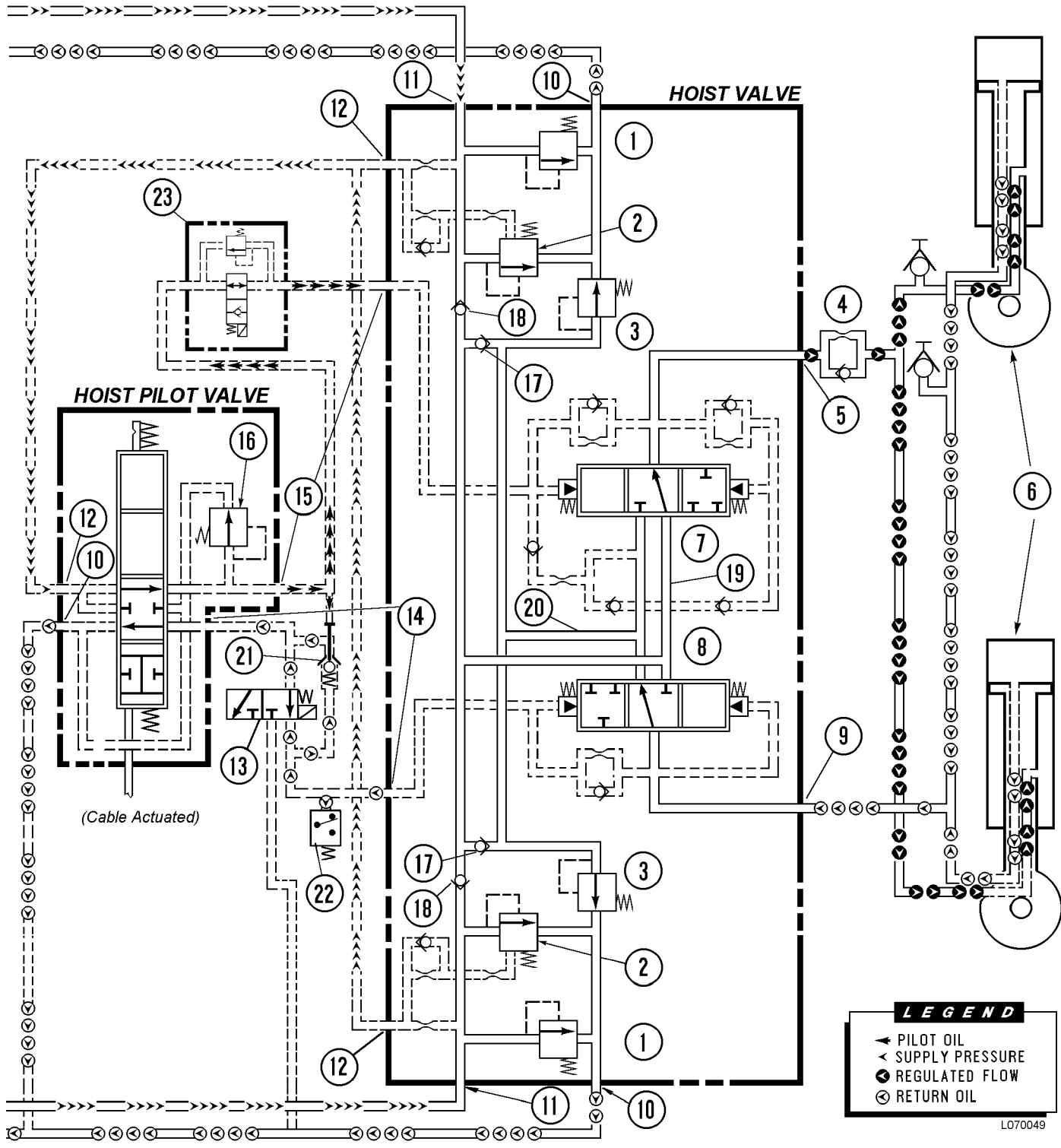


FIGURE 7-7. POWER DOWN

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 neutral 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 capscrews (10). Remove hoist pilot valve. Refer to hoist pilot valve disassembly for repair instructions.

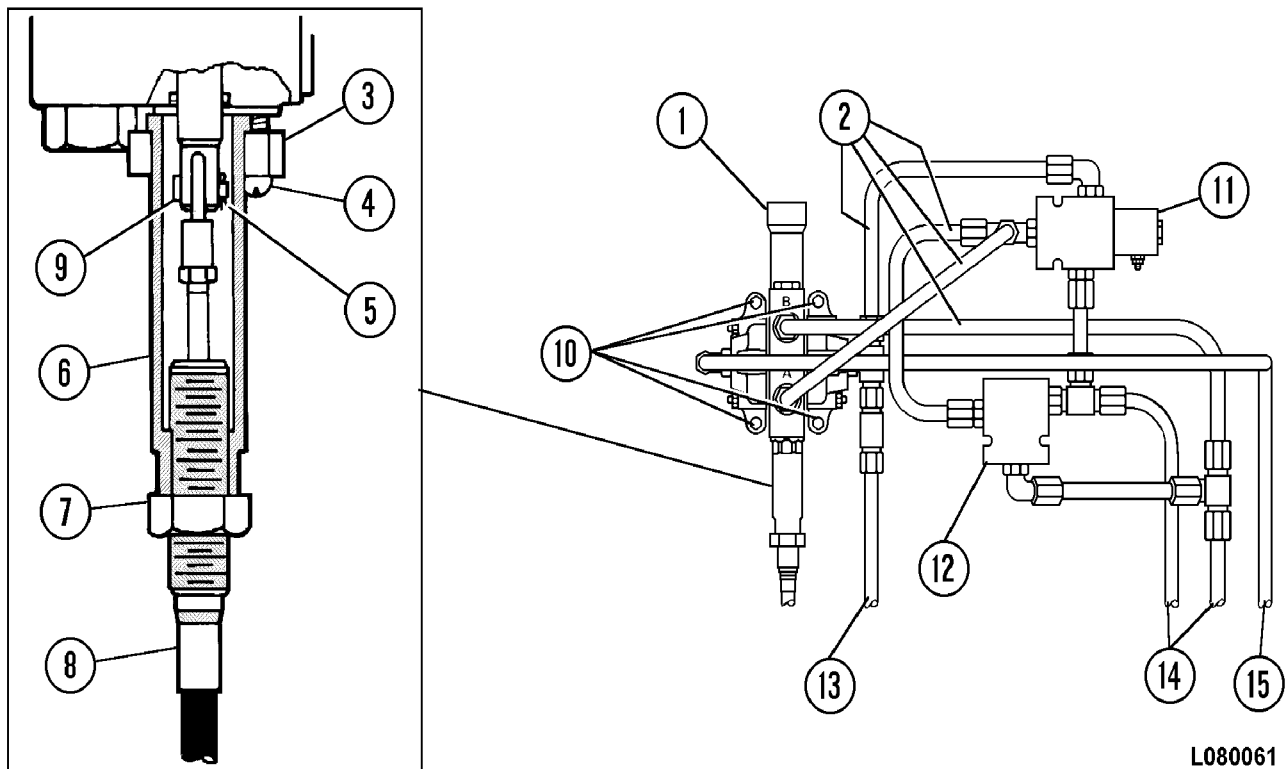
Installation

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

2. Move hydraulic lines (2) into position. Tighten hydraulic line connections securely.
3. Align spool pin hole with hoist control cable eye and install pin (9). Secure pin in place with cotter key (5).
4. Thread sleeve (6) upward until contact is made with valve body. Move flange (3) into position and secure in place with capscrews (4).
5. Thread jam nut (7) against sleeve (6). Tighten jam nut securely.
6. 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).



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FIGURE 8-11. HOIST PILOT VALVE REMOVAL

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

Assembly of Cylinder

1. Install seals (15, Figure 8-18) and bearing (14) on second stage cylinder. Install bearings (19) and buffer seal (18), rod seal (20) and rod wiper (21) on first stage cylinder. Lubricate with clean hydraulic oil (Type C-4).
 2. Align and slide the second stage cylinder (2) inside the first stage cylinder (3). Allow the second stage to protrude far enough to install the snap ring (9) on the inside of the first stage cylinder.
 3. Mount the housing (4) in the fixture with the cover end positioned at the top. Install bearings (19) and buffer seal (18), rod seal (20) and rod wiper (21) in the housing.
 4. Install lifting tool used during disassembly in the second and first stage cylinder assembly.
 5. Install bearings (13) on the first stage cylinder (3). Lift and align this assembly over the housing (4). Lower the second and first stage cylinders into the housing.
 6. Install retainer used during disassembly to hold the second and first stage cylinder in place when the housing is rotated. Rotate housing 180° to position the lower mounting eye at the top.
 7. Install bearings (19) and buffer seal (18), rod seal (20) and rod wiper (21) in the second stage cylinder (2).
 8. Attach a lifting device to the rod eye (1) and align it over the housing (4). Lower the rod into the housing. Lubricate the rod with hydraulic oil.
 9. Rotate housing 180° to position the cover end at the top. Remove retainer installed in Step 5. Install bearings (17) and seal (16) on the rod bearing retainer (6).
 10. Thread two guide bolts 4 in. (100 mm) long in the end of the rod (1). Install seal (8) on the end of the rod.
 11. Align piston rod bearing retainer (6) over guide bolts and lower it over the end of the rod (1). Remove guide bolts.
- NOTE: Check capscrews carefully for distress and, if in doubt, replace them with new.*
12. Make certain threads on capscrews (1, Figure 8-22) and threads in rod are clean and dry (free of oil and solvent).

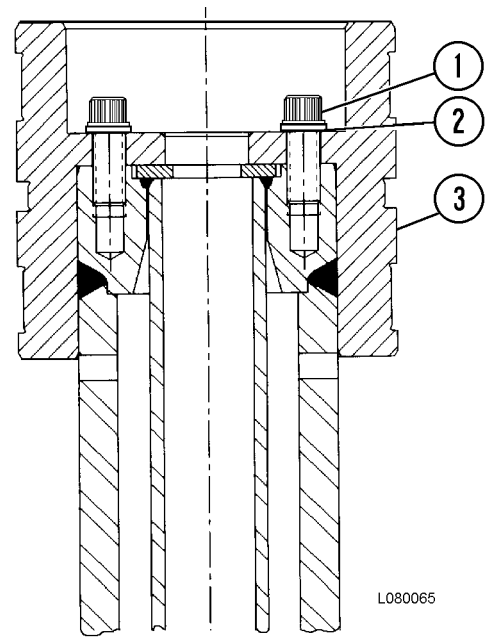


FIGURE 8-22. 3rd STAGE PISTON

- | | |
|--------------------|-----------|
| 1. 12 Pt. Capscrew | 3. Piston |
| 2. Plate | |
13. Use Loctite "LOCQUIC" Primer "T" (TL8753, or equivalent), to spray mating threads on capscrews and threads in rod. Allow primer to dry 3 to 5 minutes.
 14. Apply Loctite Sealant #277 (VJ6863, or equivalent) to threads of capscrews and threads in rod.
 15. Install plate (2), and capscrews (1). Tighten capscrews to **575 ft. lbs. (780 N.m) torque.**
- NOTE: 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.*
16. Install O-ring (12, Figure 8-18) and backup ring (23) on cover (10). Align and lower cover onto housing (4). Install capscrews (11) and lockwashers. Tighten capscrews to standard torque.
 17. Install hoist cylinder eye bearing (5, Figure 8-17) and retainer rings (4) if removed.

TROUBLESHOOTING CHART

(STEERING PUMP)

POSSIBLE CAUSES

SUGGESTED CORRECTIVE ACTION

TROUBLE: No Pump Output

Trapped air inside steering pump.

Bleed trapped air. Refer to "Pressure Check And Adjustment Procedure", Section "L".

Broken pump drive shaft.

Replace pump drive shaft.

Excessive circuit leakage.

Check for loose fittings, broken or cracked tubes.

No oil to pump inlet.

Check hydraulic tank oil level. Make sure shut-off valve is open.

TROUBLE: Low Pump Output

Low pump pressure.

Check or adjust compensator pressure setting.

Compensator valve, seat, spring or packing failure.

Repair or replace compensator.

Worn or scored pistons and bores.

Repair or replace pistons or pump housings.

Maximum volume stop limiting pump stroke.

Turn volume stop screw counterclockwise. Tighten jam nut.

Worn or damaged piston shoes, swashblock or swashblock wear plate.

Repair or replace defective parts.

Worn or grooved cylinder wear plate and/or port plate.

Repair or replace defective parts.

Restricted inlet.

Clear restriction. Make sure suction line shut-off valve is open. Clean suction strainer.

Insufficient inlet oil.

Check for proper hydraulic tank oil level and make sure suction line shut-off valve is open.

TROUBLE: Unresponsive or Sluggish Control

Control piston seals broken or damaged.

Repair or replace broken parts.

Swashblock saddle bearings worn or damaged.

Repair or replace broken parts.

**SECTION M
OPTIONS AND SPECIAL TOOLS
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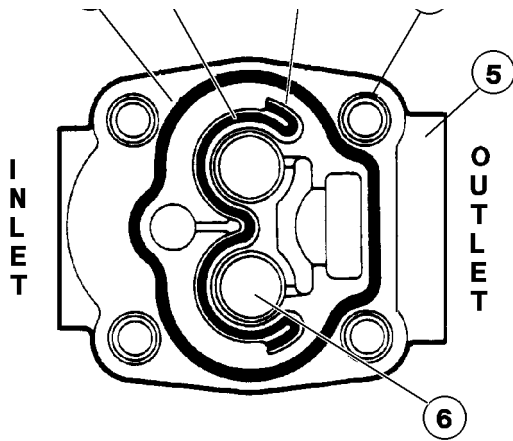


FIGURE 4-5. COVER PLATE SEALS

- | | |
|-------------------|--------------------|
| 1. 1. O-Ring | 4. Dowel |
| 2. 2. O-Ring | 5. Cover Plate |
| 3. 3. Backup Ring | 6. Drive Gear Bore |

11. Install back-up ring, O-ring, and O-ring in flange plate. Use clean, heavy grease to hold O-rings in grooves.

12. Attach a piece of tape over shaft keyway to protect seal during assembly.

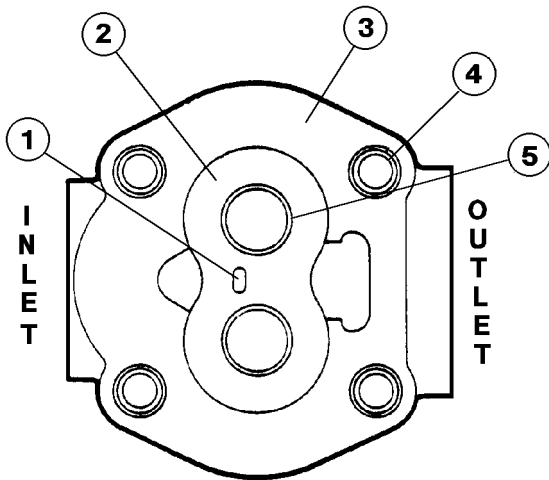


FIGURE 4-6. PRESSURE PLATE INSTALLATION

- | | |
|-------------------|---------------|
| 1. Trap | 3. Gear Plate |
| 2. Pressure Plate | 4. Dowel |

13. With O-ring in flange plate facing down and keeping plate true with shafts, slide it down until it contacts dowels in gear plate. Bump flange very lightly with hands or plastic hammer to force the plate down on dowels, at the same time making sure grease is holding O-rings in grooves. Once plate is in position, remove tape protecting seal from shaft keyway.

14. Coat capscrew (13, Figure 4-4) threads with clean hydraulic oil. Install washers (14) on capscrews. Tighten to **80 ft. lbs (108 N-m)** torque.

15. Using a twelve inch wrench, check to see if shaft will turn. It will be tight but should turn free with a **15 lbs (6.8 Kg)** maximum force on wrench.

Installation

- Slide motor shaft with key into flex coupling on blower wheel shaft. Tighten set screw of flex coupling to **65 ft. lbs. (88 N-m)** torque.
- Install motor mounting capscrews, tighten to standard torque.
- Connect all hoses, tighten split flange capscrews to standard torque.

BLOWER BEARING REPAIR

Removal

- Remove blower inlet and outlet hoses.
- Loosen setscrew in flex coupling (3, Figure 4-3) on blower wheel shaft.
- Remove all nuts, washers and capscrews securing housing halves. Remove inlet half of blower housing.
- Loosen setscrews in blower wheel. Slide wheel from shaft.
- Remove four blower housing retainer plates from blower housing and mount bracket.
- Slide bearing housing and remaining blower housing half from mount brackets and flex coupling.

Replacement

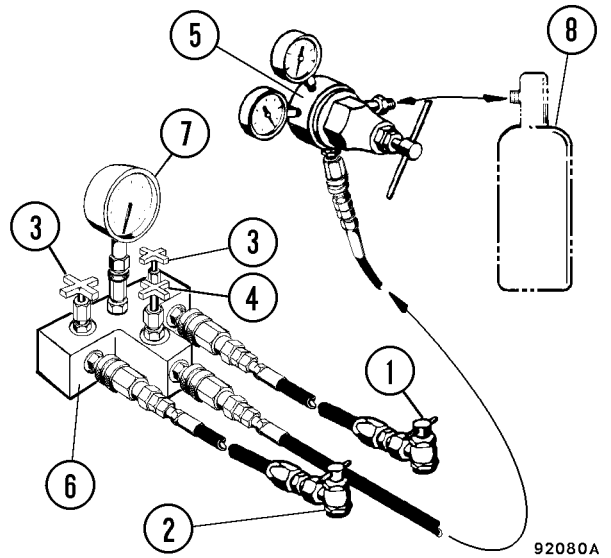
- Loosen clamp ring setscrew in locking collar (6, Figure 4-3) of one bearing.
- Push other bearing with shaft out of housing.
- Remove bearing remaining in housing.

SPECIAL TOOLS

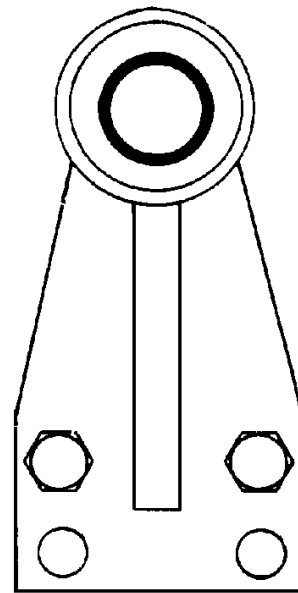
Part Number	Description	Use
EB1759	Nitrogen Charging Kit	Suspension & Accumulator Nitrogen Charging

1. "T" Handle Valve
2. Charging Valve Adapter
3. Manifold Outlet Valves (from gauge)
4. Inlet Valve (from regulator)
5. Regulator Valve (Nitrogen Pressure)
6. Manifold
7. Charging Pressure Gauge (Suspensions)
8. Dry Nitrogen Gas

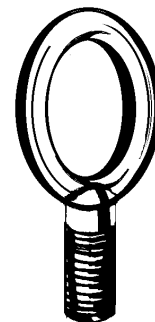
NOTE: Arrangement of parts may vary from illustration shown, depending on Charging Kit P/N.



Part Number	Description	Use
TY2930	Roller Assy.	Power Module Remove & Install



Part Number	Description	Use
TG1106	Eye Bolt, 0.75-10 UNC	Misc. lifting requirements
WA4826	Eye Bolt, 1.25-7 UNC	



Expansion Block Valve

The expansion block valve controls the amount of refrigerant entering the evaporator coil. Both internally and externally equalized valves are used.

The expansion valve is located near the inlet of the evaporator and provides the functions of throttling, modulating, and controlling the liquid refrigerant to the evaporator coil.

The refrigerant flows through a restriction creating a pressure drop across the valve. Since the expansion valve also separates the high side of the system from the low side, the state of the refrigerant entering the valve is warm to hot high pressure liquid; exiting it is low pressure liquid and gas. The change to low pressure allows the flowing refrigerant to immediately begin changing to gas as it moves toward the evaporator. This produces the desired cooling effect.

The amount of refrigerant metered into the evaporator varies with different heat loads. The valve modulates from wide open to the nearly closed position, seeking a point between for proper metering of the refrigerant.

As the load increases, the valve responds by opening wider to allow more refrigerant to pass into the evaporator. As the load decreases, the valve reacts and allows less refrigerant into the evaporator. It is this controlling action that provides the proper pressure and temperature control in the evaporator.

This system uses an internally equalized, block type expansion valve. With this type valve, the refrigerant leaving the evaporator coil is also directed back through the valve so the temperature of the refrigerant is monitored internally rather than by a remote sensing bulb. The expansion valve is controlled by both the temperature of the power element bulb and the pressure of the liquid in the evaporator.

NOTE: It is important that the sensing bulb, if present, is tight against the output line and protected from ambient temperatures with insulation tape.

Evaporator

The evaporator cools and dehumidifies the air before it enters the cab. Cooling a large area requires that large volumes of air be passed through the evaporator coil for heat exchange. Therefore, a blower becomes a vital part of the evaporator assembly. It not only draws heat laden air into the evaporator, but also forces this air over the evaporator fins and coils where the heat is surrendered to the refrigerant. The blower forces the cooled air out of the evaporator into the cab.

Heat exchange, as explained under condenser operation, depends upon a temperature differential of the air and the refrigerant. The greater the temperature differential, the greater will be the amount of heat exchanged between the air and the refrigerant. A high heat load condition, as is generally encountered when the air conditioning system is turned on, will allow rapid heat transfer between the air and the cooler refrigerant.

The change of state of the refrigerant in and going through the evaporator coil is as important as that of the air flow over the coil.

All or most of the liquid that did not change to vapor in the expansion valve or connecting tubes boils (expands) and vaporizes immediately in the evaporator, becoming very cold. As the process of heat loss from the air to the evaporator coil surface is taking place, any moisture (humidity) in the air condenses on the cool outside surface of the evaporator coil and is drained off as water.

At atmospheric pressure, refrigerant boils at a point lower than water freezes. Therefore, the temperature in the evaporator must be controlled so that the water collecting on the coil surface does not freeze on and between the fins and restrict air flow. The evaporator temperature is controlled through pressure inside the evaporator, and temperature and pressure at the outlet of the evaporator.

Purging Air From Service Hoses

The purpose of this procedure is to remove all the air trapped in the hoses prior to actual system testing. Environmental regulations require that all service hoses have a shutoff valve within 12 inches of the service end. These valves are required to ensure only a minimal amount of refrigerant is lost to the atmosphere. R-134a gauge sets have a combination quick disconnect and shutoff valve on the high and low sides. The center hose also requires a valve.

The initial purging is best accomplished when connected to recovery or recycle equipment. With the center hose connected to the recovery station, service hoses connected to the high and low sides of the system, we can begin the purging. The manifold valves and service valves should be closed. Activating the vacuum pump will now pull any air or moisture out of the center hose. This will require only a few minutes of time. The hose is the only area that is being placed in a vacuum and this will not require a lengthy process. Closing the valve will then insure the hose is purged. It is now safe to open the other manifold valves.

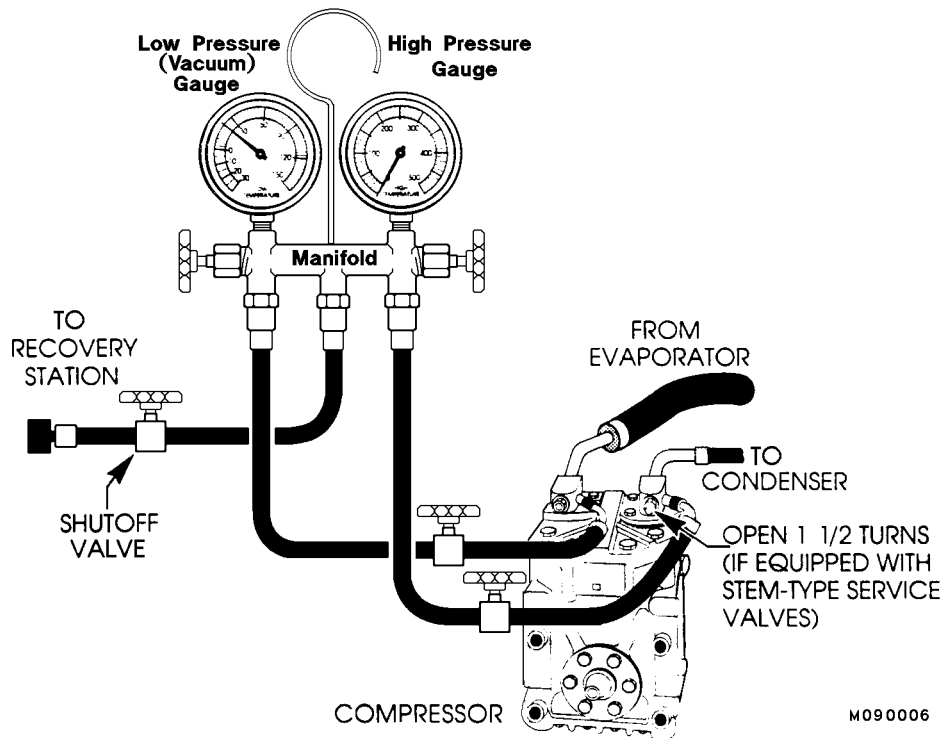


FIGURE 9-9. PURGING SYSTEM

EVACUATING THE SYSTEM

Evacuating the complete air conditioning system is required in all new system installations, and when repairs are made on systems requiring a component replacement (system opened), or a major loss of refrigerant has occurred. All these conditions will require that a vacuum be pulled using a vacuum pump that completely removes any moisture from the system. Once properly evacuated, the system can be recharged again.

Using a pump to create a vacuum in the air conditioning system effectively vaporizes any moisture, allowing the water vapor to be easily drawn out by the pump. The pump does this by reducing the point at which water boils (212°F at sea level with 14.7 psi). In a vacuum, water will boil at a lower temperature depending upon how much of a vacuum is created.

As an example, if the ambient air outside the truck is 75°F at sea level, by creating a vacuum in the system so that the pressure is below that of the outside air (in this case, at least 29.5 inches of vacuum is needed), the boiling point of water will be lowered to 72°F. Thus any moisture in the system will vaporize and be drawn out by the pump if the pump is run for approximately an hour. The following steps indicate the proper procedure for evacuating all moisture from the heavy duty air conditioning systems.

Do not use the air conditioning compressor as a vacuum pump or the compressor will be damaged.

NOTE: Lower the vacuum requirement one inch for every 1000 feet above sea level at your location.

1. With the manifold gauge set still connected (after discharging the system), connect the center hose to the inlet fitting of the vacuum pump as shown in Figure 9-10. Then open the low side hand valves to maximum.
2. Open the discharge valve on the vacuum pump or remove the dust cap from the discharge outlet. Turn the pump on and watch the low side gauge. The pump should pull the system into a vacuum (if not, the system has a leak).
3. Run the pump for five minutes and close the hand valves and shut off the pump.

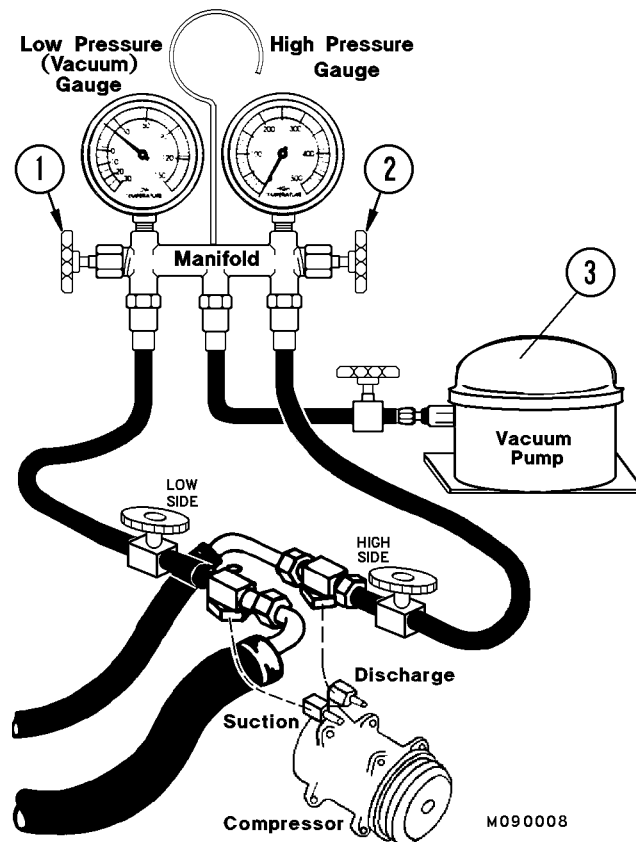


FIGURE 9-20. VACUUM PUMP HOOKUP

1. Low Pressure Hand Valve
2. High Pressure Hand Valve
3. Vacuum Pump

4. Observe gauge reading and wait 10 minutes. Reading should not vary more than 1-2 in. hg. After waiting, if more vacuum is lost than this, a serious leak is indicated and the system must be recharged, leak tested, repaired and evacuated.
5. Turn on pump, open hand valves and continue evacuation for at least one hour.

NOTE: If system has excessive amounts of moisture, 60 minutes evacuation may not be sufficient since the water must turn to a vapor to be drawn out of the system. If it has been verified that no system leaks exist and gauge readings increase after 1 hour, extend the evacuation time to ensure total moisture removal.

6. Close the manifold hand valves and turn off vacuum pump, watching the low side gauge reading. If vacuum remains for a few minutes, the system is ready for charging.

PREVENTATIVE MAINTENANCE SCHEDULE FOR AC SYSTEM

Truck Serial Number _____

Last Maintenance Check: _____

Site Unit Number _____

Name of Service Technician _____



Date: _____ Hour Meter: _____

NOTE: Compressor should be run at least 5 minutes (40°F minimum ambient temperature) every month, in order to circulate oil and lubricate components.

COMPONENT	Maintenance Interval (months)			
	3	6	12	Done
1. <u>Compressor</u> Check noise level Check clutch pulley Check oil level Run system 5 minutes Check belt tension (80-100) lbs; V-belt Inspect shaft seal for leakage Check mounting bracket (tighten bolts) Check clutch alignment w/ crankshaft pulley (within 0.06 in.) Perform manifold gauge check Verify clutch is engaging				
2. <u>Condenser</u> Clean dirt, bugs, leaves, etc. from coils (w/compressed air) Verify engine fan clutch is engaging (if installed) Check inlet/outlet for obstructions or damage				
3. <u>Receiver-Drier</u> Check inlet line from condenser (should be hot to touch) Replace, if system is opened				

COMPONENT	Maintenance Interval (months)			
	3	6	12	Done
4. <u>Expansion Valve</u> Inspect capillary tube (if used) for leakage, damage, looseness			X	
5. <u>Evaporator</u> Clean dirt, bugs, leaves, etc. from fins (w/ compressed air) Check solder joints on inlet/outlet tubes (leakage) Inspect condensation drain				
6. <u>Other Components</u> Check discharge lines (hot to touch) Check suction lines (cold to touch) Inspect fittings/clamps/hoses Check thermostatic switch for proper operation Outlets in cab: 40°F to 50° F Inspect all wiring connections Operate all manual controls through full functions				

Checking the Gain




1. Press and hold the LIGHT/INC and MODE switches until "CHEC" is flashing on the meter. 
2. Press and hold the LIGHT/INC switch until "ALLO" is flashing on the display. "A.FUL" may also be displayed. 
3. Press the LIGHT/INC switch 14 times. The number displayed will be the current G_t gain. Press MODE twice to return to normal operation.

Adjusting the Gain







Before adjusting the gain perform the following steps:

1. Confirm the suspension oil and nitrogen charges are at the levels specified in the shop manual.
2. Weigh the empty truck and then calibrate the payload meter. Do both in succession to ensure the weights are nearly identical.
3. Weigh at least 10 different loads to get an accurate deviation from actual scale weight and the payload calculation from the payload meter. Complete the gain adjustment worksheet at the end of this module. The worksheet is an accurate way to calculate the necessary gain adjustment.


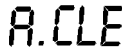




Adjustment Procedure:

1. Ensure the PLM II™ is in normal operating mode.
2. Adjust the gain potentiometer on the side of the meter. Right to decrease, left to increase.
3. Press and hold the LIGHT/INC and MODE switches until "CHEC" is flashing on the meter. 
4. Press and hold the LIGHT/INC switch until "ALLO" is flashing on the display. "A.FUL" may also be displayed. 
5. Press the LIGHT/INC switch 14 times. The number displayed will be the current G_t gain. This is not a "live" reading. Any time the gain is changed, this cycle must be repeated to view the new change.
6. Press MODE once and "CHEC" will flash on the display. 
7. Press MODE once and the meter will return to normal operation.









Setting The Machine I.D. Code

1. Press and hold the MODE switch until "Cd:dP" is displayed. 
2. Press the MODE switch once. The display will show: 
3. Press the MODE switch once. The display will show: 
4. Press the MODE switch once. "d.XXX" is displayed. 
5. Press the LIGHT/INC switch to change the last digit to the desired number.
6. Press the TOTAL/SFT switch and the display will show: 
7. Press the LIGHT/INC switch to change the middle digit to the desired number.
8. Press the TOTAL/SFT switch and the display will show: 
9. Press the LIGHT/INC switch to change the first digit to the desired number.
10. Press the MODE switch to return to normal operation.

Setting The Operator I.D. Code

1. Press and hold the MODE switch until "Cd:dP" is displayed. 
2. Press the MODE switch once. The display will show: 
3. Press the MODE switch once. The display will show: 
4. Press the MODE switch repeatedly until "o.XXX" is displayed. 
5. Press the LIGHT/INC switch to change the last digit to the desired number.
6. Press the TOTAL/SFT switch and the display will then indicate: 
7. Press the LIGHT/INC switch to change the middle digit to the desired number.
8. Press the TOTAL/SFT switch and the display will show: 
9. Press the LIGHT/INC switch to change the first digit to the desired number.
10. Press the MODE switch to return to normal operation.

Setting The Time and Date

1. Press and hold the MODE switch until "Cd:dP" is displayed. 
2. Press the MODE switch once. The display will show: 
3. Press the MODE switch once. The display will show: 
4. Press the MODE switch repeatedly until "XX:XX" is displayed. 
5. Press the LIGHT/INC switch to change the minutes.
6. Press the TOTAL/SFT switch and the display will then indicate: 
7. Press the LIGHT/INC switch to change the hours. The clock is a 24 hour clock.
8. Press the TOTAL/SFT switch and the display will then indicate: 
9. Press the LIGHT/INC switch to change the day.
10. Press the TOTAL/SFT switch and the display will then indicate: 
11. Press the LIGHT/INC switch to change the month.
12. Press the TOTAL/SFT switch and the display will then indicate: 
13. Press the LIGHT/INC switch to change the year.
14. Press MODE switch to return to normal operation.

Installation

1. Install a new O-ring onto sensor (4, Figure 20-11) and install sensor onto adapter (3). Tighten the sensor to **22-29 ft.lbs. (30-39 N.m)** torque.
2. Install a new O-ring onto adapter (3) and install complete adapter/sensor assembly onto valve (2). Hold the valve body and tighten adapter/sensor assembly to **103 ft.lbs. (176 N.m)** torque.
3. Connect the sensor wiring to the truck wiring harness. The sensors have three wires. Be sure that wires are connected correctly. (Figure 20-12)

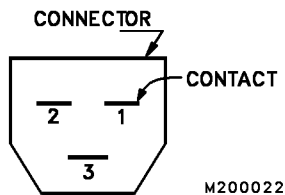


FIGURE 20-12. SENSOR SIDE CONNECTOR VIEW

Pin Number	Wire Color	Wire Function
1	Black	Ground (GND)
2	Red	+ Power
3	White	Signal

INCLINOMETER

As the truck is tilted fore or aft, the weight distribution between the front and rear axles changes. To compensate for this, the inclinometer measures the ground angle at which the truck rests. This data is then sent to the payload meter so it can calculate the correct payload weight. The inclinometer is located below the operator's center console (passenger seat structure).

Removal

1. Disconnect inclinometer wire lead from harness.
2. Remove the three capscrews, nuts and lockwashers (4, Figure 20-13) and inclinometer (3).

Installation

1. Install inclinometer (3, Figure 20-13) with capscrews, nuts and lockwashers (4).

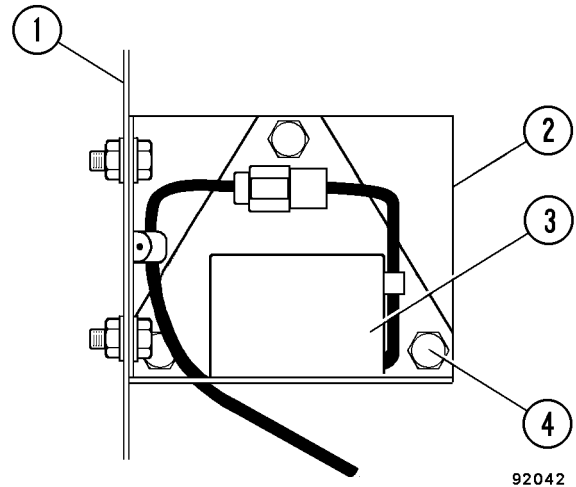


FIGURE 20-13. INCLINOMETER

- | | |
|------------------------------------|---------------------------------|
| 1. Operator's Center Console Frame | 3. Inclinometer |
| 2. Bracket | 4. Capscrew, Nut and Lockwasher |

2. Connect inclinometer wiring to the truck wiring harness. (Figure 20-14) Be sure that wires are connected correctly.

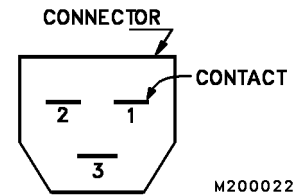


FIGURE 20-14. INCLINOMETER SIDE CONNECTOR VIEW

Pin Number	Wire Color	Wire Function
1	Black	Ground (GND)
2	Red	+ Power
3	White	Signal

Adjustment

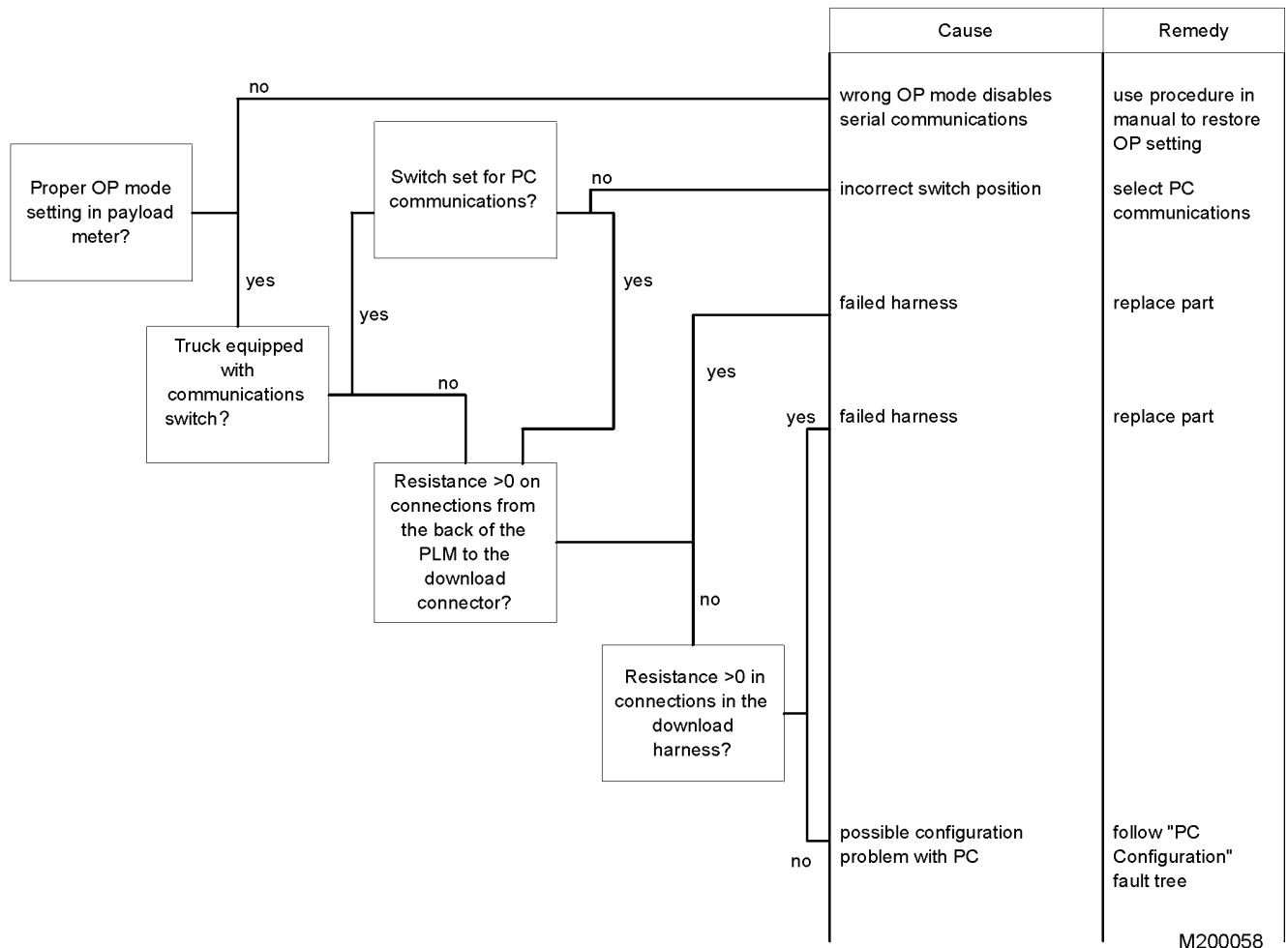
1. Park the truck on a 0% grade.
2. Loosen the three inclinometer mounting capscrews (4, Figure 20-13) and rotate the inclinometer until a voltage range of 2.6 ± 0.1 volts can be measured (using a volt-meter) at pins 1 and 2 of the inclinometer harness connector.
3. Tighten all capscrews (4, Figure 20-13) to standard torque, after the adjustment.

Cannot Download - PC Communications

The most common problem with PC communications to the payload meter is configuration of the PC. Be sure the correct serial port is selected for your laptop. In addition, be sure you have the latest PC software by checking with your distributor.

Verify the payload meter is using the proper OP setting. Refer to "Setting the Option Code" for information on OP settings.

No body-up input signal can be perceived as a communication problem with the payload meter. Without the body-up signal, the payload meter never starts a new haul cycle. When the payload meter is downloaded, and no haul cycles have been stored in memory, a technician may assume that the laptop did not communicate with the payload meter.



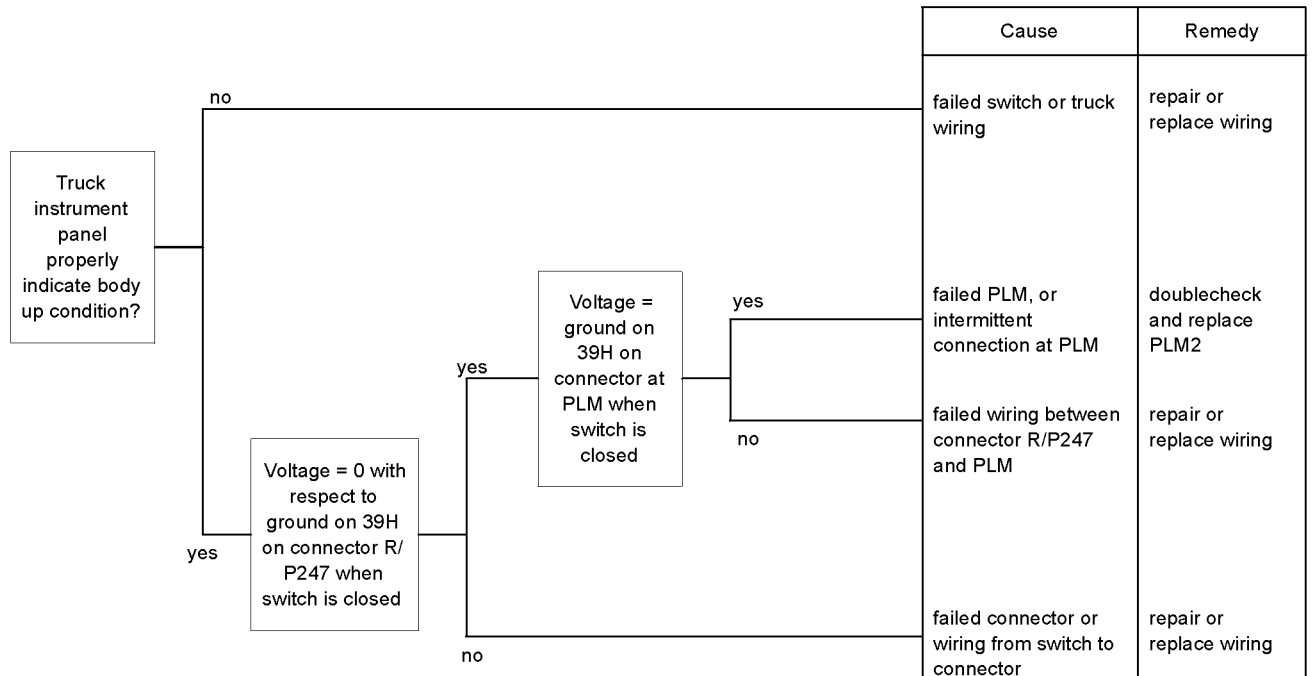
M200058

Brake Lock Input

The brake lock is used to lock only the rear wheels during loading. This allows the front wheels to rotate slightly and allows the payload meter to more accurately estimate payload. It is very important that only the brake lock be used during loading. Using the service brakes will significantly decrease payload meter accuracy.

The brake lock connects circuit 39H to ground. The circuit is wired through a small black connector behind the dash panel.

Confirm that the warning light panel indicates that the brake lock is recognized by the other truck systems. If so, follow the signal from the switch to the payload meter. It may also be that the connector on the back of the payload meter needs to be disconnected and re-inserted to clean the contacts.



M200065

All data is comma separated and can be imported into most popular spreadsheets and data analysis programs. A typical file looks like this:

9:40:27	R	4	458.21	439.71	283.18	247.6	1.28	22	2	0	1	1	1
9:40:27	R	4	465.32	448.25	278.91	246.18	1.04	22	2	0	1	1	1
9:40:28	R	4	456.78	451.09	274.64	247.6	1.33	22	2	0	1	1	1
9:40:28	R	4	443.98	465.32	276.06	256.14	2.14	23	2	0	1	1	1
9:40:28	R	3	432.59	445.4	277.49	261.83	2.61	23	2	0	1	1	1
9:40:28	R	3	436.86	424.05	278.91	256.14	2.99	24	2	0	1	1	1
9:40:29	R	3	461.05	421.21	288.87	251.87	2.61	24	2	0	1	1	1
9:40:29	R	2	486.67	421.21	286.02	241.91	1.52	24	2	0	1	1	1
9:40:29	R	2	483.82	415.52	288.87	251.87	1.85	25	2	0	1	1	1

In the sample data shown, the column marked "Type" refers to the type of data being transmitted; "R" is used for Real-Time, "F" is used for Final Load and "S" is used for Swing Load.

For the swing load data line the format is Time, S, Swing Load, Predicted Load, FL, FR, RL, RR.

For a final load transmission the format is Time, F, Final Load, FL, FR, RL, RR.

Connections to Payload Meter II™

Two harnesses are required to connect a PC to the Payload Meter II™.

- EF9159 - Connects to the back of the Payload Meter II™ to a panel mount connector.
- EF9160 - Connects from the panel mount connector to the PC.

The connectors and pins typically used for the payload meter connection are :

Description	Part Number
Terminal	7827101440
Connector	7845253670

The Payload Meter requires 5 wire RS232 communications. Payload Meter communications connections are :

1 - RTS **2** - Signal Ground **3** - RxD **4** - TxD **5** - CTS

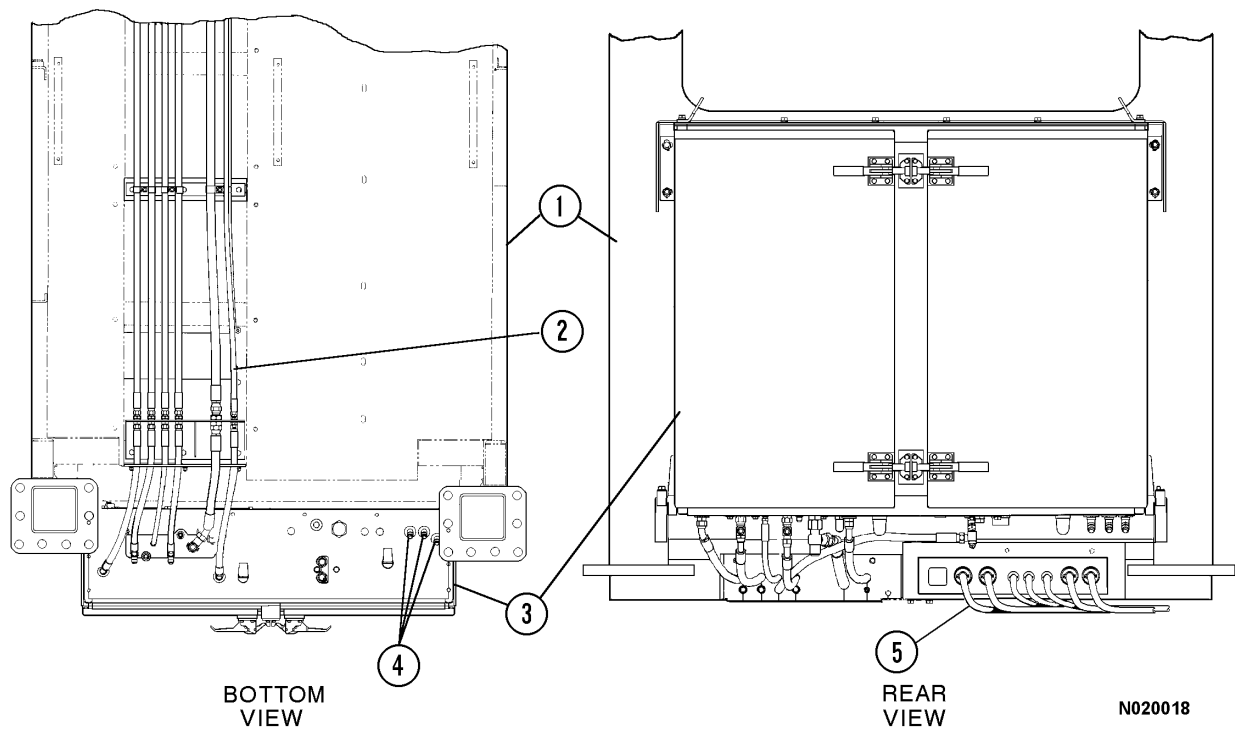


FIGURE 2-2. CAB HYDRAULIC AND ELECTRICAL CONNECTIONS

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> 1. Cab 2. Steering Control Valve 3. Hydraulic Components Cabinet | <ul style="list-style-type: none"> 4. Hoist Valve Hoses 5. Electrical Harness Connectors |
|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|

Installation

1. Lift cab assembly and align mounting pad holes with tapped pads. Insert at least one capscrew and hardened washer at each of the four pads prior to lowering cab onto the truck.

NOTE: The tool group shipped with the truck contains the following tools which may be used to remove the inner capscrews, as clearance is limited:

- PB8326 - 1-1/2" offset wrench
- TZ2733 - Tubular Handle
- TZ2734 - 3/4" torque wrench Adaptor

2. After cab is positioned, insert the remaining capscrews and hardened washers. (32 total). Tighten the capscrews to **700 ft. lbs. (950 N.m)** torque.
3. Route wire harnesses to the electrical connectors on the rear corner of the cab (5, Figure 2-2). Align cable connector plug key with receptacle key and push plug onto receptacle. Carefully thread retainer onto receptacle and tighten

securely. Install clamps if removed during cab removal.

4. Remove caps from hydraulic hoses and tubes and reinstall. Reinstall hose clamps as required.
5. Install heater hoses and clamps on fittings on underside of cab. Connect other end of hose to fittings at shutoff valves on engine. Open heater shutoff valves. Connect air cleaner restriction indicator hoses.
6. Remove caps and reinstall air conditioning system hoses from compressor and receiver/drier.
7. Refer to Section M, "Heater/Air Conditioning System" for detailed instructions regarding evacuation and recharging with refrigerant.
8. Close brake accumulator bleed down valves.
9. Close battery disconnect switch.
10. Service hydraulic tank and engine coolant as required.
11. Start the engine and verify proper operation of all controls.
12. Assure air conditioning system is properly recharged.

GLASS REPLACEMENT

ADHESIVE-BONDED WINDOWS

Recommended Tools/Supplies

- Cold knife, pneumatic knife, or a piano wire cutting device, long knife. Cutout tools are available at an auto glass supply store.
- Heavy protective gloves
- Safety eyeglass goggles
- Windshield adhesives, proper cleaners, primers & application gun
- SM2897 glass installation bumpers (6 - 7 per window)
- Window glass (Refer to Parts Catalog)

Recommended adhesives: SikaTack Ultrafast or Ultrafast II (both heated). Vehicle can be put into service in 4 hours under optimum conditions. Heated adhesives require a Sika approved oven to heat adhesive to 80° C (176° F).

Sikaflex 255FC or Drive (unheated). Vehicle can be put into service in 8 hours under optimum conditions.

Sika Corporation
30800 Stephenson Hwy.
Madison Heights, MI 48071
Toll Free Number: 1-800-688-7452
Fax number: 248-616-7452
<http://www.sika.com> or
<http://www.sikasolutions.com>

WARNING

Due to the severe duty application of off-highway vehicles, the cure times listed by the adhesive manufacturer should be doubled before a truck is moved. If the cure time is not doubled, vibration or movement from a moving truck will weaken the adhesive bond before it cures, and the glass may fall off the cab.

If another adhesive manufacturer is used, be certain to follow that manufacturer's instructions for use, including the use of any primers, and double the allowances for proper curing time.

Replacement Procedure

IMPORTANT

The first concern with all glass replacement is SAFETY! Wear heavy protective gloves and safety eyeglass goggles when working with glass.

1. Using chosen cut-out tool, slice into existing urethane adhesive and remove window.
2. Carefully clean and remove all broken glass chips from any remaining window adhesive. The surface should be smooth and even. Use only clean water.

NOTE: Removal of all old adhesive is not required; just enough to provide an even bedding base.

3. Using a long knife, cut remaining urethane from vehicle, leaving a bed 2-4 mm thick. If existing urethane is loose or otherwise unsound, completely remove. Leave the installation bumpers in place, if possible. Clean metal with Sika Aktivator, allow ten minutes to dry. Then paint on a thin coat of Sika Primer 206G+P and allow ten minutes to dry.
4. Using only the new side window(s) which are to be bonded in place, center the new glass over opening in the cab. Using a permanent marker, mark on the cab skin along all the edges of the new glass that is to be installed. All edges must be marked on the cab in order to apply the adhesive in the proper location.
5. Using Sika Primer 206G+P, touch up any bright metal scratches on the metal frame of vehicle. Do not prime existing urethane bed. Allow to dry for ten minutes.
6. Using a clean lint free cloth, apply Sika Aktivator to the black ceramic Frit surrounding the new window. Use a clean cloth and wipe off Sika Aktivator. Allow ten minutes to dry.
7. For the **side windows**, be sure to utilize a total of six or seven (SM2897) glass installation bumpers to the cab, equally spaced around the previously marked glass perimeter, approximately 0.75 in (19 mm) inboard from where the edge of the glass will be when installed.

NOTE: Be careful not to place adhesive too far inboard, as it will make any future replacement more difficult.

FAN MOTOR AND SPEED CONTROL

Fan speed is controlled by inserting resistor(s) in series with the supply circuit to the blower motor to reduce voltage. The number of resistors in series is determined by the position of the fan speed selector switch.

At low speed, 3 resistors are used, at medium speed, 1 resistor is used, and for high speed, the full +24VDC is supplied to the blower motor, bypassing all resistors.

Test

If the motor does not operate at any of the speed selections, check voltage supplied to the motor. If approximately 24 volts (at high speed setting) is available, the motor is probably defective and should be removed and replaced.

If the motor operates at high speed, but does not operate at reduced speed, inspect the resistors for physical damage or an open circuit. Replace resistors as required.

ACTUATORS

Three (3) rotary actuator motors (24, Figure 4-3) are installed inside the heater housing and are used to actuate the flappers for the following:

- Defroster outlet
- Bi-level or floor outlets
- Inside or outside air selection

A failure to switch one of the above modes of operation may be due to a faulty actuator.

Test

Visually inspect the flapper and linkage for the function being diagnosed. Make certain the flapper is not binding or obstructed, preventing movement from one mode to the other.

Verify voltage (12 volts) is present at the actuator when the toggle switch is closed or absent when the toggle switch is opened. If correct voltage is present, remove and replace actuator motor.

FILTER

Service

Inlet filters in the heater cover (6, Figure 4-3) and the cab access panel need periodic cleaning to prevent restrictions in air circulation. The recommended interval for cleaning and inspection is 250 hours, but in extremely dusty conditions, the filters may need daily service and inspection, especially the outer panel filter on the cab shell. The filter elements should be cleaned with water and dried in a dust free environment before reinstallation. Replace the filter element every 2000 hours or sooner if inspection indicates a clogged or damaged filter.

AIR CONDITIONER COMPONENTS

Air conditioner system components installed in the heater housing are discussed in Section M, *"Air Conditioning System"*.

VERRIDE SWITCH

This push-button switch (9, Figure 5-5) is spring-loaded to the "OFF" position.

When pushed in and

held, this switch may be used for several functions:

1. The override switch permits the operator to move the truck forward when the Selector Switch is in Forward, the dump body is raised, and the brakes are released.

! Use of the override switch for this purpose is intended for emergency situations only!

2. If the operator stops the truck on an uphill incline, the override switch can be used to set up forward propulsion while the brakes are applied. As soon as forward propulsion is felt, completely release the brakes and as truck begins to move forward, release the override switch.
3. The push button deactivates the retard pedal function when speed of truck is below 3 mph (4.8 kph).
4. The override switch is also used to reset an electric system fault when indicated by the red warning light (Refer to "Instrument Panel And Indicator Lights", Overhead Warning / Status panel).

ENGINE IDLE SWITCH

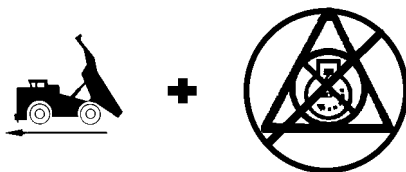
(This space may be BLANK or NOT FUNCTIONAL when Trucks are Equipped with Statex III & Fuel Enhancement)

The Engine Idle Switch (10, Figure 5-5, if truck is equipped) controls the engine idle RPM when the accelerator pedal has been released by the operator.

When the Engine Idle Switch is pressed toward this symbol, the operator can control engine speed anywhere between low idle and high idle settings. This is the "low" engine idle position. This position should be used when maneuvering in confined areas (i.e. shop area).

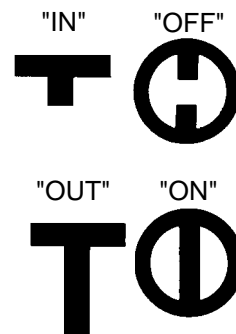
When the Engine Idle Switch is pressed toward this symbol and truck speed is above 3 mph (4.8 kph), the operator may control engine speed only between dynamic retard engine speed (1675 RPM) and high idle. The switch should be in this position during hauling operations. Increased engine RPM is required to insure adequate flow of cooling air to the main alternator and wheel motors when dynamic retarding is applied.

When truck speed is below 3 mph (4.8 kph), truck operates the same as "low" idle position.



RETARD SPEED CONTROL (RSC) "OFF/ON" SWITCH

The Retard Speed Control Switch (11, Figure 5-4) turns the system "OFF" or "ON". Push the knob "IN" to turn "OFF" and pull the knob "OUT" to turn the system "ON".



RETARD SPEED CONTROL (RSC) ADJUST DIAL

The RSC Adjust Dial (12, Figure 5-4) allows the operator to vary the downhill truck speed that the Retard Speed Control system will maintain when descending a grade.

When the dial is rotated counterclockwise toward this symbol, the truck will descend a grade at lower speeds.



When the dial is rotated clockwise toward this symbol, the truck speed will increase.



Throttle pedal position will override RSC setting. If operator depresses throttle pedal to increase truck speed, Dynamic Retarding will not come on unless truck overspeed setting is reached or foot operated retard pedal is used. When throttle pedal is released and RSC switch is "On", Dynamic Retarding will come on at, or above, the RSC dialed speed and will adjust truck speed to, and maintain, the dialed speed.

To adjust RSC control, pull switch (11) "On" and start with dial (12) rotated toward fastest speed while driving truck at desired maximum speed. Relax throttle pedal to let truck coast and turn RSC Adjusting Dial slowly counterclockwise until Dynamic Retarding is activated. Dynamic Retarding will now be activated automatically anytime the "set" speed is reached, the RSC switch is "On", and throttle pedal is released.

With RSC switch "On" and dial adjusted, the system will function 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.

INDICATOR LIGHT SYMBOLS

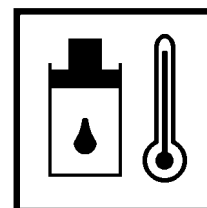
Indicator Lights which are **AMBER** (Yellow) in color alert the operator that the indicated truck function requires some precaution when lighted.

Indicator Lights which are **RED** in color alert the operator that the indicated truck function requires **immediate action** by the operator. Safely stop the truck and shut down the engine. **DO NOT OPERATE THE TRUCK WITH A RED WARNING LIGHT ILLUMINATED.**

Refer to Figure 5-7 and the descriptions below for explanations of the symbols. Location of the symbols is described by rows (A-E) and columns (1 - 8).

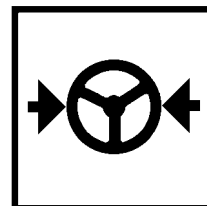
A1. High Hydraulic Oil Temperature (optional)

This warning light indicates high oil temperature in the hydraulic tank. Continued operation could damage components in the hydraulic system. Notify maintenance personnel immediately. The light turns on at 225° F (107° C).



B1. Low Steering Pressure

When the keyswitch is turned “ON”, the low steering pressure warning light will illuminate until the steering system hydraulic pressure reaches 2100 psi (14.7 MPa). The warning horn will also turn on, and both will remain on, until the accumulator has been charged.



During truck operation, the low steering pressure warning light and warning horn will turn sound if steering system hydraulic pressure drops below 2100 psi (14.7 MPa).

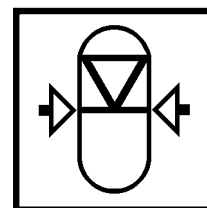
- If the light illuminates momentarily (“flickers”) while turning the steering wheel at low truck speed and low engine RPM, this may be considered “normal”, and truck operation may continue.
- If the indicator light illuminates at higher truck speed and high engine RPM, **DO NOT OPERATE TRUCK.**

If the low steering warning light continues to illuminate and the alarm continues to sound, low steering pressure is indicated. The remaining pressure in the accumulators allows the operator to control the truck to a stop. Do not attempt further operation until the malfunction is located and corrected.



C1. Low Accumulator Precharge Pressure

The low accumulator precharge warning light, if illuminated, indicates low nitrogen precharge for the steering accumulator(s). To check for proper accumulator nitrogen precharge, engine must be stopped and hydraulic system completely bled down; then turn keyswitch to “Run” position. Warning light will **NOT** illuminate if system is properly charged. The warning light *will flash* if the nitrogen precharge within the accumulator(s) is below 1100 ±45 psi (7585 ±310 kPa).



If low accumulator precharge warning light flashes, notify maintenance personnel. Do not attempt further operation until the accumulators have been recharged with nitrogen to 1400 psi (9653 kPa). Sufficient energy for emergency steering may not be available, if system is not properly charged.



LUBRICATION AND SERVICE

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

Lubrication requirements are referenced to the lube key found in the Truck Lubrication Specifications Chart (page P2-2).

For detailed service requirements for specific components, refer to the shop manual section for that component (i.e. Section "H" for Suspensions, Section "L" for Hydraulic System, etc.).

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

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

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

Many Haulpak Trucks are equipped with an Automatic Lubrication System. The initial setup for this system provides for nominal amounts of lubricant to be delivered to each serviced point. The lubrication injectors can be adjusted to vary the amount of lubricant delivered. In addition, the timer for lubrication intervals is normally adjustable. For adjustments to these devices, consult the "Automatic Lubrication System" in this section of the manual.

830E SERVICE CAPACITIES		
	Liters	U.S. Gallons
Crankcase: (including lube oil filters).		
DDC/MTU 4000 Series Engine	250.0	66.0
Cooling System:	568	150
Hydraulic System:	947	250
Hydraulic Tank	901	238
Refer to "Hydraulic Tank Service"		
Fuel Tank	4543	1200
Wheel Motor Gear Box (each side)	39.7	10.5

HYDRAULIC TANK SERVICE

There are two sight gauges on the side of the hydraulic tank. With engine stopped, keyswitch "off", hydraulic system bled down and body down, oil should be visible in either top or lower sight gauge. If hydraulic oil is not visible in the lower sight gauge, follow "Adding Oil" instructions below.

Adding Oil

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

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

1. With engine stopped, keyswitch "off", hydraulic system bled down and body down, check to see that hydraulic oil is visible in the top or lower sight gauge.
2. If hydraulic oil is not visible in the lower sight gauge, remove the tank fill cap and add clean, filtered C-4 hydraulic oil (Lubrication Chart, Lube Key "D") until oil is visible in the top sight gauge.
3. Replace fill cap.
4. Start engine. Raise and lower the dump body three times.
5. Repeat steps 1 through 4 until oil is maintained in the top sight gauge.

COOLING SYSTEM ANTI - FREEZE RECOMMENDATIONS (Ethylene Glycol Permanent Type Anti-Freeze)		
Percentage of Anti-Freeze	Protection To	
10	+ 23°F	- 5°C
20	+ 16°F	- 9°C
25	+ 11°F	- 11°C
30	+ 4°F	- 16°C
35	- 3°F	- 19°C
40	- 12°F	- 24°C
45	- 23°F	- 30°C
50	- 34°F	- 36°C
55	- 48°F	- 44°C
60	- 62°F	- 52°C

Use only anti-freeze that is compatible with engine as specified by engine manufacturer.

2500 HOUR MAINTENANCE CHECKS

Maintenance for every 10, 50, 100, 250, 500 & 1000 hour Lubrication and Maintenance Checks should also be carried out at this time.

NOTE: "Lube Key" references are to the Lubrication Specification Chart.

MOTORIZED WHEELS - Drain and replace gear oil. Refer to G.E. Motorized Wheel Service & Maintenance Manual for lubrication specifications. Lube Key "C".

Truck Serial Number _____		
Site Unit Number _____		
Date: _____ Hour Meter _____		
Name of Service person _____		
COMMENTS	√'d	INITIALS

5000 HOURS LUBRICATION AND MAINTENANCE CHECKS

Maintenance for every 10, 50, 100, 250, 500 & 1000 hour Lubrication and Maintenance Checks should also be carried out at this time.

NOTE: "Lube Key" references are to the Lubrication Specification Chart.

- FRONT WHEELS** - Drain oil and completely disassemble and check all parts for wear or damage. Refer to Section "G" of the service manual for Disassembly and Assembly procedures. Refill with oil. Check the oil level at oil level plug on wheel hub. Lube Key "C". Check bearing preload at the first 500 hours after each rebuild.
- AIR CLEANERS** - Clean the Donalclone Tubes in the pre-cleaner section of the air filter. Use low pressure cold water or low pressure air to clean tubes. Refer to Section "C" of this manual.

NOTE: Do not use a hot pressure washer or high pressure air to clean tubes, high pressure causes pre-cleaner tubes to distort.

Truck Serial Number _____		
Site Unit Number _____		
Date: _____ Hour Meter _____		
Name of Service person _____		
COMMENTS	√'d	INITIALS

FIGURE 3-6. AUTOMATIC LUBE SYSTEM HYDRAULIC SCHEMATIC

1. Grease Pump Cylinder
2. Grease Pump
3. Grease Reservoir
4. Vent Valve
5. Combination Valve
6. Solenoid (SV2)
7. Pressure Reducer
8. Solenoid (SV1)
9. Gauge (Cyl. Press.)
10. Press. Sw. (N.C., 2,000 psi)
11. Orifice Assy.
12. Hydraulic Supply
13. Hyd. Tank (Return)
14. Injectors

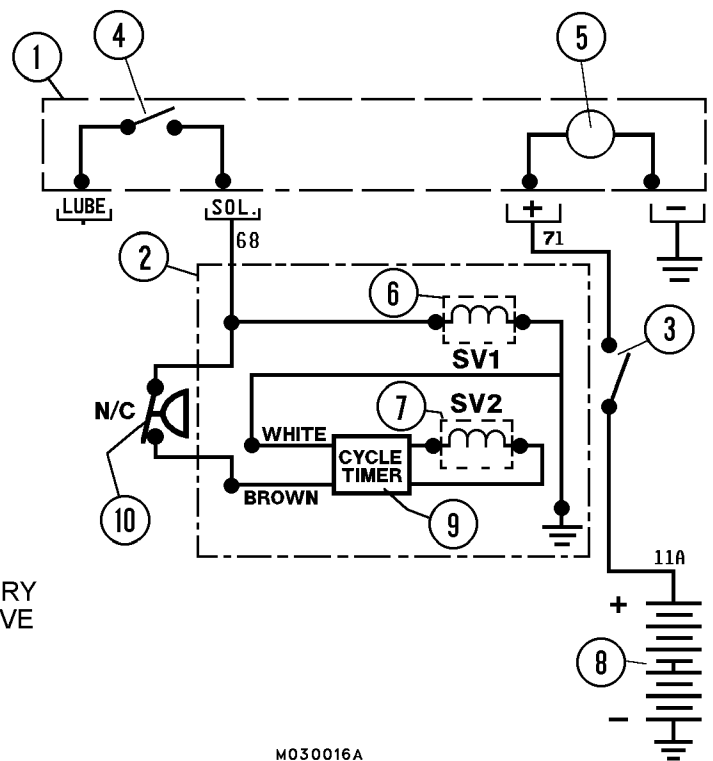
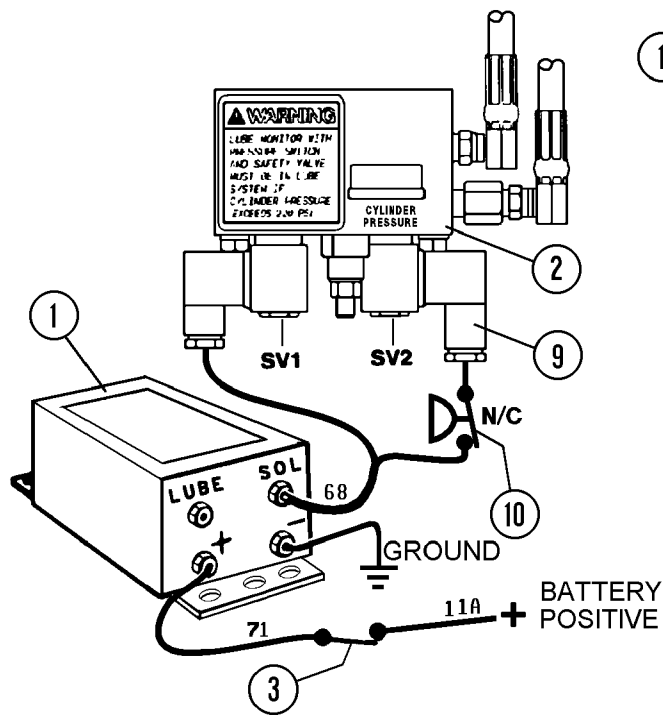
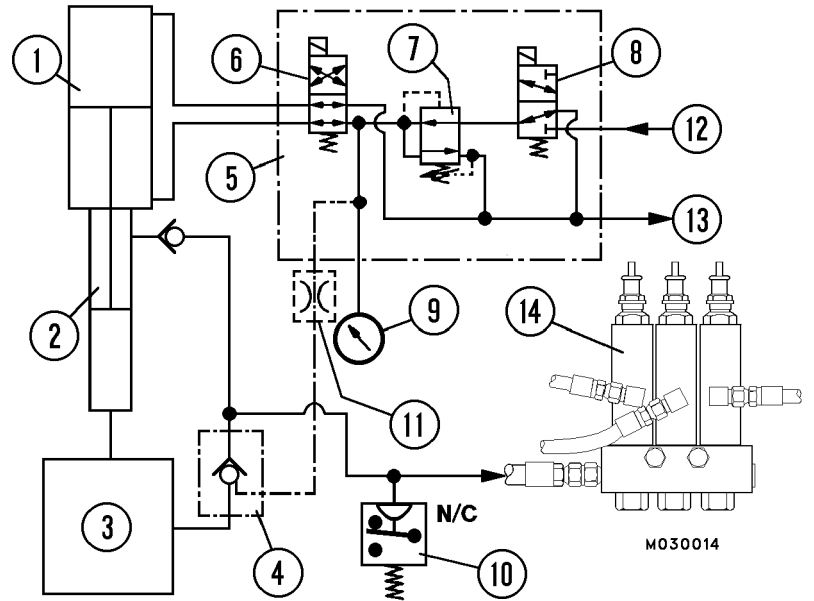


FIGURE 3-7. TYPICAL ELECTRICAL HOOKUP DIAGRAM

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none"> 1. Timer Assembly 2. Combination Valve (Press. Reducing & Solenoid Valves) 3. Keyswitch (Note: Must be ON to energize Timer) 4. Relay 5. Timer (Solid State) | <ol style="list-style-type: none"> 6. Solenoid (SV1) 7. Solenoid (SV2) 8. Battery (24V) 9. Cycle Timer 10. Pressure Sw., N.C. 2000 psi (13 709 kPa) |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

SECTION Q

ALPHABETICAL INDEX

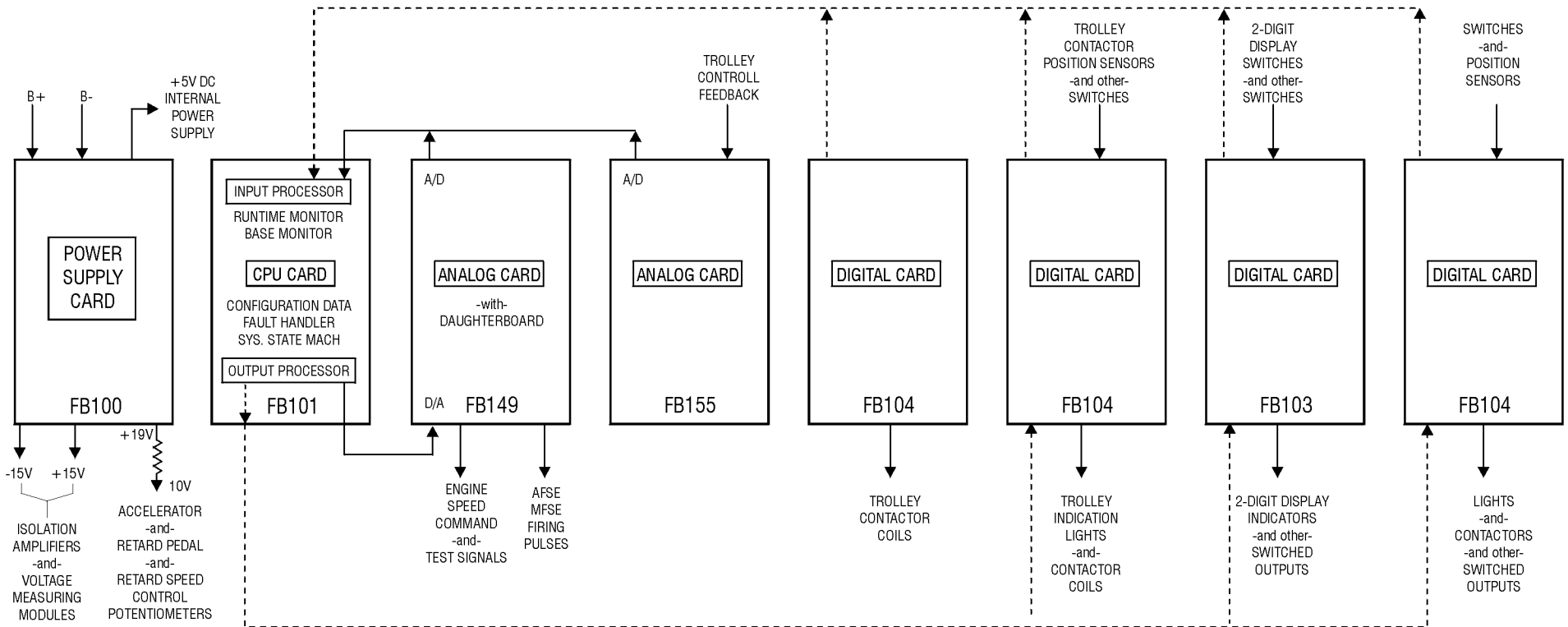
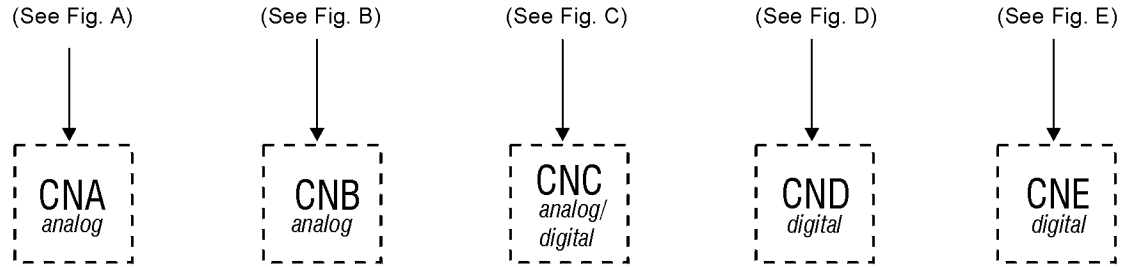
A	
Accelerator Pedal, Electronic	E2-64
Accumulator, Steering	L5-2
Accumulator, Brake	J3-15
AID System	D3-1
Air Cleaners	C5-1
Air Conditioning System	M9-1
Component Service	M9-1
Electrical Schematic	N4-5
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Alternator, 24VDC	D2-3
Alternator, Propulsion	E2-64
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Anti-sway Bar	G4-4
Automatic Lubrication System	P3-1
Axle, Rear	G4-1

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Battery Charging System	D2-3
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Troubleshooting	D2-3
Battery Equalizer	D3-5
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Front, Adjustment	G3-6
Bleeddown Manifold Valve	L5-2
Body, Dump	B3-1
Body Guide	B3-4
Body Pad	B3-3
Body Position Indicator	B3-5
Body Sling Cable	B3-4
Body-Up Switch	D3-3
Brake Accumulators	J3-15

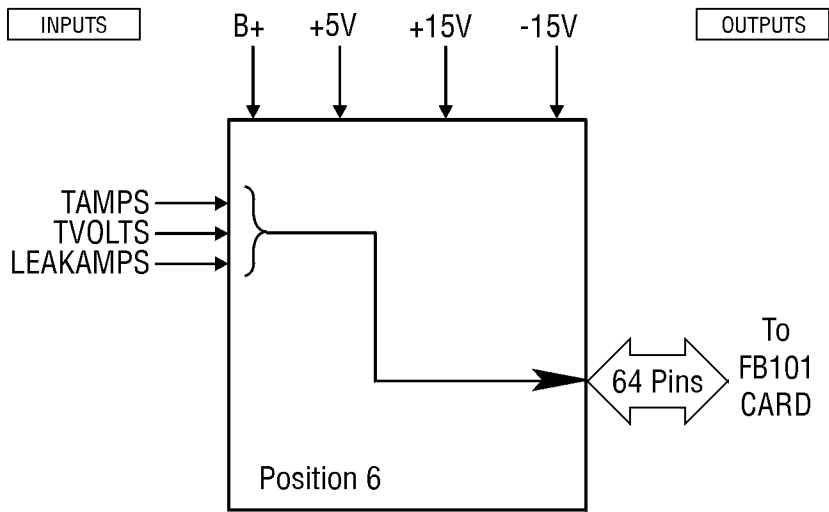
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Front	J5-8
Rear	J6-16
Parking	J7-7
Checkout Procedure	J4-1
Troubleshooting	J4-7
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Rear Brakes	J6-15
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Test and Adjustment	J3-10

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Brake Accumulators	J3-15
Steering Accumulators	L5-2
Suspension	H4-3
Checkout Procedures	
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Hoist Circuit	L10-14
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Steering	
Removal	G3-8
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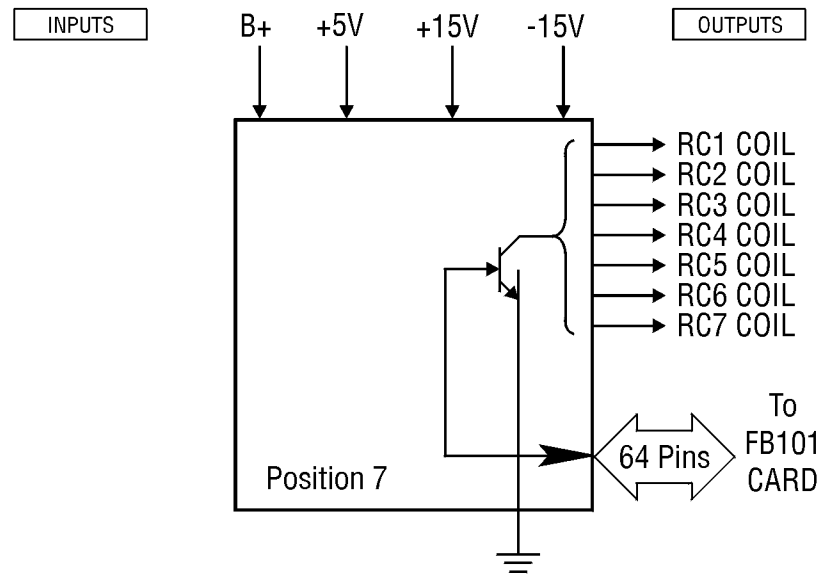
For Pin INPUTS/OUTPUTS See appropriate Figure attached.



**STATEX III
FL328 PANEL**



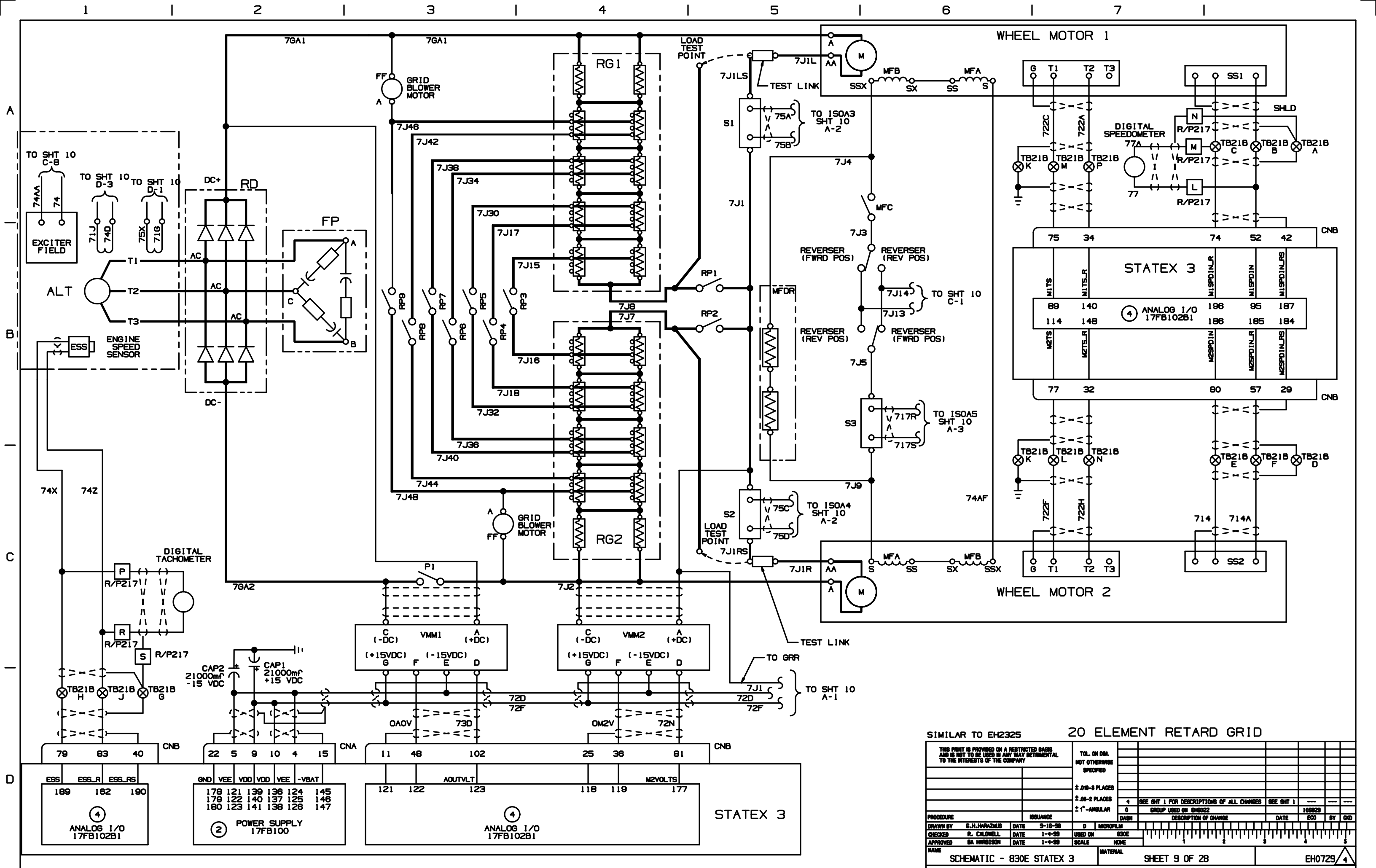
**FB155
ANALOG I/O CARD**



**FB104
DIGITAL I/O CARD**

Figure C (continued)
CONNECTOR C
(Used on trolley only)

<u>SIGNAL NAME</u>	<u>DESCRIPTION</u>	CONNECTOR PIN NO. [] = +5V < > = GROUND () = SHIELD	<u>TYPE OF SIGNAL</u>
* RC31	Energizes RC3 Contactor Coil Low Side Driver	43, <30>	OUTPUT
* RC4	Energizes RC4 Contactor Coil Low Side Driver	44, <31>	OUTPUT
* RC41	Energizes RC4 Contactor Coil Low Side Driver	32, <33>	OUTPUT
* RC5	Energizes RC5 Contactor Coil Low Side Driver	45, <60>	OUTPUT
* RC51	Energizes RC5 Contactor Coil Low Side Driver	71, <72>	OUTPUT
* RC6	Energizes RC6 Contactor Coil Low Side Driver	59, <70>	OUTPUT
* RC61	Energizes RC6 Contactor Coil Low Side Driver	58, <69>	OUTPUT
* RC7	Energizes RC7 Contactor Coil Low Side Driver	57, <68>	OUTPUT
* RC71	Energizes RC7 Contactor Coil Low Side Driver	78, <92>	OUTPUT
* Spr 1	Unused	80, <94>	OUTPUT
* Spr 2	Unused	79, <93>	OUTPUT
* Spare 1	Unused	4, <18>	OUTPUT
* Spare 2	Unused	5, <19>	OUTPUT
* Spare RC1	Spare Low Side Driver	73, <61>	OUTPUT
* Spare RC11	Spare Low Side Driver	74, <62>	OUTPUT
* Spare RC2	Spare Low Side Driver	75, <63>	OUTPUT
* Spare RC21	Spare Low Side Driver	48, <47>	OUTPUT
* TPL	Trolley Power Light Low Side Driver	1, <15>	OUTPUT
* TRL	Trolley Ready Light Low Side Driver	7, <21>	OUTPUT



20 ELEMENT RETARD GRID

THIS PRINT IS PROVIDED ON A RESTRICTED BASIS AND IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO THE INTERESTS OF THE COMPANY		TOL. ON DIM. NOT OTHERWISE SPECIFIED	
		±.010-3 PLACES	
		±.002-2 PLACES	
		±.1°-ANGULAR	
4 SEE SHT 1 FOR DESCRIPTIONS OF ALL CHANGES		SEE SHT 1	
0 GROUP USED ON EHQ22		105829	
DASH	DESCRIPTION OF CHANGE	DATE	BY
DRAWN BY G.H.HARRAZIUS	DATE 9-18-98	D MICROFILM	
CHECKED R. CALDWELL	DATE 1-4-99	USED ON G3DE	
APPROVED BA HARRISON	DATE 1-4-99	SCALE NONE	
NAME		MATERIAL	
SCHEMATIC - 830E STATEX 3		SHEET 9 OF 28	
EHO729		4	

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