

# Shop Manual

CEBM010900



# 730E

DUMP TRUCK

SERIAL NUMBER **A30212 - A30218**

# KOMATSU

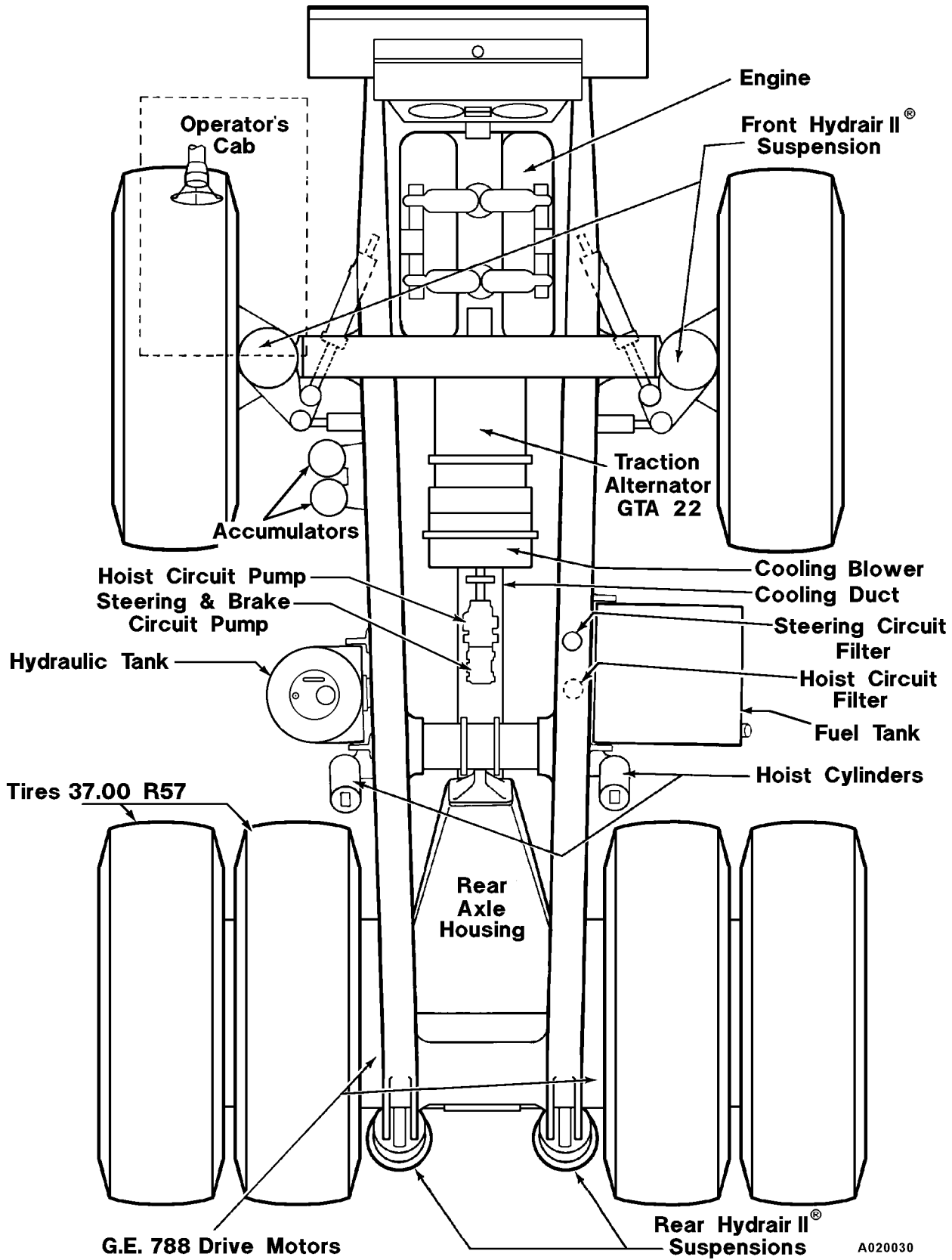
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A020030

**730E MAJOR COMPONENTS**

# PRECAUTIONS FOR MAINTENANCE

## BEFORE PERFORMING MAINTENANCE

### WARNING TAG

- If others start the engine or operate the controls while you are performing service or lubrication, you could suffer serious injury or death.
- ALWAYS attach the WARNING TAG to the control lever in the operator's cab to alert others that you are working on the machine. Attach additional warning tags around the machine, if necessary.
- These tags are available from your Komatsu distributor. (Part No. 09963-03000)



### PROPER TOOLS

- Use only tools suited to the task. Using damaged, low quality, faulty, or makeshift tools could cause personal injury.



### PERIODIC REPLACEMENT OF CRITICAL PARTS

- Periodically replace parts used to insure safety or prevent accident. (See "Periodic Replacement Of Component Parts For Safety Devices", Section 4, of the "Operation & Maintenance Manual".)
- Replace these components periodically with new ones, regardless of whether or not they appear to be defective. These components deteriorate over time.
- Replace or repair any such components if any defect is found, even though they have not reached the time specified.

## STOPPING THE ENGINE BEFORE SERVICE

- When carrying out inspection or maintenance, always stop the machine on firm flat ground, lower the dump body, then stop the engine.
- If the engine must be run during service, such as when cleaning the radiator, always set the shift control lever to the neutral position (N) and the parking brake lever to the PARKING position. Always carry out the work with two people. One person should sit on the operator's seat so that he can stop the engine if necessary. NEVER move any controls you do not need to operate.
- When servicing the machine, be careful not to touch any moving part or get your clothes caught.
- Put blocks under the wheels.
- When carrying out service with the dump body raised, always place the dump lever at the HOLD position, apply the lock, and insert the safety pins securely.

## DURING MAINTENANCE

### PERSONNEL

- Only authorized personnel can service and repair the machine. Extra precaution should be used when grinding, welding, and using a sledge-hammer.

### ATTACHMENTS

- Place attachments that have been removed from the machine in a safe place so that they do not fall. If they fall on you or others, serious injury could result.



6. Do not use the fire extinguisher for any purpose other than putting out a fire! If extinguisher is discharged, report the occurrence so the used unit can be refilled or replaced.
7. Do not allow unauthorized personnel to ride in the truck. Do not allow anyone to ride on the ladder of the truck.
8. Do not leave truck unattended while engine is running. Shut down engine and apply park brake before getting out of cab.

## MACHINE OPERATION SAFETY PRECAUTIONS

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



***If any of the red warning lights come "On" or if any gauge reads in the red area during truck operation, a malfunction is indicated. Stop truck as soon as safety permits, shut down engine if problem indicates and have problem corrected before resuming truck operation.***

***Operating truck with stalled or free spinning wheel motors may cause serious damage to wheel motors! If truck does not begin to move within 10 seconds after depressing throttle pedal (Selector Switch in a drive position), release throttle pedal and allow wheels to regain traction before accelerating engine again.***

1. Always look to the rear before backing the truck. Watch for and obey ground spotter's hand signals before making any reverse movements. Sound the warning horn (3 blasts). Spotter should have a clear view of the total area at the rear of the truck.
2. Operate the truck only while properly seated with seat belt fastened. Keep hands and feet inside the cab compartment while truck is in operation.
3. Check gauges and instruments frequently during operation for proper readings.
4. Observe all regulations pertaining to the job site's traffic pattern. Be alert to any unusual traffic pattern. Obey the spotter's signals.
5. Match the truck speed to haul road conditions and slow the truck in any congested area. Keep a firm grip on steering wheel at all times.

6. Do not allow engine to run at "Idle" for extended periods of time.
7. Check parking brake periodically during shift. Use parking brake **ONLY** for parking. Do not use park brake for loading / dumping.

*Do not attempt to apply parking brake while truck is moving!*



***Do not use "Brake Lock" or "Emergency Brake" (if equipped) for parking. With engine stopped, hydraulic pressure will bleed down, allowing brakes to release!***

8. Check brake lock performance periodically for safe loading and dump operation.
9. Proceed slowly on rough terrain to avoid deep ruts or large obstacles. Avoid traveling close to soft edges and the edge of fill area.
10. Truck operation requires concentrated effort by the driver. Avoid distractions of any kind while operating the truck.

## LOADING

1. Pull into the loading area with caution. Remain at a safe distance while truck ahead is being loaded.
2. Do not drive over unprotected power cables.
3. When approaching or leaving a loading area, watch out for other vehicles and for personnel working in the area.
4. When pulling in under a loader or shovel, follow "Spotter" or "Shovel Operator" signals. The truck operator may speed up loading operations by observing the location and loading cycle of the truck being loaded ahead, then follow a similar pattern.
5. When being loaded, operator should stay in truck cab with engine running. Place Selector Switch in "Neutral" and apply Wheel Brake Lock.
6. When loaded, pull away from shovel as quickly as possible but with extreme caution.

A plate on the side of the hydraulic tank furnishes instructions for filling the hydraulic tank.

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. All oil being put into the hydraulic tank should be filtered through 3 micron filters.

**ATMOSPHERIC BREATHER SYSTEM**

FILLING INSTRUCTIONS:

1. WITH ENGINE STOPPED, KEY SWITCH OFF AND BODY DOWN, FILL TANK TO TOP OF SIGHT GLASS.
2. RAISE AND LOWER BODY 3 TIMES.
3. REPEAT STEPS 1 AND 2 AND ADD OIL UNTIL LEVEL IS AGAIN AT TOP OF SIGHT GLASS.
4. OIL MUST BE VISIBLE IN UPPER SIGHT GLASS WITH ENGINE STOPPED, BODY DOWN AND KEY OFF FOR 90 SECONDS. OIL MUST BE VISIBLE IN LOWER SIGHT GLASS WITH ENGINE RUNNING AND BODY DOWN. REPEAT STEP 1 IF NECESSARY.

WB2724

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

 **CAUTION**

**DO NOT ADD OIL  
UNLESS ENGINE IS  
STOPPED, KEY IS  
OFF, AND BODY  
IS DOWN**

WA6628

A warning plate is attached to the frame above the hydraulic system (APU) quick disconnect fittings to alert technicians that high pressure hydraulic oil is present during operation. Care must be taken when it is necessary to open the hydraulic system. There is always a chance of residual pressure being present. Open fittings slowly to allow any pressure to bleed off before removing any connections.

**WARNING**

**HIGH PRESSURE**

**DO NOT LOOSEN OR DISCONNECT  
ANY HYDRAULIC LINE OR  
COMPONENT UNTIL ENGINE IS  
STOPPED AND KEY SWITCH IS  
OFF.**


WB2439



*Any operating fluid, such as hydraulic oil, escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. Serious injury and possibly death may result if proper medical treatment by a physician familiar with this injury is not received immediately.*

A warning plate is located above the hydraulic system (APU) quick disconnect fittings in front of the hydraulic tank which provides instructions to the operator or technician for towing a disabled truck. This plate specifies the requirements for an auxiliary source of supply for hydraulic oil and the proper hookup.

**TEST BOTH STEERING AND BRAKE SYSTEM OPERATION BEFORE TOWING.**

 **WARNING**

STEERING PROCEDURE FOR  
DISABLED TRUCK

1. ENGINE MUST BE STOPPED AND ACCUMULATOR(S) BLED DOWN (OIL DISCHARGED).
2. CONNECT EXTERNAL SUPPLY HOSE TO .75 INCH FEMALE QUICK DISCONNECT.
3. CONNECT EXTERNAL RETURN HOSE TO 1.00 INCH FEMALE QUICK DISCONNECT.
4. SECURE HOSES TO TRUCK.
5. PROCEED WITH TOWING OPERATION.

WB2726

**TABLE XIII  
COMMON CONVERSION MULTIPLIERS**

<b>COMMON CONVERSION MULTIPLIERS ENGLISH To METRIC</b>		
<b>To Convert From</b>	<b>TO</b>	<b>Multiply By</b>
inch – in.	millimeter (mm)	25.40
inch – in.	centimeter (cm)	2.54
foot – ft.	meter (m)	0.3048
yard – yd.	meter (m)	0.914
mile – mi.	kilometer (km)	1.61
sq. in. – in. <sup>2</sup>	sq. centimeters (cm <sup>2</sup> )	6.45
sq. ft. – ft. <sup>2</sup>	sq. centimeters (cm <sup>2</sup> )	929
cu. in. – in. <sup>3</sup>	cu. centimeters (cm <sup>3</sup> )	16.39
cu. in. – in. <sup>3</sup>	liters (l)	0.016
cu. ft. – ft. <sup>3</sup>	cu. meters (m <sup>3</sup> )	0.028
cu. ft. – ft. <sup>3</sup>	liters (l)	28.3
ounce – oz.	kilogram (kg)	0.028
fluid ounce – fl. oz.	milliliter (ml)	29.573
pound (mass)	kilogram (kg)	0.454
pound (force) – lbs.	Newton (N)	4.448
in. lbs. (force)	Newton.meters (N.m)	0.113
ft. lbs. (force)	Newton.meters (N.m)	1.356
ft. lbs. (force)	kilogram.meters (kg.m)	0.138
kilogram.meters (kg.m)	Newton.meters (N.m)	9.807
psi (pressure)	kilopascals (kPa)	6.895
psi (pressure)	megapascals (MPa)	0.007
psi (pressure)	kilograms/cm <sup>2</sup> (kg/cm <sup>2</sup> )	0.0704
ton (short)	kilogram (kg)	907.2
ton (short)	metric ton	0.907
quart – qt.	liters (l)	0.946
gallon – gal.	liters (l)	3.785
HP (horsepower)	Watts	745.7
HP (horsepower)	kilowatts (kw)	0.745

<b>COMMON CONVERSION MULTIPLIERS METRIC To ENGLISH</b>		
<b>To Convert From</b>	<b>TO</b>	<b>Multiply By</b>
millimeter (mm)	inch – in.	0.0394
centimeter (cm)	inch – in.	0.3937
meter (m)	foot – ft.	3.2808
meter (m)	yard – yd.	1.0936
kilometer (km)	mile – mi.	0.6210
sq. centimeters (cm <sup>2</sup> )	sq. in. – in. <sup>2</sup>	0.1550
sq. centimeters (cm <sup>2</sup> )	sq. ft. – ft. <sup>2</sup>	0.001
cu. centimeters (cm <sup>3</sup> )	cu. in. – in. <sup>3</sup>	0.061
liters (l)	cu. in. – in. <sup>3</sup>	61.02
cu. meters (m <sup>3</sup> )	cu. ft. – ft. <sup>3</sup>	35.314
liters (l)	cu. ft. – ft. <sup>3</sup>	0.0353
grams (g)	ounce – oz.	0.0353
milliliter (ml)	fluid ounce – fl. oz.	0.0338
kilogram (kg)	pound (mass)	2.2046
Newton (N)	pound (force) – lbs.	0.2248
Newton.meters (N.m)	kilogram.meters (kg.m)	0.102
Newton.meters (N.m)	ft. lbs. (force)	0.7376
kilogram.meters (kg.m)	ft. lbs. (force)	7.2329
kilogram.meters (kg.m)	Newton.meters (N.m)	9.807
Kilopascals (kPa)	psi (pressure)	0.1450
megapascals (MPa)	psi (pressure)	145.038
kilograms/cm <sup>2</sup> (kg/cm <sup>2</sup> )	psi (pressure)	14.2231
kilograms/cm <sup>2</sup> (kg/cm <sup>2</sup> )	kilopascals (kPa)	98.068
kilogram (kg)	ton (short)	0.0011
metric ton	ton (short)	1.1023
liters (l)	quart – qt.	1.0567
liters (l)	gallon – gal.	0.2642
Watts	HP (horsepower)	0.00134
kilowatts (kw)	HP (horsepower)	1.3410

## ENGINE STORAGE-CUMMINS

### Engine Storage-(Short Term)

#### 1 Month to 6 Months

This procedure describes the proper method for the short term storage of an engine.

#### Prepare the Engine for Short Term Storage

1. Operate the engine at "HIGH IDLE" until the coolant temperature is 160° F (70° C).
2. Turn the engine "OFF".
3. Disconnect the fuel lines to the engine fuel filter and the injector return line.
4. Use a preservative oil. Use Dauber T Chemical NoxRust No. 518, or equivalent. The oil must meet Military Specification MIL-L-644, Type P-9.
5. Fill two containers, one with diesel fuel, and the second with preservative oil. Put both fuel lines in the container of diesel fuel.
6. "START" the engine.
7. After the engine is operating smoothly, transfer the fuel supply line to the container of preservative oil. Operate the engine until the preservative oil flows out of the injector return line.
8. Turn the engine "OFF". Connect the fuel lines to the fuel filter and the injector return line.
9. Drain the oil pan sump, oil filters, and fuel filters.
10. Install the drain plugs in the oil sump. The sump can remain empty until the engine is ready to be returned to service.



**Put a warning tag on the engine. The tag must indicate:**

- The engine does not contain oil.
- Do not operate the engine.

11. Disconnect the electrical wiring from the fuel pump solenoid.
12. Turn the fuel pump manual shutoff valve **counterclockwise** until it stops.
13. Crank the engine slowly. Spray lubricating oil into the intake manifold and the inlet of the air compressor.
14. Cover all of the openings with tape to prevent dirt and moisture from entering the engine.
15. Drain the coolant.

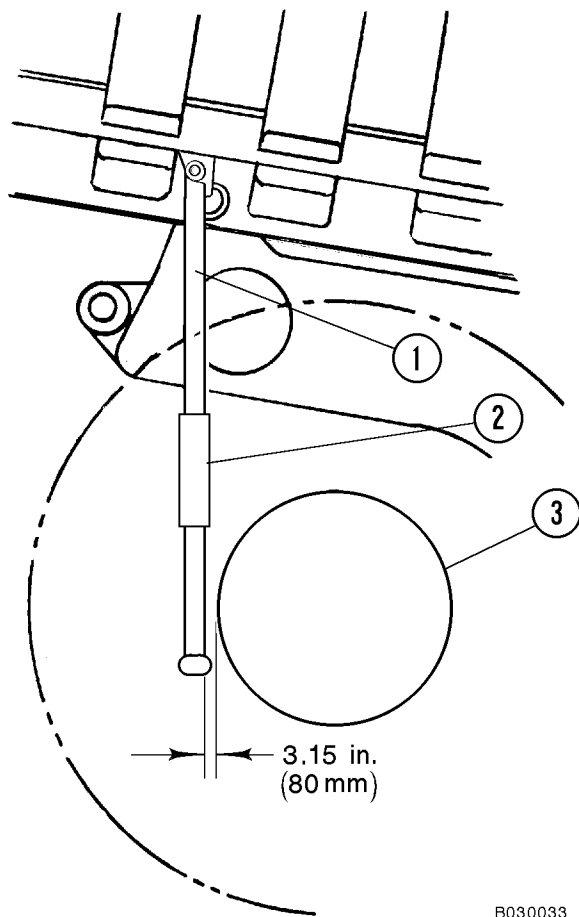
*NOTE: It is not necessary to drain the coolant if it is a permanent type antifreeze with a rust inhibitor.*

16. Store the engine in an area that is dry and has a uniform temperature.
17. Bar turn the Crankshaft two or three revolutions every 3 to 4 weeks.

#### Remove the Engine from Short Term Storage

1. Prime the lubricating system. Refer to Cummins Engine Shop Manual, (Section 14-01, Engine Run-in-Period).
2. Fill the coolant system if necessary.
3. Adjust the injector and the valve clearance. Refer to Cummins Engine Shop Manual, (Section 00-02, Engine Assembly).
4. Tighten the intake manifold mounting capscrews to specified torques, refer to the Cummins Service Manual for specifications.
5. Fill the oil pan sump, oil filters, and fuel filters with recommended lubricants and fuels.

# NOTES



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FIGURE 3-9. ROCK EJECTOR INSTALLATION

- |                     |                           |
|---------------------|---------------------------|
| 1. Rock Ejector Arm | 3. Rear Wheel Spacer Ring |
| 2. Wear Plate       |                           |

## ROCK EJECTORS

Rock ejectors are placed between the rear dual wheels to keep rocks or other material from lodging between the tires.

The rock ejectors should be inspected during tire inspections. If the ejectors are bent or worn excessively, they must be repaired or replaced to prevent possible tire damage.

### Inspection

1. The ejectors must be positioned on the vertical center line between the rear tires within 0.19 in. (5.0 mm).
2. With the truck parked on a level surface, the arm structure (2, Figure 3-6) should be approximately 3.15 in. (80 mm) from the wheel spacer ring (3).
3. If the arm (1) becomes bent, it must be removed and straightened.
4. The wear plates (2) must be replaced if severely worn.
5. Inspect the mounting brackets, pins, and stops for wear and/or damage and repair as necessary.

### Hoist Limit Switches

Refer to Section 'D', Electrical System (24VDC) for adjustment procedure of the hoist limit switches.

22. Connect wheel motor cooling blower air outlet hose. Tighten all clamps securely to insure a positive air seal.
23. Lift main alternator blower intake duct into position and install hardware at mounts. (Refer to Figure 2-2)
  - a. Install hardware at transition structure to blower inlet joint, electrical cabinet, and deck mounts.
  - b. Install control cabinet air hose, electrical cables and any other hoses and wiring removed during power module removal.
  - c. Lift rear, center deck structure in place and install hardware.
24. Connect the hydraulic pump drive shaft from the alternator to the companion flange on the pump. (Refer to Figure 2-1). Tighten cap-screws to standard torque. Install driveshaft guard.
25. If equipped with an air system, connect hoses from air compressor to tubes routed to the main air tank. Reconnect the air compressor air supply hose at the engine air inlet duct.
26. Connect all remaining electric, oil, and fuel lines.
27. Connect the air filter restriction indicator hoses.
28. Connect the batteries as follows:
  - a. Install battery positive (+) cable.
  - b. Install battery ground (-) cable.
  - c. Install battery equalizer +24V (input) terminal.
  - d. Install equalizer +12V (output) terminal.
  - e. Install equalizer GND (-) terminal.
  - f. Close battery disconnect switch.
29. If truck is equipped with air conditioning, connect hoses routed from cab to receiver/drier and air conditioning compressor.
30. Service radiator and engine with appropriate fluids. Refer to Section "P" for capacity and fluid specifications.
31. Recharge air conditioner system per instructions in Section M, Air Conditioning System.

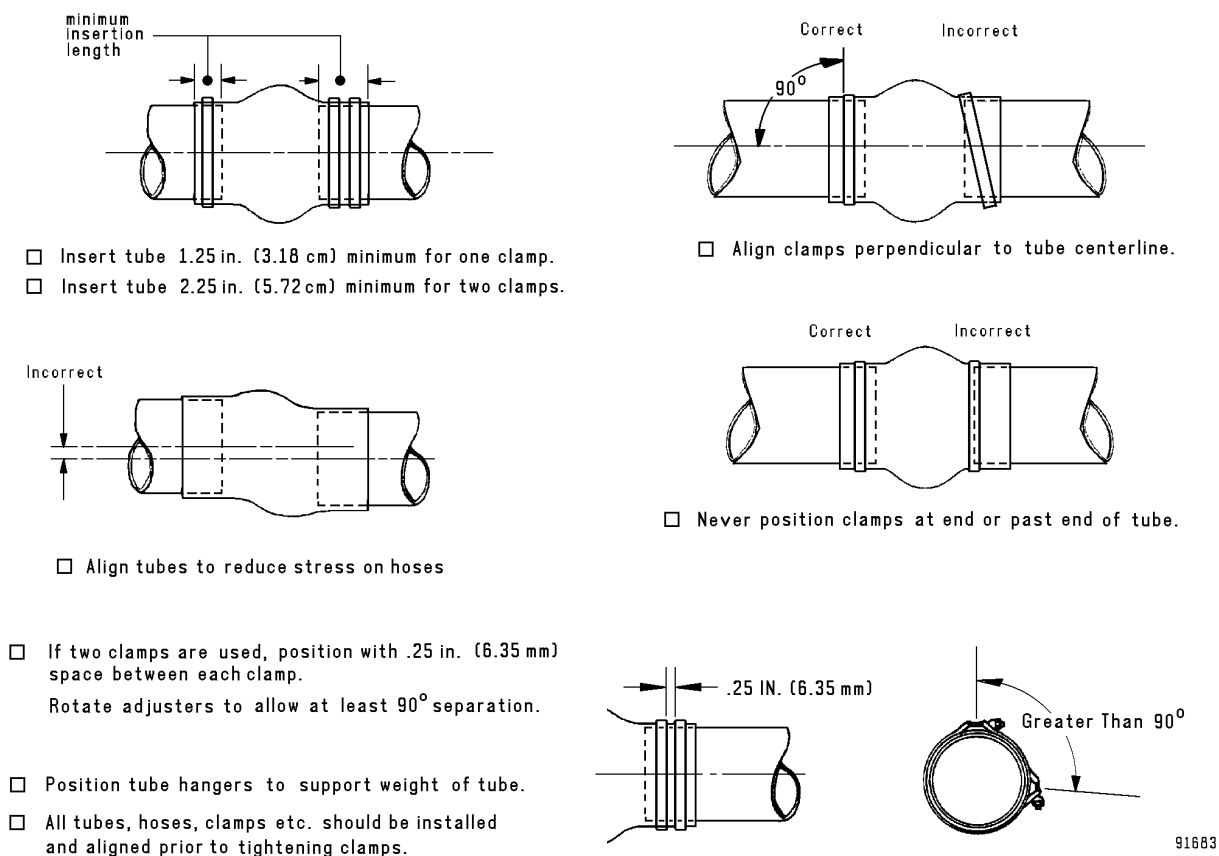
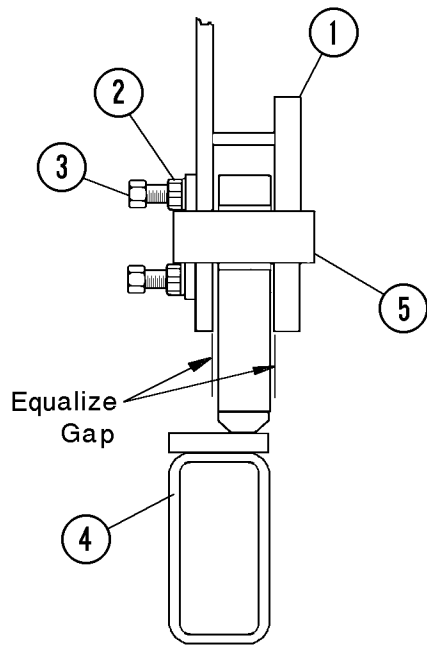


FIGURE 2-9. AIR INLET PIPING CONNECTIONS

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FIGURE 4-8. CRADLE GAP EQUALIZATION

- |                     |                        |
|---------------------|------------------------|
| 1. Cradle Structure | 3. Adjustment Setscrew |
| 2. Jam Nut          | 4. Subframe            |
|                     | 5. Pin                 |

11. Check crankshaft end play with a magnetic base dial indicator at the front of the crankshaft. Refer to the "Alternator Mounting Specifications" chart for the engine installed.



*Do not pry against the crankshaft damper.*

12. If end play cannot be obtained, repeat engine/alternator mating procedure.
13. Rotate the crankshaft one full revolution and listen for any unusual noise caused by moving components contacting stationary parts. Install engine sidecover if removed.
14. Install lockwire on all alternator mounting cap-screws.

## **WARNING**

- 1. Electric shock can cause serious or fatal injury. Only qualified electrical maintenance personnel should perform electrical testing.*
- 2. This system is capable of causing physical harm. Use caution during test procedures to protect personnel from injury.*
- 3. All potential testing should be considered hazardous. Proper precautions are necessary.*
- 4. Any time one of the plug-in circuit cards must be removed or reinstalled, be certain that the control power switch is "OFF".*
- 5. Extreme care should be exercised to prevent damage to the various semi-conductor devices and low impedance circuits under test. When using an ohmmeter to check diodes, transistors and low power conductors, care must be used when using the ohms x1 scale. Excessive current can damage the meter. When using the Hi-pot tester, megger, or when welding is to be performed on the truck, remove the printed circuit cards.*
- 6. Check wiring and cables for proper routing and termination.*

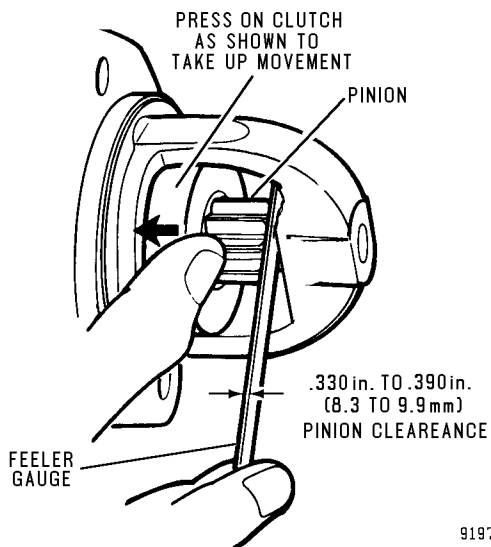


FIGURE 2-8. CHECKING PINION CLEARANCE

### Pinion Clearance

To adjust pinion clearance, follow the steps listed below.

1. Make connections as shown in Figure 2-7.
2. **Momentarily** flash a jumper lead from terminal "G" to terminal "MTR". The drive will now shift into cranking position and remain so until the batteries are disconnected.
3. Push the pinion or drive back towards the commutator end to eliminate slack movement.
4. The distance between the drive pinion and housing should be between 0.330 in. to 0.390 in. (8.3 mm to 9.9 mm) as shown in Figure 2-8.
5. Adjust clearance by turning shaft nut (64, Figure 2-3).

### Magnetic Switch

The magnetic switch is a sealed unit and not repairable.

#### Removal

1. Remove battery power as described in Cranking Motor "Removal".
2. Disconnect cables from the switch terminals and wires from coil terminals (Figure 2-9).

*NOTE: If the magnetic switch has a diode across the coil terminals, mark the leads prior to removal to ensure correct polarity during installation.*

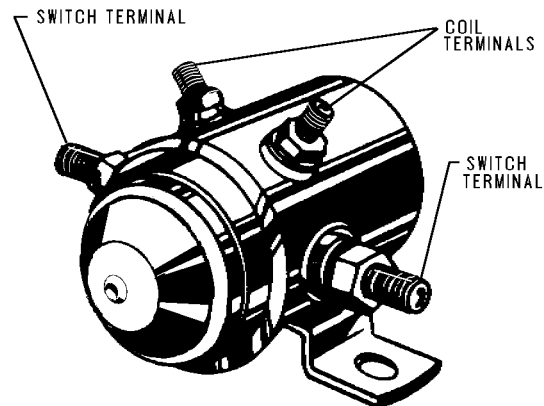
3. Remove mounting capscrews and washers. Remove switch from mounting bracket.
4. The switch coil circuit can be tested as described below.

#### Installation

1. Attach magnetic switch to the mounting bracket using the capscrews and lockwashers removed previously.
2. Inspect cables and switch terminals. Clean as required and install cables.
3. Install the diode across the coil terminals if required. Be certain diode polarity is correct. (Refer to the wiring diagrams on the following pages.) Attach wires from the truck harness to the coil terminals (See Figure 2-9).
4. Connect battery power as described in Cranking Motor "Installation".

#### Coil Test

1. Using an ohmmeter, measure the coil resistance across the coil terminals.
  - a. The coil should read approximately  $28 \Omega$  at  $72^{\circ}\text{F}$  ( $22.2^{\circ}\text{C}$ ).
  - b. If the ohmmeter reads  $\infty$ , the coil is open and the switch must be replaced.
  - c. If the ohmmeter reads  $0 \Omega$ , the coil is shorted and the switch must be replaced.



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FIGURE 2-9. MAGNETIC SWITCH ASSEMBLY

## ALARM INDICATING DEVICE (AID) SYSTEM

The Alarm Indicating Device (16) is connected to the electrical accessories circuits to provide the operator with a warning indication of a malfunction. This system consists of up to eight printed circuit cards, located under the passenger seat in the operators cab. The actual quantity of cards will depend on options installed on the truck.

The AID system enables the indicating lights to be flashing or constant. The AID also has the capability of operating an audible alarm along with the light. The eight printed circuit cards are (refer to Figure 3-2):

- Diode Matrix (With Sound) Card . . . . . (Slot 1)
- Diode Matrix (Without Sound) Card . . . (Slot 2)
- Hot Switch Inverter Card . . . . . (Slot 3)
- Hot Switch Inverter Card . . . (Slot 4) (Not Used)
- Temperature Card . . . . . (Slot 5)
- Oil Level Card . . . . . (Slot 6)
- Temperature and Latch Card . . . . . (Slot 7)
- Coolant Level and Flasher Card . . . . . (Slot 8)

*NOTE: Each card is identified with a number which corresponds with a mating number on the housing. If cards are removed, make sure card numbers correspond with housing numbers during installation (See Figure 3-2).*

The following information briefly describes each card and its function. Refer to Section "R" for circuit components described below.



**Prior to welding on the truck, disconnect the AID system plug-in cards.**

### Diode Matrix (Without Sound)

The Diode Matrix Without Sound Card (2, Figure 3-2) consists of a series of diodes capable of working with eight different indicator circuits. The indicator light can be a flashing light by connecting it to the 12F circuit or a steady light by connecting it to the 12M circuit. In addition, some of the indicator light circuits are routed through a dimmer module to allow the operator to vary the intensity of the lamps. These

lamps are fed by circuits 12FD (flashing) and 12MD (steady).

When an indicator circuit is not activated, there is no ground circuit for the bulb. When the Indicator detecting switch activates the circuit, it grounds the lamp and grounds the flasher circuit through the diodes. Any circuits connected to terminals C1 through C8 will operate in the same manner. The alarm horn is not activated by this card.

### Diode Matrix (With Sound)

The Diode Matrix With Sound Card (1, Figure 3-2) works very much like the other Diode Matrix Card, except that it contains extra diodes to activate the alarm horn in addition to the flasher. The circuits connected to terminals A1 through A8 operate in the same manner.

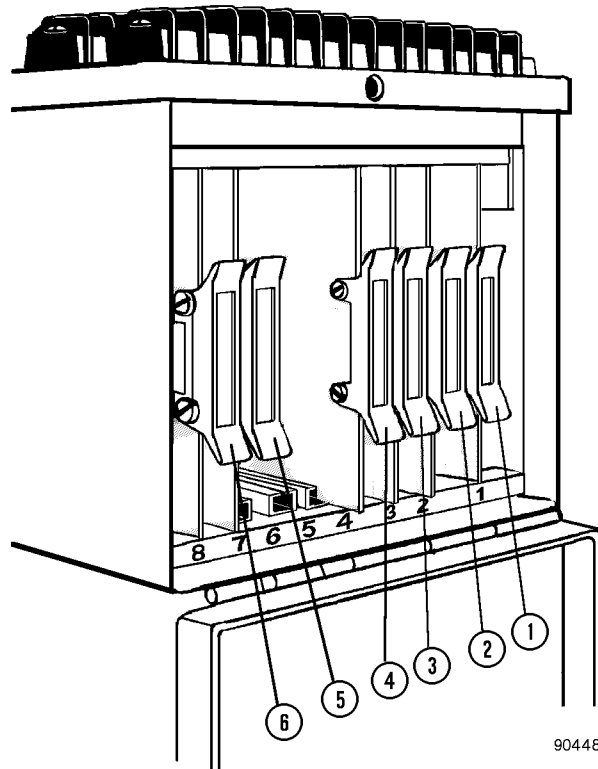


FIGURE 3-2. AID SYSTEM CARD ENCLOSURE

1. Diode Matrix With Sound
2. Diode Matrix Without Sound
3. Hot Switch Inverter
4. Hot Switch Inverter (Not Used)
5. Temperature & Latch
6. Coolant Level & Flasher

**TABLE I. CIRCUIT BREAKERS**

	<b>AMPS</b>	<b>DEVICE(S) PROTECTED</b>	<b>LOCATION</b>
CB13	15	Turn Signal & Clearance Lights	RB1, Control Cabinet
CB14	15	Flashing Lights	RB1, Control Cabinet
CB15	15	RD1, RD2, & Tail Lights	RB1, Control Cabinet
CB16	15	Dynamic Retard Lights	RB3, Control Cabinet
CB17	15	Manual Back-up Lights	RB3, Control Cabinet
CB18	15	Stop Lights	RB3, Control Cabinet
CB19	15	Back-up Horn	RB3, Control Cabinet
CB20	5	Parking Brake Failure Relay	RB4, Control Cabinet
CB21	15	Fluid Components Cabinet Service Lights, Rear Axle Service Light, Horn Solenoid, Steering Accumulator Bleed Down Solenoid, Horn	RB4, Control Cabinet
CB22	5	DDEC Master ECM Control Power (DDEC Engine Only)	RB4, Control Cabinet
CB23	15	Low Beam Headlight, L.H.	RB5, Control Cabinet
CB24	15	Low Beam Headlight, R.H.	RB5, Control Cabinet
CB25	15	High Beam Headlight, L.H.	RB5, Control Cabinet
CB26	15	High Beam Headlight, R.H.	RB5, Control Cabinet
CB27	15	Clearance Light Relay, Panel Lights, High Beam Indicator	RB5, Control Cabinet
CB28	15	Payload Meter	RB2, Control Cabinet
CB29	5	Payload Meter	RB2, Control Cabinet
CB30	15	Ladder, Engine Service & (Optional) Fog Lights, Hourmeter	Operator Cab, Power Distribution Module
CB31	15	Heater/AC Circuits	Operator Cab, Power Distribution Module
CB32	15	Warning Lights, A.I.D. Module, Voltmeter, Turn Signal Relays & Indicator Lights	Operator Cab, Power Distribution Module
CB33	15	Hoist Solenoid	Operator Cab, Power Distribution Module
CB34	10	Air Dryer Heater	Operator Cab, Power Distribution Module
CB35	10	Lincoln Lube Solenoid	Operator Cab, Power Distribution Module
CB36	10	Cigar Lighter	Operator Cab, Power Distribution Module
CB37	10	Windshield Washer & Wiper	Operator Cab, Power Distribution Module
CB38	5	Fuel gauge, Engine Temperature Gauge	Operator Cab, Power Distribution Module
CB39	5	Radiator Pressure Solenoid	Operator Cab, Power Distribution Module
CB40	5	12VDC Accessory Receptacle (DDEC Engine Only)	Operator Cab, Power Distribution Module
CB40A	5	12VDC Accessory Receptacle	Operator Cab, Power Distribution Module
CB40B	10	Radio/Cassette Player	Operator Cab, Power Distribution Module
CB41A	15	Cab Door Window, L.H.	Operator Cab, Power Distribution Module
CB41B	15	Cab Door Window, R.H.	Operator Cab, Power Distribution Module
CB42	15	Air Seat	Operator Cab, Power Distribution Module
CB43	10	Starter Solenoid, Oil Pressure Latch Relay	Operator Cab, Power Distribution Module
CB44	20	DDR Connections, Coolant Level Module (DDEC Engine Only)	Battery Equalizer Box
CB45	20	DDEC Main ECM 12VDC Power (DDEC Engine Only)	Battery Equalizer Box
CB46	20	DDEC Main ECM 12VDC Power (DDEC Engine Only)	Battery Equalizer Box
CB47	20	DDEC Receiver ECM 12VDC Power (DDEC Engine Only)	Battery Equalizer Box
CB48	20	DDEC Receiver ECM 12VDC Power (DDEC Engine Only)	Battery Equalizer Box
CB50	20	Communications Radio	Operator Cab, Power Distribution Module
CB51	20	Dispatch Radio	Operator Cab, Power Distribution Module
CB52	10	Spare	Operator Cab, Power Distribution Module
CB53	10	Spare	Operator Cab, Power Distribution Module

## 2-DIGIT DISPLAY PANEL

The 2-Digit Display panel (Figure 2-1.), located in the control cabinet, consists of the following:

- Two digit “event” number display,
- “First” LED
- “Last” LED
- “Previous (up arrow) search key
- “Next” (down arrow) search key
- “Reset” key

Under normal operation, with no events having been recorded, the 2-Digit Display Panel will display only two zeros (00). The “first” LED and the “last” LED will be dark (not illuminated). The “previous” and “next” search keys will be illuminated (green). The “reset” key will also be illuminated (red).

NOTE: The terms “event” and “fault” are used interchangeably to indicate a system occurrence which has been recorded into memory. The system recognizes each as an event, that is, a fault is nothing more to the system than an event. Some events (or faults) result in restrictions being placed on truck operation. Therefore, when discussing a fault situation, the term “fault” seems more appropriate and less confusing.

### THE CODED NUMBER

The 2-Digit Display panel displays a coded two digit number. This number indicates certain data stored in the memory of the CPU card regarding the recent operating history of the truck's propulsion and control systems. Refer to Table I for a description of the two digit code numbers ranging from 00 to 99.

If an active fault condition exists, in which a fault has not been locked out or reset, the corresponding fault number will appear on the display. For example, if the P1 contactor is out of position, a number thirteen (13) will be displayed. By referring to Table I, you can quickly determine that a 13 refers to P1 contactor. Troubleshooting tips are provided for isolating the cause of the fault.

If another fault were to occur, such as the RP1 feedback indicating that RP1 contactor is in the wrong position, a number seventeen (17) would be displayed. Referring to Table I, you could see that a problem exists with the RP1 contactor. You can also see that the “last” LED is illuminated and the “first” LED is extinguished. This means that event 17 is the last one stored in the 2-Digit Display. To view the first event, simply press the “previous” search key (up arrow).

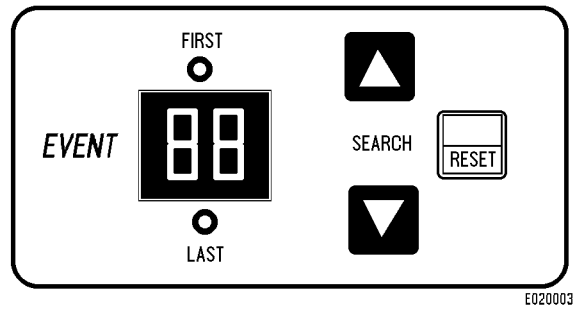


FIGURE 2-1. 2-DIGIT DISPLAY PANEL

If the first event were being displayed, the “first” LED would be illuminated and the “last” LED would be off. This indicated that the event being displayed is the first one in the CPU memory and that there are additional events to be displayed. To view the last event, press the “next” search key (down arrow).

Once a fault has been serviced, press the “reset” key and the event will be reset. If the problem has not been corrected, the fault will be relogged the next time it occurs.

NOTE: Resetting the fault from the 2-Digit Display does not remove the event from the CPU memory on the FB101 card in the FL275 panel. This can only be done using the Portable Test Unit (PTU).

### EVENTS

This panel provides a variety of operational and fault codes which electronically document certain system events. For this reason, these codes are referred to as “event” codes.

The diagnostic system on the CPU card stores up to 500 events. If more are encountered after the storage is full, the system will purge the oldest event to make room for the newest event. It will then record the fact that this purge has occurred.

Stored events can only be removed from the system using the PTU, or by being purged by the system when new events occur after the storage is full.

When an event is reported, the system records the time and date, as well as the event's code, subcode, and 2 floating point values. This data, besides the time and date, are determined by the section of software reporting the event. This data is stored in the computer's memory and the “event” code is displayed on the 2-Digit Display panel.

**TABLE II. 2-DIGIT DISPLAY PANEL SUBCODES**

PRIMARY CODE No.	SUBCODE No.	TERM	DESCRIPTION
<b>ANALOG OUTPUT</b>			
<b>30:</b>	54	AF_CURR_REF	D/A Commanded to output >10 volts for over 0.05 seconds
	55	MF_CURR_REF	D/A Commanded to output >10 volts for over 0.05 seconds
	56	BRKBLV	D/A Commanded to output >10 volts for over 0.05 seconds
	57	ENGRPMCMD	D/A Commanded to output >10 volts for over 0.05 seconds
	61	SIG1	D/A Commanded to output >10 volts for over 0.05 seconds
	62	SIG2	D/A Commanded to output >10 volts for over 0.05 seconds
	63	SIG3	D/A Commanded to output >10 volts for over 0.05 seconds
	64	SIG4	D/A Commanded to output >10 volts for over 0.05 seconds
	65	SIG5	D/A Commanded to output >10 volts for over 0.05 seconds
<b>ANALOG INPUT</b>			
<b>32:</b>	18	GND	A/D Scaled output > 16 or <-16 for 0.02 seconds
	19	GAINCHK	A/D Scaled output > 1675 or <-1600 for 0.02 seconds
	20	GROUND_FAULT	A/D Scaled output > 523 or <-523 for 0.3 seconds
	21	M1_AMPS	A/D Scaled output > 3500 or <-3500 for 1.0 second
	22	M2_AMPS	A/D Scaled output > 3500 or <-3500 for 1.0 second
	23	MF_AMPS	A/D Scaled output > 1500 or <-1500 for 1.0 second
	24	ALT_F_AMPS	A/D Scaled output > 800 or <-30 for 0.5 seconds
	25	ENGHPCUT	A/D Scaled output > 4.95 or <-4.95 for 1.0 second
	26	SRS	A/D Scaled output > 23 or <-1 for 1.0 second
	27	RPINHI	A/D Scaled output > 23 or <-1 for 1.0 second
	28	ALTFVOLT	A/D Scaled output > 1000 or <-25 for 1.0 second
	29	ALT_OUT_VOLT	A/D Scaled output > 2250 or <-50 for 1.0 second
	30	M2_VOLTS	A/D Scaled output > 1200 or <-1200 for 1.0 second
	31	APINHI	A/D Scaled output > 25 or <-1.0 for 1.0 second
	32	SVBE	A/D Scaled output > 5.2 or <-5.2 for 10.0 seconds
	33	TMFSE	A/D Scaled output > 5.2 or <-5.2 for 10.0 seconds
	34	ATOC	A/D Scaled output > 2400 or <-50 for 1.0 second
	35	MTOC	A/D Scaled output > 2400 or <-50 for 1.0 second
	36	M1TS	A/D Scaled output > 5.2 or <-5.2 for 10.0 seconds
	37	M2TS	A/D Scaled output > 5.2 or <-5.2 for 10.0 seconds
	38	TAFSE	A/D Scaled output > 5.0 or < 0 for 1.0 second
	39	PAYLOAD	A/D Scaled output > 10.0 or < 0 for 1.0 second
	40	COOLT	A/D Scaled output > 5.2 or <-5.2 for 10.0 seconds
	41	COOLP	A/D Scaled output > 5.2 or <-5.2 for 10.0 seconds
42	CRANKP	A/D Scaled output > 5.2 or <-5.2 for 10.0 seconds	
43	OILP	A/D Scaled output > 5.2 or <-5.2 for 10.0 seconds	

```

STATEX III CONFIGURATION CONVERTER 12.xx TO 1.00 <MINE UER: 2.02>
F1: HELP          F2: NEWCFG=OLDCFG NAME      F3: BLANK NEWCFG NAME
F4: MAKE = CURRENT NEWCFG F5: MAKE ALL NEWCFGS  F6: RESET NEWCFG NAMES
F7: SORT BY OLDCFG NAME  F8: sort by oldcfg ext      F9: EXIT CFG CONVERTER
-----
      1 OLDCFG      OLDOEMCFG      2 NEWOEMCFG      1 NEWCFG
<<=K641131E.210  *XHFF003A.301  ? K661131A.100  * K641131E.210 =
>>  .....          .....          ? K645131A.100

```

E020096

FIGURE 2-7. CONFIGURATION CONVERSION SCREEN

9. Note in Figure 2-7 the four columns headed by “OLDCFG”, “OLDOEMCFG”, “NEWOEMCFG” and “NEWCFG.” These are described as follows:

- Files listed under “OLDCFG” are the old truck configuration files created by the mine using the previous software release which is displayed for possible conversion.
- Files listed under “OLDOEMCFG” are the old OEM files created by Komatsu and given to the mine to create the previous release configuration files.
- Files listed under “NEWOEMCFG” are the new OEM files created by Komatsu and given to the mine for the current software release version to create the new configuration files.
- Files listed under “NEWCFG” are the names of the new configuration files to be created by the Configuration Conversion Tool. The cursor is there, blinking in front of the first file name in the last column to indicate that the computer is ready to edit these file names. The numbers which precede each column heading indicate the number of different files listed.

10. Note equal (=) signs appear at the beginning and the end of the first file name line, and follows the cursor up and down the list of files.

11. Using the RIGHT arrow key, move the cursor to the right. The cursor will fall under the first letter of the first file name in the last column. The UP, DOWN and LEFT arrow keys are now ineffective.

12. Type in the name for the new file over the old name. There is room for eight characters. If there are more letters in the old name than in the new, simply erase them using the space bar.

If an error is made in naming this file, the operation can be cancelled any time before [ENTER] is pressed by first pressing [ESC]. This returns the cursor to its original starting position where it can once again be moved with the arrow keys. A note to this effect is displayed at the bottom of the screen.

Note the asterisk (\*) which appears in front of the new name, and another asterisk appears in front of the column heading when you begin typing. This means the file name is being changed, but the file has not yet been created. The asterisks disappear if [ESC] is pressed to cancel the renaming operation.

13. After the new name has been typed in, press [ENTER]. This records the new file name. Note the cursor moves back to its starting position at the left of the file name asterisk.

This operation can be cancelled, even after [ENTER] has been pressed by pressing [F6]. This resets the file back to its original name.

14. Press [F4] to create the new file. The mine data from the file in the first column is copied and put into the OEM file in the third column to create the name you entered in the fourth column. Note that both asterisks (\*) have changed to plus signs (+), indicating the file has been created and copied to the hard disk.

Use the DOWN arrow to move the cursor to the next file name. Note the equal (=) signs move with the cursor.

15. Use the RIGHT arrow key and move the cursor to the right.

16. Type in the new file name.

17. Press [ENTER]. The example in Figure 2-9 shows the new file name to be “TEST2.”

**“7) Save a Truck Configuration, filename: . . .”**

*NOTE: If the configuration file is to be saved into a directory other than the directory shown at the end of line 8), the new directory must be specified before “Save a truck configuration, . . .” in line 7) is selected. Refer to “Save Directory: . . .” on the following page.*

Changes to the Configuration File represent changes made by the mine specific to their equipment and operating conditions. When the Truck Configuration file is modified, it should be saved under a new file name rather than being resaved under the originally selected file name.

*Example:*

The Mine configuration file name may be defined as M123131A.202 where:

- M = Mine designation letter
- 123 = Mine truck identification number (last three digits)
- 131 = Hardware Configuration (GE defined truck config. screen)
- A = Revision Letter (A =1st release of this config. file)
- . = Period (Used to separate first 8 characters from last 3)
- 2 = Current Month (Jan =1, ... Sep =9, Oct = A, Nov = B, Dec = C)
- 02 = Current Year (2002)

The Mine may choose to set up its own system for naming and recording the Truck configuration files cur-

rently installed on its trucks, but it is strongly recommended that a file naming system be established.

*NOTE: The file name length is limited to 8 characters maximum, followed by a period, then followed by a maximum 3 characters.*

1. From the TRUCK SETUP CONFIGURATION MINE MENU screen, move the cursor to line 7) and press [ENTER] or press [7] key to select “Save a truck configuration, filename:”
  - a. After “filename: . . .” the original selected truck configuration file name will appear as a prompt.
  - b. Type the desired Mine truck configuration file name defined above to replace the original file name as shown by the arrow in Figure 2-16. Press [ENTER] key.
  - c. The saved Mine configuration file name should now appear in the source directory. Press the [0] key to verify the file has been added to the list of configuration files as shown by the arrow in Figure 2-17. The Mine configuration file is now accessible in the subdirectory for installation into the CPU.
  - d. Press [ESC] key to return to the previous menu screen.

```

                                     <C>opyright GE 1991 - 2001
PTUSTX: TRUCK SETUP CONFIGURATION MINE MENU <ver: 1.00>
-----
      5 STATEX truck configurations in ...
A> Source Directory: C:\GEOHU3E\CFG\STXAPR01\TRUCK
0) Select a truck configuration, currently using file:K645131A.100
1) View truck configuration screen; data curves screen
2) Change/view Serial and Model Numbers
3) View OEM Options
4) View GE Product Service Data
5) Change/view Truck Specifics
6) Change/view Overspeeds
7) Save a truck configuration, filename:
8) Save Directory: C:\GEOHU3E\CFG\STXAPR01\TRUCK\M123131A.202
9) Quit

```

FIGURE 2-16. ENTERING NEW CONFIGURATION FILE NAME  
(Enhanced Version 1.00 Software Shown)

## STATISTICAL DATA CODES - COUNTERS

The Statistical Data Collector uses Parameter Counters and Parameter Profiles to record operating conditions for various occurrences on the truck.

To make data most useful, there are four counters for every statistical counter and five for every statistical profile. These counts are named by the method used to reset the count to zero. For the counter, there is a lifetime count, "LCount", which is associated with its date, "LCount Start". Then there are three other counters, "Last Qtr", "This Qtr", and "This Day".

A "parameter" is a defined occurrence. Each parameter has an identification number called "Par #", and a short name called "Description". Each parameter is an occurrence that is counted in some unit such as hours or the number of times the conditions have been correct to declare that the occurrence happened.

The units for which the counters count is listed under "Units" in Table III. The tables contain additional explanation of the conditions which define a statistical parameter as having occurred. This column is entitled "Count Conditions".

There are two types of parameters; Counter (Table III, and Profile (Table IV). The profile parameters have one more characteristic, "Range Counted", which sorts the actual value of the parameter and then counts time of the parameter-at-the-value.

When examining the number of counts for a parameter, it is often useful to know over what period of time the counts occurred. To aid in determining how long it took to get a certain number of counts for a Statistical Data Counter parameter, the Statistical Data is presented in the form of four counters. The first counter, "LCount, indicates how many counts have occurred since the "LCount Start" date. This is intended to be lifetime counter. It can be reset to zero by a privileged user, and the "LCount Start" will automatically be set to the date on the CPU board when the user performed the reset.

The second counter, "Last Qtr" is just the total number of counts for the parameter over the last-fiscal-quarter, also known as the last-three-months. This counter has the same value in it all quarter long. At midnight on a quarter change, this counter is overwritten by the "This Qtr" value as this-quarter becomes last-quarter.

The third counter, "This Qtr", keeps a moment by moment count of occurrences of the parameter. The counts are not reset to zero until midnight of the next quarter.

The fourth counter, "This Day", keeps a moment by moment count of occurrences of the parameter just as "This Qtr", except the "This Day" count is reset to zero every midnight whether it is a quarter change or not.

If the GE control panel is shut off before midnight, any necessary resetting of counters is done when the panel next powers up after midnight.

Whenever the truck is programmed, that is, the CPU Card has the contents of the flash prompts changed, the "LCount", "Last Qtr", and "This Qtr" counts are not changed. However, the "This Day" count will be reset to zero.

In order to use the Statistical Data Collector to monitor maintenance of the vehicle, it is recommended that an office spread sheet or data base computer program be used to keep quarterly records of the statistical data. To aid in getting the data off the CPU card and into the office computer, a feature called UPLOAD STATISTICAL DATA TO A FILE has been provided in the PTU. This feature puts all the collected statistical data in an ASCII file which can then be processed in the office to keep records on truck use. The [F2] feature of the PTU can be used to capture statistical data playback on the PTU in the office.

*NOTE: The Statistical Data Collector is a part of the program run by the CPU card. If the CPU card does not have power, or if the code is stopped (as when looking at event and statistical data via the (PTU), then the Statistical Data Collector is also stopped. Hence, the Statistical Data Collector cannot count occurrences of, for example, toggling the AS pedal, while the code is stopped.*

Also note that the Statistical Data Collector is initialized at power-up. The counter conditions are initialized to their respective inactive states, usually false. If, again for example, the AS pedal is depressed while power is cycled, then the Statistical Data Collector will be initialized to AS not depressed at power-up. Momentarily after power-up however, the Statistical Data Collector will detect that AS is depressed and increment the count. Thus, cycling power has resulted in the Statistical Data Collector counting an occurrence of AS depressed even though AS has been depressed for some time and has not really been released and depressed again.

## TRUCK SPECIFIC INFORMATION

To quickly review the various options on the current truck, the **TRUCK SPECIFIC INFORMATION MENU** can be used to view configuration options, speed settings, serial numbers, etc. Information accessed through this menu is for viewing only and cannot be changed. If changes are required, use the "TRUCK SETUP (CFG)" selection from the **GE OHV STATEX III MENU**.



**Selecting "SPECIAL OPERATION" in the following procedure may present a safety hazard if the engine is running. 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. With the **GE STATEX III PTU MAIN MENU** displayed, select "SPECIAL OPERATION" and press [ENTER]. The screen shown in Figure 2-26 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 2-27 will be displayed. The PTU user should always keep the truck driver apprised of this control.
2. Select "YES" on the caution screen (Figure 2-26) and press [ENTER]. The **SPECIAL OPERATION MENU** will be displayed.

3. Use the arrow keys to move the cursor to the "TRUCK SPECIFIC INFORMATION MENU" selection and press [ENTER].

Selections available on this menu are:

- "VIEW OEM CONFIGURATION OPTIONS"

This selection permits reviewing the setup information programmed into the truck configuration file by Komatsu. (These options cannot be changed by mine personnel.)

- "VIEW MINE CONFIGURATION OPTIONS"

This selection displays options set by mine personnel when the truck configuration file was setup for a specific truck.

- "VIEW SPEED SETTINGS"

This selection allows viewing the current speed settings contained in the configuration file.

- "VIEW SERIAL AND MODEL NUMBERS"

This selection permits verification of component serial and model numbers.

- "VIEW GE VERSION INFORMATION"

This selection lists the truck ID number, model number, and applicable filenames. This screen also lists the GE code version number and CFG version number. This information can be useful in determining whether or not the software has been updated to the latest release version.

- "VIEW GE PRODUCT SERVICE DATA"

This selection lists information pertinent to the specific truck.

- "EXIT"

Select "EXIT" to leave the **TRUCK SPECIFIC INFORMATION MENU** and return to the **GE STATEX III PTU MAIN MENU**.

Selection of NORMAL OPERATION gives truck control to the driver.

Continue?             Yes  
                           No

OR

Selection of SPECIAL OPERATION will override truck driver controls until you exit to the PTU main menu.

Continue?             Yes  
                           No

FIGURE 2-26. CAUTION SCREEN

Return to PTU Main Menu gives truck control to the driver. CAUTION: Contactors may move!

Continue?             Yes  
                           No

FIGURE 2-27. CAUTION SCREEN

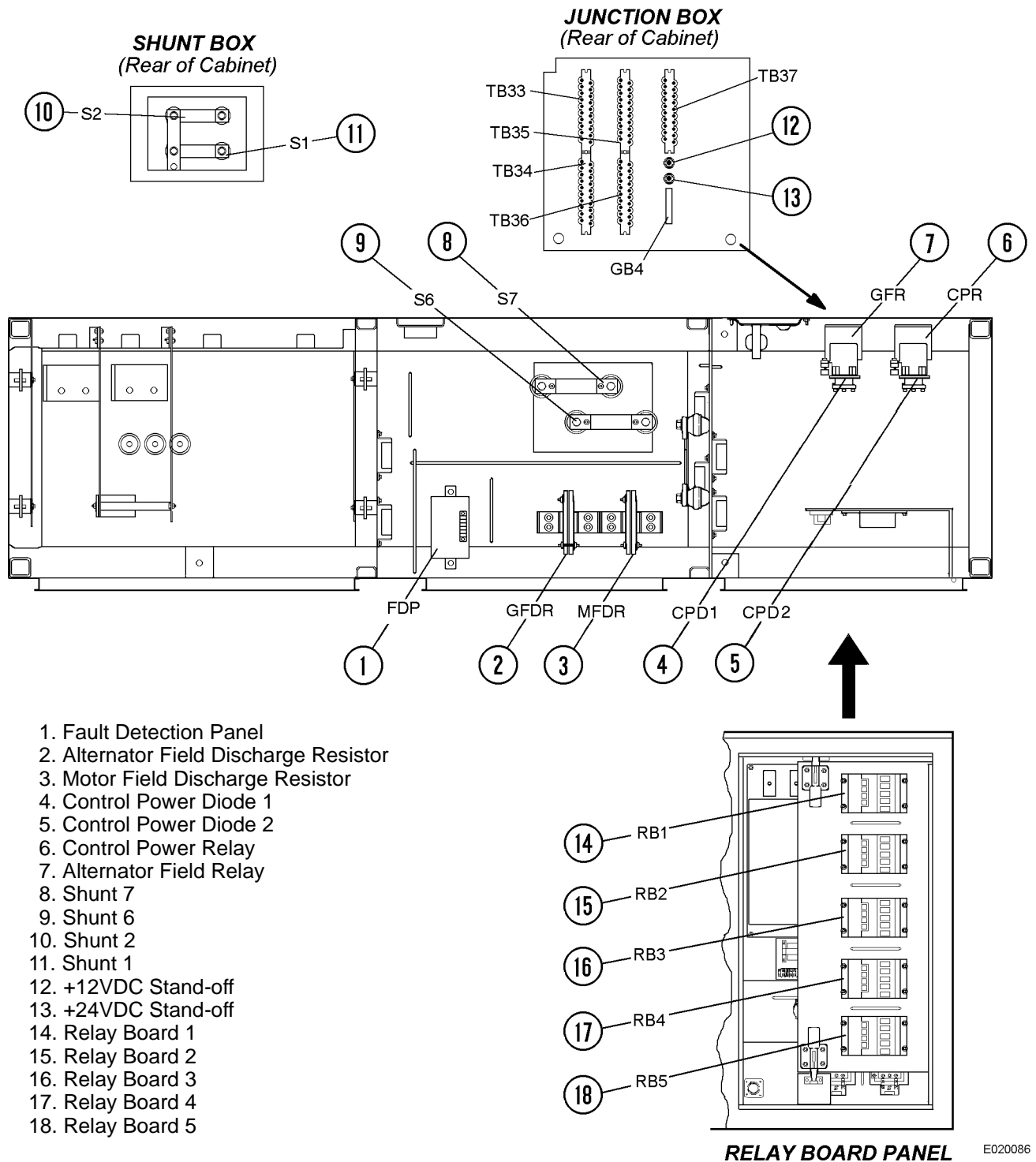


FIGURE 2-37. CONTROL CABINET, VIEW E

## **1.0 SEQUENCE TESTS - (Engine not running)**

### **Preparation & Setup**

It is assumed the truck has been programmed using the correct Truck Configuration File and GE Statex III Enhanced version 1.00 (if truck is equipped with a 17FB144 CPU card) or version 14.00 (if truck is equipped with a 17FB101 CPU card) or later software prior to proceeding with the following tests. If not, refer to *“Electrical Propulsion Components”* for instructions for preparing the Truck Configuration File, programming the truck, and usage of the GE software menu system.

- Always disconnect 74C at GFR for static testings (engine not running). Failure to do so may result in damage to battery boost SCR and/or dead batteries.
- If the truck body has not been installed or the body is raised, place a steel washer on Body Up Switch or jumper circuit 71F to circuit 71, to simulate body down condition.
- If hydraulic pressure is low, connect a jumper wire between circuit 73S and 710. (This step will be necessary if all hydraulic brakes are installed and engine is not running).

### **CONTROL SYSTEM SELF-TEST**

1. Set up PTU as described previously using the communication port in the electrical cabinet.
2. Turn control power switch On.
3. Verify the two digit display shows 00 after a 10 second delay. If only a single digit 8 is displayed, check for a faulty CPU (FB101 or FB144) card.
4. If the two digit display shows numbers other than 00, refer to “Electrical Propulsion Components” for a listing of possible codes, code descriptions, event restrictions, detection information and possible reasons for the problem. An attempt should be made to correct any obvious problems before proceeding.
5. If the problem has not been resolved, select the proper section of this procedure (digital, analog etc.) and use the PTU to aid in troubleshooting the problem.
6. If the entire electrical system is to be checked, the checkout procedures should be performed in the sequence listed if possible.

- a. "RETARD" should be highlighted:

RETARD

3. Momentarily jumper from circuit 71 to terminal "A" on GFIP.

GFAULT

4. All contactors should remain energized. Event code 01 should appear on two digit display. Electric system fault light should come on.
5. Release retard pedal.
6. With jumper removed from circuit 71 to terminal "A", operate Override pushbutton on console to reset electric system fault light. Press reset button on two digit display panel to clear event code.

## 1.8 Override Operation Check

1. Move selector switch to FORWARD, and depress throttle fully.

FORIN AS

- a. Verify the feedback signal:

FORFB

2. Propulsion contactors MF, P1/(P2), GF and GFR should pick up.

MF P1 (P2) GF GFR

- a. Verify the feedback signals:

MFFB P1FB (P2FB) GFFB GFRFB

3. Depress retard pedal.

RS

4. Verify that propulsion contactors MF, P1/(P2), GF and GFR drop out and then retard contactors RP1, RP2, MF, GF, GFR, RP3, RP4, RP5, (and RP6-RP9 if used) pick up. MF, GF and GFR must pick up after RP1 and RP2 but timing is very close.

RP1 RP2 MF GF GFR RP3 RP4 RP5 RP6 RP7 RP8 RP9

- a. Verify the feedback signals:

RP1FB RP2FB MFFB GFFB GFRFB RP3FB RP4FB RP5FB

RP6FB RP7FB RP8FB RP9FB

5. Operate Override Switch.

DOS

6. Verify that retard contactors RP1, RP2, MF, GF, GFR, RP3, RP4, RP5, (and RP6-RP9 if used) drop out. Propulsion contactors P1/(P2) should pick back up when RP1 and RP2 drop out. MF, GF and GFR should then pick up.

P1 (P2) MF GF GFR

7. Release Override Switch. The propulsion contactors drop out and retard contactors pick back up (as in step 4).

8. Release retard pedal and throttle pedal.

### 3.0 ANALOG INPUT SIGNALS TEST - FL275 CARD PANEL

The PTU will be used to test analog inputs to the FL275 panel analog I/O Card, to verify proper truck wiring, control panel wiring and component operation.

- Connect PTU at control cabinet as described previously.
- Turn PTU On and type “gemenu3e” (or “gemenu”) at the DOS “C:” prompt. Press [ENTER].

#### 3.1 Setup Analog Input Monitor Screen 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** should appear on the screen.
5. Move cursor to select “NORMAL OPERATION”. Press [ENTER] key.
  - a. A screen will appear that states: “Selection of NORMAL OPERATION gives truck control to the driver. Continue?”
  - b. With the cursor next to “Yes”, press [ENTER].
6. The **NORMAL OPERATION MENU** should appear on the screen.
7. Move cursor to select “MONITOR ANALOG INPUT CHANNELS”. Press [ENTER] key.
8. The **MONITOR ANALOG INPUT CHANNELS** screen, Figure 3-10. should appear.

```
PTUSTX:i.1.2 MONITOR ANALOG INPUT CHANNELS < >GETI < >EXIT
< > trolley
Normal Operation SYSTEM STATE =
ground fault = 0.0 ma alt tert current = 0.0 ac amps
motor 1 amps = 0.0 mf tert current = 0.0 ac amps
motor 2 amps = 0.0 motor 1 temp = 0.000 U; 0.0 C
motor 2 volts = 0.0 motor 2 temp = 0.000 U; 0.0 C
motor field amps = 0.0
alt output volts = 0.0 eng coolant temp = 0.00 U 0.0 C
alt field volts = 0.0 eng coolant pres = 0.00 U 0.0 PSI
alt field amps = 0.0 eng crankc pres = 0.00 U 0.0 "H2O
eng oil pressure = 0.00 U 0.0 PSI
ret spd pot set = 0.0 v
ret pedal = 0.0 % = 0.0 v 15 v positive = 0.0
acc pedal = 0.0 % = 0.0 v 15 v negative = 0.0
engine speed = 0.0 rpm battery voltage = 0.0
engine command = 0.0 rpm pot reference = 0.0
Motor 1 : 0.0 rpm; 0.0 mph afse temp = 0.000 U; 0.0 C
Motor 2 : 0.0 rpm; 0.0 mph mfse temp = 0.000 U; 0.0 C
rpm x 0.00000 = mph alt intake temp = 0.000 U; 0.0 C
ENTR=Sel. F1=Help F2=Files ESC=Abort →←F1=Navigate E030069
```

FIGURE 3-10. MONITOR ANALOG INPUT CHANNELS SCREEN

## 4.0 SPEED EVENT CHECKS

### Preparation & Setup

- Always disconnect 74C at GFR for static testings. Failure to do so may result in damage to battery boost SCR and/or dead batteries.
- If the truck is equipped with the Two Speed Overspeed, remove and insulate circuit wire 73LS going to the control cabinet junction box. There should be one circuit wire 73LS from the terminal block to the FL275 card panel.



*If the 73LS circuit wire going to the control cabinet junction box hasn't been removed and insulated, damage may result to the Rear Suspension Pressure Switches.*

- Wheelmotor Speed Sensors:
  - a. Disconnect external 714 wire and external 77 wire at control cabinet terminal board.
  - b. Jumper from 77 to 714 and jumper from 77A to 714A.
  - c. Connect an oscillator to 714 and 714A.
- All checks are to be made with control power On and the selector switch in FORWARD.
- Obtain speed event setting information and extended range retarding pickup speeds from the truck configuration file and use the Retard State Logic screen as instructed below:

### Setup PTU

1. With the **GE OHV STATEX III MENU** on the screen, select TRUCK SETUP (CFG).
2. At the **TRUCK SETUP CONFIGURATION MINE MENU** screen, select the proper truck configuration file.
3. From the **TRUCK SETUP CONFIGURATION MINE MENU** screen, select “6) Change/view Overpeeds.”
4. Record the values shown on the **OVERPEEDS ENTRY SCREEN**.
5. Exit back to the **TRUCK SETUP CONFIGURATION MINE MENU** and select “1) View truck configuration screen; data curves screen”.
6. Record the values for “EXT RANGE PICK\_UPS” listed on the second screen that appears.
7. Exit back to the **GE OHV STATEX III MENU** and select “PTU TALK TO TRUCK”.
8. After logging on, select “NORMAL OPERATION” from the **GE STATEX III PTU MAIN MENU**.
9. From the **NORMAL OPERATION** menu, select “RETARD STATE LOGIC”. Information will be read from this screen for the following procedures.

## 8.5 Battery Boost Adjustment

1. Turn On key switch and control power. Start engine and place selector switch in NEUTRAL.
2. Setup the PTU to read values on the AUTOMATIC LOAD BOX TEST SCREEN.
3. Connect voltmeter to R1 battery boost resistor, 74C (+) and 74AA (-).
4. Depress the override switch to clear any faults. If necessary, clear event codes on 2 digit display.
5. Place the selector switch in FORWARD. Slowly depress accelerator.
  - Observe +15 to +20 volts at R1 as engine rpm increases from low idle speed.
  - Verify R1 voltage drops to 0.0 volts as the engine begins to load (approximately 800 to 1000 rpm). Adjust Pot P1 on AFSE panel if necessary
  - Verify positive (+) values for MOTOR 1 & 2 AMPS, MOTOR FIELD AMPS, and ALTERNATOR VOLTS on PTU screen.
6. Seal pot adjustment screw when completed.
7. Place selector in NEUTRAL and shut down engine. Remove voltmeter.
8. Exit back to the **GEOHV STATEX III MENU** screen.

## 8.6 Isolation amplifier & voltage module test.

*NOTE: If there is a discrepancy with the card test procedure results, consult the appropriate GE Publication.*

The system utilizes two types of Isolation Amplifiers (Iso-Amps). Two are used for voltage measurement (VMM1 and VMM2). The other six are used for current measurement (ISOA-3, ISOA-4, ISOA-5, ISOA-6, ISOA-7, and ISOA-8).

### 8.6.1 Voltage Measuring Module Test (VMM1 and VMM2)

*NOTE: There are two recommended test procedures for testing the 17FM458 Voltage Measuring Module. One test requires the use of a high voltage power supply and can be found in the 17FM458 Instruction Book and all appropriate Vehicle Test Manuals. The alternate test method is detailed below.*

1. Disconnect 74C at GFR relay.
2. Disconnect the wires from terminals "A" and "C".
3. Turn On control voltage (B+).
  - Verify +15V on terminal "G" and -15V on terminal "E."
  - Measure and record B+ voltage on wire 71.
4. Connect a voltmeter from terminals "D" (+) to "F" (-).
5. Jumper terminals "C" to "F" and terminals "A" to "F".
  - Verify  $0.00 \pm 0.02V$  on the voltmeter.
6. Remove jumper from terminals "A" to "F".
7. Jumper terminal "A" to B+.
  - Verify voltmeter reads  $(B+) \div 200, \pm 2\%$ .

*Example: If  $B+ = 25v$ , the voltmeter should read:  $25 \div 200 = 0.125 \pm 0.0025$  volts.*

8. Turn off control power, disconnect voltmeter and jumpers and reconnect all wiring to the panel.

### 8.6.2 ISOA3, ISOA4, ISOA5, ISOA6, ISOA-7, and ISOA-8 Test.

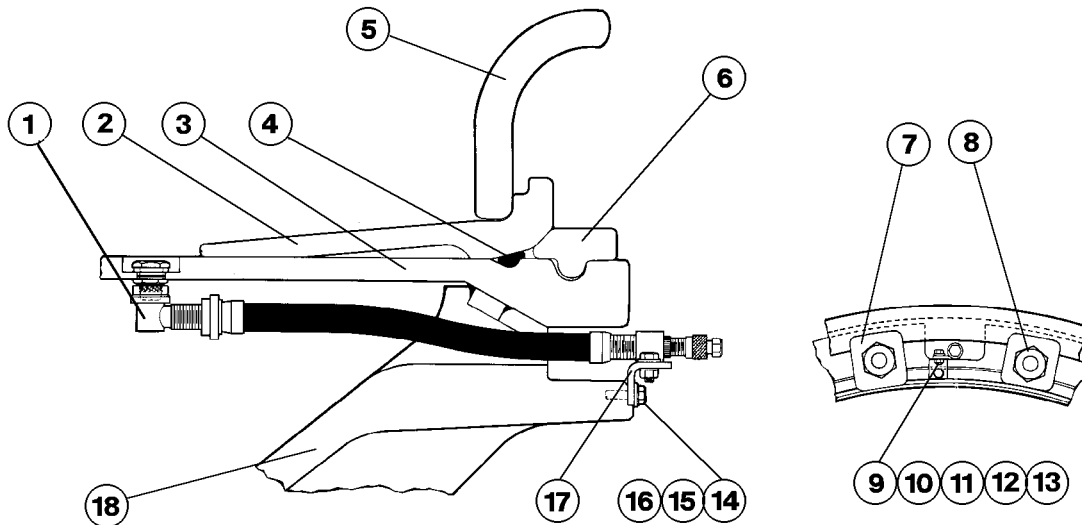


FIGURE 2-2. FRONT WHEEL ASSEMBLY

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

## FRONT TIRES AND RIMS

### Removal

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

### CAUTION

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

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

### WARNING

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

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

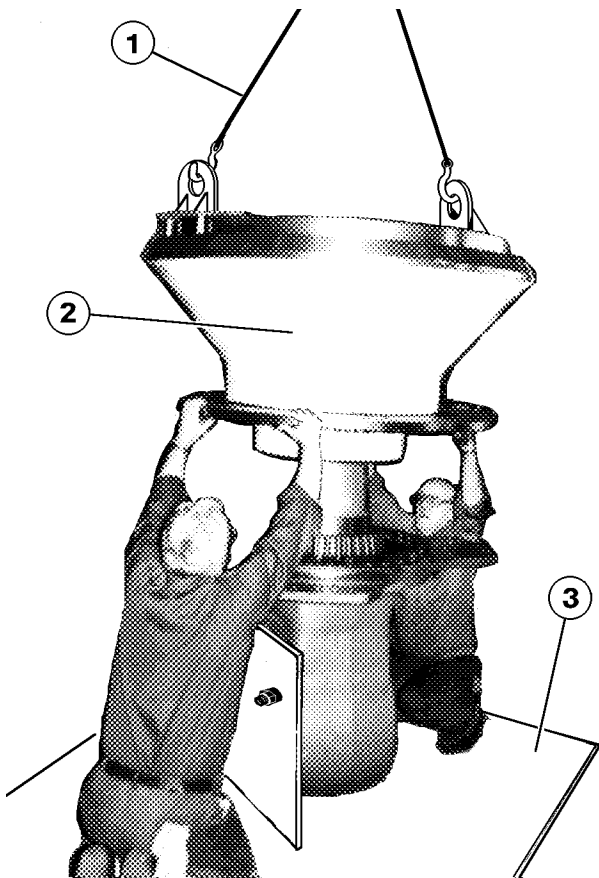


FIGURE 3-8. WHEEL HUB INSTALLATION

- |                   |                             |
|-------------------|-----------------------------|
| 1. Support Chains | 3. Fabricated Support Stand |
| 2. Wheel Hub      |                             |

7. If removed, assemble brake disc (1, Figure 3-5) on the wheel hub using capscrews and hardened flat washers (2). Tighten capscrews to **1,675 ft. lbs. (2271 N.m)** torque.

8. If removed, install bearing cups (4 & 21, Figure 3-3) in the wheel hub (1) as follows:

a. Pre-shrink cups by packing them in dry ice, or by placing them in a deep-freeze unit.

**NOTE: Do not cool below -65°F (-18.3°C).**

b. Install cups in wheel hub bores.

c. After cups have warmed to ambient temperature, press the cups tight against hub shoulder as follows:

- Inner Cup (21) - Apply **15 tons (13,600 kg)** force.
- Outer Cup (4) - Apply **11.5 tons (10,430 kg)** force.

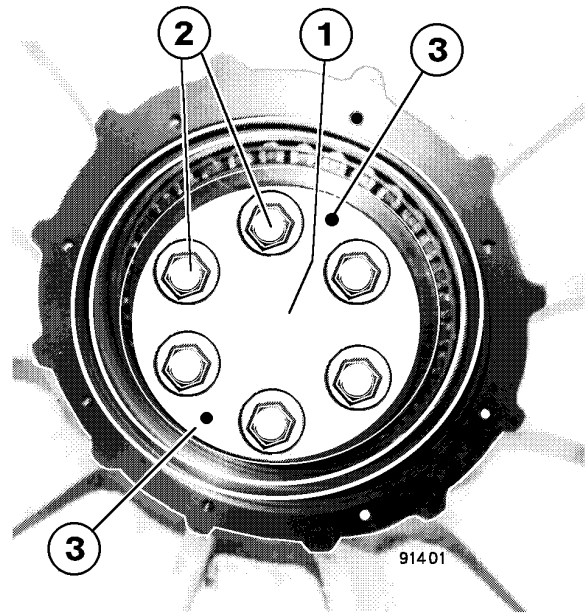


FIGURE 3-9. BEARING ADJUSTMENT

- |                   |                           |
|-------------------|---------------------------|
| 1. Retainer Plate | 3. Depth Measurement Hole |
| 2. Capscrews      |                           |

9. Install the other half of the seal assembly (22, Figure 3-3) in the hub using installation tool (TY2150) and soft tipped mallet. Follow procedure outlined in step 5.

10. Check outer bearing cone (5) for free fit on the spindle (18).

11. Referring to Figure 3-8, lift the hub and carefully lower it down over the spindle. To help installation and to prevent damaging the seal, the spindle and hub should be level.

12. Install outboard bearing cone (5) onto spindle.

- If outer bearing cone (5) is "pinned" type, install pin (29) into slot on spindle (18) and install cone over pin (29).

#### Wheel Bearing Adjustment - (Spindle Vertical)

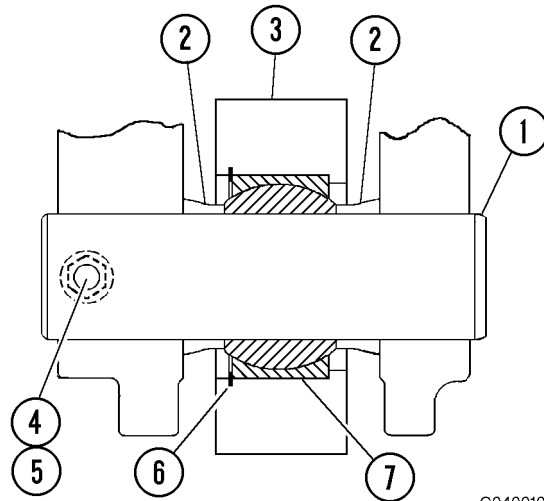
1. Install bearing retainer (1, Figure 3-9), without shims, with the thickness dimension stamp facing toward the outside. Install capscrews (2) and flat washers. Torque capscrews alternately using the following procedure:

- a. Tighten all capscrews to **100 ft. lbs. (136 N.m)** torque and rotate the hub a minimum of three revolutions.
- b. Increase torque to **250 ft. lbs. (339 N.m)** and tighten capscrews. Rotate hub a minimum of three revolutions.

## ANTI-SWAY BAR

### Removal

1. Position frame and rear axle housing to allow use of a puller arrangement to remove anti-sway bar pins (1, Figure 4-4) on the rear axle housing and the frame.
2. Block securely between frame and axle housing.
3. Disconnect lubrication lines. Position a fork lift or attach lifting device to anti-sway bar (3) for removal from truck.
4. Remove capscrews (4) and locknuts (5) at each mount.
5. Attach puller and remove pin (1) from each end of anti-sway bar.
6. Remove anti-sway bar from mounting brackets.
7. Remove bearing spacers (2).



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FIGURE 4-4. ANTI-SWAY BAR ASSEMBLY  
(Typical, Both Ends)

- |                   |                  |
|-------------------|------------------|
| 1. Pin            | 5. Locknut       |
| 2. Bearing Spacer | 6. Retainer Ring |
| 3. Anti-Sway Bar  | 7. Bearing       |
| 4. Capscrew       |                  |

### Installation

1. Start pin (1) in through the front of the frame mount and one spacer (2, Figure 4-4). Rotate pin to align retaining capscrew (4) hole with the hole in the mounting bracket.
2. Raise the anti-sway bar into position and push pin through spherical bearing, insert second spacer and continue pushing into other ear of bracket. If necessary, realign pin with retainer capscrew hole. Install capscrew (4) and locknut (5).
3. Repeat above procedure to install remaining pin, spacers, capscrew and locknut. Start the pin into the bore of the axle housing mount from the rear of the truck.
4. Attach lubrication lines.
5. Remove blocking.
6. If necessary, recharge suspensions. Refer to Section "H" for charging procedure.

### Disassembly

1. Remove retainer rings (6, Figure 4-4) from bores of both ends of anti-sway bar (3).
2. Drive out spherical bearings (7).

### Cleaning and Inspection

1. Inspect bearing bores of anti-sway bar. If bores are damaged, repair or replace anti-sway bar.
2. Inspect bearing spacers (2) for damage or wear.

### Assembly

1. Press in new bearings.
2. Install retainer rings. Be certain rings are properly seated in grooves.

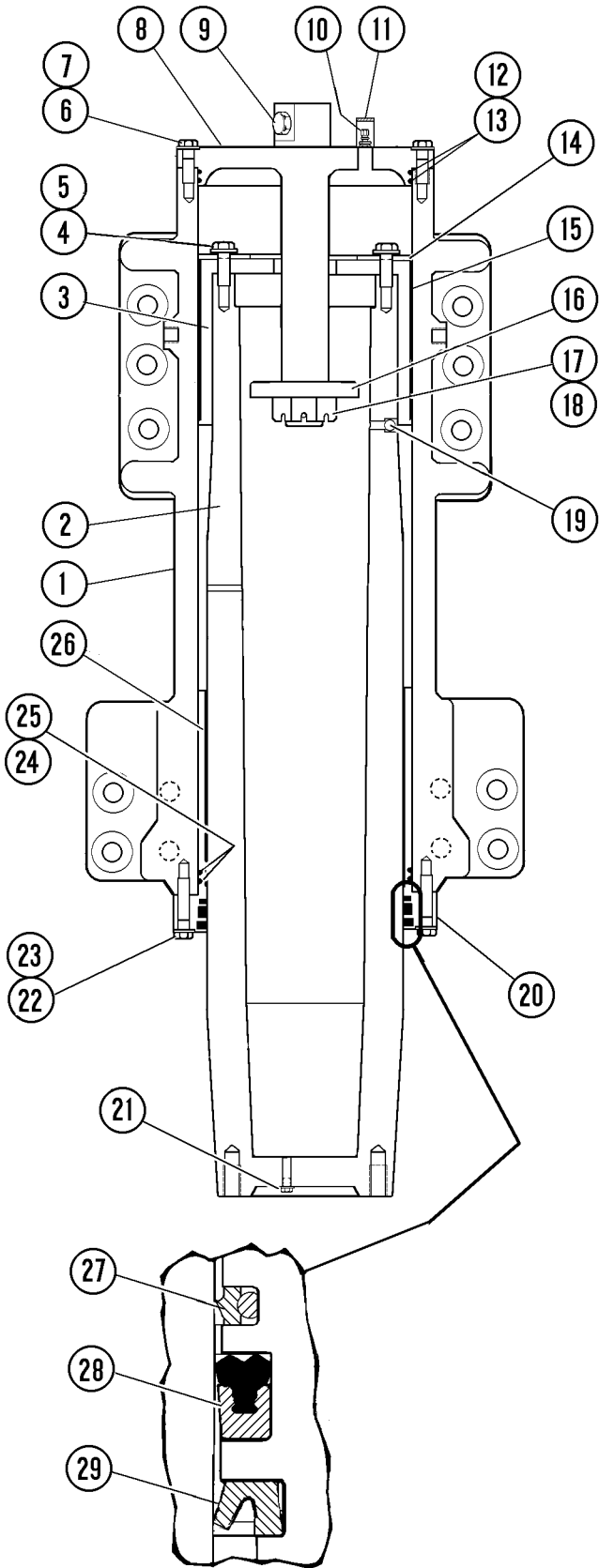


FIGURE 2-8. FRONT SUSPENSION

- |                     |                            |
|---------------------|----------------------------|
| 1. Housing          | 16. Piston Stop            |
| 2. Piston           | 17. Nut                    |
| 3. Bearing Retainer | 18. Roll Pin               |
| 4. Hardened Washer  | 19. Steel Ball             |
| 5. Capcrew          | 20. Lower Bearing Retainer |
| 6. Washer           | 21. Plug                   |
| 7. Capscrew         | 22. Capscrew               |
| 8. Cap Structure    | 23. Hardened Washer        |
| 9. Plug             | 24. O-Ring                 |
| 10. Charging Valve  | 25. Backup Ring            |
| 11. Cover           | 26. Lower Bearing          |
| 12. O-Ring          | 27. Step Seal              |
| 13. Backup Ring     | 28. Rod Seal               |
| 14. Ring            | 29. Rod Wiper              |
| 15. Bearing         |                            |

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3. Ensure outlet valves (3) and inlet valve (4) are closed (turned completely clockwise).
4. Turn swivel nut (small hex) on charging valve three full turns counterclockwise to unseat the valve.
5. Attach charging valve adapters (2) to each suspension charging valve stem.
6. Turn "T" handles (1) clockwise (this will depress core of charging valve and open the gas chamber of the suspension).
7. Open both outlet valves (3).

*NOTE: By selective opening and closing of outlet valves (3), and inlet valve (4), suspensions may be charged separately or together.*

#### Removal of Charging Kit

1. Close both outlet valves (3).
2. Turn "T" handles (1) counterclockwise to release charging valve cores.
3. Remove charging valve adapters (2) from charging valves.
4. Tighten swivel nut (small hex) on charging valve. If a new charging valve is being used, tighten swivel nut to **10.5 ft. lbs. (14.2 N.m)** torque, then loosen and retighten swivel nut to **10.5 ft. lbs. (14.2 N.m)** torque. Again loosen swivel nut and retighten to **4 ft. lbs. (5.4 N.m)** torque. Replace valve cap (1) and tighten to **2.5 ft. lbs. (3.3 N.m)** torque (finger tight).
5. Install charging valve caps and protective covers on both suspensions.

## SUPPORT BLOCKS FOR OILING AND CHARGING DIMENSIONS

Prior to starting oiling and charging procedures, supports should be fabricated which will maintain the correct exposed piston rod extensions.



***Rear support blocks for nitrogen charging are no longer necessary. Rear suspensions still require support blocks for oil charging.***

Exposed piston rod extensions are specified for both oil level and nitrogen charging for HYDRAIR®II suspensions. These dimensions are listed in the Tables below Figures 4-2 and 4-4. Measure dimensions from the face of the cylinder gland to the machined surface on the spindle at the front suspension. Measure from the face of the cylinder gland to the piston flange at the rear suspension.

Support blocks may be made in various forms. Mild steel materials are recommended. Square stock or pipe segments [1 in. (25 mm) minimum] may be used. Blocks must be capable of supporting the weight of the truck during oiling and charging procedures while avoiding contact with plated surfaces and seals on the suspension. Refer to Figure 4-2 for front suspension support block placement and Figure 4-4 for rear support block placement.

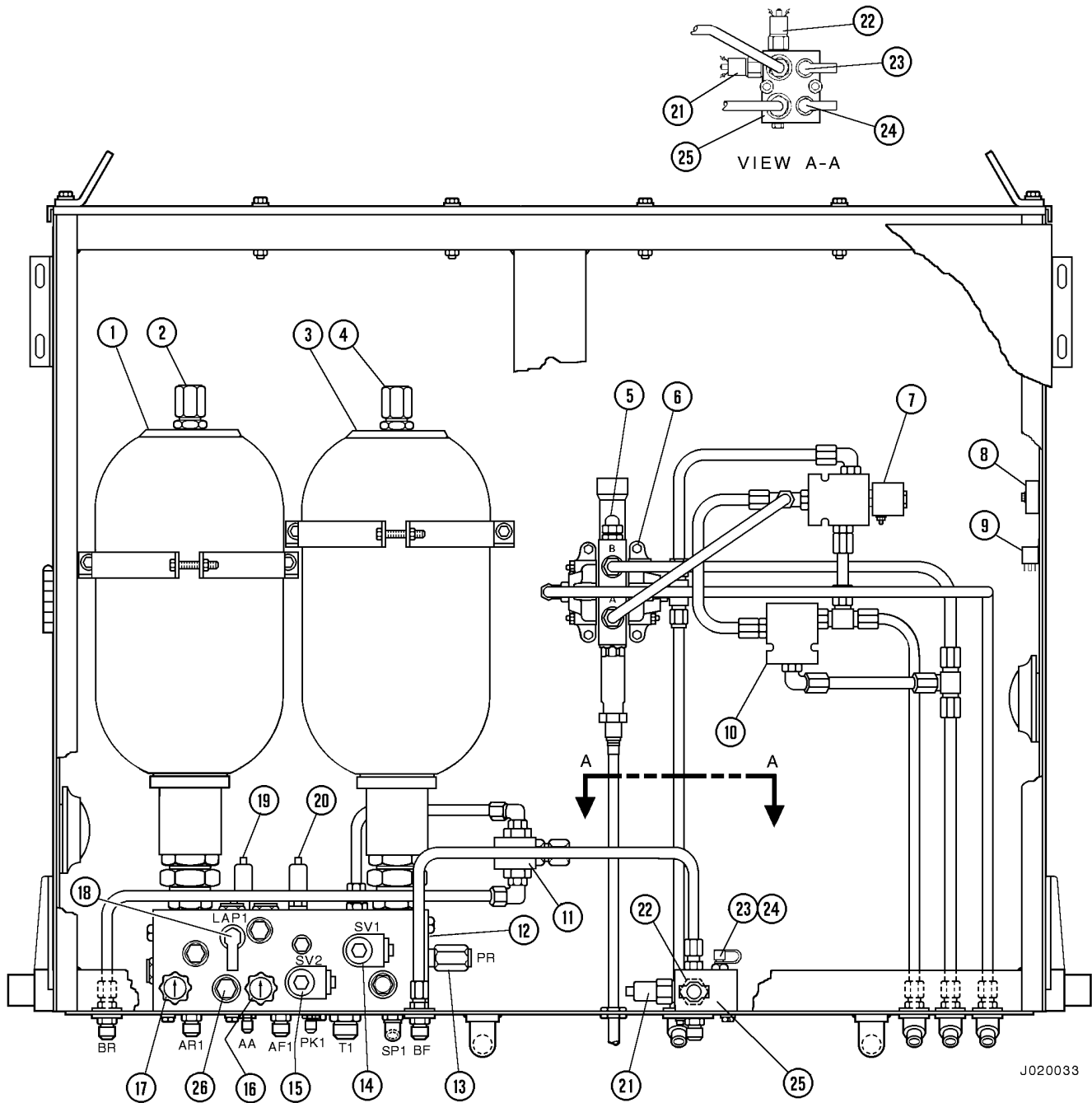
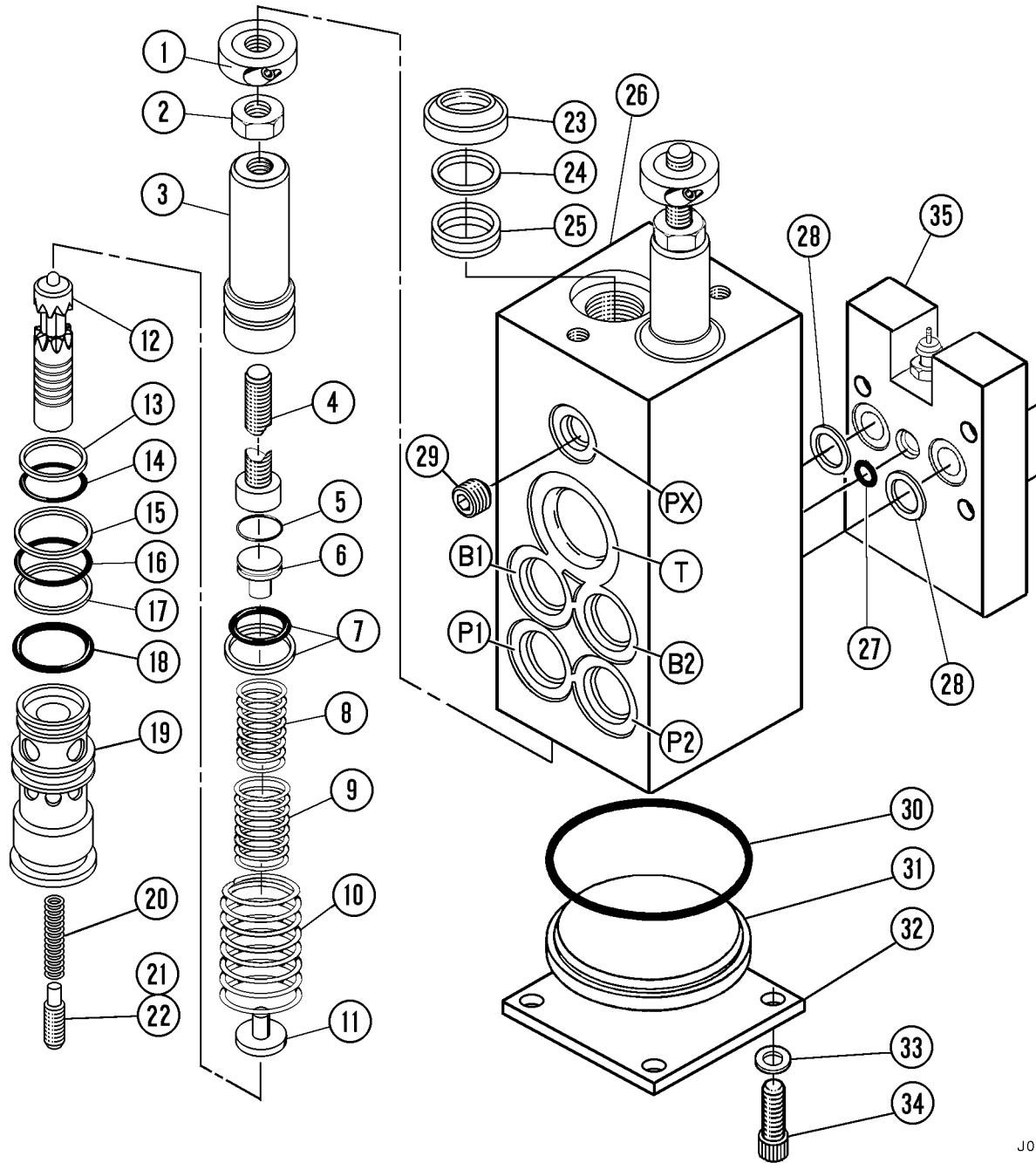


FIGURE 2-1. HYDRAULIC BRAKE CIRCUIT

- |                                    |                                    |   |
|------------------------------------|------------------------------------|---|
| 1. Rear Brake Accumulator          | 10. Check Valve (Hoist Circuit)    | 19. Low Brake Pressure Switch           |
| 2. Charging Valve                  | 11. Brake Lock Shuttle Valve       | 20. Park Brake Pressure Switch          |
| 3. Front Brake Accumulator         | 12. Brake Manifold                 | 21. Stop Light Pressure Switch          |
| 4. Charging Valve                  | 13. Pressure Reducing Valve (PR)   | 22. Brake Lock Degradation Switch       |
| 5. Relief Valve (Hoist-Power Down) | 14. Brake Lock Solenoid (SV1)      | 23. Rear Brake Pressure Test Port (BR)  |
| 6. Hoist Pilot Valve               | 15. Park Brake Solenoid (SV2)      | 24. Front Brake Pressure Test Port (BF) |
| 7. Hoist-Up Limit Solenoid         | 16. Front Brake Accum. Bleed Valve | 25. Manifold                            |
| 8. Brake Warning Delay Timer       | 17. Rear Brake Accum. Bleed Valve  | 26. Automatic Apply Valve               |
| 9. Brake Warning Light Relay       | 18. Low Accum. Test Port (LAP1)    |   |



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FIGURE 3-5. BRAKE VALVE

- |                           |                         |                            |                                  |
|---------------------------|-------------------------|----------------------------|----------------------------------|
| 1. Adjustment Collar      | 11. Spring Seat         | 21. Reaction Plunger (B1)  | 30. O-Ring                       |
| 2. Nut                    | 12. Regulator Spool     | 22. Reaction Plunger (B2)  | 31. Retainer Plug                |
| 3. Actuator Plunger       | 13. Back-Up Ring        | 23. Wiper Seal             | 32. Base Plate                   |
| 4. Stud                   | 14. O-Ring              | 24. Back-Up Ring           | 33. Washer                       |
| 5. Packing                | 15. Back-Up Ring        | 25. Poly-Pak Seal          | 34. Capscrew                     |
| 6. Staging Seat           | 16. O-Ring              | 26. Valve Body             | 35. Differential Pressure Switch |
| 7. Glyde Ring Assembly    | 17. Back-Up Ring        | 27. O-Ring                 | 36. Capscrew                     |
| 8. Regulator Spring       | 18. O-Ring              | 28. Face Seals             |                                  |
| 9. Regulator Spring       | 19. Regulator Sleeve    | 29. Set Screw Orifice Plug |                                  |
| 10. Plunger Return Spring | 20. Spool Return Spring |                            |                                  |

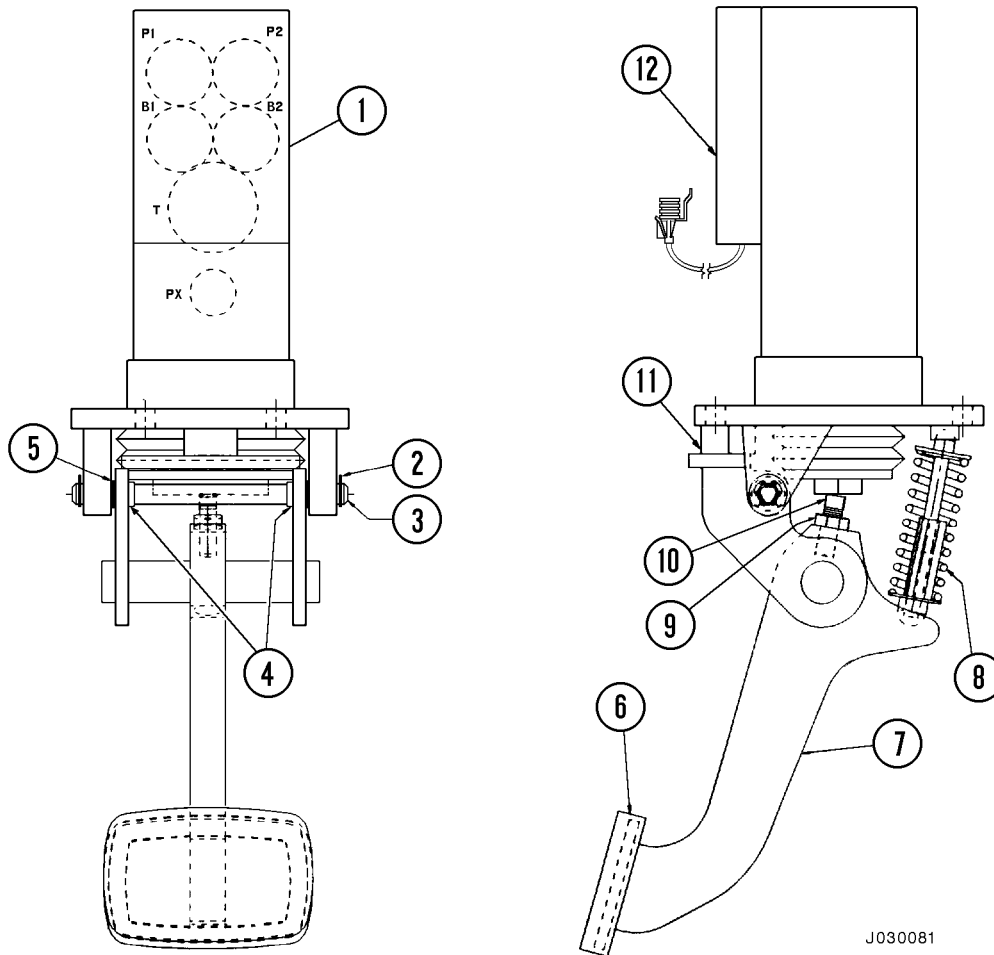


FIGURE 3-11. SINGLE PEDAL BRAKE VALVE ASSEMBLY

- |                  |             |                         |                                  |
|------------------|-------------|-------------------------|----------------------------------|
| 1. Brake Valve   | 4. Bushings | 7. Brake Pedal Actuator | 10. Set Screw                    |
| 2. Retainer Clip | 5. Shims    | 8. Spring Assembly      | 11. Pedal Return Stop            |
| 3. Pivot Shaft   | 6. Foot Pad | 9. Jam Nut              | 12. Differential Pressure Switch |

## INITIAL SYSTEM SET-UP

Prior to checking the brake system, the hydraulic steering system must have proper accumulator pre-charge and be up to normal operating temperatures. Refer to Section L, "Hydraulic System", for steering system operation procedures and specifications. Also prior to checking the brake system, make sure the parking brake is properly adjusted. Refer to parking brake adjustment this section. With the steering system functioning properly and the parking brake adjusted, proceed as follows:

1. Install pressure measuring instruments at:
  - a. Test Port BF (Brake Cabinet)
  - b. Test Port BR (Brake Cabinet)
  - c. Test Port LAP1 (Brake Manifold)
2. Open each brake accumulator bleddown valve and precharge both accumulators to 1400 psi (9652 kPa). Allow gas temperature to approach ambient temperature before completing pre-charge process.

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

3. Close both accumulator bleddown valves. If brakes have not been assembled to truck when checkout is performed, attach brake simulators to the brake application lines.
4. Start engine to fill accumulators with oil. Observe rising brake pressures as system charges. Brake pressure should begin to fall when Auto-Apply Valve releases. The brake pressures when auto apply releases should be approximately 1750 PSI Front and 1700 PSI Rear.

*\*Record on data sheet.*

5. Partially depress brake pedal and bleed air from bleeders located at each brake or brake simulators.

### Parking Brake

**NOTE:** Move one of the pressure measuring instruments from the BF or BR locations to the park brake or test port on the park brake simulator.

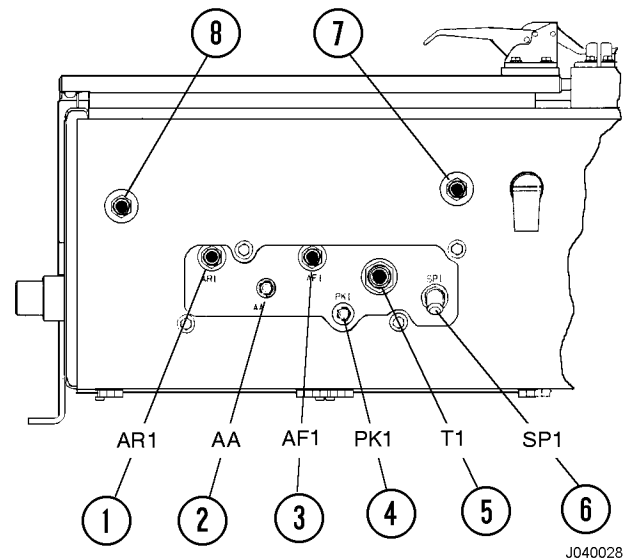


FIGURE 4-3. BRAKE CABINET PORT IDENTIFICATION  
(Viewed from Bottom of Cabinet)

1. AR1: Rear Brake Oil Supply to Treadle Valve
2. AA: Automatic Apply Oil Supply to Treadle Valve
3. AF1: Front Brake Oil Supply to Treadle Valve
4. PK1: Oil Supply to Park Brake
5. T1: Oil Return to Hydraulic Tank
6. SP1: Brake System Oil Supply from Bleddown Manifold
7. Front Brake Oil Supply from Brake Valve (B2)
8. Rear Brake Oil Supply from Brake Valve (B1)

6. Apply brake lock. Release Parking Brake with park brake switch. Verify that Park Brake Status light indicates parking brake is released. Record parking brake release pressure. (Pressure should be 2600 ± 100 PSI).

*\*Record on data sheet.*

7. If parking brakes are on vehicle, then measure the lining to disc clearance with feeler gauge and record the clearances.

*\*Record on data sheet.*

8. Cycle park brake switch several times to assure crisp application and release of pressure and proper function of status light.
9. Apply parking brake and release brake lock.

*Return the pressure measuring device to the BF or BR location.*

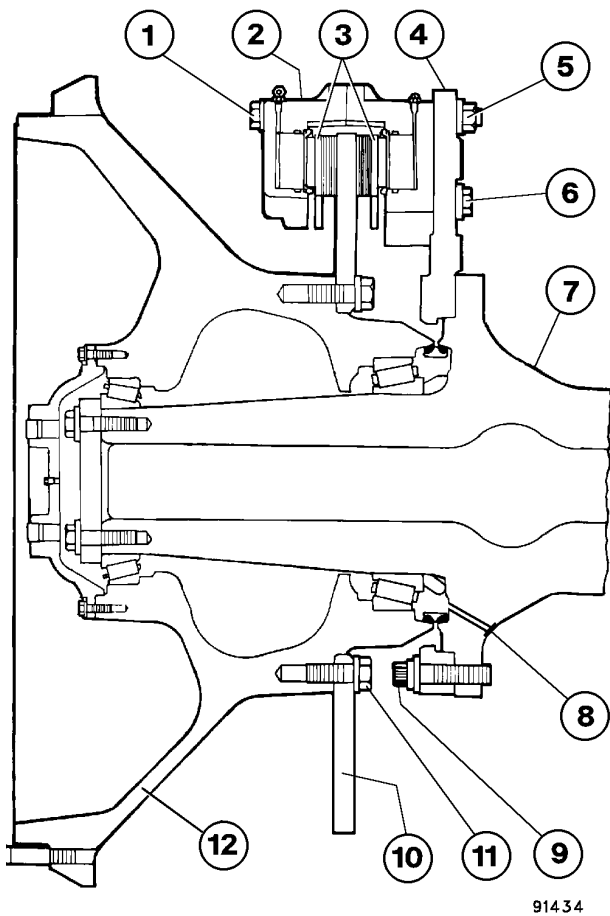


FIGURE 5-2. DISC AND CALIPER ASSEMBLY

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

- Remove nuts and flatwashers (5, Figure 5-2) and remove outboard half of brake caliper. Remove capscrews and flatwashers (6) securing inboard half of caliper to the brake adapter (4). Remove Inboard caliper.

*NOTE: It may be necessary to pry between the brake lining and disc in order to force the piston inward to permit inboard caliper removal.*

- Move the brake caliper assemblies to a clean work area for rebuild.

## Installation

Prior to brake caliper installation, refer to "Brake Lining" for wear limits regarding brake linings and brake discs. If linings and/or disc is worn beyond acceptable limits, replace the parts at this time.

- After repair, cleaning and inspection of the brake caliper, install each brake component to its original location.
- Install the inboard half of caliper assembly (2, Figure 5-2) to the top leg of the brake caliper support and secure caliper assembly with four capscrews (6). Tighten capscrews to standard torque.
- Repeat Step 2. at the other two brake caliper support legs.
- Install the upper outboard half of brake caliper assembly (2) to the top leg of the brake caliper adapter (4) and secure with six capscrews, washers and nuts (1 & 5). The pistons in both caliper assemblies will collapse against the brake disc. Tighten capscrews to standard torque.
- Install crossover tubes (2, 4 & 7, Figure 5-1). Tighten crossover tube connections securely.
- Install the three brake line hoses at each "T" connection (3, 5 & 6).
- Refer to "Brake Bleeding Procedures" in this Section and bleed air from caliper assemblies.

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.

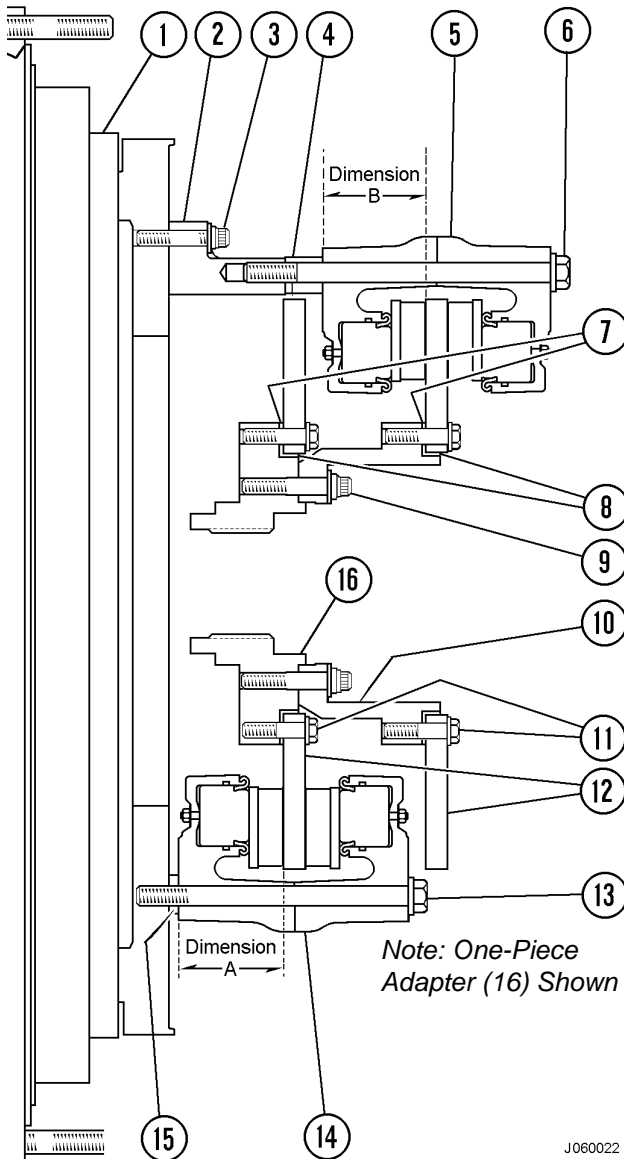


FIGURE 6-3A. REAR DISC BRAKE

- |                        |                                     |
|------------------------|-------------------------------------|
| 1. Wheel Motor         | 9. Capscrew                         |
| 2. Adapter             | 10. Adapter, Brake Disc             |
| 3. Capscrew            | 11. Capscrew/Flatwasher             |
| 4. Park Brake Bracket  | 12. Disc                            |
| 5. Brake Assembly      | 13. Capscrew/Flatwasher             |
| 6. Capscrew/Flatwasher | 14. Brake Assembly                  |
| 7. Shims               | 15. Spacer                          |
| 8. Bushing             | 16. Adapter/Armature<br>Shaft Drive |

### CALIPER, DISC, & PARKING BRAKE REMOVAL [For trucks equipped with one-piece adapter (16, Figure 6-3A)]

*NOTE: Refer to "Caliper, Disc, and Parking Brake Removal", Steps 1-6 (page 1) to remove the park brake caliper.*

1. Remove crossover tube (4, Figure 6-2) from upper service brake caliper. Remove crossover tube on lower brake assembly.
2. Removal of brake caliper is easier with linings removed. Remove retainer capscrews (1), lining retainers (2) and linings.
3. Remove two center caliper mount capscrews (6, Figure 6-3A) from outboard caliper and install two 0.875 in., 9 UNC x 14 in. studs.
4. Remove two remaining caliper mount capscrews and remove outer half of caliper (5).
5. Support outer disc (12) and remove disc mount capscrews (11) and washers. Slide disc from outboard adapter (10). Shims (7) will be found between disc and adapter. Remove bushing (8) and inner half of caliper (5). Remove park brake bracket (4).
6. Remove capscrews and flatwashers (9). Remove adapter (10).
7. Remove two center caliper mount capscrews (13) from inboard caliper and install two 0.875 in., 9 UNC x 14 in. studs.
8. Remove two remaining caliper mount capscrews and remove outer half of caliper (14).
9. Support inner disc (12) and remove capscrews and flatwashers (11). Remove inboard disc (12). Remove shims (7) and bushing (8) between disc and adapter.
10. Remove inner half of caliper (14) and spacer (15).
11. Remove capscrews and flatwashers (3) and remove adapter (2).

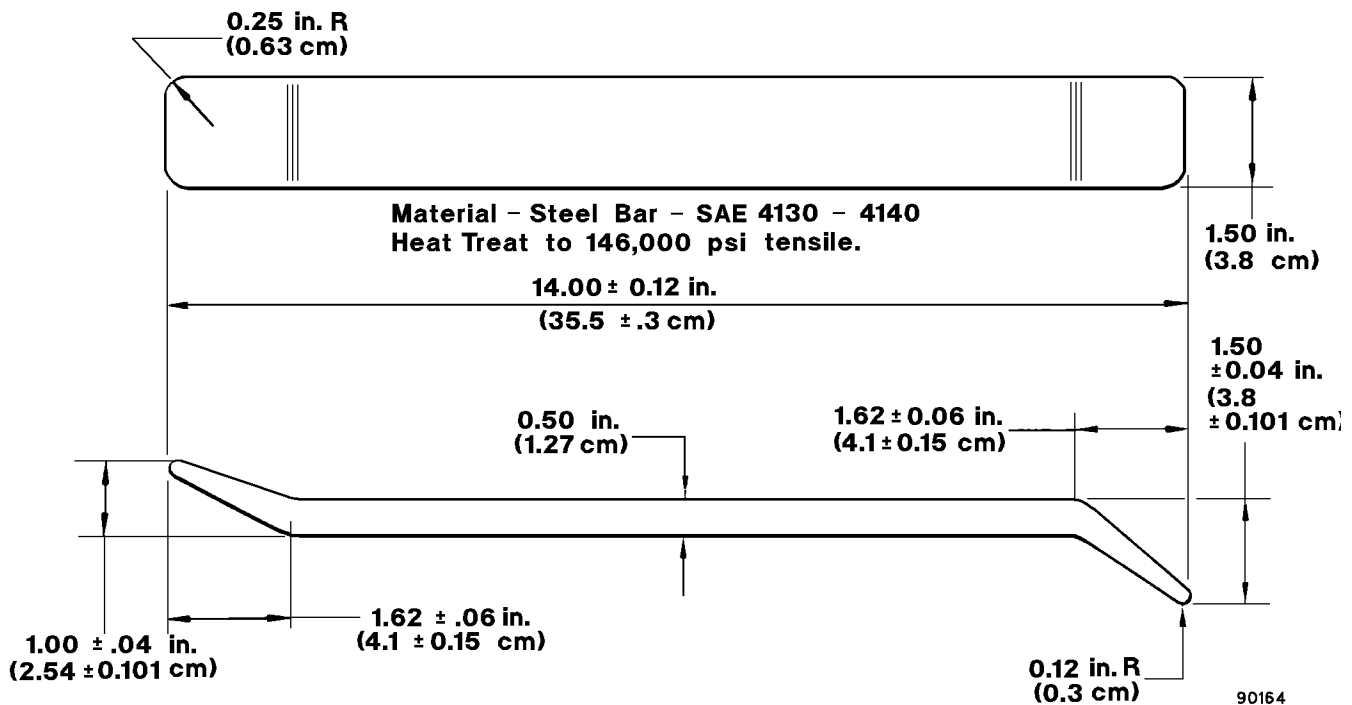


FIGURE 6-17. PISTON RETRACTION TOOL

3. Inspect condition of brake caliper thoroughly before installing linings.
  - a. Inspect for evidence of fluid leakage. If present, brake must be removed for disassembly, inspection and repair.
  - b. Inspect condition of dust shields. These should be soft and pliable, and show no evidence of hardening of material, rupture, etc. Where replacement is necessary, removal and disassembly of brake for inspection is recommended to insure that dirt has not entered piston cavity through a ruptured seal.
  - c. Inspect condition of tubing and fittings. If leakage is evident, correct or replace fittings as necessary.



**Do not rub or press dust shield directly over sharp edge around piston cavity. This may cause dust shields to be cut.**

- d. Wipe brake housing and lining retaining plates clean before installation of new linings. If a petroleum base cleaning fluid is used, such as diesel fuel, use sparingly on dust shields and wipe dry after cleaning.

4. Inspect discs for wear (Figure 6-18). Place a straight edge across face of disc and measure from straight edge to worn face. It is recommended that the disc be replaced when this measurement is 0.06 in. (1.52 mm) each side of disc or at a minimum worn thickness of 0.88 in. (22.3 mm). It may be difficult to use a straight edge on the back surface of the disc so a visual comparison may be used with that of the front. Normally, wear will be the same on both sides.

*NOTE: When installing new linings to be used against a worn disc, useful lining life will be shortened by the depth of the disc wear, since the lining must advance this additional distance before braking force is effective. In addition, the uneven wear on the disc face will accelerate lining wear.*

## 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".

## 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.

## 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.

## CAUTION

**The hoist pump weighs approximately 150 lbs (68.2 kg). The hoist and steering pumps together weigh approximately 270 lbs (122.6 kgs). Use a suitable lifting or support device that can handle the load safely.**

7. Attach a suitable lifting or support device to the hoist pump capable of handling approximately 150 lbs (68.2 kg). Attach a support to the front end of the steering pump to hold it in place during removal of the hoist pump.
8. Remove the four capscrews (3) securing the hoist pump to the front support bracket. Remove the six capscrews holding the support bracket to the "T" bracket and remove support bracket.

9. Make sure the lifting and support devices are in place on both pumps. Loosen (but do not remove) the rear support bracket capscrews holding the steering pump. Lower the pumps allowing hoist pump to come down further than steering pump.

10. Remove the two capscrews (7, Figure 3-2). Slide hoist Pump forward to disengage the splines of drive coupling (12) from the steering pump.

11. Move pump to a clean work area for service.

### Installation

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

1. Install O-ring (11, Figure 3-2) to steering pump (10). Install coupler (12) with snap ring (6) to hoist pump (1).

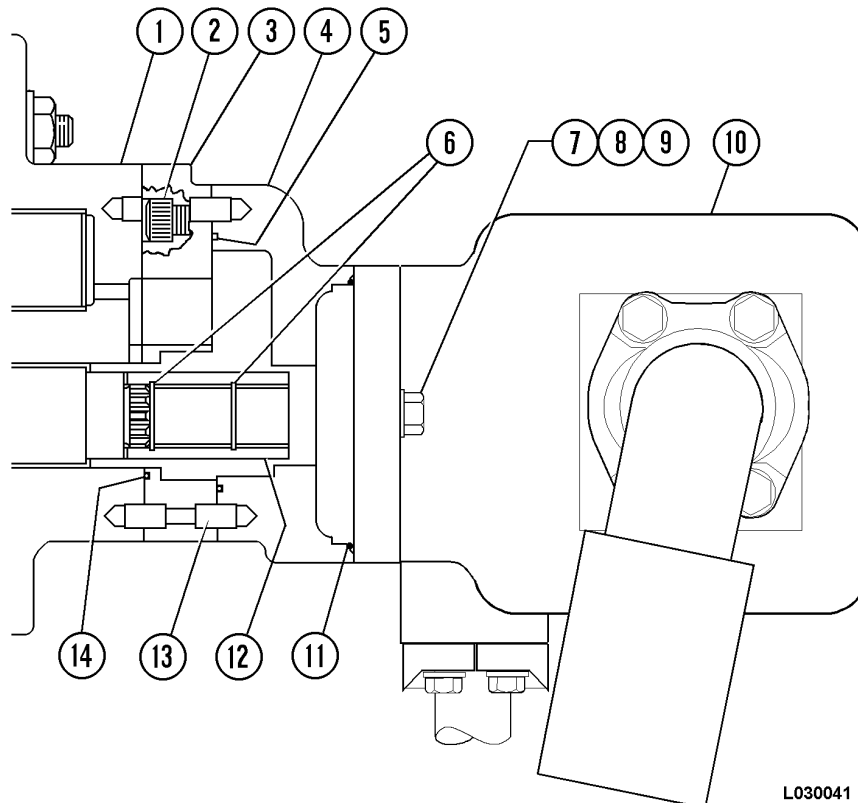


FIGURE 3-2. HOIST & STEERING PUMP

- |                     |               |                         |            |
|---------------------|---------------|-------------------------|------------|
| 1. Hoist Pump       | 5. O-Ring     | 9. Lockwasher           | 13. Dowel  |
| 2. Capscrew         | 6. Snap Ring  | 10. Steering/Brake Pump | 14. O-Ring |
| 3. Transition Plate | 7. Capscrew   | 11. O-Ring              |            |
| 4. Adapter Plate    | 8. Flatwasher | 12. Coupling            |            |

## Removal

### **WARNING**

**Do not loosen or disconnect any hydraulic line or component connection until engine is stopped and key switch has been "off" for at least 90 seconds.**

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

**Take care to avoid contact with hot oil if truck has been operating. Avoid spillage and contamination.**

1. Turn key switch "Off" and allow at least 90 seconds for the steering accumulators to bleed down.
2. Drain the hydraulic tank (3, Figure 3-13) by use of the drain (2) or drain plug, located in the bottom of the tank.
3. Thoroughly clean the outside of the hydraulic tank and attached equipment.
4. Disconnect hydraulic lines. Plug lines to prevent spillage and possible contamination to the system. Tag each line as removed for proper identification during installation.
5. Attach a lifting device to the hydraulic tank.
6. Remove the capscrews and lockwashers securing the hydraulic tank to the frame.
7. Move hydraulic tank to a clean work area for disassembly or repair.

## 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. Fill the hydraulic tank with C-4 hydraulic oil.
4. Bleed all air from hydraulic pump suction lines before starting engine.

## HYDRAULIC TANK STRAINER AND DIFFUSER

### Removal

1. Shut engine down, turn key switch "Off", and wait at least 90 seconds for accumulators to bleed down.

**NOTE:** Be prepared to contain approximately 193 gal. (731 l) of hydraulic oil. If oil is to be reused, clean containers must be used with a filtering system available for refill.

2. Open the drain valve (9, Figure 3-14) at the bottom of the hydraulic tank and drain the oil.

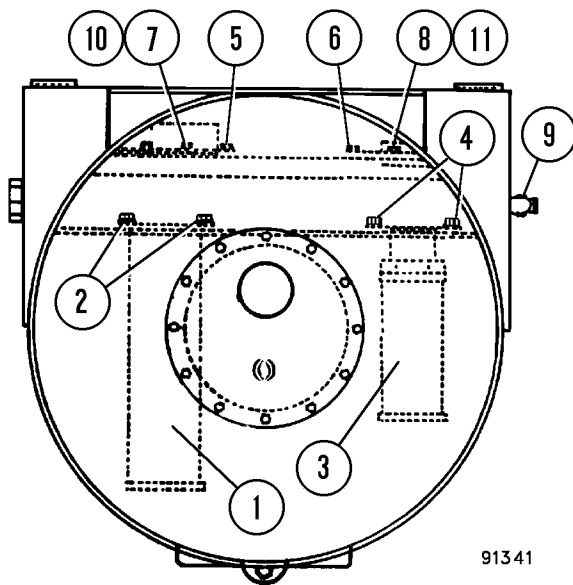


FIGURE 3-14. HYDRAULIC TANK (TOP VIEW)

- |                     |                |
|---------------------|----------------|
| 1. Strainer         | 7. Gasket      |
| 2. Capscrews        | 8. Gasket      |
| 3. Diffuser (Inlet) | 9. Drain Valve |
| 4. Capscrews        | 10. Cover      |
| 5. Capscrews        | 11. Cover      |
| 6. Capscrews        |                |
3. Remove nuts and lockwashers securing the pump inlet line and return line to the hydraulic tank. Plug or cap lines to prevent contamination.
  4. Remove capscrews (5 and 6, Figure 3-14). Remove covers (10 and 11) and gaskets (7 and 8).
  5. Remove capscrews (2 and 4). Pull strainer (1) and diffuser (3) from hydraulic tank.

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## FLOW AMPLIFIER SYSTEM OPERATION

Refer to Figures 4-12 through 4-15 for oil flow paths during the following conditions:

- Neutral
- Steering Left
- Steering Right
- External shock load

### No Steer

(Refer to Figure 4-12):

High pressure oil from the steering pump and steering accumulators is available through the steering bleeddown manifold to the "HP" port on the flow amplifier assembly.

Upon Entering the priority valve, it goes past the spool to the closed amplifier valve and also out port "P" through a hose to port "P" on the steering control valve. In the steering control valve, it goes to a closed area in the control.

As pressure builds up in these two areas, oil passes through orifices in the end of the priority valve and builds pressure on the end of the valve and port PP. When pressure reaches approximately 500 psi (3.5 MPa), the spool moves, compressing its spring and closes off oil supply through area "A" resulting in high pressure at "PP", but only 500 psi (3.5 MPa) at the amplifier spool and steering control unit.

# ⚠ WARNING

**Serious personal injury to the operator or to anyone positioned near the front wheels may occur if a truck is operated with the hydraulic steering lines improperly installed. Improperly installed lines can result in uncontrolled steering and/or SUDDEN AND RAPID rotation of the steering wheel as soon as the steering wheel is moved. It will turn rapidly and cannot be stopped manually.**

**After servicing the steering control unit, hydraulic steering lines should be checked for correct hook-up before starting the engine.**

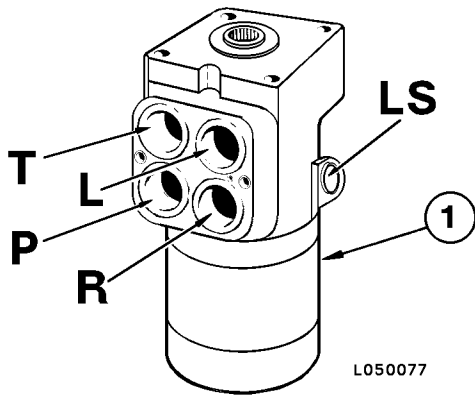


FIGURE 5-3. VALVE PORT IDENTIFICATION

- |                           |                      |
|---------------------------|----------------------|
| 1. Steering Control Valve | "L" - Left Steering  |
| "T" - Return to Tank      | "R" - Right Steering |
| "P" - Supply from Pump    | "LS" - Load Sensing  |

5. Check for proper steering wheel rotation without binding. Be certain wheel returns to neutral after rotating 1/4 turn left and right.

## STEERING CONTROL UNIT REBUILD

### Disassembly

The steering control unit is a precision unit manufactured to close tolerances, therefore complete cleanliness is a must when handling the valve assembly. 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. Allow oil to drain from valve ports.
2. Match mark gear wheel set and end cover to insure proper relocation during reassembly. Refer to Figure 5-4.

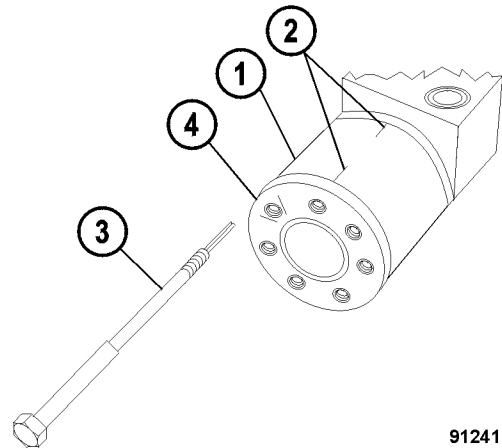
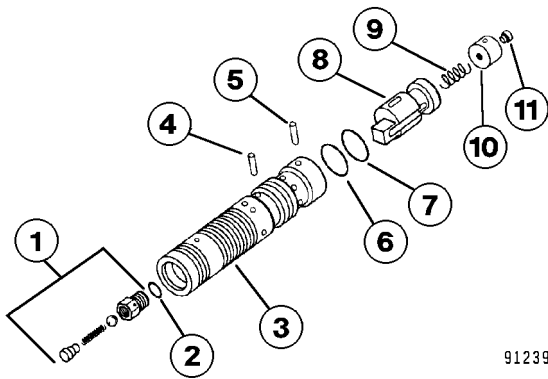


FIGURE 5-4. MARKING VALVE COMPONENTS

- |                   |                             |
|-------------------|-----------------------------|
| 1. Valve Assembly | 3. Capscrew With Rolled Pin |
| 2. Match Marks    | 4. End Cover                |

3. Remove end cover capscrews and washers. Remove capscrew with rolled pin (3, Figure 5-4). Mark hole location of capscrew with rolled pin on end cover to facilitate reassembly.

# NOTES



91239

FIGURE 6-9. AMPLIFIER SPOOL ASSEMBLY

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

#### Assembly

1. Thoroughly lubricate each part prior to installation using clean, type C-4 hydraulic oil.
2. Reassemble the Amplifier spool assembly in reverse order. Refer to steps 12 & 13, and Figure 6-9 under disassembly.
3. Install orifice screw (13, Figure 6-7). Tighten orifice screw to **4 in. lbs. (.5 N.m)** torque.
4. Install check valve (47). Tighten check valve to **8 in. lbs. (1 N.m)** torque.
5. Install orifice screw (45). Tighten orifice screw to **8 in. lbs. (1 N.m)** torque.

*NOTE: Late model trucks are not equipped with relief valve assembly (54).*

6. Install seal (55). Install relief valve assembly (54), seal (19), and plug (18). Tighten plug to **22 in. lbs. (2.5 N.m)** torque.
7. Install counterpressure valve assembly (15). Install plug (17) using new O-ring (16).
8. Install both shock and suction valves (12 & 26) as complete units. Install spring stop (20) springs (21 & 22) and spring control (23). Install orifice screws (24 & 33) if removed from main spool (27). Install main spool (27).
9. Install amplifier spool assembly (53). Install priority valve spool (44) and spring (43). Install spring (52).
10. Install spring control (29), springs (30 & 31) and spring stop (32).
11. Lubricate O-rings (6, 7 & 8) with molycote grease and position on cover (5). Install end cover (5). Install capscrews (3) with lockwashers (4). Tighten capscrews to **2 ft. lbs. (2.7 N.m)** torque. Install capscrew (1) and lockwasher (2). Tighten capscrew to **6 ft. lbs. (8 N.m)** torque.
12. Lubricate O-rings (38 & 40) with molycote grease and install on cover (39). Install end cover (39). Install capscrews (34) with lockwashers (37). Tighten capscrews to **2 ft. lbs. (2.7 N.m)** torque. Install capscrew (35) with lockwasher (36). Tighten capscrew to **6 ft. lbs. (8 N.m)** torque.
13. To prevent contamination, fit plastic plugs to each valve port.

### **HOLD OPERATION (Figure 7-6)**

The Pilot Valve spool is positioned to allow the pilot supply oil entering Port(12) to return to the tank through Port(10). Pilot supply pressure in Ports(12) then decreases to no pressure allowing Flow Control Valve(2) to open and return the incoming pump oil to the tank through Port(10). Both pilot Ports(14&15) in the Pilot Valve are closed by the Pilot Valve spool. In this condition pressure is equalized on each end of each main spool allowing the springs to center the spools and close all ports to trap the oil in the cylinders and hold the body in its current position.

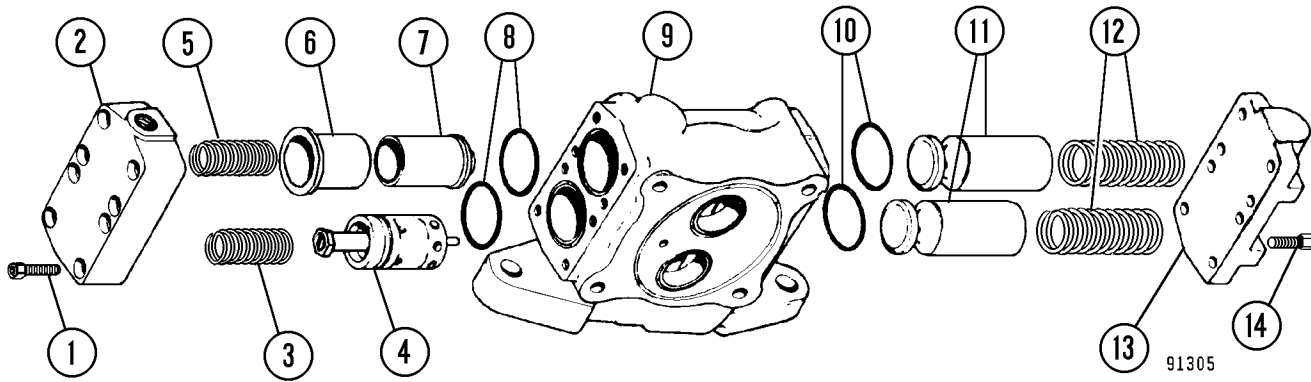


FIGURE 8-5. INLET SECTION DISASSEMBLY

- |                                     |                                  |                     |               |
|-------------------------------------|----------------------------------|---------------------|---------------|
| 1. Capscrew                         | 5. Spring                        | 8. O-Rings          | 12. Springs   |
| 2. Inlet Cover                      | 6. Sleeve                        | 9. Inlet Valve Body | 13. Cover     |
| 3. Spring (Orange)                  | 7. Secondary Low Pressure Relief | 10. O-Rings         | 14. Capscrews |
| 4. Flow Control & Main Relief Valve |                                  | 11. Check Valves    |               |

## INLET SECTION

### Disassembly

1. Match mark or identify each part when removed in respect to its location or respect to its mating bore to aid reassembly.
2. Disconnect the external tube (7, Figure 8-2) at the cover end and remove. Remove capscrews (14, Figure 8-5), remove cover (13). Remove springs (12), check valves (11) and O-rings (10).

*NOTE: Inlet section shown removed from main valve body for clarity.*

3. Remove capscrews (1) and cover (2). Remove springs (3 & 5) and flow control/main relief valve (4). Remove sleeve (6), low pressure relief (7) and O-rings (8).

*NOTE: If restrictor poppet removal in cover (2, Figure 8-5) is required, refer to step 4 and figure 8-6.*

4. Remove sleeve (9), backup ring (8), O-ring (7), backup ring (6). Remove backup ring (5), O-ring (4), backup ring (3) and restrictor poppet (2).
5. Repeat steps 1 through 4 for the opposite inlet section if disassembly is required.

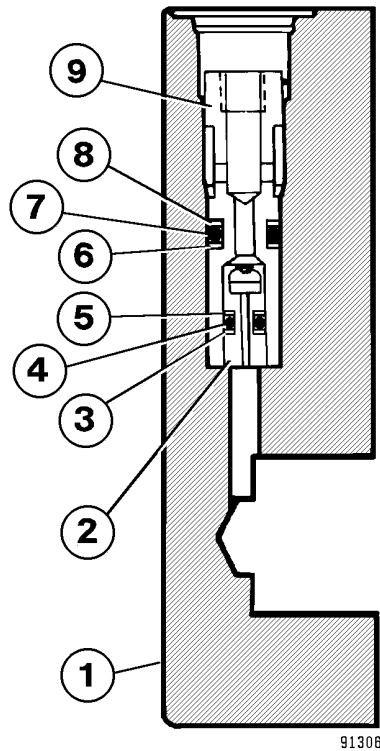


FIGURE 8-6. RESTRICTOR POPPET REMOVAL (Inlet Cover)

- |                      |                |
|----------------------|----------------|
| 1. Inlet Cover       | 6. Backup Ring |
| 2. Restrictor Poppet | 7. O-ring      |
| 3. Backup Ring       | 8. Backup Ring |
| 4. O-Ring            | 9. Sleeve      |
| 5. Backup Ring       |                |

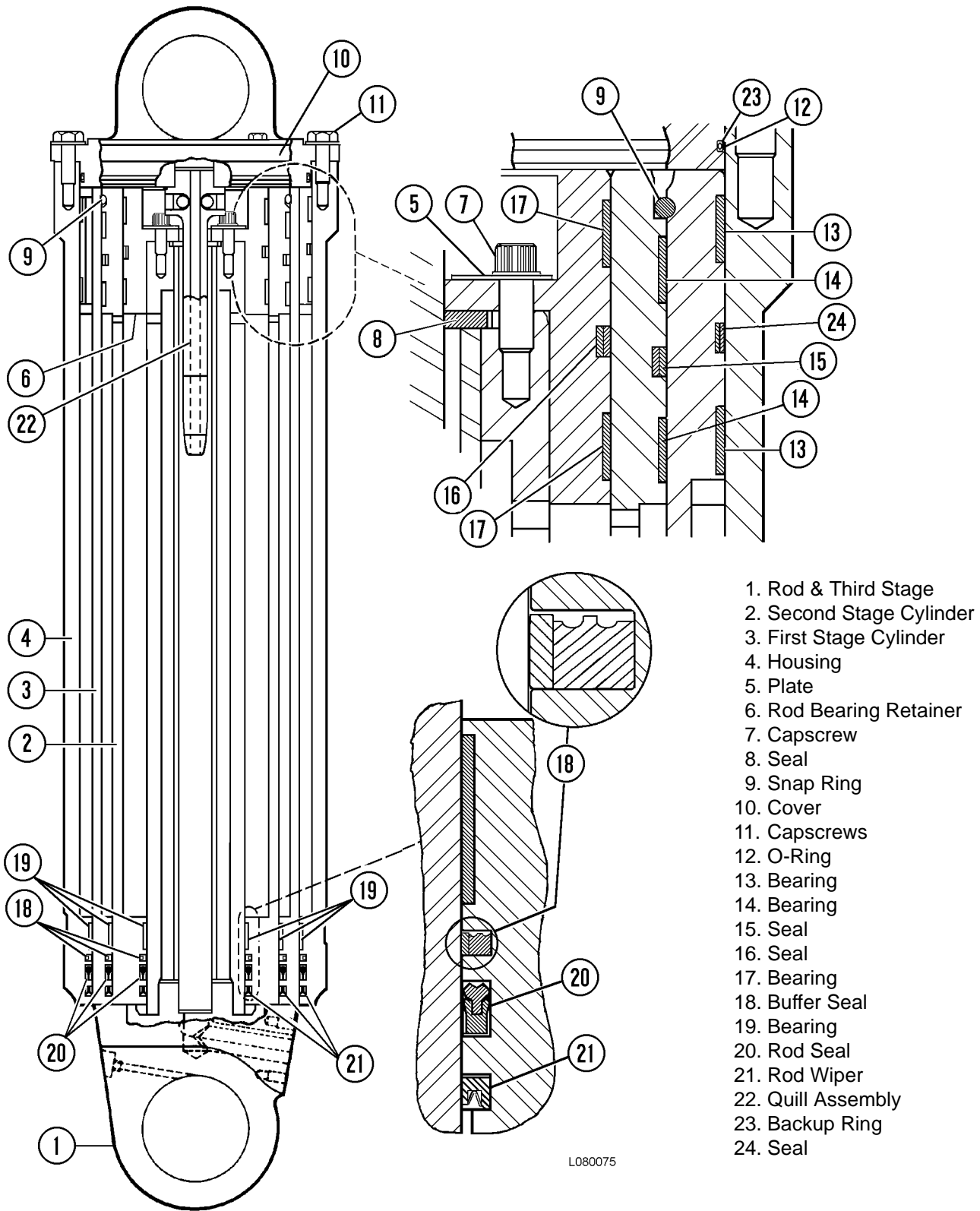


FIGURE 8-19. HOIST CYLINDER ASSEMBLY

## Removal

1. With the key switch "Off" allow at least 90 seconds for the accumulators to bleed down.
2. Remove plug (10, Figure 9-2), loosen bleed plug (4) and drain oil from the housing into a suitable container.



**Take care to avoid contact with hot oil if truck has been operating. Avoid spillage and contamination!**

3. Remove bowl (8) and element (7).
4. Remove and discard O-ring (6) on filter bowl.
5. Clean bowl in solvent and dry thoroughly.

## Installation

1. Install new element (7). Install new O-ring (6) on bowl.
2. Install bowl on filter head and tighten.
3. Install drain plug (10), and O-ring (9). Tighten bleed plug (4).

## INDICATOR SWITCH

The indicator switch (1, Figure 9-2) is factory preset to actuate at 40 psi (275 kPa). The switch and warning light should be routinely tested as a part of the regular vehicle maintenance program. Refer to "*Indicator Switch Test Procedure*".

## INDICATOR SWITCH

The hydraulic filter indicator switch is factory preset to actuate at 40 psi (275 kPa). Switch adjustment is not necessary or recommended, however the switch and warning lamp should be tested periodically for proper operation. The indicator switch is not repairable and if inoperative, replace switch assembly.

Figure 9-3 shows a pressure switch tester and Figure 9-4 shows a test block to accept the switch during testing. The test block may be fabricated as shown.

### Test Procedure

1. With the key switch "Off" allow at least 90 seconds for the accumulators to bleed down.
2. Disconnect wiring harness and remove switch from filter head.
3. Install switch in test block. Connect pressure tester to pipe nipple. Reconnect wires to switch.
4. Turn key switch on. Pump up pressure to test block while observing tester gauge and hydraulic oil filter warning light in cab. Light should turn on at  $40 \pm 5$  psi ( $275 \pm 34.5$  kPa). If not, test bulb and switch as follows:
  - a. If lamp fails to light, remove wire (circuit # 39) from switch and short to ground. If warning lamp does not light, replace bulb.
  - b. If lamp lights when wire # 39 is grounded in previous step, use an ohmmeter to verify switch contacts close at 40 psi (275kPa).
5. If switch contacts fail to close, replace switch assembly.

*NOTE: The hydraulic filter warning lamp may be activated by either the hoist or steering/brake circuit filter indicator switch.*

## CHECKING HOIST SYSTEM RELIEF VALVE PRESSURES

*NOTE: If relief valve or hoist valve assembly has been replaced or rebuilt, hoist valve "power up" pressure should be checked. Check hoist system "power down" relief pressure if the hoist pilot valve has been replaced or rebuilt.*



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

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

### " Power Up" Relief Pressure Test

1. Install a 0-5000 psi (0-35,000 kPa) pressure gauge at the pressure test port at the hoist filter (located behind the fuel tank).
2. Start engine and run at low idle. After the accumulators are filled and the steering pump is unloaded, pressure at the hoist pump filter should be approximately 75 psi (517 kPa) or less with oil temperature at 70°F (29°C).
3. To allow full extension of the hoist cylinders, disconnect the hoist up limit solenoid from the wiring harness located in the hydraulic cabinet behind the operators cab.



**Be sure there is adequate (safe) overhead clearance before raising body to full up position.**

4. With engine at low-idle, place hoist lever in power up position and hold. When body is in the full raised position, pressure at the hoist pump filter test port should be 2500 ± 100 psi (17,237 ± 690 kPa).

### Adjustment

1. If power up relief pressure is incorrect, adjust pressure as follows:
  - a. Lower body until it is resting on frame rails and shut down engine. Wait at least 90 seconds until accumulators bleed down.
  - b. Relieve all hydraulic pressure from hoist system.
  - c. Move hoist control lever to the "power down" position and allow body to **completely** rest on frame rails.
  - d. Disconnect tube from inlet section cover (2, Figure 10-5).
  - e. Remove capscrews (1) from cover (2). Remove cover and spring (3) from relief valve.
  - f. Loosen jam nut on relief valve (4) and turn screw "in" (clockwise) to increase pressure or "out" (counter-clockwise) to decrease pressure.

*NOTE: Each 1/4 turn of the adjustment screw will cause approximately 150 psi (1,034 kPa) change in pressure.*

- g. Install spring (3) and cover (2) with new O-rings (8). Install and tighten capscrews (1). Install tube to cover fitting.
2. Check pressure again, repeating steps 2 - 4. If necessary, repeat adjustment procedure until correct pressure is attained.

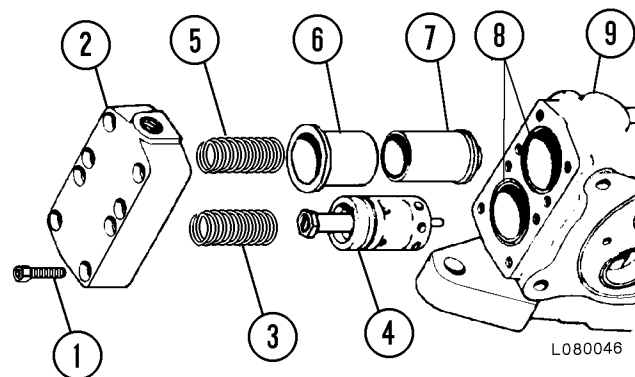


FIGURE 10-5. INLET SECTION

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

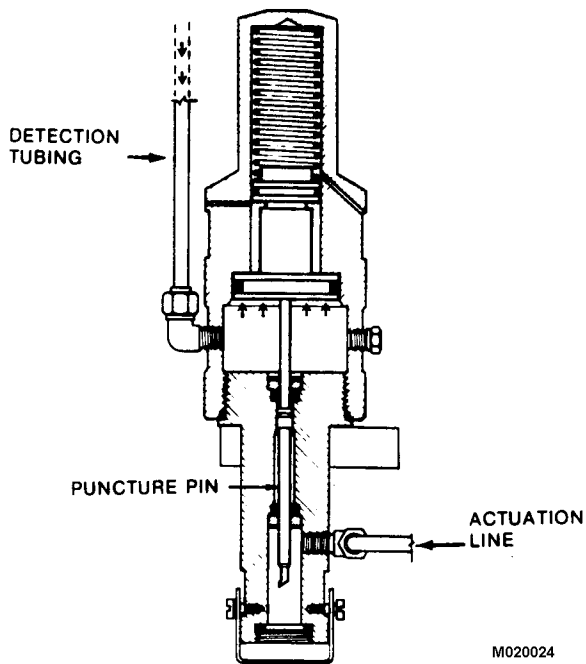


FIGURE 2.2-2. DETECT & ACT (DAD)  
(System Charged)

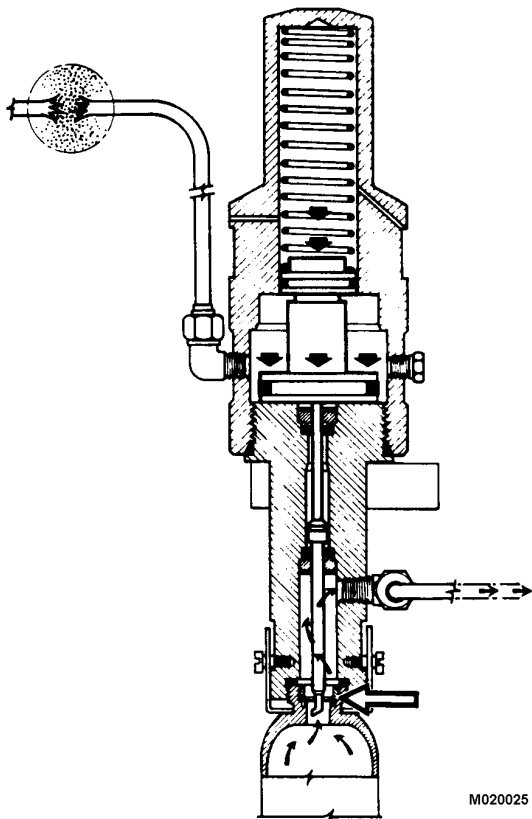


FIGURE 2.2-3. DETECT & ACT DEVICE (DAD)  
(System Fired)

When sufficient pressure has built up in the low pressure chamber [approximately 80 psi (552 kPa)], the piston is forced back allowing the valve to close. This process repeats itself every time the low pressure side drops below 65 psi (448 kPa).

The pressure switch assembly is connected in series with the detection tubing. When the SCAD system pressure falls to about 45 psi (310 kPa), the pressure switch closes and the warning light flashes and instrument panel horn sounds. This indicates that the SCAD pressure is below required levels and should be serviced or a fire has caused the pressure to drop.

*NOTE: The system pressure must drop to 21 psi (145 kPa) before the DAD will actuate.*

### LOW PRESSURE WARNING DEVICE

The low pressure warning device is used to provide visual indication when pressure in the detection tubing has fallen below 45 psi (310 kPa). This normally indicates that replacement of the PMD cartridge is required.

There are two separate components to the complete pressure warning device, a pressure switch assembly (Figure 2.2-5) and a warning light and horn.

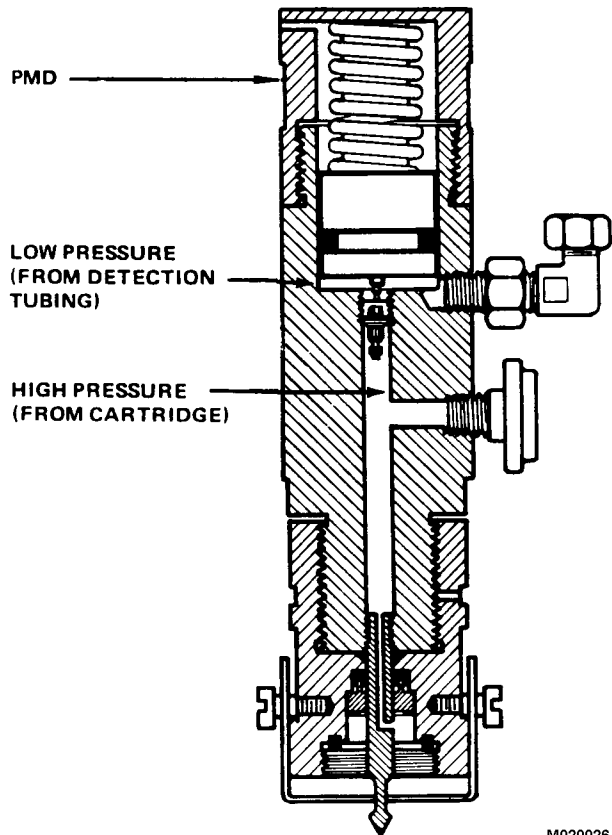


FIGURE 2.2-4. PRESSURE MAKE-UP DEVICE

## INSPECTION AND MAINTENANCE SCHEDULES FOR ELECTRIC DETECTION AND ACTUATION SYSTEM



*Proper inspection and maintenance procedures must be performed at the specified intervals to be sure that the Electric Detection and Actuation System will operate as intended.*

### Daily

The machine operator should manually test system power by pushing the button and noting illumination of indicator light. This confirms battery power is available. If light is not illuminated, refer to "Troubleshooting" covered in this section.

### Normal Maintenance Based On Actual Operating Hours

Total system should be checked monthly or sooner, depending on working conditions or truck maintenance to perform total system check.

*NOTE: The squib should be replaced after being in service for five years. The proper disposal of the old squib should be done by actuating the squib within the actuator body. To do this, remove actuator LT-5-R cartridge (PB0674) from body. Install test jumper assembly to end of linear detection wire assembly. This jumper will service as a wiring short and cause the squib to discharge.*

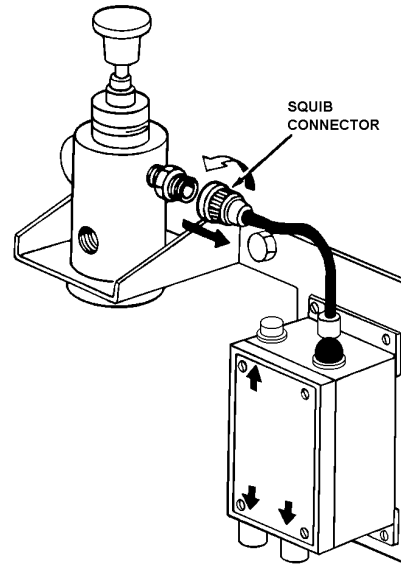
*Remove jumper, clean actuator, install new squib and reinstall cartridge.*

*System is now back in service.*

*Record date of installation of new squib.*

1. Check all mounting bolts for tightness.
2. Check all wiring connectors for tightness and possible evidence of corrosion.
3. Inspect detection and power wire as follows:
  - a. Check for wear due to abrasion (at wall penetrations, around corners, etc.).
  - b. Check for damage from direct impact or other abuse.
  - c. Check mounting locations for tightness.
  - d. Insure mounting hardware has not come loose or been broken, either of which would allow the wire to sag.

4. Weigh the actuation cartridge on the Electric Detection and Actuation System. Replace cartridge if the weight is 1/4 oz. (7 g) less than that stamped on cartridge. Check the cartridge threads for nicks, burrs, cross threading and rough on feathered edges. Examine gasket in bottom of Electric Detection and Actuation System for elasticity. If the temperature is below freezing, warm the gasket with body heat to insure a good seal. Clean and coat lightly with a high heat resistant silicone grease.



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FIGURE 2.3-19. REMOVE CARTRIDGE AND DISCONNECT SQUIB

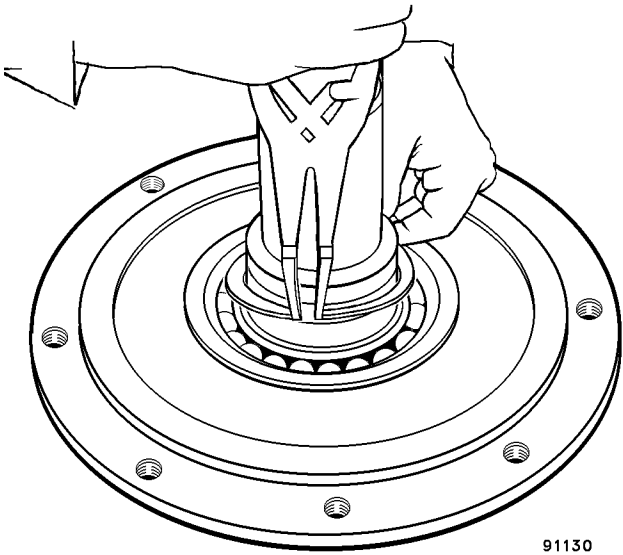


**Do Not reinstall cartridge at this time.**

5. Test system power by depressing button on control module. Note illumination of light while button is depressed.
6. Remove squib connector before proceeding with next series of checks (Figure 2.3-19).
7. Using the furnished test kit assembly, proceed to the end of the last length of detection wire. Remove the plugged blank connector and install the jumper assembly (retain plugged blank connector to be reinstalled after testing is completed).
8. With jumper in place, screw the squib connector into receptacle on test module (Figure 2.3-20). Light on the test module should immediately illuminate. This test confirms that the detection wire is properly installed and will function as intended.

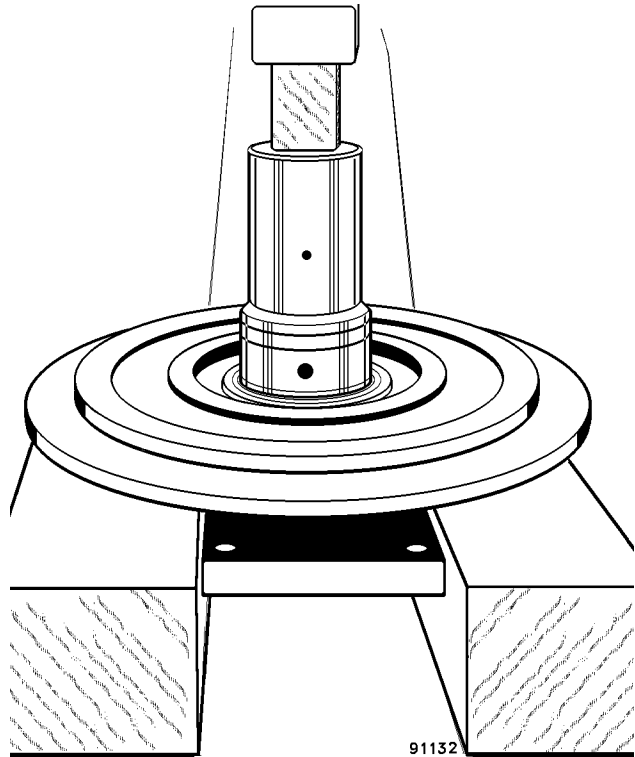
# NOTES

# NOTES



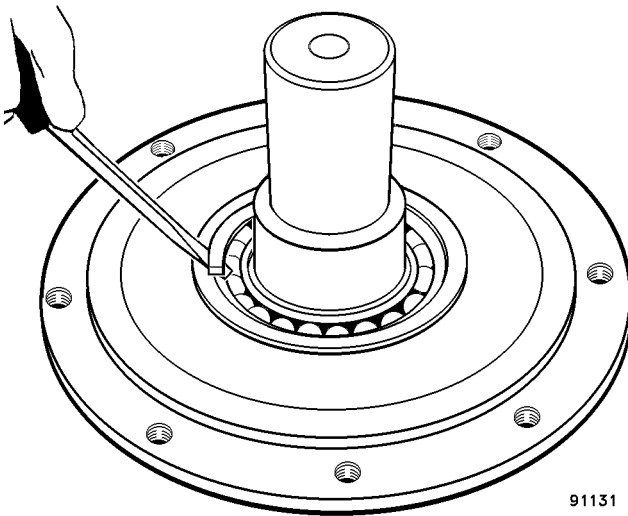
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21. Remove external snap ring (38).



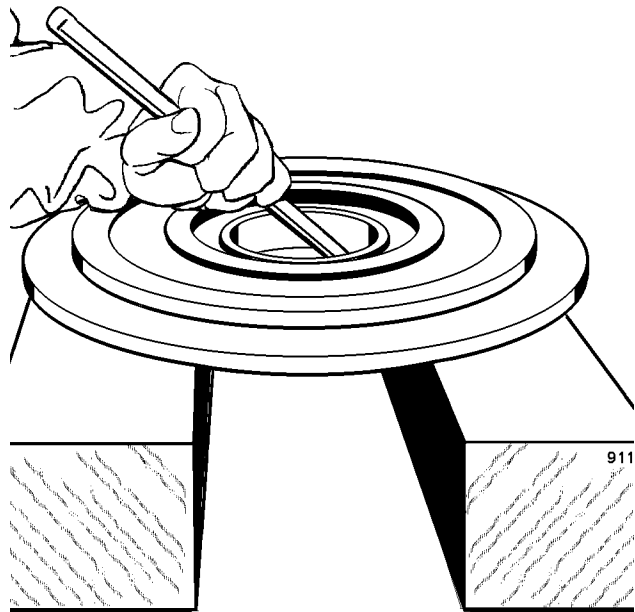
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23. Support beneath the bearing retainer (as close as possible to the bearing bore, but not so close as to damage the retainer/seal assembly). Press the shaft out of bearing (37).



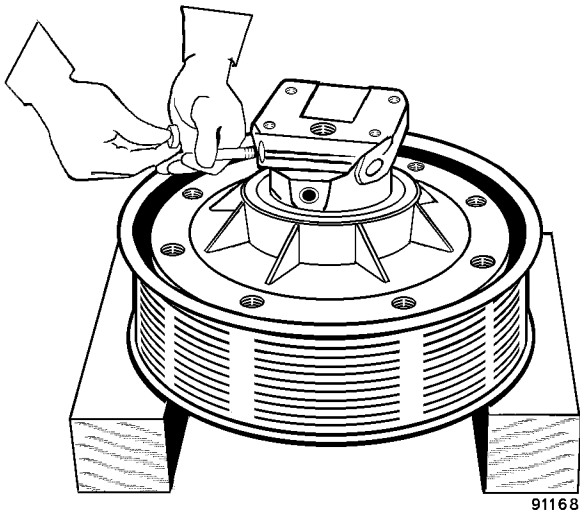
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22. Remove internal snap ring (25).

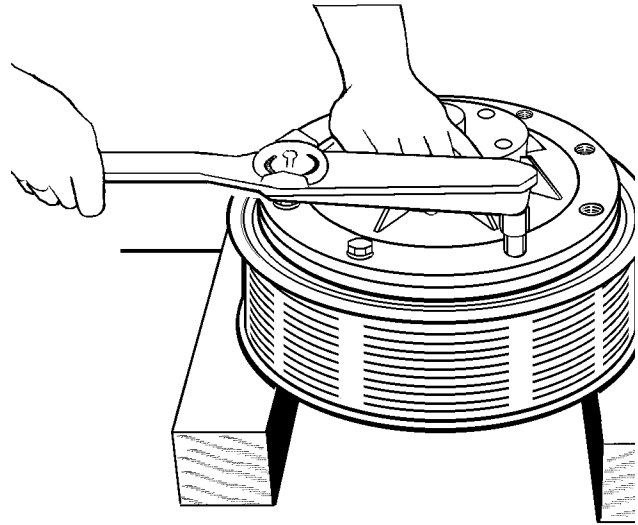


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24. Remove oil seal (24).



60. Install orifice fitting (35) in the "oil in" port of the bracket.



61. Turn the assembly over on the bench. Install the remaining bolts (14) with lockwashers (15), and torque all to **38-42 ft. lbs. (51-57 N.m)**.

**ASSEMBLY OF THE FAN CLUTCH IS COMPLETE**

- b. Screw heating element into cartridge and tighten securely to insure against leaks.
2. Connect the electrical leads.
3. Slide element cover into position and secure with screws.
4. Open shut-off valves.
5. Plug in the external power source. After allowing time for the element to warm up, outlet hoses should feel warm to the touch.
6. Check for leaks and proper coolant level.

## THERMOSTAT

### Removal

1. Disconnect the external power source at the plug in receptacle.

*NOTE: It is not necessary to remove the thermostat assembly from the heater.*

2. Remove the two screws and slide cover out of the way.
3. Disconnect the two electrical leads.
4. Loosen the two setscrews and remove the temperature sensing unit.

### Installation

1. Install a new temperature sensing unit and secure in place with two setscrews.
2. Connect the electrical leads.
3. Move cover into position and secure in place with screws.
4. Plug in the external power source.

After allowing time for the element to warm up, outlet hoses should feel warm to the touch.

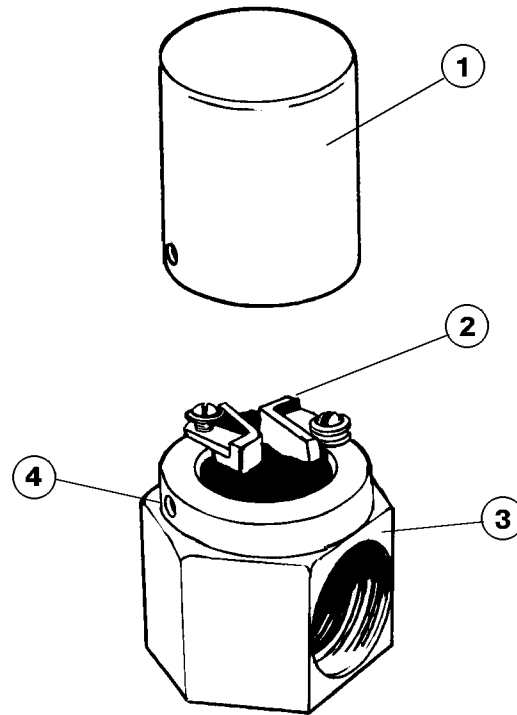
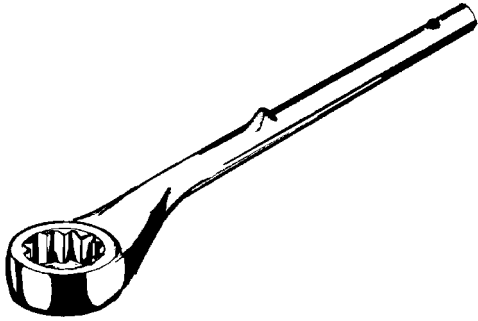
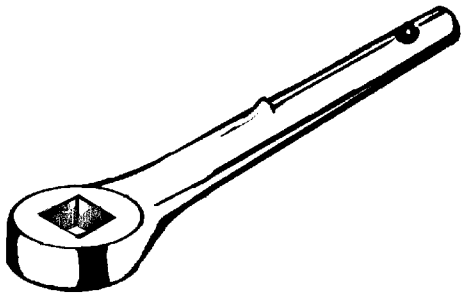


FIGURE 7-2. THERMOSTAT ASSEMBLY

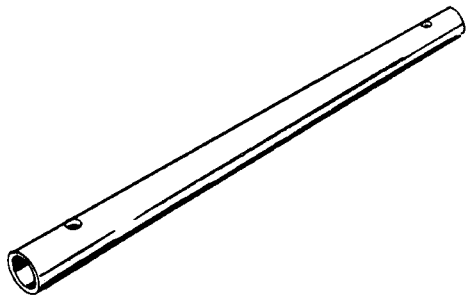
- |                             |             |
|-----------------------------|-------------|
| 1. Cover                    | 3. Housing  |
| 2. Temperature Sensing Unit | 4. Setscrew |



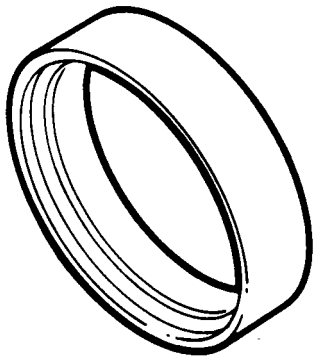
Part Number	Description	Use
PB8326	Offset Box End Wrench, 1 7/16 in.	Miscellaneous & Cab Mounting



Part Number	Description	Use
TZ2734	3/4 in. Torque Adapter	Miscellaneous



Part Number	Description	Use
TZ2733	Tubular Handle	Use with PB8326 & TZ2734



Part Number	Description	Use
TY2150	Seal Installation Tool	Installation of front wheel bearing face seals.

## AIR CONDITIONER SYSTEM COMPONENTS

### COMPRESSOR (Refrigerant Pump)

The compressor is where the low pressure side of the system changes to high pressure. It concentrates the refrigerant returning from the evaporator (low side) creating high pressure and a temperature much higher than the outside air temperature. The high temperature differential between the refrigerant and the outside air is necessary to aid rapid heat flow in the condenser from the hot refrigerant gas to much cooler outside air.

To create high pressure concentration, the compressor draws in refrigerant from the evaporator through the suction valve and during compression strokes, forces it out through the discharge valve to the condenser. The pressure from the compressor action moves the refrigerant through the condenser, receiver-drier and connecting hoses to the expansion valve.

The compressor is driven by the engine through a v-belt driving an electrically operated clutch mounted on the compressor drive shaft.

### SERVICE VALVES

Quick-connect hose end fittings with integral service valves attach to system service ports for servicing the unit. A manifold gauge set is connected into the system at the service valve ports and all procedures, such as discharging, evacuating and charging the system, are performed through the service valves.

### CONDENSER

The condenser receives the high pressure, high-temperature refrigerant vapor from the compressor and condenses it to high pressure, hot liquid.

It is designed to allow heat movement from the hot refrigerant vapor to the cooler outside air. The cooling of the refrigerant changes the vapor to liquid. Heat exchange is accomplished using cooler air flowing through the condenser. Condenser cooling is achieved by air flowing from the radiator fan along with ram air provided by vehicle movement. The radiator fan moves more than 50% of condenser air flow unless travel speed is at least 25 mph.

Ram air condensers depend upon the vehicle movement to force a large volume of air past the fins and tubes of the condenser. The condenser is usually located in front of the radiator or on the roof of the truck.

Condensing of the refrigerant is the change of state of the refrigerant from a vapor to a liquid. The action is affected by the pressure of the refrigerant in the coil and air flow through the condenser. Condensing pressure in an AC system is the controlled pressure of the refrigerant which affects the temperature at which it condenses to liquid, giving off large quantities of heat in the process. The condensing point is sufficiently high to create a wide temperature differential between the hot refrigerant vapor and the air passing over the condenser fins and tubes. This difference permits rapid heat transfer from the refrigerant to ambient air.

### RECEIVER-DRIER

The receiver-drier is an important part of the air conditioning system. The drier receives the liquid refrigerant from the condenser and removes any moisture and foreign matter present which may have entered the system. The receiver section of the tank is designed to store extra refrigerant until it is needed by the evaporator. The storage of this refrigerant is temporary and is dependent on the demand of the expansion valve.

A desiccant is a solid substance capable of removing moisture from gas, liquid or solid. It is held in place within the receiver between two screens, which also act as strainers.

The receiver-drier is also equipped with a sight glass and a moisture indicator. The sight glass can give a good indication of the charge of the system. If the sight glass is not clear, the system is low on refrigerant.

The moisture indicator is a device to notify service personnel that the drier is full of moisture and must be replaced. The indicator is blue when the component is free from moisture. When the indicator turns beige or tan, the drier must be replaced.

## INSTALLING MANIFOLD GAUGE SET

Before attempting to service the air conditioning system, a visual inspection of both the engine and system components is recommended. Particular attention should be given to the belts, hoses, tubing and all attaching hardware plus the radiator cap, fan clutch, and thermostat. Inspect both the condenser and the radiator for any obstructions or potential contamination. Minimize all the possibilities for error or malfunction of components in the air conditioning system.



**Shut off engine. DO NOT attempt to connect service equipment when the engine is running.**

1. Be sure all valves on the manifold are closed all the way (turn them clockwise).
2. Check the hose connections on the manifold for tightness.
3. Locate the low and high side system service fittings and remove their protective caps.
4. Connect the two service hoses from the manifold to the correct service valves on the compressor as shown in Figure 9-8. (High side to compressor discharge valve and low side to compressor suction side.) Do not open service valves at this time.

This gauge hook-up process will be the same, regardless of the gauge set being installed. Whether it is a recovery station or individual gauges, the connections are the same. The procedures performed next will vary depending what type of equipment is being used. If a recovery/recycling station is being used, complete servicing can be accomplished. Using only a set of gauges will limit the servicing to only adding refrigerant or observing pressures.

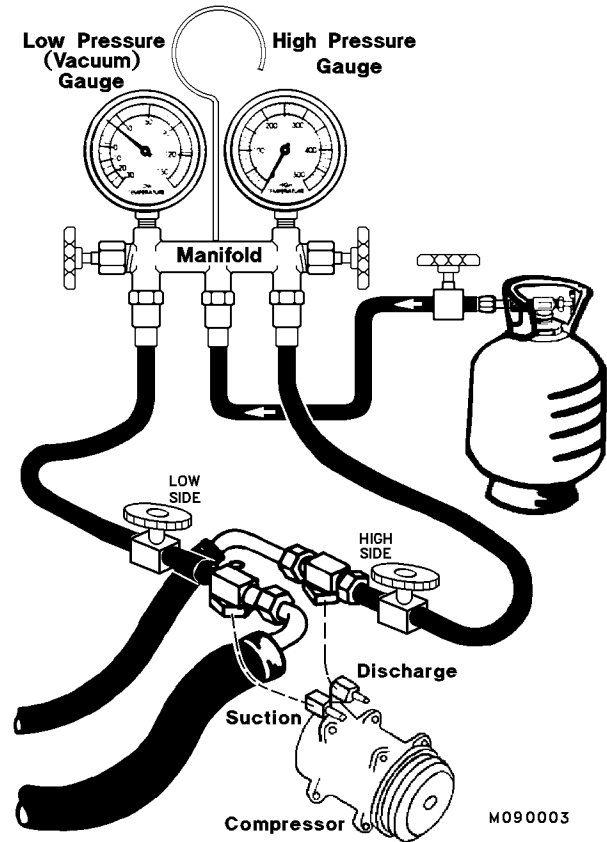


FIGURE 9-8. SERVICE HOSE HOOK-UP

## RECOVERING AND RECYCLING THE REFRIGERANT

### Draining the Oil from the Previous Recovery Cycle

1. Place the power switch and the controller on the recovery unit in the OFF position.
2. Plug in the recovery station to the correct power source.
3. Drain the recovered oil through the valve marked OIL DRAIN on the front of the machine.
4. Place the controller knob in the ON position. The low pressure gauge will show a rise.
5. Immediately switch to the OFF position and allow the pressure to stabilize. If the pressure does not rise to between 5 psi and 10 psi, switch the controller ON and OFF again.
6. When the pressure reaches 5 to 10 psi, open the OIL DRAIN valve, collect the oil in an appropriate container, and dispose of container as indicated by local, state or Federal Regulation. THE OIL IS NOT REUSABLE, DUE TO CONTAMINANTS ABSORBED DURING USE.

### Performing the Recovery Cycle

1. Be sure the equipment being used is designed for the refrigerant you intend to recover.
2. Observe the sight glass oil level. Having drained it, it should be zero.
3. Check the cylinder refrigerant level before beginning recovery to make sure you have enough capacity.
4. Confirm that all shut-off valves are closed before connecting to the AC system.
5. Attach the appropriate hoses to the system being recovered.
6. Start the recovery process by operating the equipment as per the manufacturer's instructions.
7. Continue extraction until a vacuum exists in the AC system.
8. If an abnormal amount of time elapses after the system reaches 0 psi and does not drop steadily into the vacuum range, close the manifold valves and check the system pressure. If it rises to 0 psi and stops, there is a major leak.

9. Check the system pressure after the recovery equipment stops. After five minutes, system pressure should not rise above "0" gauge pressure. If the pressure continues to rise, restart and begin the recovery sequence again. This cycle should continue until the system is void of refrigerant.
10. Check the sight glass oil level to determine the amount of oil that needs to be replaced. (The amount of oil that was lost during the recovery cycle must be replaced back into the system).
11. Mark the cylinder with a RECOVERED (red) magnetic label to reduce the chance of charging a system with contaminated refrigerant. Record the amount of refrigerant recovered.

### Performing the Recycling Procedure

The recovered refrigerant contained in the cylinder must undergo the recycle procedure before it can be reused. The recycle or clean mode is a continuous loop design and cleans the refrigerant rapidly. Follow equipment manufacturer's instructions for this procedure.

### Evacuating and Charging the AC System

Evacuate the system once the air conditioner components are repaired or replacement parts are secured, and the AC system is reassembled. Evacuation removes air and moisture from the system. Then, the AC system is ready for the charging process, which adds new refrigerant to the system.

**PROBLEM: Condenser Malfunction or System Overcharge**

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**Indications:**

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

---

**Possible Causes**

- Lack of air flow through the condenser fins

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**Suggested Corrective Actions**

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

## Maintenance Free types:

Immediately after engine start, system volts are lower than regulator set-point with low amps.

15-30 minutes into charge cycle, still low volts and low amps.

15-30 minutes into charge cycle, volts rise several tenths, amps increase gradually then increase quicker to medium to high amps.

20-35 minutes into charge cycle, volts rise to set-point and amps lower.

## High-Cycle Maintenance Free Types:

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

## CHARGE VOLT AND AMP VALUES

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

## DEFINITIONS

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

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

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

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

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

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

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

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

## BENCH TEST

*Results of on-vehicle test should be confirmed by these bench tests, if possible. When it is not possible to perform on-vehicle test, alternator performance can be checked quickly by referring to these bench tests.*

### Equipment:

- Test Bench, with 15 - 20 Hp motor set up to drive alternator to 7000 RPM.
- Voltmeter, 0 - 40 Volt Range
- Ammeter, 0 - 400 Amp Range

Mount alternator on test bench according to the bench manufacturer's instructions. Refer to Figure 13-1 for set-up to measure voltage and amperage produced by alternator. Voltage within +/- .2V of regulator setpoint is "normal". Amperage within +/- 10% of rated output at 5000 rpm is "high".

## TEST 1 - NO-LOAD TEST

Without electrical load but with battery connected, run alternator at 5000 rpm. Refer to Table 13-3 below.

AMPS	VOLTS	DIAGNOSIS
HIGH	LOW	Test bench battery is discharged (or defective). Allow to charge or replace.
HIGH	NORMAL	Give time to stabilize while monitoring VOLTS. If VOLTS rise above normal range (Table 13-2) regulator and/or field coil must be replaced. If AMPS fall, charging system is OK.
HIGH	HIGH	Stop test. Regulator and/or field coil should be replaced. (Go to Static Tests.)
LOW	LOW	Alternator and/or regulator must be repaired or replaced. Go to Test 3.
LOW	NORMAL	Regulator OK. Go to Test 2.
LOW	HIGH	Stop test. Bench malfunction or wiring error.

## TEST 2 - FULL LOAD TEST

With load set to rated output (nameplate) +/- 10%, run alternator at 5000 rpm. Refer to Table 13-4.

AMPS	VOLTS	DIAGNOSIS
HIGH	LOW	Test bench battery is discharged (or defective). Allow to charge or replace.
HIGH	NORMAL	Charging system OK.
HIGH	HIGH	Stop test. Regulator and/or field coil should be replaced. (Go to Static Tests.)
LOW	LOW	Alternator and/or regulator must be repaired or replaced. Go to Test 3.
LOW	NORMAL	Increase load.
LOW	HIGH	Stop test. Bench malfunction or wiring error.

## TEST 3 - REGULATOR BYPASS TEST

Perform this test only when suggested by other tests.

Alternator connections and load same as test 2. Bypass regulator as shown in Figure 13-3. Note whether amps rise to within +/- 10% of output rating when connecting F- terminal to ground. Note whether amps fall when disconnecting F- terminal. Then refer to Table 13-5 below.



**Limit terminal connection to a few seconds to protect charging system from excessive voltages.**

CONNECT	DISCONNECT	DIAGNOSIS
Amps Rise	Amps Fall	Alternator is OK. See note, replace regulator only if low AMPS/low VOLTS indicated in Test 1 and/or Test 2.
No Change	No Change	Alternator must be repaired. Go to Static Tests.

*Note: Before replacing regulator, check continuity of energize circuit (refer to Static Tests, Test 5).*

4. Seat field coil bobbin ears over stator tabs (Figure 13-21) by inserting field winding and rotating about 20 degrees after insertion with tool BF4820. Align screw holes in bobbin ears with screw holes in stator tabs.

*Note: Bobbin ears go over stator tabs as viewed from both ends of tube assembly.*

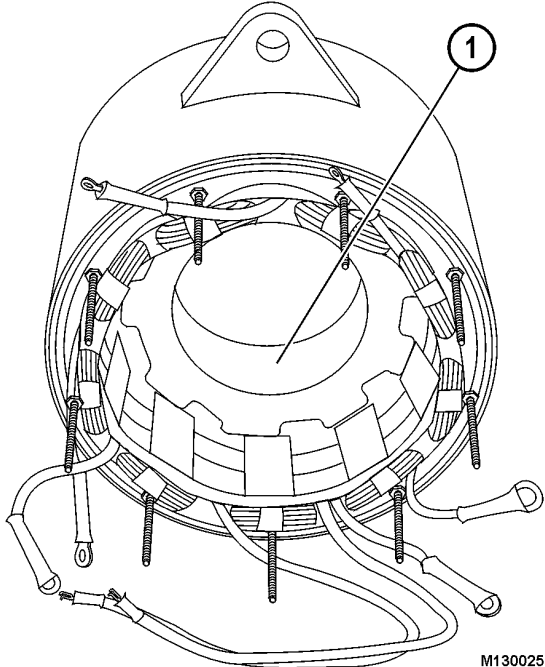


FIGURE 13-21.

1. Field Coil Bobbin Ear

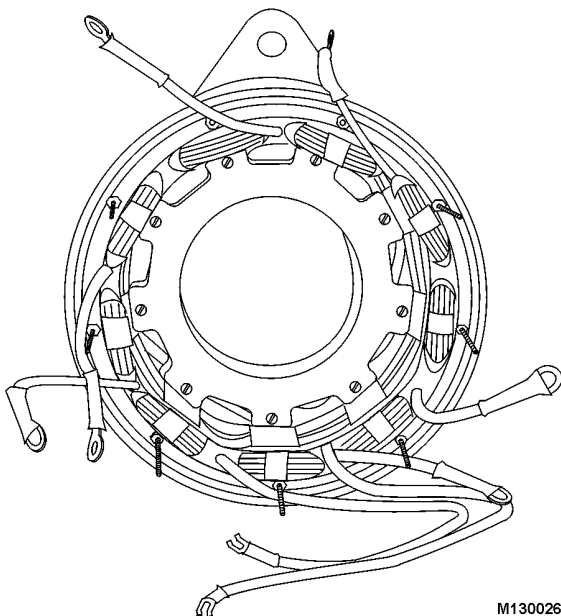


FIGURE 13-22.

5. Make sure field coil leads (white spade terminals) are pulled through proper stator openings with no slack at the field coil and that neither wire is pinched by the bobbin ears.

6. Using eighteen screws coated with loctite, fasten field coil bobbin ears to stator tabs (Figure 13-22). Tighten screws to 8-10 lb-in. (0.9- 1.1 Nm) torque.

*Note: If field coil leads cannot be threaded through stator openings with the terminal attached, unsolder terminals, remove sleeving and then insert leads. After field coil is in place slip sleeving on field leads, solder terminals to wires and slip sleeving back over terminal.*

### FRONT BEARING ASSEMBLY

1. Clean bearing I.D. surface of front housing.
2. Install retaining ring in rear inner groove of front housing.

*Note: This retaining ring has two flat sides (3, Figure 13-23).*

3. Coat outer race of front bearing (4, Figure 13-23) with thin coat of loctite.

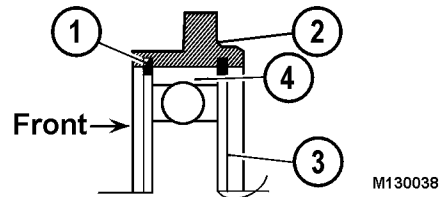


FIGURE 13-23.

- |                             |                                      |
|-----------------------------|--------------------------------------|
| 1. Retaining Ring (Tapered) | 3. Retaining Ring (Flat, both sides) |
| 2. Front Housing            | 4. Bearing - Outer Race              |

**PRESSURE PLATE SET UP (Refer to Figure 13-42)**

8. Place thrust washer on jack screw. Lube the jack screw for 1", about 1" from the tip of the jack screw. Lubricate approximately 1" of the jack screw where it enters the pressure plate with white lube or a wheel bearing type of grease. Also place a dab of this grease on both sides of the thrust washer that is placed under the hex head of the jack screw.

Insert the jack screw through the top thrust plate. Screw jack screw into the pressure plate about 5 turns. Place a dab of lube on both sides of the thrust washer under hex head of the jack screw. Screw jack screw into the pressure plate until contact is made between head of the jack screw and top thrust plate.

9. Continue threading the jack screw in, until stator contacts shell/shell assembly. Measure from top of locating pin to the top of the top thrust plate. Record this measurement as starting point to be used later.

10. Check the position of stator leads by looking through the large torque arm holes in the top thrust plate. Turn jack screw until significant resistance is encountered.

*NOTE: If the tool assembly starts to rotate, insert torque arm into holes in the top thrust plate for additional leverage.*

11. Check the distance the stator has been inserted into the shell by measuring from the top of the locating pin to the top of the top thrust plate (first measurement taken in step 9, above). This measurement should increase, which indicates the stator is entering the shell.

12. After the stator has been properly seated, disassemble the tool. Pull the stator leads through the correct slots. Continue with the alternator assembly as per instructions in this manual.

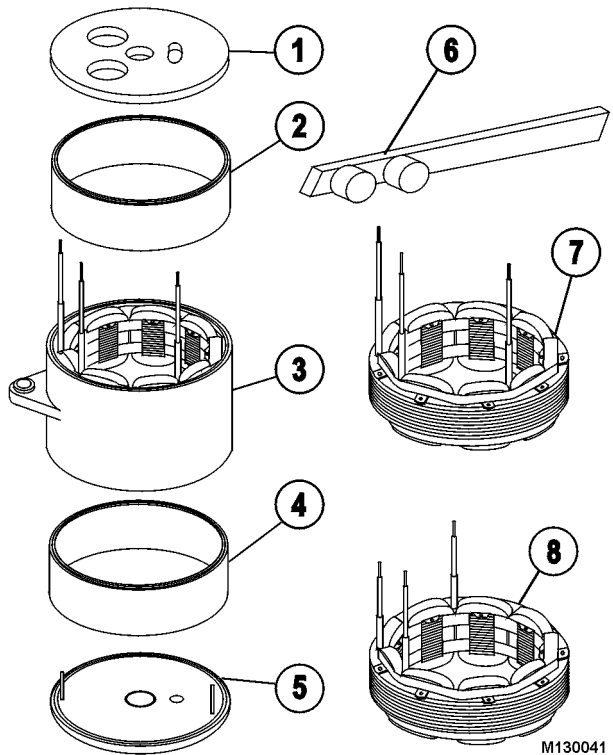


FIGURE 13-42.

- |                            |                        |
|----------------------------|------------------------|
| 1. Top Thrust Plate        | 5. Bottom Thrust Plate |
| 2. Support Ring            | 6. Torque Arm          |
| 3. Stator & Shell Assembly | 7. Front Stator        |
| 4. Support Ring            | 8. Rear Stator         |

## **Wiring and Termination**

Most of the PLMIII truck connections use a heavy-duty cable. This yellow multi-conductor cable uses a 16awg, finely stranded wire designed for continuous motion operations. The conductors are protected by a foil and braided shield for electronic noise immunity and physical strength. A typical part number for this wire is LW086-63. This wire is typically terminated with a #10 ring terminal, part number VH2584. Most connections for the PLMIII system are made in the payload meter junction box.

## **TCI Outputs**

The GE drive system on the 930E requires information from the payload meter regarding the loaded condition of the truck. There are three outputs from the payload meter to GE to indicate the relative load in the truck. 24 vdc on the 73MSL circuit indicates that the load is 70% of rated load. 24 vdc on the 73FSL circuit indicates the truck is 100% loaded. The 73OSL circuit is not currently used.

## Downloading Data

PLMIII records many types of data. The PLMIII PC software is designed to download the data from a whole truck fleet. Instead of creating one data file for each truck, the PC software combines all the data from many trucks into one database on the hard drive of the computer. The software then allows users to query the database to create custom reports and graphs. Data for individual trucks or groups of trucks can be easily analyzed. This same data can be exported for use in other software applications like word processors and spreadsheet applications.

As the database grows, performance of the PC software for analysis will slow down. It may be helpful to periodically export data. For example, query the database to show the oldest quarter, month, or half year and print out a summary report. Then export the data to a compressed format and save the file in a secure location. Once the data is exported, delete the entire query results from the database. If necessary, the data can easily be imported back into the main database for analysis at a future date. Removing this older data will improve performance.

The PC software downloads the data from the pay-



load meter into a single Paradox database. The data from all the trucks is added to the same database. Downloading the payload meter can take several minutes. The data is added to the database on the laptop used to download.

To move the data to another computer, a query must be run to isolate the particular data for export. Do not press the operator switch on the dashboard while downloading

1. Connect to the payload meter and start the PC software.
2. From the main menu, select "Connect to Payload Meter". The PC will request the latest status information from the payload meter. The number of haul cycles and alarms will be displayed.
3. Select the "Begin Download" button. The PC will request the payload and alarm data from the payload meter and save it into the database. This may take several minutes. A progress bar at the bottom will show the approximate time left.

To download the payload meter:

Truck#	Date	Time	Payload	Swingload	Operator	Status	Fla	Carry	Bac	Total Cyc	E-Run	Tin	E-Stop	Tu	Loading
374	2/11/00	4:06:48 PM	294.4	2	0	E		-1.2	2.7	1	0.2	0			
374	2/11/00	4:10:09 PM	298.6	2	0	I		-1.4	7.2	0.6	0.6	0			
374	2/11/00	4:41:01 PM	265.5	3	0			15.6	20.1	4.6	3.9	2			
374	2/11/00	5:24:54 PM	277.5	0	0	AK		0	27	4.6	6.4	1			
374	2/11/00	6:21:27 PM	231	3	0			15.5	27.7	4.5	5	1			
374	2/11/00	7:09:08 PM	265.5	3	0	H		17.1	23.9	4.2	3.2	1			
374	2/11/00	7:59:53 PM	262.4	4	0			14.1	29.7	4.3	3.7	2			
374	2/11/00	8:29:32 PM	225.1	3	0			15.6	27.7	4.5	5	1			
374	2/11/00	8:57:11 PM	265.5	3	0			15.6	20.1	4.6	3.9	2			
374	2/11/00	9:17:13 PM	265.4	3	0	H		17	23.9	4.2	3.1				
374	2/11/00	9:41:05 PM	277.6	0	0	AK		0	27	4.6	6.4	1			

Two sets of data are exported. At the top of the file will be the haul cycle data. The columns, left to right are:

- Truck number
- Haul cycle start date
- Haul cycle start time
- Payload
- Swingloads
- Operator ID
- Warning Flags
- Carry Back
- Total Haul Cycle time
- Empty Running Time
- Empty stop time
- Loading time
- Loaded running time
- Loaded stopped time
- Dumping time
- Loading start time
- Dumping start time
- Loaded haul distance
- Empty haul distance
- Loaded maximum speed
- Time when loaded maximum speed occurred
- Empty maximum speed
- Time when loaded maximum speed occurred
- Maximum + frame torque
- Time when the maximum + frame torque occurred
- Maximum - frame torque
- Time when the maximum - frame torque occurred
- Maximum sprung weight calculation
- Time when the maximum sprung weight calculation occurred
- Left Front Tire-kilometer-hour
- Right Front Tire-kilometer-hour
- Average Rear Tire-kilometer-hour
- Frame serial number

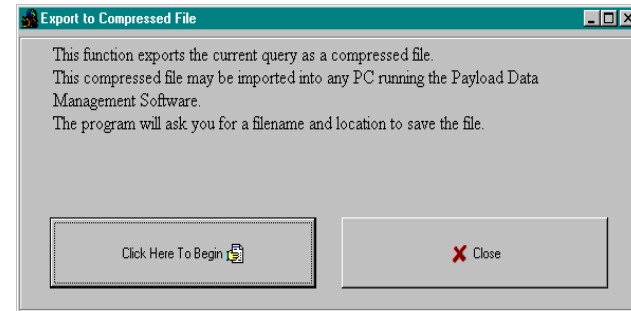
- Reserved 1-5, 7-10: These values are internal calculations used in the continued development of PLMIII and should be ignored.
- Reserved 6: This value is the payload estimate at the shovel just before the truck begins to move.

Alarm Type	Date Set	Time Set	Description	Date Cleared	Time Cleared
	10	12/5/99	8:51:25 AM	INCL SENSOR LO	12/5/99 8:51:29 AM
	10	12/5/99	8:56:07 AM	INCL SENSOR LO	12/5/99 8:56:12 AM
	10	12/5/99	9:00:49 AM	INCL SENSOR LO	12/5/99 9:00:54 AM
	10	12/5/99	9:05:31 AM	INCL SENSOR LO	12/5/99 9:05:36 AM
	10	12/5/99	9:10:13 AM	INCL SENSOR LO	12/5/99 9:10:17 AM
	10	12/5/99	9:14:54 AM	INCL SENSOR LO	12/5/99 9:14:59 AM
	10	12/5/99	9:19:37 AM	INCL SENSOR LO	12/5/99 9:19:41 AM
	10	12/5/99	9:24:19 AM	INCL SENSOR LO	12/5/99 9:24:24 AM
	10	12/5/99	9:29:01 AM	INCL SENSOR LO	12/5/99 9:29:06 AM
	10	12/5/99	9:33:44 AM	INCL SENSOR LO	12/5/99 9:33:48 AM
	10	12/5/99	9:38:26 AM	INCL SENSOR LO	12/5/99 9:38:30 AM
	10	12/5/99	9:43:08 AM	INCL SENSOR LO	12/5/99 9:43:13 AM
	10	12/5/99	9:47:50 AM	INCL SENSOR LO	12/5/99 9:47:55 AM
	10	12/5/99	9:52:32 AM	INCL SENSOR LO	12/5/99 9:52:37 AM
	10	12/5/99	9:57:13 AM	INCL SENSOR LO	12/5/99 9:57:17 AM
	10	12/5/99	10:01:55 AM	INCL SENSOR LO	12/5/99 10:01:59 AM

The second series of data below the haul cycle data is the alarms. The alarm columns, left to right are:

- The alarm type
- The date the alarm was set
- The time the alarm was set
- Alarm description
- The date the alarm was cleared
- The time the alarm was cleared

### Compressed



This export function allows the data from one laptop to be transferred to another computer. This can be useful when a service laptop is used to download multiple machines and transfer the data to a central computer for analysis. This can also be used to copy haul data from a particular truck onto a diskette for analysis.

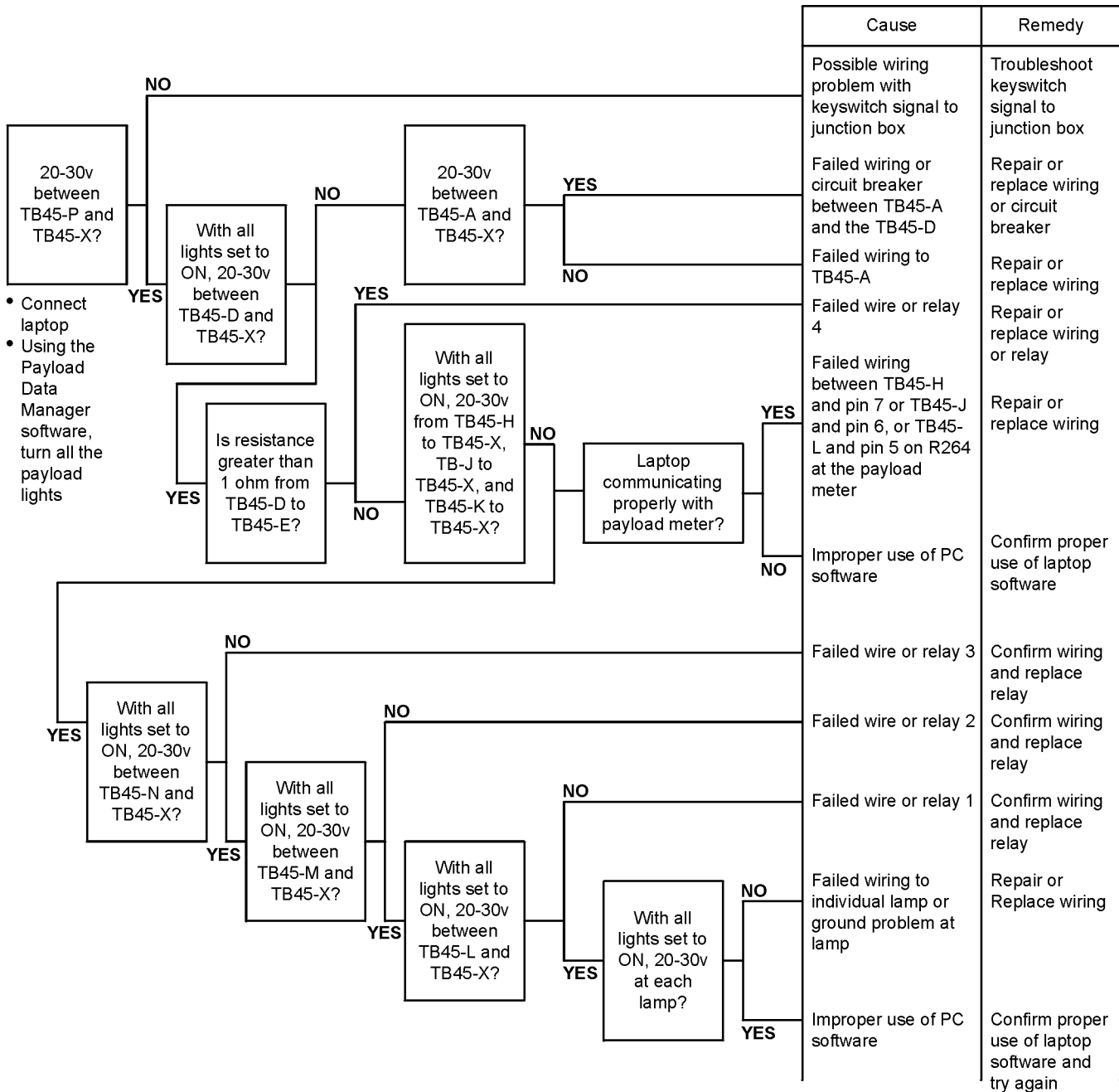
The file format is a compressed binary form of the displayed query. The file can only be imported by another computer running the PDM Software.

## Load Lights Remain ON

### Load Lights Remain ON During Dumping

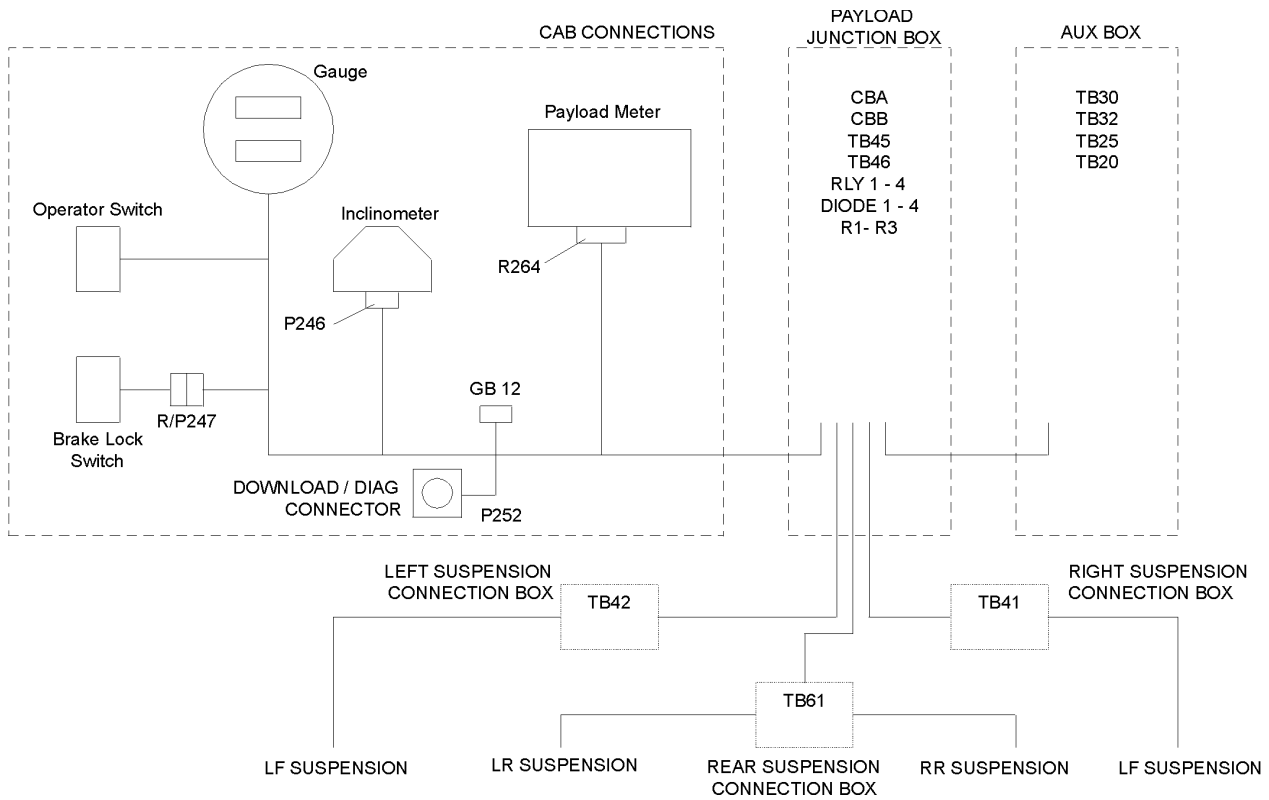
### Display Doesn't Clear When The Load Is Dumped

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

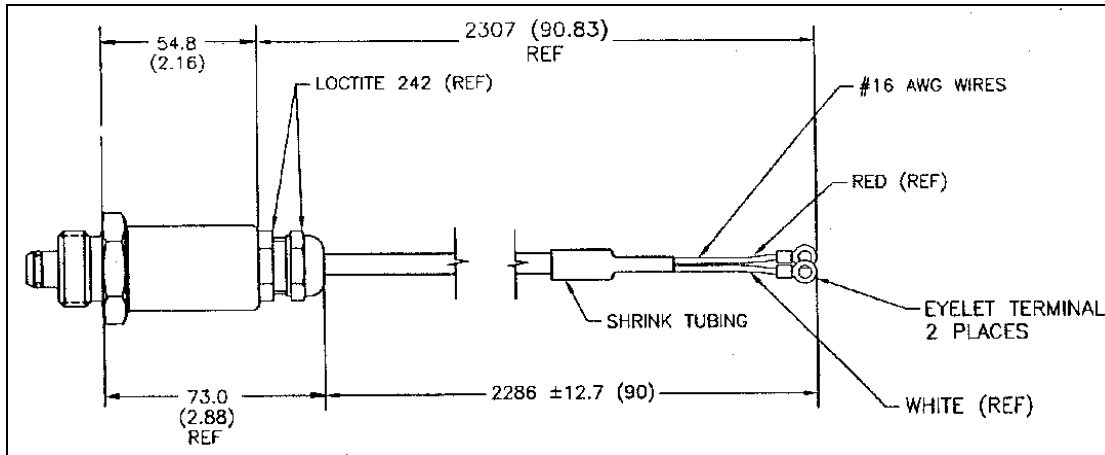


## Connector Map

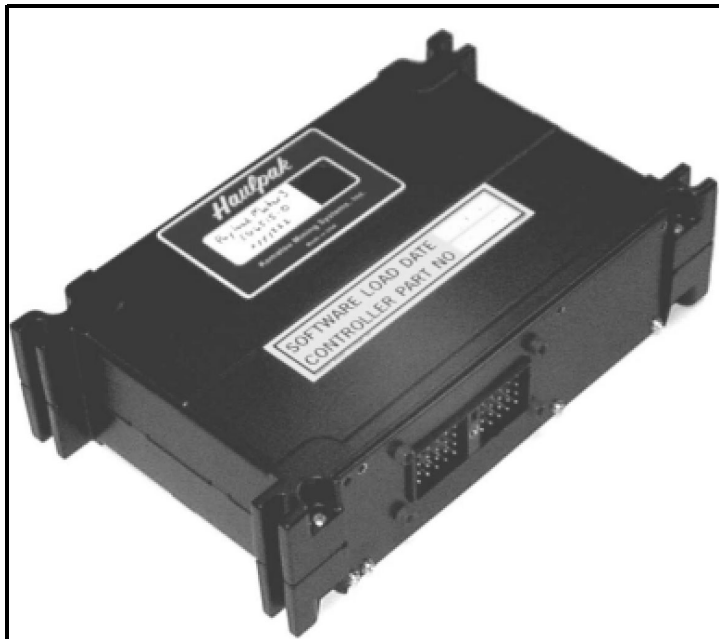
This diagram shows the general location of connectors, terminal boards and miscellaneous connections.



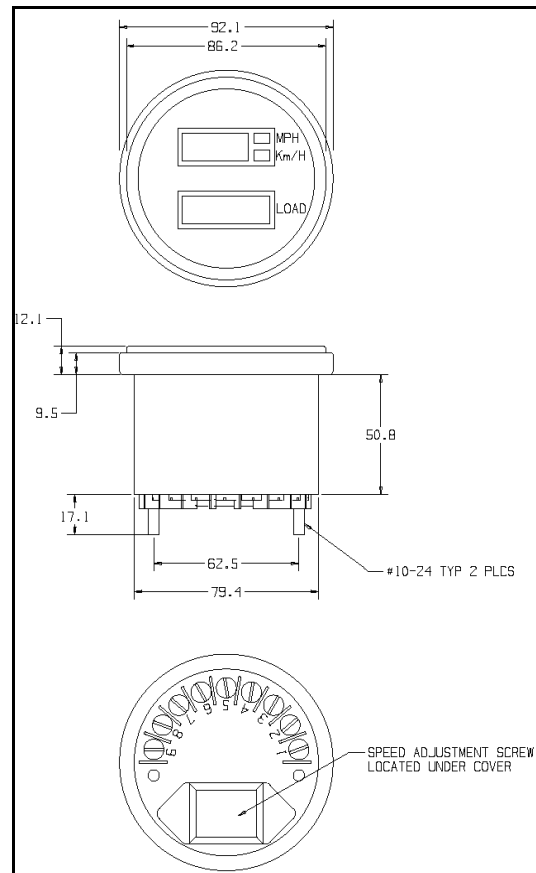
## Payload Meter III - COMPONENTS



Pressure Sensor - PC0328



PLMIII Controller - EG6514



Speedometer - PC0550

All Reference dimensions are in mm.

PORTIONS OF THIS PRODUCT RELATING TO PAYLOAD MEASURING SYSTEMS ARE MANUFACTURED UNDER LICENSE FROM

L.G. HAGENBUCH holder of  
U.S. Patent Numbers 4,831,539 and 4,839,835

7. Remove 2 screws (Figure 2-8) holding the roller track to the bottom of the door glass.

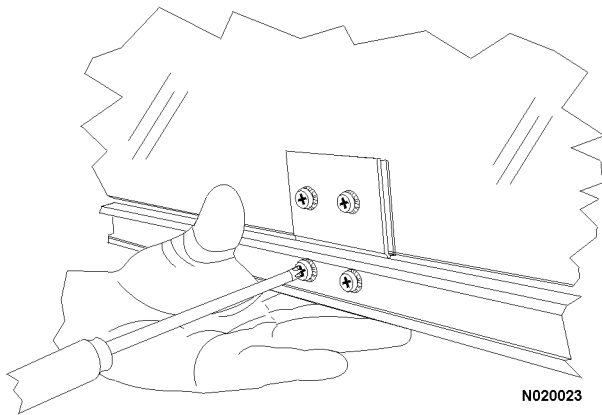


FIGURE 2-8.

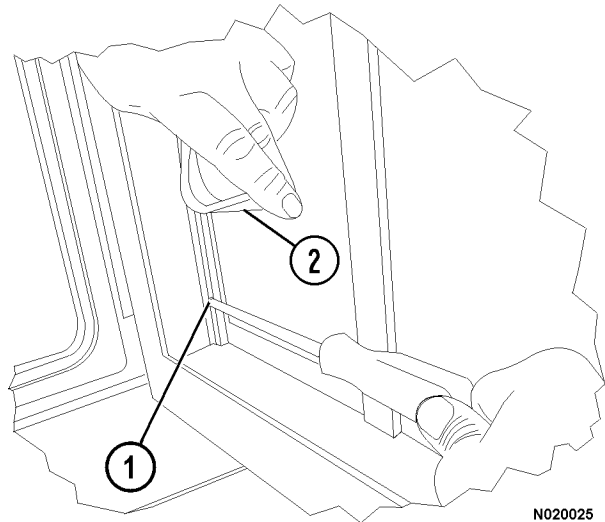


FIGURE 2-10.

- 1. Screws
- 2. Rubber Felt Insert

8. Support glass in door frame as shown (1, Figure 2-9). Remove screws (2) that hold the adapter for the window regulator track.

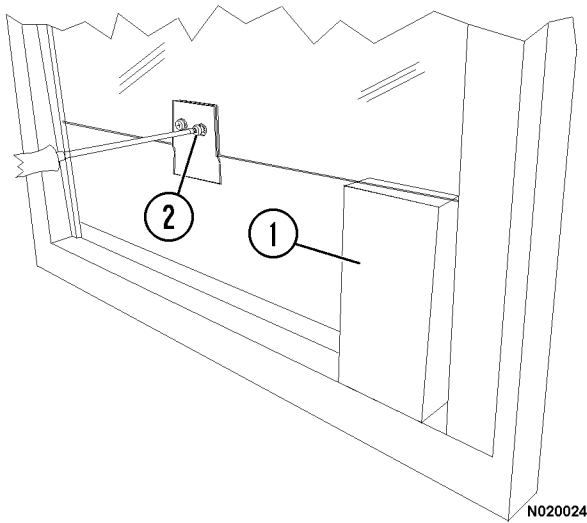


FIGURE 2-9.

- 1. Support Block
- 2. Screw

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

*Note: Screws along the bottom of window frame may be shorter than along the top and sides.*

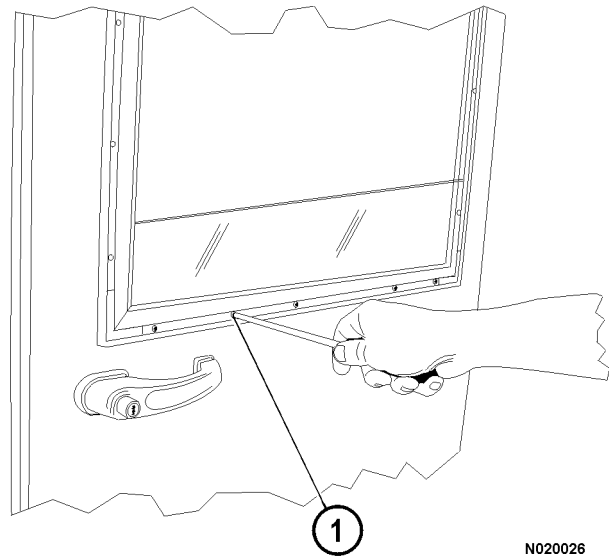


FIGURE 2-11.

- 1. Screws

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

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

## Installation

1. Place wiper arm (1, Figure 3-2) into the position noted during removal. Install the washer and nut (2). Tighten the nut to **142-177 in. lbs. (16-20 Nm)**. Close the cover.
2. Connect the washer hose to the wiper arm.
3. Ensure the wipers arms operate properly and park in the proper position after installation is complete. Refer to Figure 3-3.

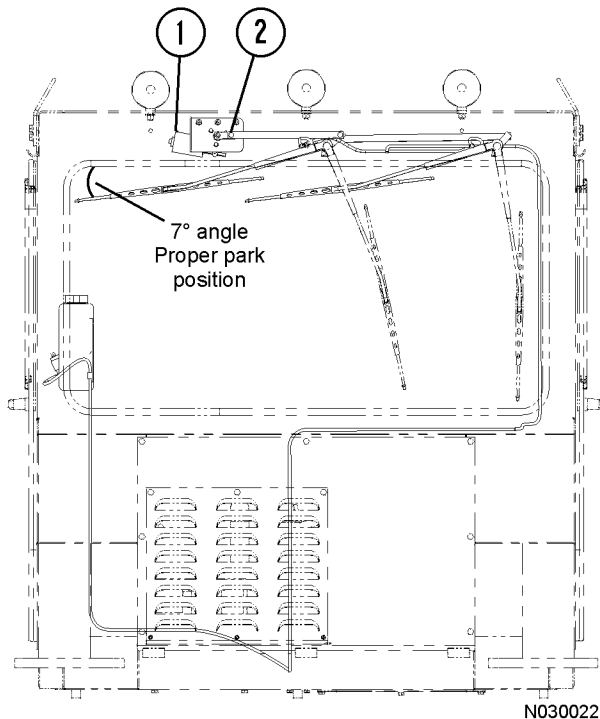


FIGURE 3-3. PARK POSITION

1. Wiper Motor
2. Linkage Retainer

## Wiper Linkage Replacement

### Removal

1. Remove the wiper arms. Refer to *Wiper Arm Replacement* in this section.
2. Remove wiper retainer (2, Figure 3-3) and disconnect the wiper linkage from the wiper motor drive arm.
3. Remove nut (3, Figure 3-2) and the washer from each wiper shaft.

4. If equipped, remove four capscrews (2, Figure 3-4), the washers, and the nuts that secure pillow blocks (3). Remove spacer blocks (1). Note the orientation of the spacer blocks for assembly purposes.

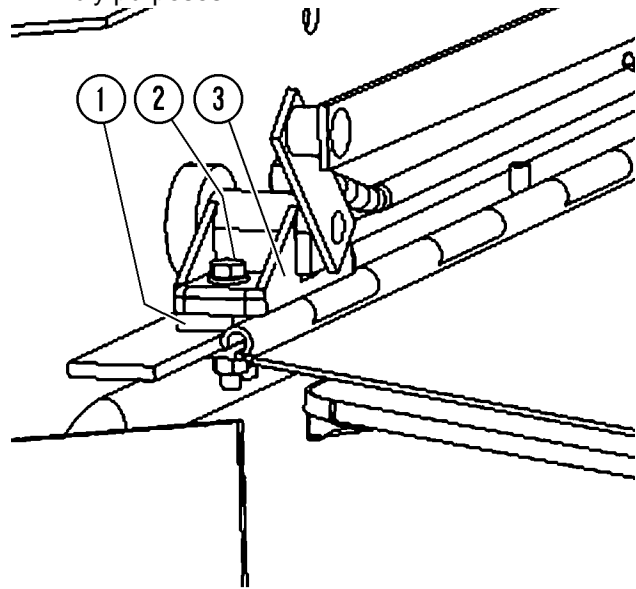


FIGURE 3-4. PILLOW BLOCK INSTALLATION

1. Spacer Block
2. Capscrew
3. Pillow Block

5. Remove the linkage from the wiper compartment.

### Installation

1. Place the linkage into position in the wiper compartment.
2. If equipped, place spacer blocks (1, Figure 3-4) into position under pillow blocks (3). Install capscrews (2), the washers, and the nuts that secure the pillow blocks.
3. Install nut (3, Figure 3-2) on each wiper shaft and tighten finger-tight. Torque the nuts to **160-177 in. lbs. (18-20 Nm)**. **Do not overtighten. The threads on the shafts are easily stripped when improperly tightened.**
4. Align the linkage and attach to the wiper motor drive arm using retainer (2, Figure 3-3).

*NOTE: When the motor is parked, the drive arm will be in the 3 o'clock position as shown in Figure 3-3.*

5. Install the wiper arms. Refer to *Wiper Arm Installation*. Ensure the wipers arms operate properly and park in the proper position after installation is complete.

## STEERING WHEEL AND CONTROLS

The steering wheel (1, Figure 5-2) will telescope “in” and “out” and adjust through a tilt angle to provide a comfortable wheel position for most operators.

### HORN BUTTON

The horn (2, Figure 5-2) is actuated by pushing the button in the center of the steering wheel. Operation of the horn should be verified before moving the truck. Observe all local safety rules regarding the use of the horn as a warning signal device before starting engine and moving the vehicle.

### TILT / TELESCOPE LEVER

The steering column can be telescoped or the wheel tilted with the lever (3, Figure 5-2) in front of the turn signal lever.

Adjust the tilt of the steering wheel by pulling the lever toward the steering wheel and moving the wheel to the desired angle. Releasing the lever will lock the wheel in the desired location.

Adjust the telescope function by pushing the lever forward to unlock. After positioning as desired, release the lever to lock position.

### TURN SIGNAL / HEADLIGHT DIMMER

The Turn Signal Lever (4, Figure 5-2) is used to activate turn signal lights and to select either high or low headlight beams.



Move the lever upward to signal a turn to the right.

An indicator in the top, center of the instrument panel will illuminate to indicate turn direction selected. Refer to INSTRUMENT PANEL & INDICATOR LIGHTS.



Move the lever downward to signal a turn to the left.

Moving the lever toward the steering wheel changes the Headlight beam. When high beams are selected, the indicator in the top, center of the instrument panel will illuminate.

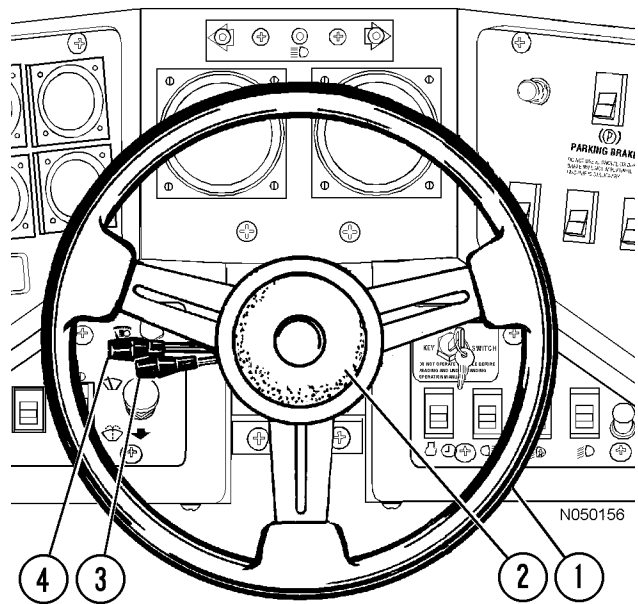
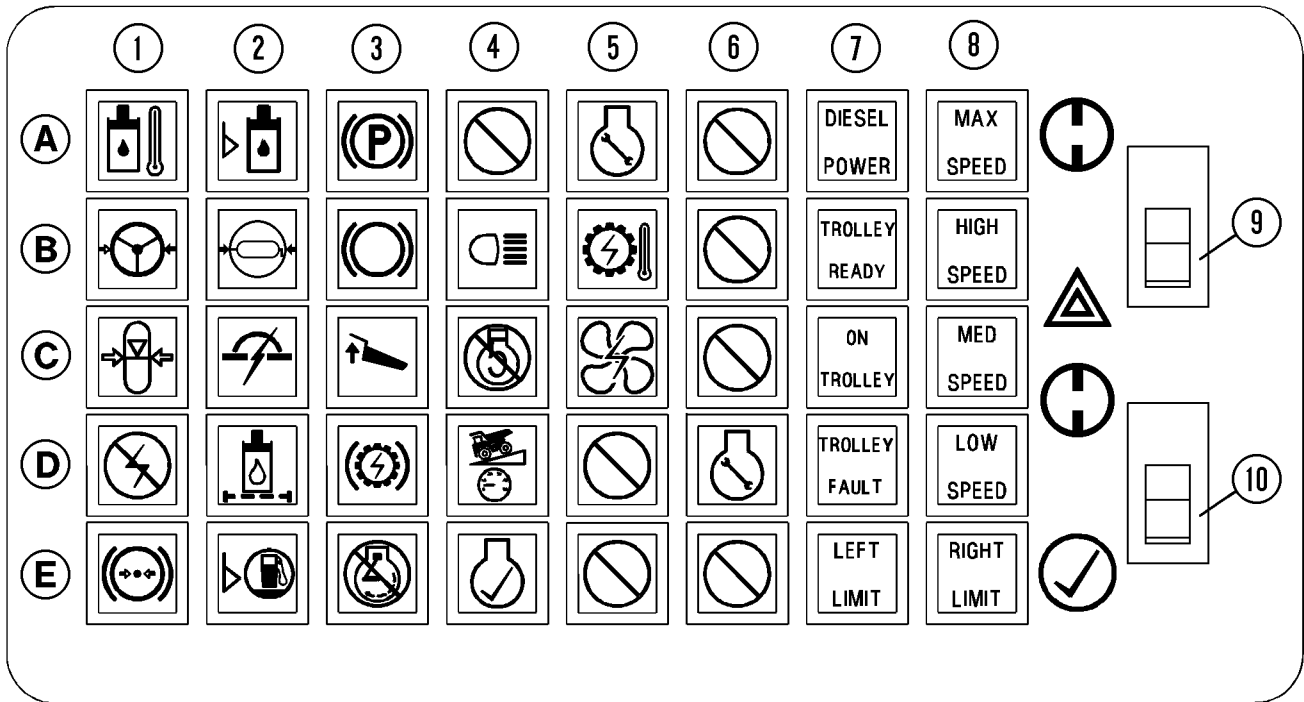


FIGURE 5-2. STEERING WHEEL AND CONTROLS

## STEERING COLUMN

### Removal

1. Shut down engine by turning the key switch OFF and allow at least 90 seconds for the steering accumulators to bleed down. Turn the steering wheel to be certain no pressure remains.
2. Open the battery disconnect switch.
3. Remove the access cover (8, Figure 5-3) from the front of the cab. Place a container under steering control unit to catch oil and loosen hose fittings.
4. Loosen capscrews (7 & 10) on steering control unit (9).
5. Disconnect wire harness from the steering column at the connector.
6. Remove screws retaining trim cover (2) where steering column enters the instrument panel and remove cover.
7. Remove the four capscrews and washers (4) at the saddle bracket (5). Access to these screws is from the front of the cab, through the access opening (8). Also remove capscrews and washers (3).
8. Lift the steering column out of the instrument panel.



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FIGURE 5-8. OVERHEAD STATUS / WARNING INDICATOR LIGHTS

## INDICATOR LIGHTS

Figure 5-8 illustrates the system indicator lights located on the Overhead Display, above the operator's line-of-sight. The following describes the lamps shown in Figure 5-8 and should be referenced by the intersection of row locators A through E and column locators 1 through 8. (Refer to Table I for a chart of symbols and descriptions.)

- The AMBER (Yellow) indicator lamps are intended to alert the operator that the indicated truck function requires some precaution when lit.
- The RED indicator lamps 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.**

### 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. Refer to Section L for hydraulic system troubleshooting and repair procedures.

- The light turns on at 225° F (107° C).

### B1. Low Steering Pressure

When the key switch 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 lamp and warning horn will turn on if steering system hydraulic pressure drops below 2100 psi (14.7 MPa).

- If the light illuminates momentarily while turning the steering wheel at low truck speed and low engine RPM, this may be considered normal, and truck operation may continue.

# NOTES

## 500 HOUR LUBRICATION AND MAINTENANCE CHECKS

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

Truck Serial Number \_\_\_\_\_  
 Site Unit Number \_\_\_\_\_  
 Date: \_\_\_\_\_ Hour Meter \_\_\_\_\_  
 Name of Service Person \_\_\_\_\_

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

1. FINAL DRIVE CASE BREATHERS - Remove breather elements for motorized wheels and clean or replace elements.
2. HYDRAULIC SYSTEM FILTERS - Replace filter elements. Check oil level. Add oil as necessary. Lube Key "B".
3. HYDRAIR® SUSPENSION - Check for proper piston extension (front and rear).
4. THROTTLE AND BRAKE PEDAL (NOT SHOWN) Lubricate treadle roller and hinge pins with lubricating oil. Lift boot from mounting plate and apply a few drops of oil between mounting plate and plunger. Lube Key "B".
5. HYDRAULIC TANK BREATHER - Replace breather.
6. FRONT WHEELS - Check front wheel bearing preload 500 hours after truck commissioning (and at 500 hours after each rebuild) as per Section G (in the service manual for Disassembly and Assembly procedures) and every 5,000 hours there after.

COMMENTS	CHECKED	INITIALS

## FILTER AND RESERVOIR

A filter assembly (2, Figure 3-6) is mounted on the right upright (1) and filters the grease when the grease supply is refilled through the "quick fill" fittings.

Grease is pumped into the filter through a hose (4) routed from the Service Center and then flows out the filter through a hose (3) to the reservoir (5). A vent hose (7) purges air from the reservoir as it is being filled and prevents a vacuum as grease is pumped out.

A cap (6) allows the reservoir to be drained if desired and a plate secured on the end of the reservoir (frame torque tube) can be removed if the reservoir requires cleaning.

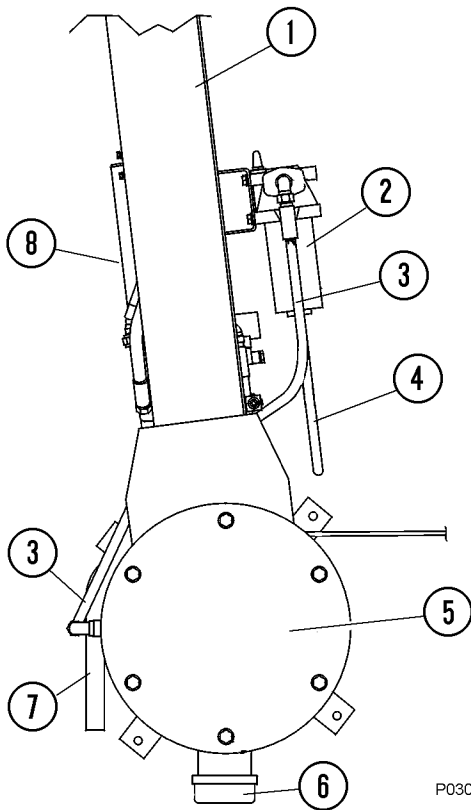


FIGURE 3-4. FILTER AND RESERVOIR

- |                       |                     |
|-----------------------|---------------------|
| 1. R.H. Upright       | 5. Grease Reservoir |
| 2. Filter Assembly    | 6. Cap              |
| 3. Filter Outlet Hose | 7. Vent Hose        |
| 4. Filter Inlet Hose  | 8. Pump Access Door |

## Filter Assembly

The filter assembly element (5, Figure 3-7) should be replaced if the bypass indicator (2) shows excessive element restriction.

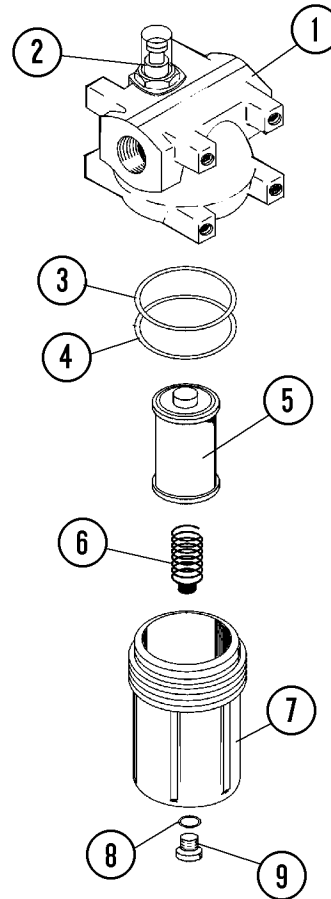
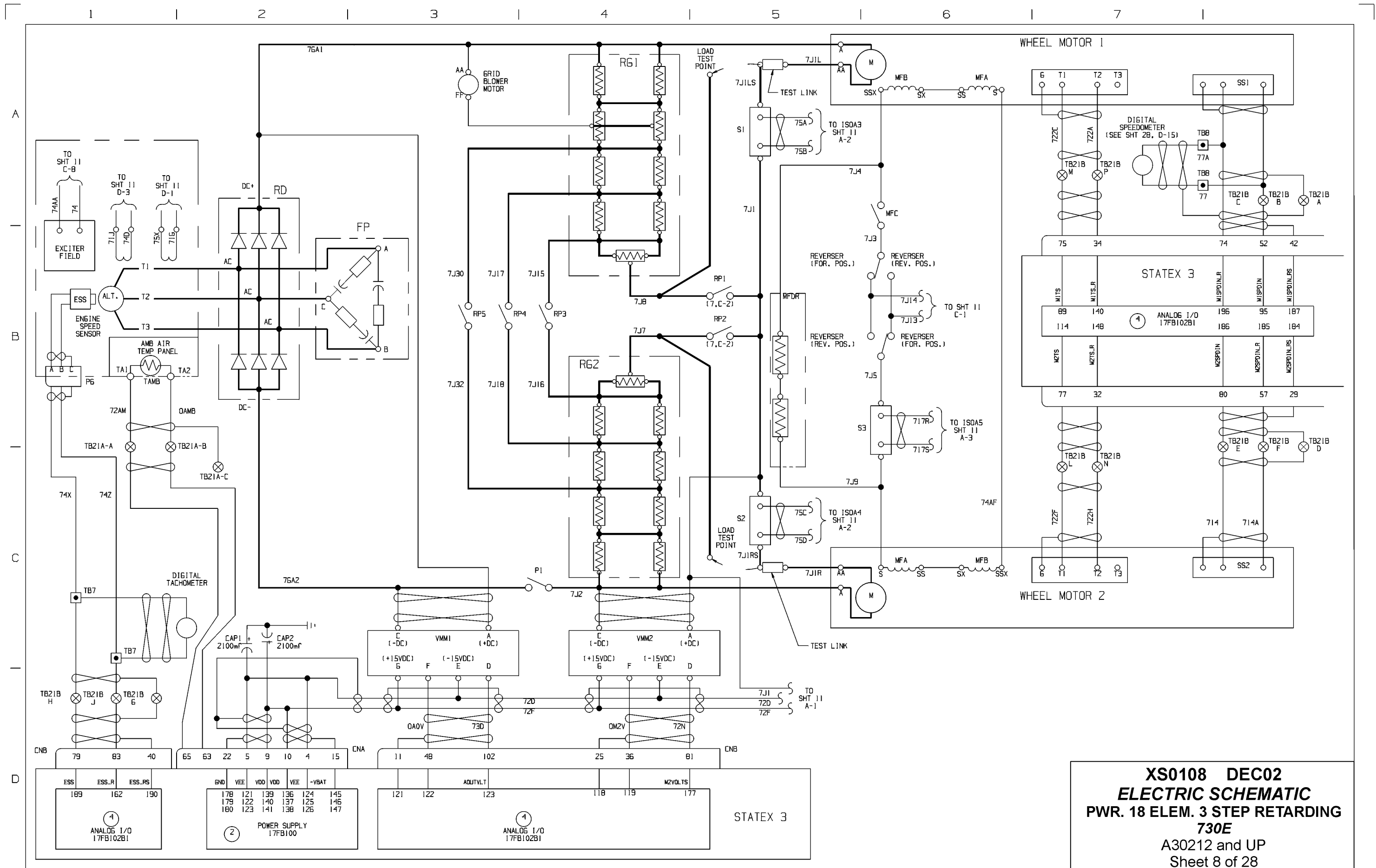


FIGURE 3-5. FILTER ASSEMBLY

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

# NOTES

# NOTES



**XS0108 DEC02**  
**ELECTRIC SCHEMATIC**  
**PWR. 18 ELEM. 3 STEP RETARDING**  
**730E**  
 A30212 and UP  
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