



## Section D: Electrical System

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**MAINTENANCE OR REPAIRS ON EX RATED UNITS SHOULD BE DONE BY AUTHORIZED AND TRAINED PERSONNEL ONLY IN NON-HAZARDOUS LOCATIONS.**

See Section X for EX information



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### I. GENERAL

This section contains information on circuit operation, electrical system troubleshooting, replacement and adjustment of components, and repair instructions for repairable components.

### II. CIRCUIT OPERATION

#### A. Battery

All electrical energy for operating the electrical system is supplied by a storage battery mounted on the truck and connected to the main terminal block through a battery cable connector. The storage battery may be either 12, 24 or 36 volts.

#### B. Drive Motor and Drive Motor Control Circuit

The drive motor is an externally-connected four-pole or six-pole three phase AC motor. Operation of the motor requires that the brake cutout switch be closed since all contactors on the contactor panel depend upon battery current through this switch. The brake cutout switch is mechanically operated by the control handle. The switch is open when the handle is in the vertical or horizontal position and is closed only when the handle is lowered to the operating position. Rotating the throttle control to the "forward" or "reverse" position closes the handle switch which completes the power circuit from the battery to the controller(s) to the drive motor(s).

#### C. Lift and Lower Electric Valve Circuit (when push buttons are used see hydraulics if not)

Pressing in on the Lift momentary contact push-button completes the battery circuit to the Lift solenoid valve raising the load. Pressing in on the lower momentary contact push-button completes the battery circuit to the Lower solenoid valve Lowering the load.

#### D. Horn Circuit

The horn is energized by means of the momentary contact horn push-button switch on the control handle. A fuse is included for protection in the horn circuit.

### III. PREVENTATIVE MAINTENANCE

Please refer to the PREVENTATIVE MAINTENANCE TABLE found at the end of this section for general maintenance checks.

#### A. Battery

Follow the instructions supplied in the battery section.

#### B. Contactor Panel

At least once a month under normal operating conditions, remove the drive unit front cover and inspect and service the contactor panel as outlined below.

1. Blow out the accumulation of dust with compressed air at approximately 40 lbs. psi.
2. Check that all electrical connections are tight. Tighten any loose connections.

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3. Inspect for damage to wiring, contactor coils, timer and resistor such as scorching or burning of insulation due to electrical overloading.
4. Check that all screws and nuts are tight. Tighten loose items.
5. Check and service contactors as follows:
  - a. Darkening of contact tips does not indicate burning. The darkening of the tips is normal. Burning is judged by actual loss of contact material or by droplets of molten contact material being displaced. The contact itself may be used until the contact material has been almost completely worn away; however, it is advisable to replace tips when there is not enough tip material remaining to last until the next regular maintenance check.
  - b. Do not file contact tips for the purpose of removing discoloration or minor surface irregularities. Such action wastes good contact material and produces a contact surface which is susceptible to sticking. Occasionally a core and crater may develop on a pair of tips. To ensure continuous reliability of such contacts, remove the core only with a fine-tooth file. Do not use sandpaper or emery cloth.

### C. Drive Motor & Pump Motor

**Normal Service** –8 hours per day operations, ambient temperature -10°C to 40°C. Ambient conditions must not allow an accumulation of dust, debris or sludge on or in the motor.

**Severe Service** –15 hours or more per day operations or operations in environments such as:

- Dusty or dirty locations like cement plants, mills, mines, food processing plants, etc.
- High temperature areas like steel mills, foundries, etc. or where ambient temperatures are above 40°C or below -10°C.
- Environments with sudden ambient air temperature changes.
- Seaboard environments and environments that regularly see 100% humidity and condensation.

1. At intervals not exceeding three months for normal service, and one month for severe service, remove the drive unit covers and inspect and service the drive motor as follows:
  - a. Check that nothing appears to be burnt or charred
  - b. Check that cables are tight and have not frayed.
  - c. Check that all other connections are tight
2. At intervals not exceeding six months, perform the following additional services to those outlined in preceding paragraph D.1 while drive unit covers are removed:



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- a. Blow out the accumulation of dust from inside the drive motor by directing compressed air nozzle (approximately 40 lbs. psi) into openings in the ends of motor.
- b. Check that all mounting posts are tight and that electrical connections are secure. Tighten any loose parts.

### IV. ELECTRICAL OPERATION TROUBLESHOOTING.

Troubleshooting of electrical operating malfunctions is presented in table D-2.

### TABLE D-2

TROUBLE	PROBABLE CAUSE	REMEDY
Truck will not drive forward.	Discharged battery  Loose electrical connection Between battery and -Terminal Block.  Between terminal Block and -Brake cutout switch. -Contactor panel. -Drive motor.  Between U, V, W cables and -Controller -Motor  Defective brake cutout switch.  Defective drive motor.  Controller Fault	Recharge or replace battery.  Locate and repair electrical connection.      Replace brake cutout switch.  Repair or replace motor.  See Controller Manual
Truck drives in forward but will not drive in reverse.	Defective Reverse switch on control handle.  Loose electrical connection between Reverse switch and -Terminal block.  Controller Fault	Adjust or repair Reverse switch.    Locate and repair loose electrical connection.  See Controller Manual



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TROUBLE	PROBABLE CAUSE	REMEDY
Truck drives in reverse but will not drive in forward.	Defective Forward switch on control handle.	Adjust or repair Forward switch.
	Loose electrical connection between Forward switch -Terminal block.	Locate and repair loose electrical connection.
	Controller Fault	See Controller Manual
Truck drives in forward and reverse at high speed but will not drive at low speed.	Controller Fault	See Controller Manual Contact Customer Service
Truck drives in forward and reverse at slow speed but will not drive at high speed.	Controller Fault	See Controller Manual Contact Customer Service
Pump motor will not operate.	Loose electrical connection between -Battery and terminal block. -Terminal block and raise contactor, motor, or raise switch. -raise contactor & motor.	Locate and repair loose electrical connection.
	Defective raise contactor.	Replace raise contactor.
	Defective raise switch.	Replace raise switch.
	Defective pump motor.	Repair or replace pump motor.
	Controller Fault	See Controller Manual



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TROUBLE	PROBABLE CAUSE	REMEDY
Lower Electric valve does not operate.	Loose electrical connection between -Battery and terminal block. -Terminal block and lower contactor, motor, or lower switch. -Solenoid valve and lower switch.  Defective lower switch.  Defective lower solenoid valve.	Locate and repair loose electrical connection.    Replace lower switch.  Replace lower solenoid valve.
Horn will not sound.	Blown Forward fuse.  Loose electrical connection between -Battery and terminal block. -Terminal block and "F" fuse on HORN switch. -HORN and "F" fuse on HORN switch.  Defective HORN switch.  Defective HORN.	Replace blown fuse. (See Schematic in parts section for ref.)    Replace HORN switch.  Replace Horn.

### V. DRIVE MOTOR & PUMP MOTOR DESCRIPTION

#### A. Drive Motor

The drive motor is of the four-pole or six-pole, three phase AC motor. The output shaft is designed to mount the drive pulley and (when required) a fan. The drive shaft is ball-bearing mounted at both ends. Bearings are permanently lubricated and sealed and require no periodic lubrication.

#### B. Pump Motor

The Pump motor is of the four-pole or six-pole, three phase AC motor. The Motor mounts direct to the Hydraulic Pump. The drive shaft is ball-bearing mounted at both ends. Bearings are permanently lubricated and sealed and require no periodic lubrication.

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### VII. PREVENTATIVE MAINTENANCE CHECKLIST

The following checklist contains information in which preventative maintenance is recommended and can be preformed. When doing your preventative maintenance, **ALWAYS** remember to initiate safety first before starting any maintenance task preformed on this truck.

TROUBLE	AFTER USE	DAILY	WEEKLY	MONTHLY
Check tightness of cables and connections.			X	
Check motors for mounting and connections.			X	
Observe all motors for proper response.		X		
Check motors and all components for overheating.		X		
Inspect points of contactors for overheating or burning.			X	
Check hourmeter for operation.		X		
Check battery for damage and corrosion.			X	
Check battery cables for condition and cleanliness.			X	
Inspect battery for cracks and for leakage.			X	