Section D: Electrical System

Section D: Electrical System

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, 18, 24 or 36 volts.

B. Drive Motor and Drive Motor Control Circuit

The drive motor is an externally-connected four-pole or six-pole DC motor and operates as a series connected 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 control handle grips to the first "forward" position closes the handle switch to complete the battery circuit to contactor. When energized, the contactor completes a circuit from positive battery to motor field terminal S1. Since the contactor remains de-energized, a series circuit is completed through the motor field, resistor RES. and the motor armature, causing the motor to rotate in the counter-clockwise direction as viewed from the output shaft end. When the control handle grips are rotated to the first "reverse" position, handle switch closes, completing the battery circuit to the contactor. The contactor completes a similar series circuit to the motor except that the current flow through the field is reversed, causing the motor to rotate in the clockwise direction. Rotating the handle grips to the second position (either forward or reverse) closes the handle switch 1A which in turn completes the circuit to contactor 1A. Energized, contactor 1A shunts resistor RES, thus allowing full battery voltage to be applied to the series connected motor for maximum forward or reverse speed. The timer provides a slight time delay to prevent lurching and to assure smooth acceleration. If the brake cutout switch opens while the drive motor is running, the circuit to the contactor forward or reverse is opened, causing the contactor to be de-energized to open the drive motor circuit.

C. Lower Solenoid Valve Circuit

Pressing in on the LOWER momentary contact push-button completes the battery circuit to the lower solenoid valve. When energized, the lower solenoid valve allows the hydraulic fluid in the raising cylinder to return to the hydraulic fluid reservoir and thus the truck forks lower. Note that the LOWER push-button switch is effective with the control handle in any position.

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.

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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 by the manufacturer of the battery for care and charging.

B. Drive Motor Control Switch

The drive motor control switch is located under the cover at the top of the control handle and is actuated by the roller grip handles. Remove the handle switch cover for access to these switches.

C. 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.
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.

D. Drive Motor

1. At intervals not exceeding one month, remove the drive unit covers and inspect and service the drive motor as follows:

    a. Remove the band cover from the commutator end of the drive motor.

    b. Lift brush holders and compare length against new brush from stock. If any brush is less than one half the length of new brush, replace all brushes as a set.

c. Check to make sure that the brushes slide freely in brush holders.

d. Check to make sure the force of brush springs against brushes is between 1 pound 4 ounces and 1 pound 12 ounces. Replace brush springs if this requirement is not met.

e. Check the surface of the commutator is smooth with a glossy brown color. If commutator has this appearance, no servicing is required. If commutator is pitted, the reason might be:

(1) Worn brushes.

(2) Brushes not free in brush holders.

(3) Weak brush springs.

(4) Motor has been overloaded.

(5) Operation with insufficiently charged battery.

(6) Loose electrical connections in motor circuit.

(7) Dirty contactor tips.

f. If brushes have been replaced or if commutator is pitted or has other slight surface defects, proceed as follows:

CAUTION

WHEN PERFORMING THE FOLLOWING PROCEDURE, APPLY ONLY ½ to 2/3 OF RATED MOTOR VOLTAGE TO THE DRIVE MOTOR. OPERATION OF THE DRIVE MOTOR AT FULL RATED VOLTAGE WHILE UNLOADED WILL CAUSE THE MOTOR TO OVER SPEED, RESULTING IN SERVICE DAMAGE TO THE MOTOR.

(1) Jack up the rear end of the truck so that the drive wheel clears the floor.

(2) Disconnect the cables from motor terminals. Connect the armature and field in series across a DC voltage source equal to 1/6 to 1/3 rated motor voltage.

(3) With motor running, stone the commutator until the surface is clean and bright and the brushes are completely seated as evidenced by little or no sparking between brushes and commutator. Do not use emery cloth to clean the commutator.

(4) Disconnect voltage source from motor and reconnect cables to motor terminals.

(5) Remove jack from rear end of truck.

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:

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.

E. Pump Motor and Pump Motor Contactor

Disassembly of the pump motor for inspection of brushes and commutator condition is recommended each time the hydraulic pump and reservoir are serviced. Refer to the disassembly and reassembly instructions in this section.

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	Recharge or replace battery.
	Loose electrical connection between battery and terminal block.	Locate and repair electrical connection.
	Between terminal block and -Brake cutout switch. -Contactor panel. -Drive motor.	
	Between resistor RES and motor.	
	Defective brake cutout switch.	Replace brake cutout switch.
	Defective drive motor.	Repair or replace motor.
Truck drives in forward but will not drive in reverse.	Defective “R” switch on control handle.	Adjust or repair “R” switch.
	Defective “R” contactor on contactor panel.	Repair or replace “R” contactor.
	Loose electrical connection between “R” contactor and -Terminal block. -Motor. -Resistor RES.	Locate and repair loose electrical connection.

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TROUBLE	PROBABLE CAUSE	REMEDY
Truck drives in reverse but will not drive in forward.	Defective “F” switch on control handle. Defective “F” contactor on contactor panel. Loose electrical connection between “F” contactor and -Terminal block. -Motor. -Resistor RES.	Adjust or repair “F” switch. Repair or replace “F” contactor. Locate and repair loose electrical connection.
Truck drives in forward and reverse at high speed but will not drive at low speed.	Defective 1A contactor. Defective resistor RES. Defective 1A switch on control handle.	Repair or replace 1A contactor. Replace resistor RES. Adjust or replace 1A switch.
Truck drives in forward and reverse at slow speed but will not drive at high speed.	Loose electrical connection between contactor panel 1A and -Brake cutout switch. -Control handle 1A Switch. -Resistor RES. -Timer. Defective 1A switch on control handle. Defective timer. Defective 1A contactor.	Locate and repair loose electrical connection. Adjust or replace 1A switch. Replace timer. Repair or replace 1A contactor.
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. Defective RAISE contactor. Defective RAISE switch. Defective pump motor.	Locate and repair loose electrical connection. Replace RAISE contactor. Replace RAISE switch. Repair or replace pump motor.

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TROUBLE	PROBABLE CAUSE	REMEDY
LOWER solenoid 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 “F” 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. Replace HORN switch. Replace Horn.

V. DRIVE MOTOR REPAIR AND OVERHAUL.

A. General

The drive motor is of the four-pole or six-pole, externally series-connected DC type. Voltage may be either 12, 18, 24 or 36 volts depending on the internal design of the motor. The output shaft is designed to mount the drive pulley and (when required) a fan. The armature shaft is ball-bearing mounted at both ends. Bearings are permanently lubricated and sealed and require no periodic lubrication.

NOTE - Disassembly of the drive motor is not recommended because of the special service facilities needed for satisfactory repair. Service exchanges for the drive motor and the drive motor armature are available from your dealer.

B. Drive Motor Disassembly

Clean the exterior of the drive motor thoroughly to remove dust, dirt, and foreign matter. Next, disassemble only as far as necessary to accomplish repair as described in the following procedure. (See figure D.4).

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1. Loosen screw and nut then slide cover band off commutator end of motor.
2. Take out screws and lock washers. Then remove brushes from brush holders in commutator end head assembly.
3. Remove the brush springs from brush holder in commutator end head assembly.
4. Scribe match marks on drive end head, commutator end head assembly and motor frame to aid in reassembly.
5. Remove screws which secure commutator end head assembly to motor frame. Separate commutator end head assembly from motor frame by tapping lightly with a mallet if required to loosen.
6. Remove spring washer from bearing recess in commutator end head assembly.
7. Remove screws which secure drive end head to motor frame. Separate drive end head from motor frame by tapping lightly with a mallet if required to loosen parts.
8. Withdraw armature from the motor frame. Use a bearing puller to pull ball bearings from shaft of armature.
9. Remove nuts, lock washers, plain washers, shake proof washers, and insulated washers from studs of connector and stud assemblies. Then withdraw connector and stud assemblies from inside of motor frame. Remove bushings, insulating washers, and shake proof washers from studs on connector and stud assemblies.
10. Remove nuts, lock washers, plain washers, shake proof washers and insulating washers from field studs. Remove field studs from inside motor frame and remove bushings, insulating washers, and shake proof washers from field studs.
11. Remove insulator from inside motor frame.
12. Remove pole shoe screws from motor frame, and withdraw field coil package with pole shoes (not shown) from inside motor frame. Do not disconnect field coil package.

C. Parts Cleaning

1. Remove as much dirt and foreign matter from parts as possible with compressed air (40 lbs. psi.).
2. Wipe remaining dirt and foreign matter from parts with a cloth moistened with cleaning solvent. Do not wet armature or field windings with solvent.
3. Check field coils for continuity and for resistance when connected as shown in the following chart.

FIELD CONNECTIONS	MOTOR DESIGN VOLTAGE	RESISTANCE (OHMS)
	12	S1 TO S2: 0.0062-0.0070
	14	S1 TO S2: 0.0076-0.0086

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4. Check armature on a growler for opening and shorted windings. Also check for charred or burnt insulation as evidence of damage from overheating.

5. Inspect commutator on armature for grooving, pitting, scoring, metallic slivers between segments, and for evidence of solder having been thrown from connections.

6. Inspect brush springs for distortion or loss of tension due to overheating. Check brush springs for proper tension during reassembly as described in assembly instructions.

7. Inspect brushes for excessive wear, for burnt shunts, and for security of shunts and terminals. Also check that brushes slide freely in brush holders in commutator end head assembly.

8. Inspect connector and stud assemblies for frayed insulation, security of terminal studs and for damage due to overheating.

9. Inspect brush holders in commutator end head assembly for distortion or other damage.

10. Inspect field coil assemblies for frayed wrapping and for damage to winding insulation due to overheating.

11. Inspect bearing mounting surfaces on armature and bearing bores in drive end head and commutator end head assembly for scoring, wear and other damage due to bearing failure.

12. Inspect ball bearings for corrosion. Inspect for damage to the inner and outer races which would prevent good fit-up during reassembly. Also check bearings for roughness by holding inner race lightly between fingers on one hand and slowly rotating outer race with fingers on the other hand. Check for discoloration of races as evidence of overheating.

D. Repair and Replacement of Drive Motor Parts

1. Replace all parts that are distorted or cracked or that have been damaged due to overheating.

2. Replacement of both ball bearings at each reassembly is recommended. However, bearings that have been subjected to limited service may be reused if they pass the inspection requirements stated in preceding paragraph C.12.

3. Repair minor damage to field coil wrapping by rewrapping damaged or frayed areas with glass fiber tape and applying electrical insulating varnish to the repair areas. Do not attempt this repair if wire of field coils has been damaged.

4. Replace connector and stud assemblies if damaged in any way.

5. Replace brushes if worn to less than 9/16 of an inch in length or if shunts are damaged.

6. Repair minor thread damage with tap or thread chaser.

7. If required, true up commutator on armature by chucking armature in a lathe. Do not remove more metal from commutator than necessary to produce a smooth, bright, continuous surface on all segments. Commutator requirements after turning and undercutting requirements are shown in the following chart. Clean all chips from between segments.

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MTR	MIN. DIA. (IN.)	MAX. SURFACE ROUGHNESS (MICRO INCHES)	UNDERCUTTING	
			DEPTH (IN.)	WITH OF SAW (IN.)
	2.750	50	1/32	0.025

E. Assembly and Testing.

1. Insert pole shoes in field coils and install in motor frame. Secure pole shoes with screws.
2. Insert insulation into motor frame.
3. Place shake proof washers on field studs and insert field studs through terminals on field coil assembly. Then apply insulating washers on field studs, and insert studs through holes in motor frame. Place an insulating bushing on each field stud, and complete installation with insulating washers, shake proof washers, plain washers and one nut. Tighten nut securely. Install one split lock washer and one nut on each terminal stud.
4. Place shake-proof washers and insulating washer on stud of each connector and stud assembly. Assembly connector and stud assemblies in motor frame. Apply insulating bushings to studs; then install insulating washer, shake proof washer, plain washer and one nut on each stud. Tighten nuts securely. Install one split lock washer and one nut on each stud.
5. Press ball bearings on shaft of armature until they bear against shoulders.
6. Place spring washer in bore of commutator end head assembly. Then assemble commutator end head assembly on commutator end of armature.
7. Work the free ends of connector and stud assemblies out through rectangular openings in motor frame, then insert armature into motor frame and align match marks on motor frame. Secure commutator end head assembly to motor frame with screws.
8. Install drive end head on other end of motor frame (with match marks aligned) and secure with screws.
9. Check that the armature rotates freely without any evidence of binding. If binding is detected, determine the cause of the binding and correct the trouble before proceeding.
10. Insert brushes into brush holders and install brush springs.
11. Attach shunts of brushes and ends of connection and stud assemblies to the brush holders with screws and washers.
12. Using a spring balance, check the force of each brush spring against the associated brush by slowly applying force to ends of brush springs that bear on brushes. At the point where the end of the spring just raises off the brush, spring balance should read 1 pound 6 ounces to 1 pound 10 ounces.

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CAUTION

DO NOT APPLY MORE THAN 2/3 OF RATED VOLTAGE TO MOTOR UNLESS MOTOR HAS A LOAD APPLIED. MOTOR WILL OVER SPEED IF OPERATED AT RATED VOLTAGE WITHOUT A LOAD, RESULTING IN SEVERE DAMAGE.

13. With motor securely clamped to a bench, apply 2/3 of rated voltage to terminals through a reversing switch as shown in figure D.5. Check the motor rotation is clockwise as viewed from the shaft end when field terminal S2 is positive. Stop the motor and reverse the field connection with the reversing switch. Check that the rotation is now counterclockwise.

14. Lightly stone commutator if excessive sparking is noted between brushes and commutator.

15. After completing the above, disconnect leads from motor terminals.

16. Install cover band (figure D.4) on motor frame with screw and nut.

CAUTION

DURING THE FOLLOWING PROCEDURE, DO NOT ALLOW MOTOR TO OPERATE AT RATED VOLTAGE WITHOUT TORQUE LOADING. MOTOR WILL OVER SPEED AND MAY BE SEVERELY DAMAGED.

17. Install a drum on the motor shaft and clamp motor securely to bench top. Apply a torque arm to the drum (Figure D.6). The torque arm must be capable of applying increasing load to the drum. Connect motor electrically as shown in figure D.6. The motor performance characteristics must be as shown in figure D.6.

18. After completing the test above, disconnect the leads from the motor and remove drum from the motor shaft.

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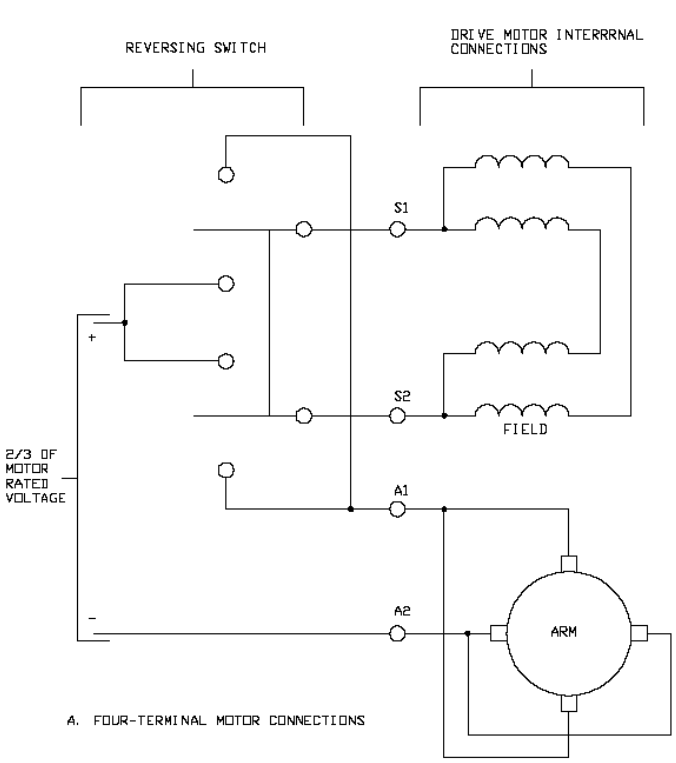
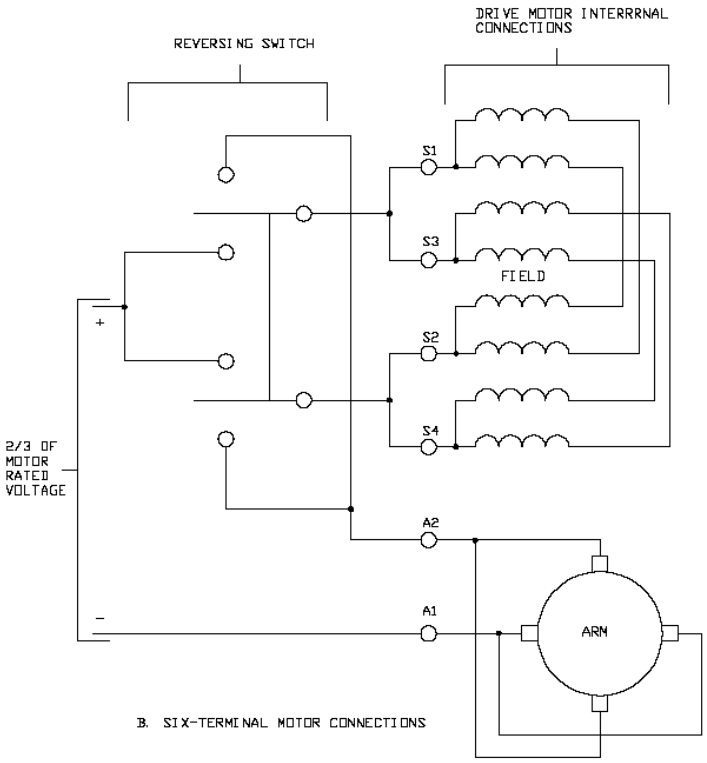
FIGURE D.5
Set-up for Checking Drive Motor Rotational Direction



A. FOUR-TERMINAL MOTOR CONNECTIONS



B. SIX-TERMINAL MOTOR CONNECTIONS

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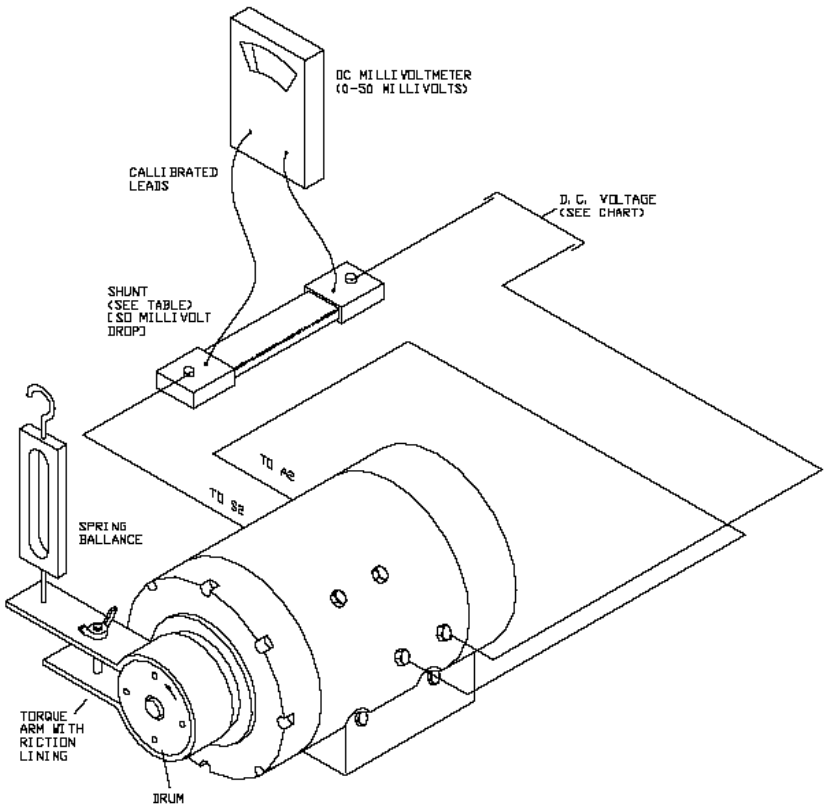
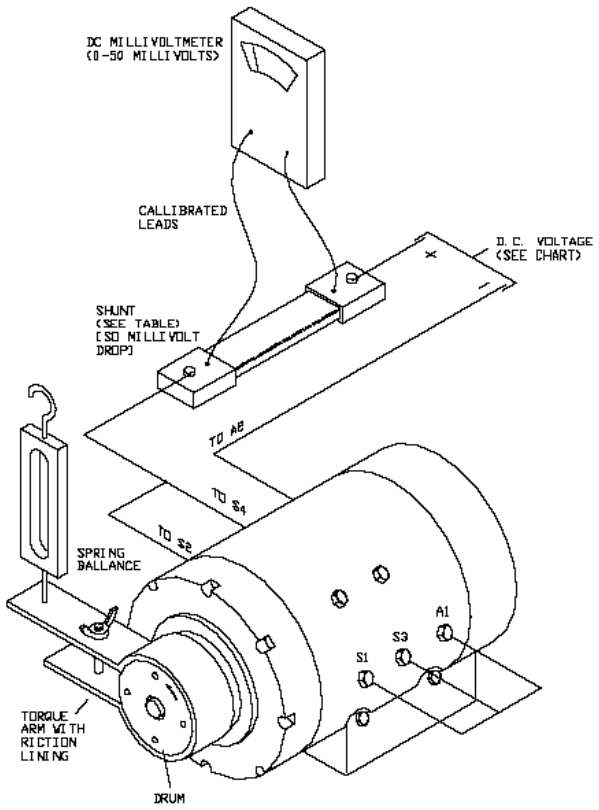
FIGURE D.6
Set-up For Testing Drive Motor



A. FOUR-TERMINAL MOTOR TEST CONNECTIONS



B. SIX-TERMINAL MOTOR TEST CONNECTIONS

MTR TYPE	TYPE OF TEST	SHUNT RATING	APPLIED VOLTAGE	CURRENT DRAW (MAX. AMPS)	RPM	TORQUE (FT. LB. MIN.)
MEA	NO LOAD	100	12	31	3,400 MIN.	0
	LOAD	100	23	69	3,400-3770	2.0
MJO	NO LOAD	100	12	30	3,300 MIN.	0
	LOAD	100	10.68	70	1,590-1,770	2.0
MKA	NO LOAD	100	24	80	4,200 MIN.	0
	LOAD	100	18.5	160	1,700-2,200	3.5

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VI. PUMP MOTOR REPAIR AND OVERHAUL.

A. General

The pump motor is of the four-pole, internally series connected DC type. Voltage may be either 12 or 24 volts. Electrical systems rated at 18 volts are equipped with 24-volt pump motors. The pump motor output shaft is slotted to receive a coupling through which the pump motor drives the hydraulic pump. The ball bearing on the output end of the shaft is normally supported in the hydraulic pump adapter which is part of the hydraulic unit assembly. Therefore, the pump motor cannot be operated unless it is mounted on the pump adapter. The commutator end of the motor shaft is supported by a sleeve-type bearing in the head assembly. **NOTE**: - Disassembly of the pump for purposes other than inspection and replacement of brushes and bearing is not recommended because of the special facilities needed for satisfactory repair. Service exchanges for the pump motor and the pump motor armature are available from your dealer.

B. Pump Motor Disassembly

Clean the exterior of the pump motor thoroughly to remove dust, dirt, and foreign matter. Next, disassemble only as far as necessary to accomplish repair as described in the following procedures (see figure D.7). Do not attempt to disassemble beyond the point described in the following procedure.

1. Pull out thru bolts and lock washers.
2. Withdraw head assembly from motor frame.
3. Pull out pins and remove brush holders and brush springs from motor frame.
4. Remove screws securing brushes to brush holders and separate brushes from brush holders.
5. Withdraw armature from motor frame; then remove ball bearing, spacers and thrust washer from armature shaft.
6. Take out screws and lock washers. Then remove nuts, lock washers, plain washers, insulator washers, bushings, insulator washer, terminals and lead assembly from motor frame.
7. Remove screws; then withdraw field coil assembly and insulation from motor frame. Separate pole shoes (not shown) from field coil assembly. Do not disconnect field coil assembly.

C. Cleaning Parts

1. Remove as much dirt and foreign matter as possible with compressed air (approximately 40 lbs. psi.).
2. Wipe remaining dirt and foreign matter from parts with a cloth moistened with cleaning solvent. Do not wet armature or field windings.

D. Parts Inspection and Replacement

1. Inspect motor frame, bushings, insulator washers, and head assembly for cracks and distortions.
2. Inspect all threaded parts and tapped holes for stripped threads or other damage.

3. Check fields coils for continuity and for resistance as shown in the following chart:

MOTOR TYPE	FIELD COIL RESISTANCE (OHMS)	
	SERIES	SHUNT
MFD	.146 +/- 10%	2.240 +/- 10%
MBD	.0045 +/- 10%	----------
MDY	.003 +/- 10%	1.156 +/- 10%
ML	.0021 +/- 10%	----------

4. Check armature on a growler for openings and shorted windings. Also check for charred or burnt insulation as evidence of damage from overheating.

5. Inspect commutator on armature for grooving, pitting, scoring, metallic slivers between segments, and for solder slinging as evidence of overheating. Normal appearance of commutator is a smooth glossy brown color.

6. Inspect brush springs for distortion, or loss of tension due to overheating.

7. Inspect brushes for excessive wear.

8. Inspect head assembly for frayed insulation, security of terminals, and for damage due to overheating.

9. Inspect brush holders for distortion or other damage.

10. Inspect field coil assembly for frayed wrapping and for damage to wire insulation due to overheating.

11. Inspect plain end of shaft on armature for scoring, grooving or wear of bearing surface, and for nicks, scratches, and burrs.

12. Inspect ball bearing for corrosion of races. Inspect for damage to inner and outer races which would prevent good fit-up and alignment during reassembly. Also check bearing for roughness by holding inner race lightly with the fingers on one hand and slowly rotating the outer race with tips of fingers on other hand. Check also for discoloration of races as evidence of overheating.

13. Insert end of shaft of armature into sleeve bearing in head assembly, and check for wear. Shaft should turn freely in bearing with only perceptible clearance.

E. Repair and Replacement of Pump Motor

1. Replace all parts that are distorted, worn, cracked, or that have been damaged by overheating.

2. Replacement of ball bearing is recommended at each reassembly. However, a bearing that has been subjected to only limited service may be reused if it passes the inspection requirements state in preceding paragraph D.12.

3. Repair minor damage to field coil wrapping by rewrapping damage or frayed area with glass fiber tape and applying electrical insulating varnish to the repair. Do not attempt this repair if wire of field coils have been damaged.

4. Replace the lead assembly if damaged in any way.
5. Replace brushes if worn to less than a 3/8 of an inch in length.
6. Replace brush springs if distorted or heat damaged.
7. Repair minor thread damage with a tap or thread chaser.

F. Assembly and Testing.

1. Insert pole shoes into field coil assembly. Install field coil assembly and insulation into motor frame and secure with screws.
2. Place lead assembly in motor frame.
3. Place insulator washer on each terminal and insert terminals through square holes in motor frame from inside. Install bushings, insulator washer, plain washers, nuts, and lock washers on terminals. Tighten nuts next to washers securely.
4. Connect terminals on the lead assembly and field coil assembly to terminals with screws and lock washers.
5. Place spacers on the shaft of armature. Then press ball bearing onto the shaft until it bears against shoulder.
6. Place thrust washer on the shaft of armature.
7. Insert the armature into the frame and field coil assembly.
8. Attach terminals of the lead assembly and the brushes to brush holders and secure brush holders and brush springs in the motor frame with pins. Check that the brushes ride squarely and evenly on commutator or armature.
9. Place head assembly motor frame and insert thru bolts with lock washers through head assembly and motor frame.
10. Align pump adapter on the output end of motor frame and secure with thru bolts.
11. Insert a thin strip of wood or plastic into slot in the end of motor armature, and check that the armature rotates freely. If binding or dragging is detected, disassemble the motor and correct the trouble before proceeding.

CAUTION **WHEN PERFORMING THE FOLLOWING PROCEDURES, DO NOT APPLY VOLTAGE HIGHER THAN 2/3 OF RATED MOTOR VOLTAGE. OPERATING THE PUMP MOTOR AT RATED VOLTAGE WITHOUT LOAD MAY CAUSE SEVERE DAMAGE DUE TO OVER SPEED.**

12. Connect a DC source equal to 2/3 the motor rated voltage to motor terminals S (positive) and A (negative) when viewing from pump adapter end. Check that motor armature rotates in counterclockwise direction. Also check for any unusual noises such as brush noise or bearing whine. Correct any problems that are detected.

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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 motor brushes for wear and spring tension.				X
Check motors for mounting and connections.			X	
Observe all motors for proper response.		X		
Check motors and all components for overheating.		X		
Inspect motor commutators.				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	