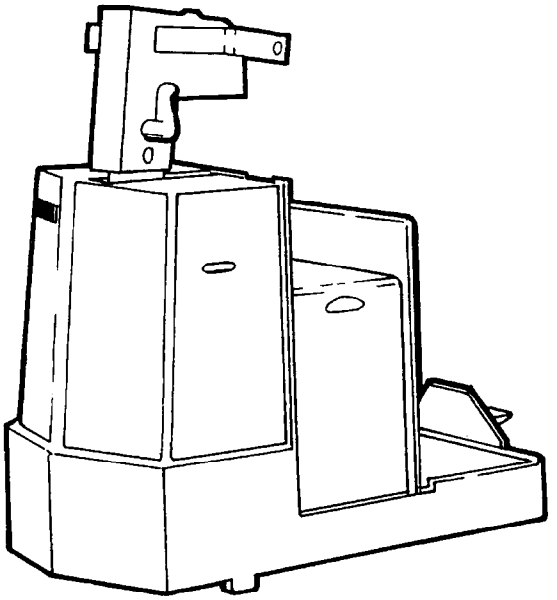
# SM-614
# PWC 30, PWT 7
# Service Manual



Technical
Publications
Lexington, KY
40508

# RECORD KEEPING

Model & Serial No._____ Stock No._____

Date Placed in Service_____

# PWC MAINTENANCE SCHEDULE

| Period | Time | Function |
|---|---|---|
| **Daily** | | |
| - | - | Check water level in battery. |
| - | - | Check oil level transmission. |
| - | - | Check all wheels and tires. Remove any and all tape, plastic and material. |
| - | - | Check operation of truck steering and speed change including all warning and safety devices (if equipped), horn, speed limit switch, lift limit switches, lights. Ensure that unit lifts and lowers properly. |
| - | - | Check brake operation and stopping distance (approx. the length of the truck including forks, unloaded). |
| - | - | Check oil levels and insure unit has been greased. Check hydraulic tank with load carrying device (forks) fully lowered. Check for and correct any leaks. |
| **Weekly** | **100 Hours** | |
| - | - | Check speed of truck and plugging distance (PMC/SCR only). |
| * | * | Check brake linkage, adjust as necessary. Lubricate pivot points, see lubrication chart (located in Service Information Section). |
| - | - | Check entire truck for loose items, power and control wiring, linkage, nuts and bolts. |
| - | - | Clean battery terminals of corrosion. Check electrolyte level. Inspect plug and battery cables. |
| - | - | Clean and inspect motor brushes. Use only low pressure air or vacuum. |
| - | - | Check all hydraulic hoses and fittings for wear or leaks, repair as required. |
| - | - | Inspect contact tips. |
| - | - | Clean any and all dirt or corrosion from terminal area of PMC Controller units. |
| **30 Days** | **200 Hours** | |
| - | - | Check steerhead bearing for wear. |
| * | * | Lubricate entire truck see lubrication chart (located in Service Information Section, for type and points). |
| - | - | Check safety devices, horn, alarms (if equipped), lift limit switch and slow speed adjustment. Repair or adjust before truck goes back into operation. |

# BATTERY CARE AND SERVICE

**The Chemical Reaction (cont'd.)**

During cell discharge, Lead Peroxide and Sponge Lead combine with sulfuric acid to form Lead Sulfate (Pb $SO_4$) on both plates (See Fig. 3). This action decreased cell voltage as the two electrodes approach being of the same chemical composition (Lead Sulfate). As the sulfuric acid is removed from the electrolyte solution the specific gravity of the electrolyte decreased and approaches the specific gravity of water (See Fig. 4). The discharged cell will have a voltage potential of approximately 1.75 volts.

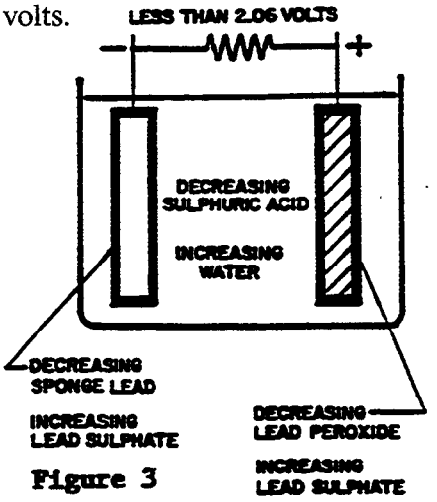


Figure 3

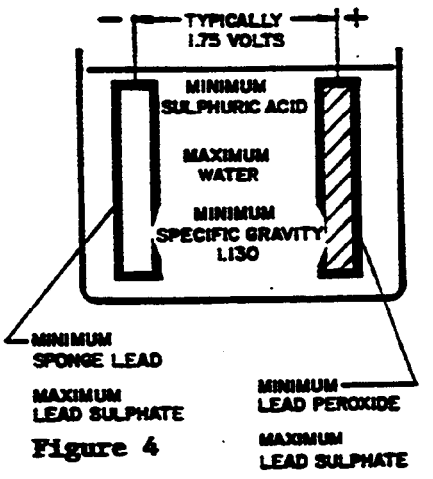


Figure 4

When charging current is applied to a discharged cell (as shown if figure 5) the Lead Sulfate is broken up, the active materials are restored to their respective plates and the electrolyte again becomes a sulfuric acid solution. Cell voltage rises as the two elements become increasingly different in composition. The specific gravity of the electrolyte increases as more and more is formed.

Once again we have a fully charged cell, the positive electrode is Lead Peroxide, the negative electrode is Sponge Lead and the electrolyte is a sulfuric acid solution.

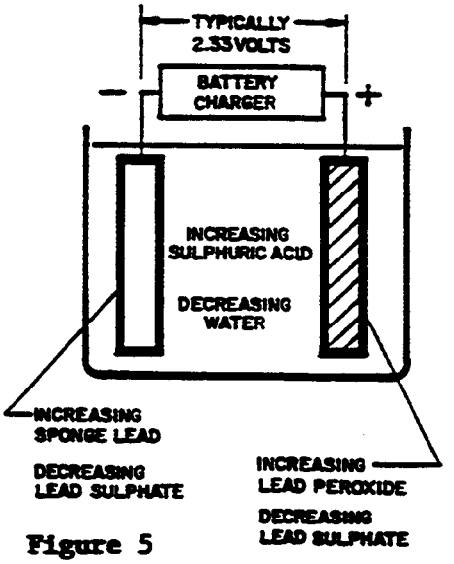


Figure 5

# BATTERY CONTROLLER

**What The Gage Measures (cont'd.)**

When the truck does heavy work consisting of a lot of lifting and little driving, the gage will not permit as much total energy to be removed from the battery as when the truck does light work.

This will be evidenced in two ways:
1. Lockout will occur sooner.
2. The specific gravity of the battery at lockout will be higher.

Only when the occurrence of lockout interferes with the work schedule should adjustments be made. This should be done in consolation with the truck supplier and the battery supplier to insure the equipment is not damaged and warranties invalidated.

Precise details of when to adjust and how to adjust are given later.

**Troubleshooting**

Equipment Needed:

Digital Voltmeter with better than .5% accuracy
Curtis 1142 2048 tester
1141 FasTesT Accessory (Optional - speeds up discharge testing from 30 minutes to 1 minute.

Description and hookup of the 1141 and 1142 are on the attached data sheet.

**Symptom:** Gage does not reset to full with a freshly charged battery.

Check battery voltages across controller terminals 1 and 8. No current should be flowing from the battery at the time. If voltage is greater than 25.3 volts for 24 volt butteries or 38 volts for 36 volt batteries, gage should rest.

Before replacing controller, check that reset pot is at B. If not, set to B, disconnect the battery for 15 seconds and reconnect. If reset is not, achieved replace controller.

If battery voltage is less than the values above, the following problems can exist:

a. Battery needs to have sulfuric acid added to it.
b. Insufficient time on the charger to bring the battery up.
c. Charger malfunctioning.
d. Battery has shorted cells.

While corrective action is being taken, the battery still can be used but with reduced capacity and shorter work time on the floor.

# PAINT & DECAL
## PWC

| ITEM NO. | PART NO. | DESCRIPTION | QTY. |
|---|---|---|---|
| | 38693-900 | Standard Paint & Decal | |
| | 38693-901 | Fixed Steerhead Paint & Decal | |
| | 38693-902 | Tilt Steerhead Paint & Decal | |
| 1 | 39250-004 | Decal, 24V Only | 1 |
| 5 | 39065-005 | Non-Skid Matting | 2 |
| 6 | 97836-10K00-F1 | Decal, Warning (Pinch Point) | 2 |
| 7 | 39250-006 | Decal, Clark | 1 |
| 11 | 27607-001 | Rivet (use additional qty. of 6 on Fixed Steerhead) | 4 |
| 12 | * | Serial Number & Capacity Plate | 1 |
| 13 | 39241-000 | Decal, Warning (Operator) | 1 |
| 14 | 27763-011 | Anti-Fatigue Matting | 1 |
| 15 | 39250-001 | Decal, USA Flag | 1 |
| 16 | 15817-013 | Sponge Rubber Knee Pad | 1 |
| 17 | 15817-011 | Sponge Rubber Knee Pad | 1 |
| 18 | 39245-000 | Decal, Warning (Do Not Tilt, use on Tilt Steerhead) | 1 |
| 19 | 39244-000 | Decal, Warning (Apply Parking, use on Tilt Steerhead) | 1 |
| 20 | 39247-000 | Decal, Warning (Caution, use on Tilt Steerhead) | 1 |
| 21 | 39250-003 | Clark Logo Plate | 1 |
| 22 | 12485-092 | Key Switch Nameplate (use on Fixed Steerhead) | 1 |
| 23 | 11434-015 | Reverse Switch Nameplate (use on Fixed Steerhead) | 1 |
| 24 | 11434-038 | Horn Switch Nameplate (use on Fixed Steerhead) | 1 |
| 25 | 39243-000 | Decal, Caution Polartiy | 1 |
| 26 | 39409-000 | Decal, Warning (Battery Gate) | 4 |
| 27 | 39430-000 | Decal, Control Function | 1 |
| 28 | 39801-000 | Rubber Strip | 1 |
| 29 | 6183-000 | Nameplate, Lift/Lower (use on Fixed Steerhead) | 1 |
| 31 | 39323-000 | Nameplate, UL - ES Rated Trucks (use additional qty. of 4 of Item # 11) | 1 |
| 32 | 96917-L4000-F1 | Decal, ES Rated Trucks | 2 |
| -- | * | Black Paint | AR |
| -- | * | Green Paint | AR |

*Consult Factory with Model and Serial Number.

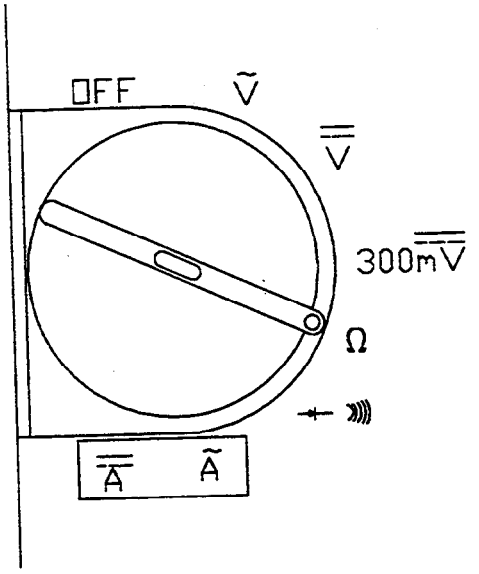
# BASIC TEST (TOOLS) EQUIPMENT IN TROUBLESHOOTING

On the following pages, proper use of the Simpson VOM and Handyman Component Tester is presented. Proper use of the Electric Vehicle System Analyzer has been presented at the end of each section on component identification.

CLARK stresses that the minimum test equipment to properly troubleshoot an Electric Forklift would consist of:

1) A high quality Volt-OHM-Current meter as the Simpson VOM or Fluke Multimeter.
2) A Handyman Component Tester.
3) AMP Meter or Stunt.

## ROTARY SWITCH



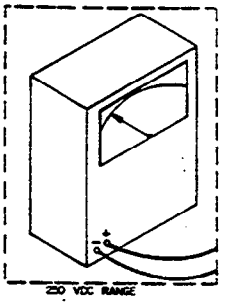

To turn the meter on, turn the rotary switch from the OFF position. The meter performs a selftest, then starts taking readings.

| Function | Red Lead | Description/Input Limits |
|---|---|---|
| V~ | V Ω →\|— | Volts AC-750V ac |
| V⎓ | V Ω →\|— | Volts DC -1000V dc |
| mV⎓ | V Ω →\|— | Millivolt-500V dc or rms ac |
| Ω | V Ω →\|— | Ohms resistance-500V dc or rms ac |
| →\|— ))))) | V Ω →\|— | Continuity with beeper-500V dc or rms ac |
| A~ | 10A | Amps AC-10A/600V (20A < 30 sec) |
| A⎓ | 300mA | Amps DC -320 mA/250V |

# HANDYMAN COMPONENT TESTER

## SCR BLOCKING VOLTAGE (LEAKAGE) TEST DIODE REV.

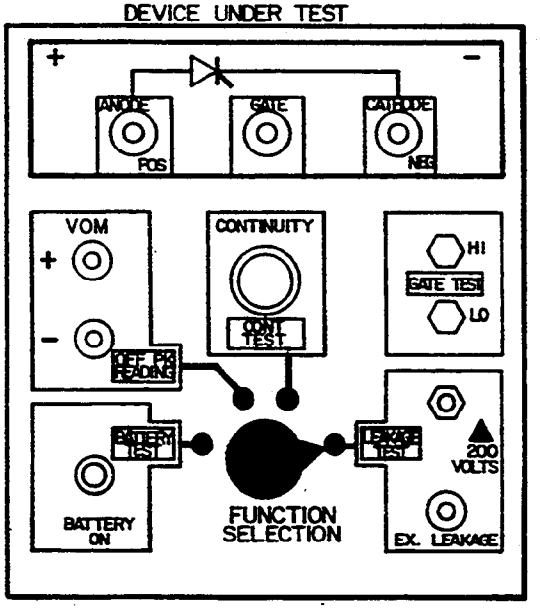
VOM-OPTIONAL




VOM MEASURES TEST VOLUME

FUNCTION SELECTOR IN "LEAKAGE" TEST POSITION

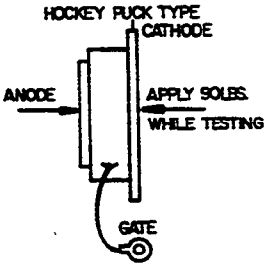
DEVICE UNDER TEST

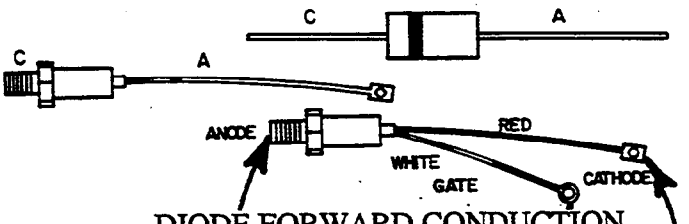



**- IMPORTANT -**
SOME STUD TYPE DIODES HAVE THEIR ANODE AND CATHODE REVERSED. SUFFIX "R" IN PART NO.

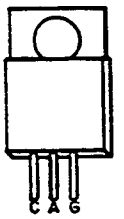
PRESS LEAK TEST BUTTON MOMENTARILY, APPLIES 200V.

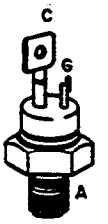
LED INDICATOR SHOWS LEAKAGE IN EXCESS OF 1 MA



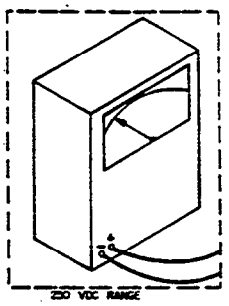




DIODE FORWARD CONDUCTION




VOM MEASURES "ON" VOLTAGE

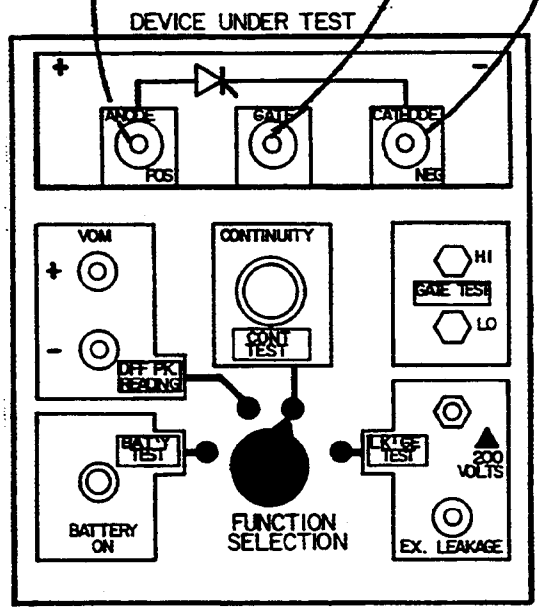



2.5 VDC RANGE GOOD SCR'S WILL RANGE BETWEEN 0.6 & 1.5V

FUNCTION SELECTOR IN "CONTINUITY" TEST POSITION

SWITCH FUNCTION SELECTOR MOMENTARILY TO OFF/PEAK READING AND THEN BACK TO REPEAT TEST

DEVICE UNDER TEST




**- IMPORTANT -**
SOME STUD TYPE DIODES HAVE THEIR ANODE AND CATHODE REVERSED. SUFFIX "R" IN PART NO.

"CONTINUITY" LAMP SHOWS PROPER FIRING AND HOLDING OF SCR

PRESS GATE TEST BUTTONS TO FIRE SCR AND CHECK

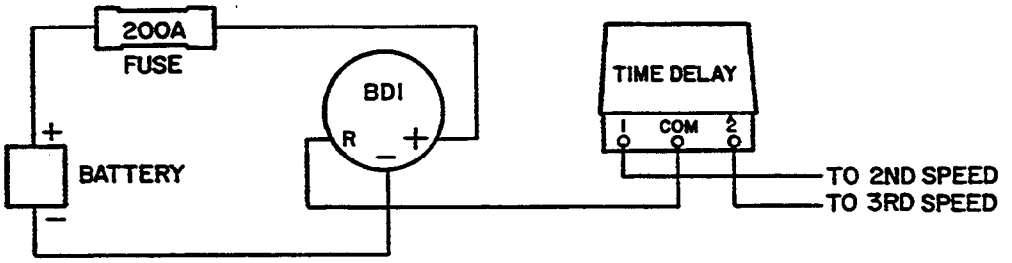
TEST ALL SCR'S USING"LO" GATE TEST BUTTONS

SOME LARGER SCR'S ONLY MAY REQUIRE USING "HI" GATE TEST BUTTON TO FIRE

# BASIC OPERATION FOR PWT
# RESISTOR CONTROL CONTACTOR

**B.D.I. Speed Control Option**

One of the most common options is to use a Battery Discharge Interrupt to cut the speed of the unit when the battery voltage is lower than 80%. The simple diagram below shows how a battery discharge interrupt meter can be used to cut out the battery negative (-) lead to the speed time delay. This then cuts both 2nd and 3rd speed from turning on. Please note that this is only the most common type of speed interrupt and you should always refer to your units Parts Manual for the correct assembly used.



## PWT 7 24V POWER WIRING 3 SPEED RESISTOR, W/EV-1 FWD./REV. CONTACTORS & TILT OR FIXED STEERHEAD

| ITEM NO. | PART NO. | DESCRIPTION | QTY. |
|---|---|---|---|
| 1 | 8268-000 | SB-2 Connector | 1 |
| 2 | 7028-008 | 1/4-20 x 1.50" Lg. Hex Head Bolt | 2 |
| 3 | 7000-009 | 1/4 Lock Washer | 12 |
| 4 | 7001-001 | 1/4-20 Hex Nut | 2 |
| 5 | 39069-001 | Standoff Resistor | 6 |
| 6 | 39080-005 | Resistor (Use Qty. 2 on PWT 7) | 1 |
| 7 | 7162-005 | 1/4 Flat Washer | 10 |
| 8 | 7028-004 | 1/4-20 x .75" Lg. Hex Head Bolt | 2 |
| 9 | 7028-005 | 1/4-20 x .88" Lg. Hex Head Bolt | 6 |
| 14 | 27732-031 | Buss Bar | 1 |
| 15 | 29000262-000 | 200 Amp Fuse | 1 |
| 23 | 7028-002 | 1/4-20 x .50" Lg. Hex Head Bolt | 2 |
| 50 | 7000-010 | 5/16 Lock Washer | 4 |
| 52 | 39080-001 | Resistor (Used Only on PWT 7) (Fast Resistor) | 1 |

## PWT 7 24V POWER WIRING 3 SPEED RESISTOR, W/EV-1 FWD./REV. CONTACTORS & TILT OR FIXED STEERHEAD

| ITEM NO. | PART NO. | DESCRIPTION | QTY. |
|---|---|---|---|
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| 3 | 7000-009 | 1/4 Lock Washer | 12 |
| 4 | 7001-001 | 1/4-20 Hex Nut | 2 |
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# SERVICE GUIDE
# FOR PMC CONTROL (1204/1205/1209B)

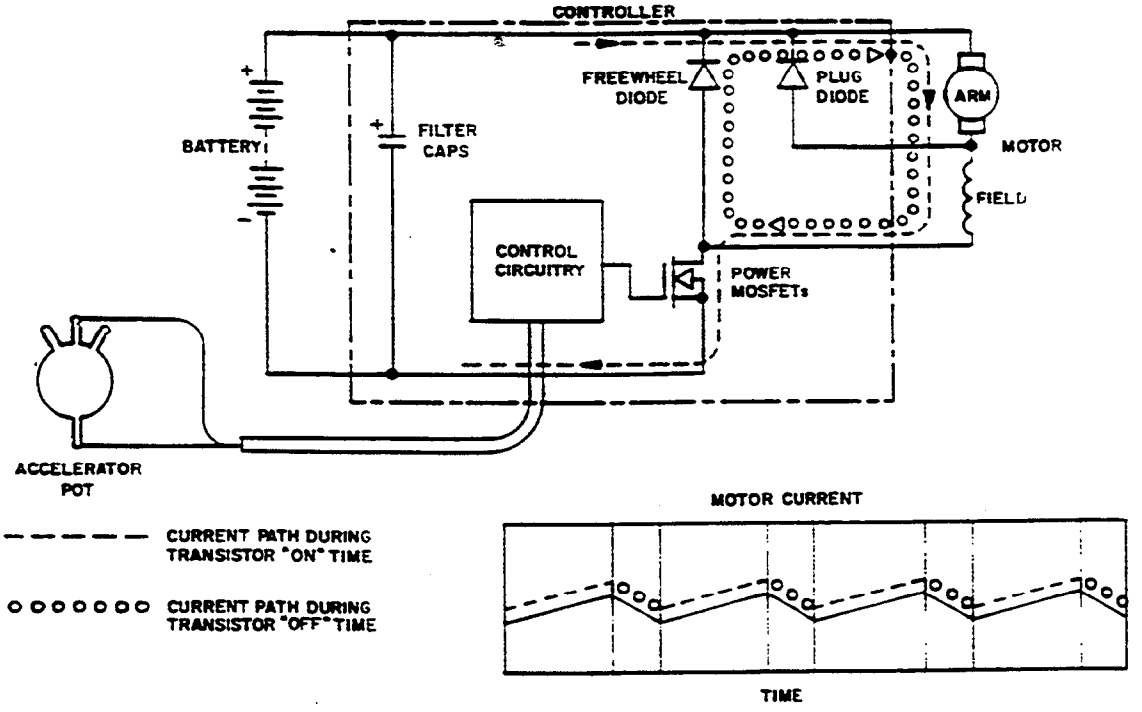
This manual covers all current Curtis PMC units (1204/1205/1209).

## SECTION 1 FEATURES OF CURTIS PMC SERIES TRANSISTORIZED MOTOR CONTROLLERS

### 1.1 Smooth Stepless Operation

The Curtis PMC 1204/1205/1209 series of transistorized motor speed controllers give electric vehicles new and improved driving characteristics by allowing superior operator control of the vehicle's drive motor speed. This is possible through the use of electronic control techniques by which the power delivered to the motor can be smoothly varied from fully off to full on. There are no speed steps or increments.

A high power semiconductor switch, consisting of an array of paralleled power MOSFET transistors, controls the current in the motor windings. As sown in figure below, the transistors are connected in series with the battery and the motor. The transistors are turned on and off at the rate of 15,000 timers per second by the control circuitry, while the ratio of the on and off times is varied in response to the input demanded by the throttle. This technique is called pulse width modulation. When the transistors are on, the current through the motor builds up, storing energy in the motor's magnetic field. When the transistors turn off, this stored energy causes the motor current to continue to flow through the freewheel diode. As shown in figure below, the motor current ramps up and down as the switch turns on and off, the average current (which determines the motor torque) being controlled by the ratio of the on and off times. In this way, smooth, stepless control of the power delivered to the motor is achieved with the very low power loss in the control components.



# SERVICE GUIDE
# FOR PMC CONTROL (1204/1205/1209B)

## SECTION 4 TROUBLESHOOTING

### 4.1 Introduction

The following procedures are intended to help users of Curtis PMC 1204/1205/1209 controllers diagnose problems in the field. The controllers themselves are sealed and thus not field serviceable, so the intent is to enable the user to determine if the trouble is in the controller or some other part of the motor control circuitry. This guide is detailed enough to enable users to track down these other problems to their source and repair them.

**CAUTION:**
IT IS IMPORTANT THAT THE TEST BE DONE IN THE ORDER THAT THEY ARE WRITTEN; IF NOT, THE CONCLUSIONS REACHED MAY NOT BE VALID.

The controllers have features designed to protect against damage caused by low batteries. The power to the motor is cut back when the battery voltage goes below approximately 16 volts (for 24-36 volt controllers). The loss of power felt when the batteries become this far discharged is normal. Similarly, the controllers are protected against damage from overheating by reducing the power to the motor if the internal temperature exceeds 165°F. In typical applications of these units, overheating will very rarely be a problem. Operation with oversized motors and/or vehicle overloading may cause overheating, particularly if the controller is mounted so that heat cannot be conducted away from its case. Power output will be reduced for as long as the overhead condition remains; full power will return when the unit cools.

### 4.2 Symptoms and Cures

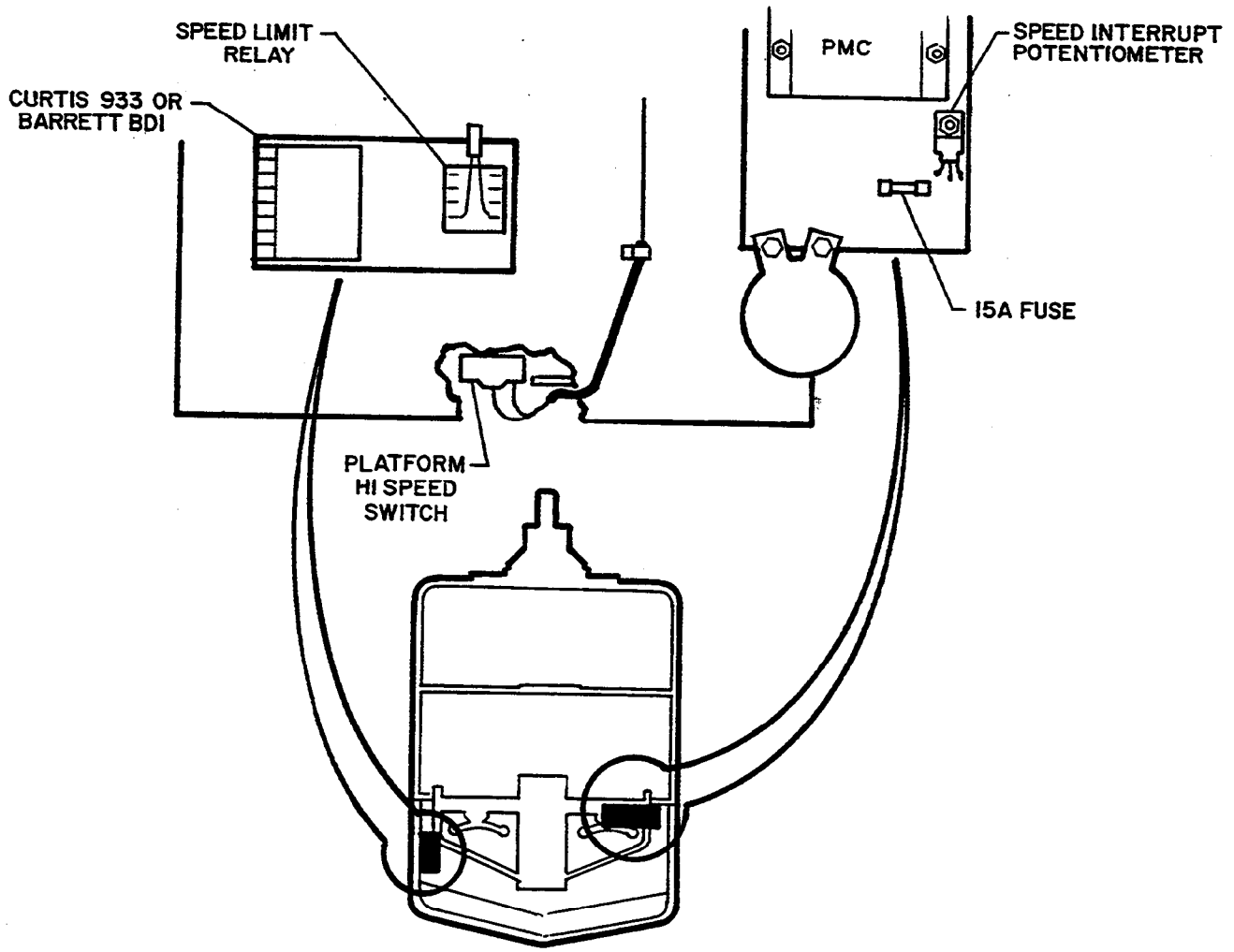
Some of these "symptoms" do not indicate a problem but rather are typical of normal operation. The 1 kHz tone heard during plug braking and the inability of the vehicle to plug brake to a stop on a steep ramp, for example, are not indicative of controller malfunctions.

Controller operation is normally silent. An exception is that a 1 kHz tone may be heard during plug braking. This noise is normal and indicates that plugging is taking place. The noise will stop when plug braking stops. A 1 kHz tone may also be heard if the controller overheats. The controller shifts frequency during over-temperature from its normal 15 kHz to 1 kHz, providing an audible tone to alert the operator to the over-temperature condition.

# BASIC OPERATION FOR PWT CURTIS PMC

**Battery Discharge Speed Interrupt**
This operation uses either Curtis 933/3 or BDI with Lift Interrupt to put the unit into creep speed when the battery becomes discharged below allowable voltage levels.

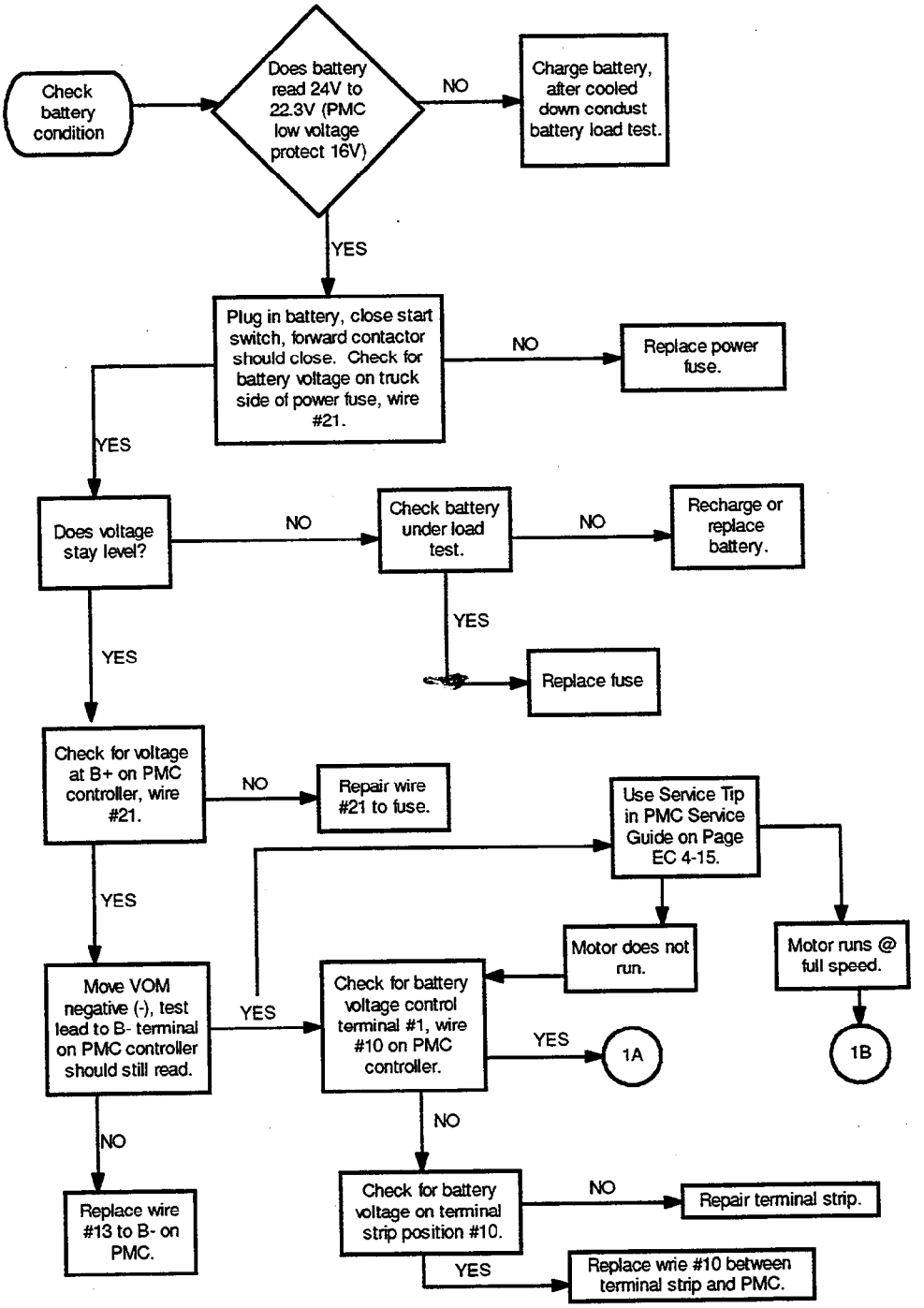
In this system the battery interrupt is connected to a relay. This relay is connected to the acceleration pots. When the battery becomes to low, the relay bypasses the main acceleration system to a third walkie speed pot, which is adjustable to a creep speed of approximately 1.5 mph. The relay is mounted by the BDI itself and the pot is mounted in the lower right corner of the contactor panel (see figure below).



# TROUBLESHOOTING
# PWC CURTIS PMC CONTROL

## NO TRAVEL - FORWARD & REVERSE CONTACTORS ARE CLOSING

**WARNING:**
Follow all warnings on Page EC 6-5.



# EV-100 CONTACTOR AND MAINTENANCE

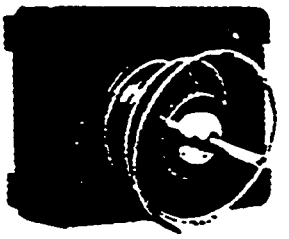
**Component Replacement**
**Contactor (Pump, 1A) 39186-001, 010, 011**

**Contact Tip Replacement** (See Page EC 7-8 of this Section)

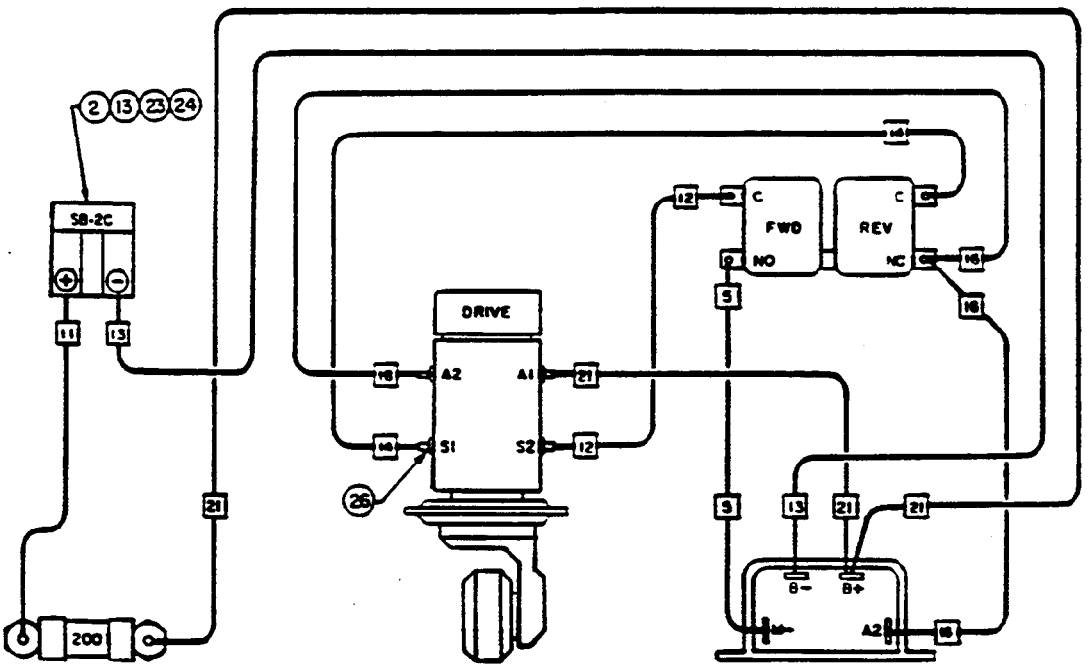
1. Remove nut (Item 1) from armature, Lift washer, spring retainer, spring and spring guide washer (Item 2, 3, 4, 5) from armature.
2. Lift movable contact (Item 6) from armature. Install replacement contact.
3. Assemble spring guide washer, spring & spring retainer and washer on armature.
4. Install nut on armature and tighten between 14-18 inch-pounds (torque) (1.6-2.0 Newton meters.
5. Remove four (4) long screws (Item 7) and remove the stationary tip clamps (Item 9) from contactor assembly.
6. Remove stationary contacts (Items 11 & 12).
7. Install replacement contacts and secure in place with stationary tip clamps. Tighten four screws in one turn increments using a diagonal pattern. Tighten screw between 14-18 inch-pounds (torque) (1.6-2.0 Newton meters).

**Coils**

1. Remove four (4) long screws (Item 7) and stationary tip clamps (Item ().
2. Remove stationary contacts.
3. Lift stationary tip carrier (Item 24) with the armature assembly (Item 26) from the contactor assembly.
4. Remove magnet frame (Item 28).
5. Lift coil (Item 29) from post on base plate (Item 30). Note position of coil terminals in relation to base plate for assembly.
6. Position replacement coil on base plate, as noted in disassembly, and locate projections on base plate in indentations of coil.
7. Position magnet frame over coil and locate projections on magnet frame in indentation of coil.
8. Make certain the small end of spiral spring (Item 27) is formed over small diameter of plunger (Item 26). Assemble armature assembly and stationary tip carrier on top of magnet frame (as shown below).



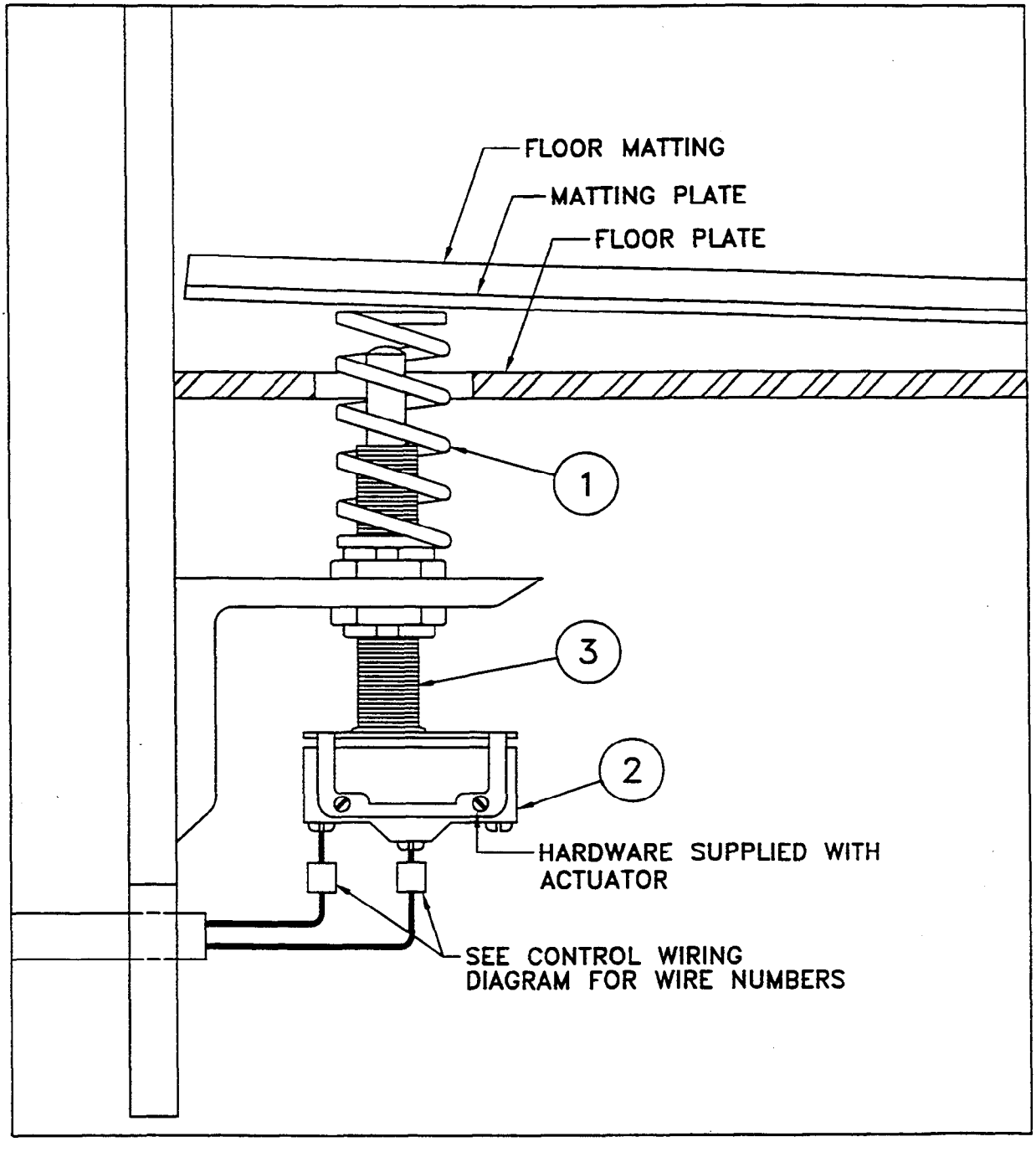
## POWER WIRING FOR PWT 7 12 & 24V CURTIS PMC CONTROL W/TILT OR FIXED STEERHEAD




| ITEM NO. | PART NO. | DESCRIPTION | QTY. |
|---|---|---|---|
| 2 | 8268-000 | SB-2 Connector | 1 |
| 13 | 7028-008 | 1/4-20 x 1.50" Lg. Hex Head Bolt | 2 |
| 23 | 7000-009 | 1/4 Lock Washer | 2 |
| 24 | 7001-001 | 1/4-20 Hex Nut | 2 |
| 26 | 7000-010 | 5/16 Lock Washer | 4 |

## PLATFORM HI-SPEED SWITCH FOR PWT 7 CURTIS PMC CONTROL

**For Final Assembly Breakdown See Parts Page 1017-2 Located in Final Assembly Section.**

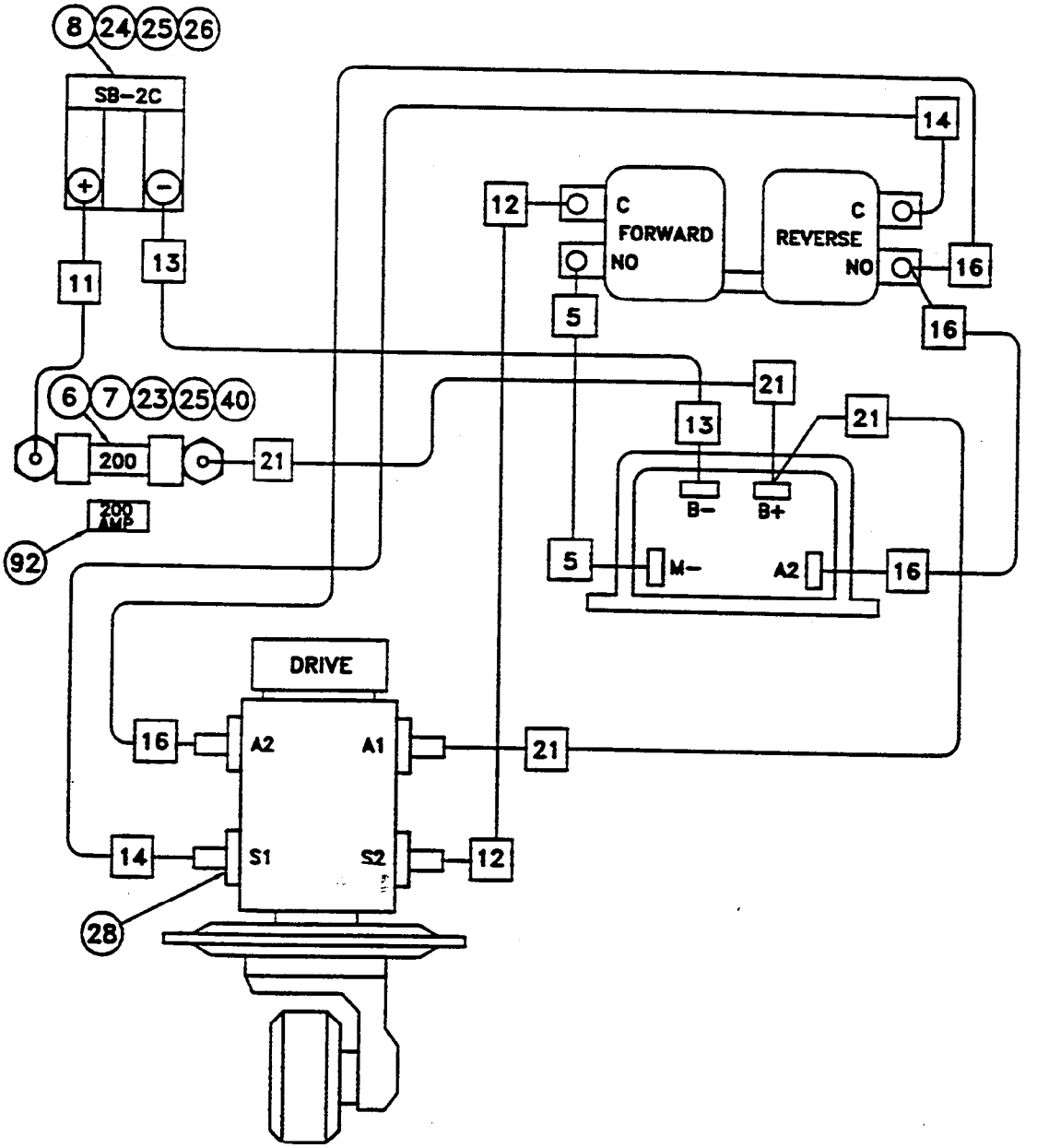



| ITEM NO. | PART NO. | DESCRIPTION | QTY. |
|---|---|---|---|
| 1 | 7660-093 | Spring | 1 |
| 2 | 27350-025 | Switch, Plunger Pin | 1 |
| 3 | 27350-026 | Actuator Plunger | 1 |

## CONTROL WIRING FOR PWC 30/40 24V CURTIS PMC CONTROLLER WITH TEE HANDLE INTERMEDIATE SECTION

| ITEM NO. | PART NO. | DECRIPTION | QTY. |
|---|---|---|---|
| 1 | 38900-025 | Contactor Panel (See Pages 5-12 and 6-12) | 1 |
| 3 | 38460-000 | Potentiometer Bracket | 1 |
| 4 | 27140-002 | Potentiometer, Slow Speed | 1 |
| 5 | 29000465-000 | Brake Switch | 1 |
| 10 | 7910-001 | Insulated Standoff | 5' |
| 12 | 38905-012 | Steerhead Harness | 1 |
| 30 | 7001-005 | 3/8-16 Hex Nut | 2 |
| 31 | 7000-011 | 3/8 Lock Washer | 2 |
| 33 | 7162-009 | 1/2 Flat Washer | 2 |
| 35 | 7099-014 | #6-32 x 1.25" Lg. Round Head Screw | 2 |
| 36 | 7002-013 | #6-32 Hex Nut | 2 |
| 37 | 7162-001 | #6 Flat Washer | 2 |
| 38 | 7000-005 | #6 Lock Washer | 2 |

## POWER WIRING FOR PWC 30/40 24V CURTIS PMC CONTROLLER WITH TEE HANDLE INTERMEDIATE SECTION




| ITEM NO. | PART NO. | DESCRIPTION | QTY. |
|---|---|---|---|
| 1 | 29000262-000 | 200 Amp Fuse | 1 |
| 7 | 39069-001 | Insulated Standoff | 2 |
| 8 | 8268-000 | SB-2 Connector | 1 |
| 23 | 7028-002 | 1/4-20 x .50" Lg. Hex Head Bolt | 2 |
| 24 | 7028-009 | 1/4-20 x 1.50" Lg. Hex Head Bolt | 2 |
| 25 | 7000-002 | 1/4 Lock Washer | 4 |
| 26 | 7001-001 | 1/4-20 Hex Nut | 2 |
| 28 | 7000-010 | 5/16 Lock Washer | 4 |
| 40 | 7028-003 | 1/4-20 x .62" Lg. Hex Head Bolt | 1 |
| 92 | 39252-005 | Decal, 200 Amp Fuse (Used on UL Turcks Only) | 1 |

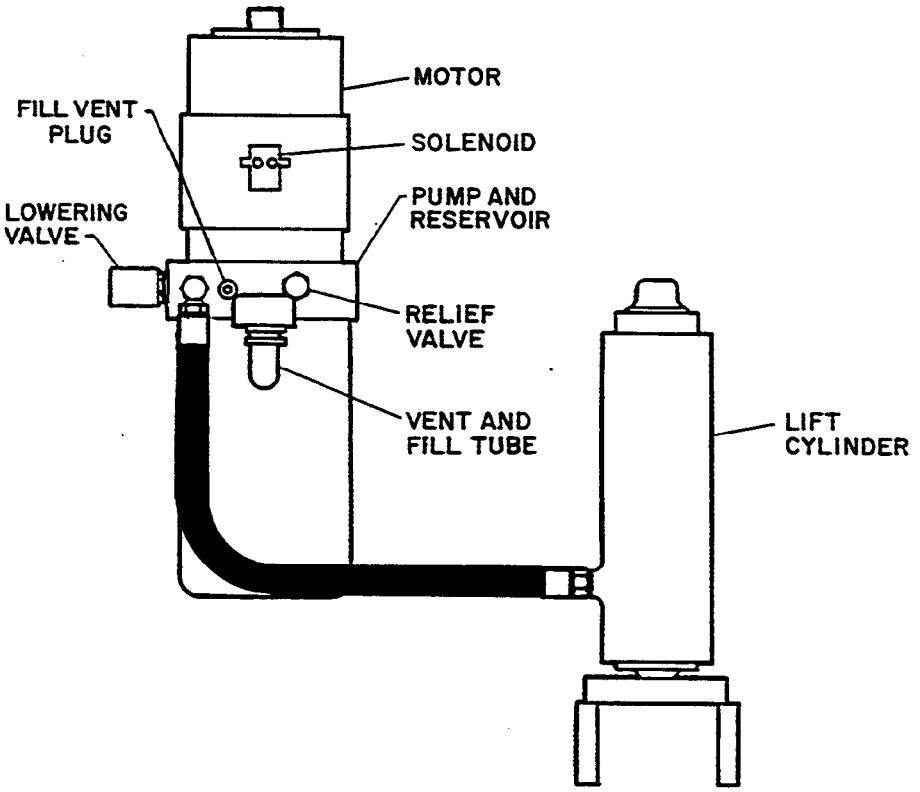
## LIFT LIMIT SWITCH ASSEMBLY
## FOR PWC 30/40

| ITEM NO. | PART NO. | DESCRIPTION | QTY. |
|---|---|---|---|
| 1 | 15420-012 | Lift Limit Switch | 1 |
| 2 | 15590-002 | Lift Limit Switch Bracket | 2 |
| 3 | 40868-001 | Lift Limit Switch Bracket | 1 |
| 4 | 40868-004 | Lift Limit Switch Flat | 1 |
| 5 | 40868-005 | Lift Limit Flat Bracket | 1 |
| 6 | 7028-008 | 1/4-20 x 1.50" Lg. Hex Head Bolt | 2 |
| 7 | 7000-009 | 1/4 Lock Washer | 4 |
| 8 | 7162-005 | 1/4 Flat Washer | 4 |
| 9 | 7001-001 | 1/4-20 Hex Nut | 4 |
| 10 | 7028-002 | 1/4-20 x .62" Lg. Hex Head Bolt | 2 |
| 11 | 7080-005 | #10-32 x .88" Lg. Socket Head Cap Screw | 2 |
| 12 | 7000-007 | #10 Lock Washer | 4 |
| 13 | 7162-003 | #10 Flat Washer | 4 |
| 14 | 7002-018 | #10-32 Hex Nut | 4 |
| 15 | 7080-008 | #10-32 x 1.25" Lg. Socket Head Cap Screw | 2 |
| 85 | 11824-013 | Diode | 1 |
| 86 | 39923-001 | Capacitor | 1 |

# BASIC HYDRAULIC OPERATION

**Lift Operation**

As shown below, the 4,000, 6,000 and 8,000 lb. Walkie and Walkie Rider units use a simple hydraulic system for lifting the load carrying device (forks). The system contains a hydraulic pump assembly, which is self contained with motor lift contactor, relief valve, reservoir tank and lowering valve. The lift cylinder is a displacement type with no internal packing (seals) on the piston parts.




Fluid is drawn from the reservoir, through the 100 mesh pick up screen to the inlet of the gear pump. As the gear pump rotates, oil is forced out by the pressure port and is blocked from returning to the reservoir by the closed valve and lowering valve. The oil continues to flow to the base of the cylinder and pushes against the end of the cylinder rod to extend the rod from the cylinder barrel.

# TRANSMISSION DRIVE ASSEMBLY

**Gears, General Description**
As described before there are two sets of gears in the this transmission. The upper hi-speed reduction gears which determine the speed and power of a unit and the beveled gear set which transfers the speed and power to the output shaft.

A. The hi-speed reduction gears come in four gear ratios and can be ordered separately. Always order high speed gears with the correct ratio.

SERVICE NOTE: New lock nuts must be ordered whenever replacing either gear.

The following list gives the ratios and a brief description of their uses:

12:1 Hi-speed operation but reduces overall torque and capacity. Most commonly used for long hauls and transportation. Not recommended for short runs, loading trailers or docks.

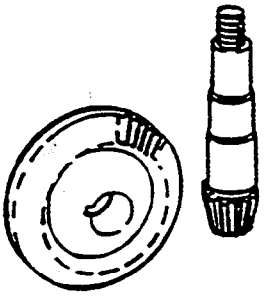
15:1 Mid-speed, has increased capacity over 12:1. Most commonly used for long hauls, transportation or picking type operation. Not recommended for loading trailers or dock operations.

18:1 Standard and most commonly used gear ratio. Excellent for trailers, docks, picking and most common warehouse operations.

21:1 Hi-torque ratio, mainly used for Hi-Lift models or Low-Lift units where high capacity is required or ramps are in use.

**CAUTION:**
Do not change gear ratio without ensuring the motor and power supply can effectively work with new ratio.

B. The beveled gear set does not change from unit to unit and can only be purchased as a set (as shown below).

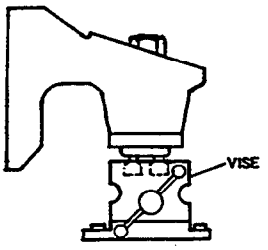


**CAUTION:**
As described later these gears must be installed and adjusted to the proper backlash for quiet and efficient operation.

# TRANSMISSION DRIVE ASSEMBLY
# (UNITS BUILT FROM FEB. 1995)

**Dismantling Lower Transmission Section (Cont'd)**

9a. Thread two (2) of the wheel bolts back into the output shaft and place the transmission in the vise, as shown below.




9b. Using an air impact wrench with a 1-7/8 socket or ratchet wrench, remove the lock nut.

9c. Remove the bevel gear and shims. **Measure** the shims total thickness and record the figure.

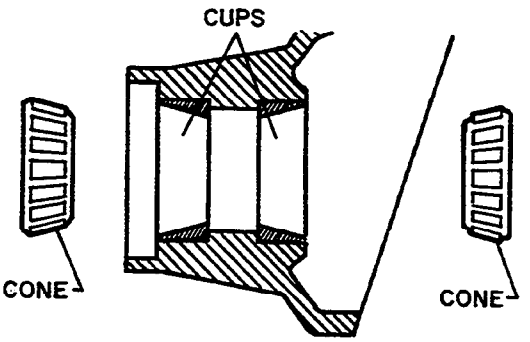
9d. Inspect the shims for any damage, replace any that may be cracked. Always make sure to replace damaged shims with correct thickness. It is highly recommended replacing all the shims if any appear to or have been damaged.

9e. Lift housing from shaft.

SERVICE NOTE: In some cases you may have to remove the housing and shaft from vise. Tap the drive shaft from the bearing with a soft faced mallet.

9f. Carefully inspect the bearing and cups for damage or wear.

**CAUTION:**
If any part of the bearing cup or cone is damaged they both must be replaced.




9g. Remove the cups **only** if damage is found.

10. Remove oil seal and discard.

11. Using cleaning solvent and air, clean the housing and all other parts.

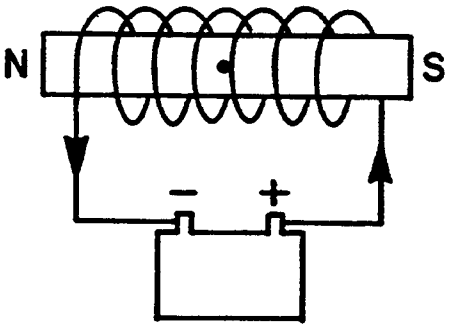
NOTE: If you can not assemble the transmission after cleaning the parts, oil all bearings and put them in a plastic bag.

# G.E. DC DRIVE MOTORS

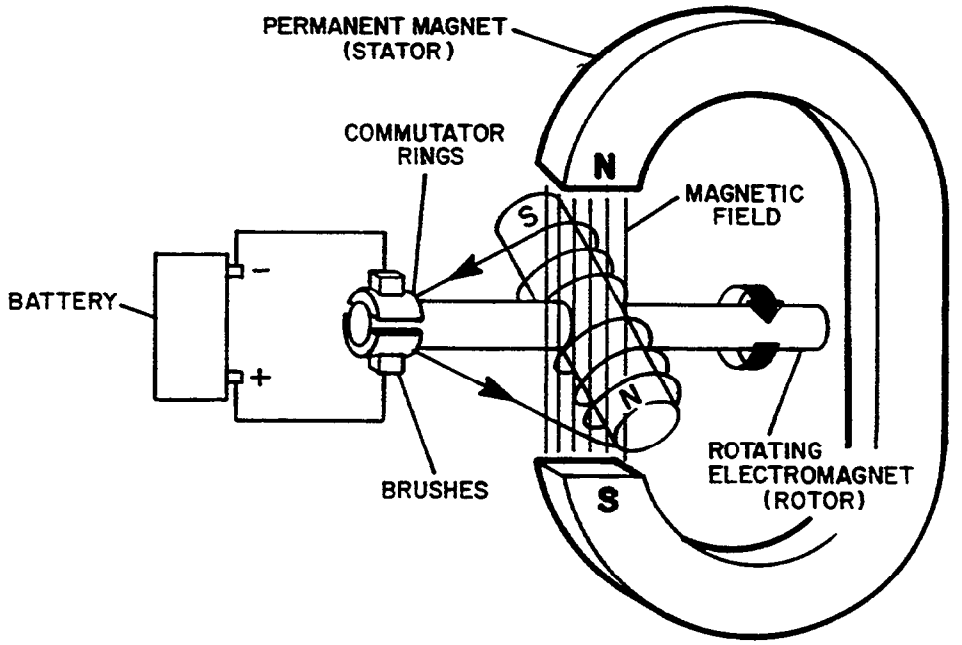
**Testing and Repair (Cont'd)**

III. THEORY OF MOTOR OPERATION (Cont'd)

1. b. Electricity - This is where the second principle comes in: the principle of electricity. It would help maintain motion if you could change the poles of the magnet in your hand from North to South as the magnet on the pivot swung around. With electricity, this is quite easily accomplished by winding wire around an iron rod and attaching the ends of the wire to the leads of a battery. This creates, by the movement of electricity, a magnet with North and South poles, just as shown in the figure below.




c. Electromagnet - The great advantage of this electromagnet is that you can reverse the poles simply by reversing the leads on the battery. If we could solve the awkward problem of having to manually switch the leads, we could change the poles or polarity of the rod. Then we'd have a primitive model of a simple motor - the kind that a child might construct from a kit. The diagram in the figure below shows how this problem can be solved.



# G.E. DC DRIVE MOTORS

**Testing and Repair (Cont'd)**

VII. DC MOTOR "OUT OF TRUCK" DIAGNOSIS AND REPAIR

1. Disassembly (Cont'd)

   d. Remove the four cover bolts which hold the motors rabbeted end shield and stator to the transmission.

   e. The slip fit of the armature shaft in the ball bearing locked in the commutator end permits careful removal of the commutator end shield from the stator. However, since the stator may also tend to come off with the end shield, be careful that both pieces are well supported as they are removed.

   f. When necessary, the commutator end shield may be further disassembled to change brushes, brush rigging, and crossover leads by removing the appropriate and obvious screws. This should be done if the brush holders or insulation plate appear burned, warped or have loosened rivets.

   g. Remove the stator assembly. Take care that the stator is not allowed to drop on the armature commutator or shaft and damage any of the stator or armature parts. When necessary, the field coils can be removed by removing the terminal screws, nuts, and the pole piece screws from the stator.

   h. The armature is then carefully removed. **Pull the armature straight up.** Have cloth ready to cover the transmission gear as it will have oil on it.

**CAUTION:**
Caution should be used so as not to damage the transmission gear or bearing.

2. Diagnosis - Field Coil

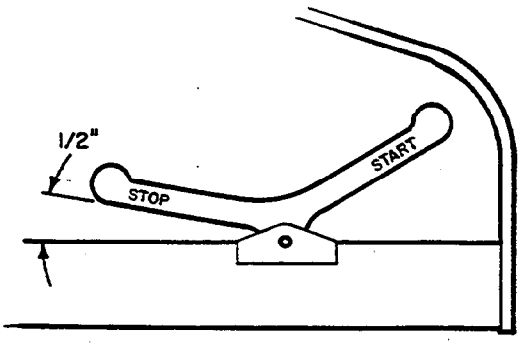
   a. Check all the insulators for all terminals. If these check good then the fields are grounded and must be replaced. The fields normally have a very low resistance and consequently it is hard to detect fields which are shorted since the difference in current draw between normal motor field windings would not be great. If shorted fields are suspected, the only procedure is to install new fields and check for performance.

   b. Before inspecting the armature, you must check the insulators for the terminals A-1 and A-2 and the brush rigging for grounds. If this all tests good then the armature must be tested.

# BRAKE SYSTEM
# (BR)

# FIXED STEERHEAD
# BRAKE ADJUSTMENT

7. Final Check: Apply the brakes to insure the brake holds correctly and the brake switch disconnects. Check braking at the butterfly handles, with brakes fully applied there should be a minimum of 1/2" clearance between the handle and hand grip. Set the parking brake and insure the truck does not move.




The brakes are now properly adjusted. Replace the hood and steerhead cover. Return the truck to service.

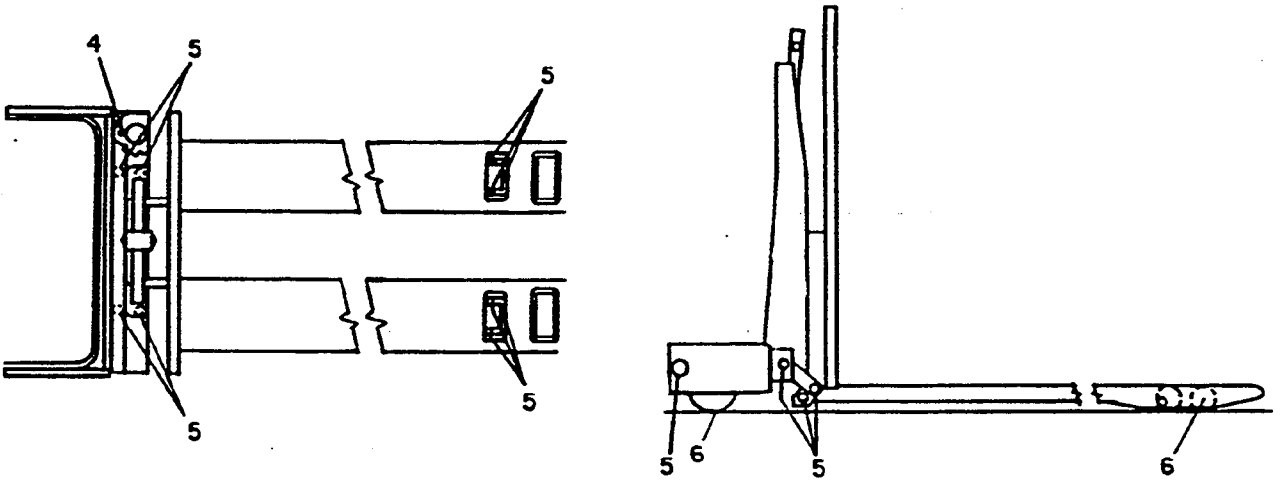
# PLANNED MAINTENANCE

Equipment Required:

| | |
|---|---|
| Standard Hand Tools | Grease (Mobilux 22 - Standard)* |
| Flush Type Grease Nipple | Rags |

*Service Note: The type of lubricant and interval may change according to the application in your plant. Your local lubricant supplier should be able to assist you in selecting any special lubricant you may need.

Below is the lube points for only the load carrying device (forks) and their interval.




| ITEM # | DESCRIPTION | LUB. POINTS | TYPE OF LUBRICANT | INTERVAL |
|---|---|---|---|---|
| 4 | Hydraulic Reservoir | (1) | *Valvoline Super Hydro F-32U | Check Daily<br>Change Yearly |
| 5 | Pivot Points | (12) | *Mobilux 22 Grease | 30 Days; 200 Hours |
| 6 | Wheel Assemblies | (6) | *Mobilux 22 Grease | 30 Days; 200 Hours |

Daily Checks: Ensure hydraulic tank is full.
Ensure that unit has been lubricated, especially the load and caster wheels.
Remove any and all foreign material from load and caster wheels.

Every 30 Days; 200 Hours: Lubricate the entire unit.
Inspect and replace any damaged or worn wheels.
Always pack bearings before installing new wheels.

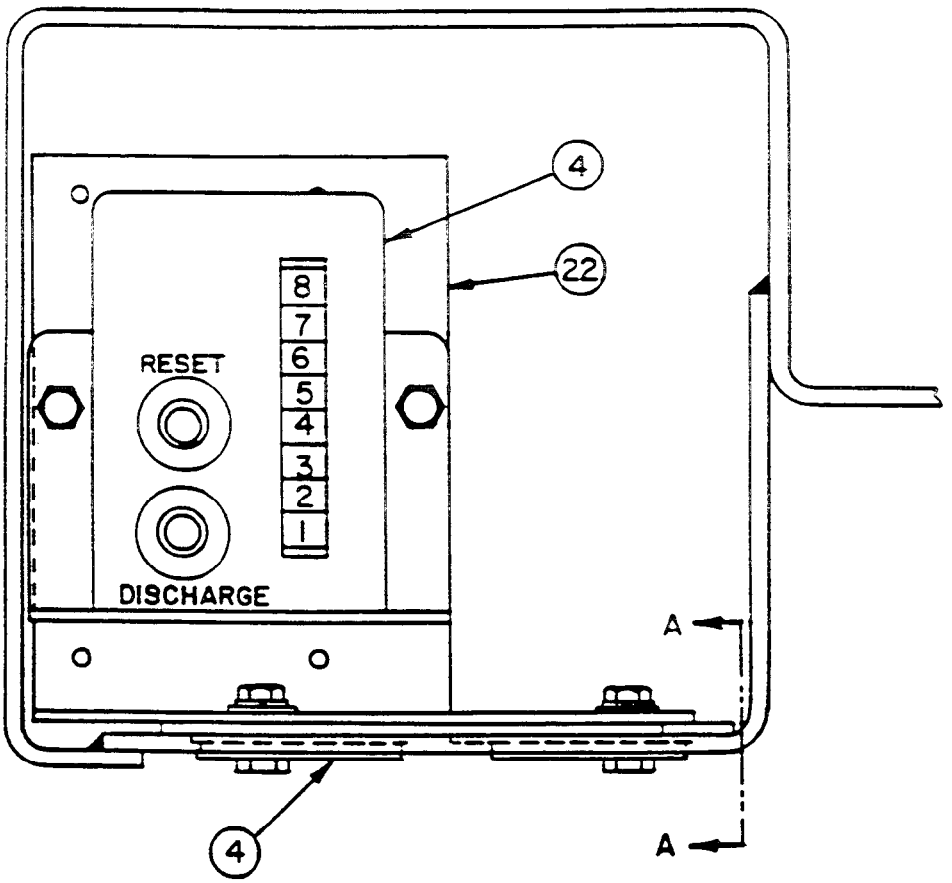
Every 60 Days; 300 Hours: Inspect all pivot points for worn oilite bushing (bearing) and replace as required.

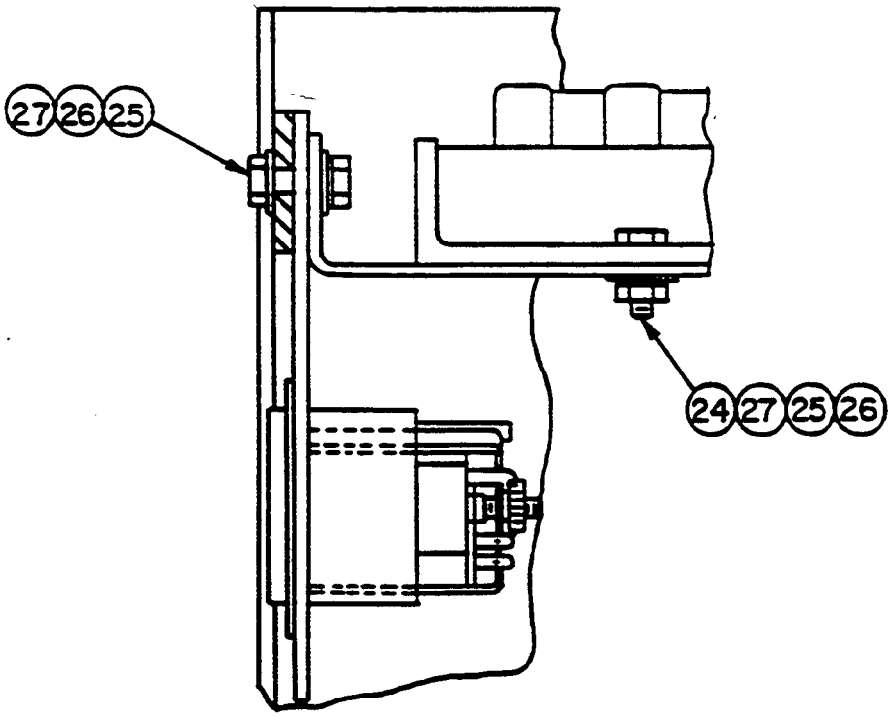
# BODY AND FRAME
# (BF)

## PWT 7 W/CURTIS PMC 24V BDI (CHARGE GUARD) & SPEED INTERRUPT

| ITEM NO. | PART NO. | DESCRIPTION | QTY. |
|---|---|---|---|
| 1 | 7028-007 | 1/4-20 x 1.25" Lg. Hex Head Bolt | 2 |
| 2 | 7001-001 | 1/4-20 Hex Nut | 2 |
| 3 | 7000-009 | 1/4 Lock Washer | 2 |
| 4 | 7000-005 | #6 Lock Washer | 2 |
| 5 | 7099-005 | #6-32 x .38" Lg. Round Head Screw | 2 |
| 6 | 7002-013 | #6-32 Hex Nut | 2 |
| 7 | 7162-001 | #6 Flat Washer | 2 |
| 8 | 27642-002 | Relay | 1 |
| 9 | 27522-046 | BDI, Charge Guard | 1 |
| 11 | 24170-040 | Relay Filter Assembly | 1 |
| 12 | 30392-003 | Mounting Plate | 1 |

CURTIS 933/3 BDI W/LIFT INTERRUPT




VIEW A–A