BATTERY BACK–UP MANUAL

OHIO MAGNETICS, INC.
A SUBSIDIARY OF PEERLESS-WINSMITH, INC.

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INTRODUCTION

1 . 1 Ohio Magnetics Warranty - BATTERY BACK-UP SYSTEMS

Ohio Magnetics, Inc. a subsidiary of Peerless-Winsmith, Inc. warrants to the original purchaser of each new Battery Back-up System, manufactured by and sold by Ohio Magnetics, Inc., to be free from manufacturing defects in material and workmanship under normal service for a period of ninety (90) days, from and after the date of shipment from our Maple Hts., Ohio plant.

Ohio Magnetics' obligation under this warranty is expressly limited to the replacement or repair of any part or parts which are proven to our satisfaction to be defective under normal use and service, at the Ohio Magnetics, Inc. plant at Maple Heights, Ohio or at a point designated by it.

Ohio Magnetics, Inc. will not be held responsible for the cost of consequential labor, loss of profit, down time, or any transportation charges incurred in connection with the replacement of or repair of said Battery Back-up System or parts thereof found to be defective. It shall not be responsible for consequential damages or contingent liabilities arising from the use of, or performance of, Ohio Battery Back-up Systems.

This warranty does not apply to any Ohio Battery Back-up System or parts thereof, which have been subject to accident, negligence , alteration, abuse or misuse , or upon which repairs or alterations have been made by other than Ohio Magnetics, Inc., except where said repairs are made by others with its prior written approval.

Ohio Magnetics, Inc. makes no warranty with respect to accessory equipment manufactured by others and sold by Ohio Magnetics, Inc.. These items are subject to the warranties the manufacturer and any warranty claims on these items shall be directed by the user to the respective manufacturer.

Ohio Magnetics, Inc. makes no other express, implied or statutory warranties, nor is anyone authorized to make any on its behalf .

1.2 **RECEIVING**

If damage incurred in shipping is observed upon receipt of rectifier, notify and file claim with carrier.

BEFORE YOU FULLY UNPACK THIS UNIT READ THIS FOR YOUR PROTECTION!
(This information applies only on shipments within the United States)

DAMAGE

This shipment was packaged and delivered to the carrier with the utmost care to insure safe delivery of goods. When shipment is received and signed for by the transportation company, consignor's responsibility ceases. Do not accept shipment which evidences damage or shortage until agent of carrier endorses a statement of the irregularity on the face of the transportation receipt. Without documentary evidence, claim can not be filed.

CONCEALED DAMAGE

Interstate Commerce Commission has indicated that a carrier is as much responsible for concealed damage as for visible damage in transit. Upon receipt of shipment, promptly unpack and check thoroughly. If concealed damage is discovered, cease further unpacking and request immediate inspection by local agent of carrier. A written report of the agent's findings, with his signature, is necessary to support claim.

SHORTAGE

Check shipment against shipping papers. Do not discard packing materials or packing cases until contents have been found to be correct. The removal of badly needed items, before shipment has been checked, may create a shortage. Check all possibilities before reporting a shortage.

CLAIMS

If your agent or carrier has been given an opportunity to inspect the shipment, any claim for a shortage or damaged merchandise can be handled as a simple and routine procedure. Claims must be filed by consignee. Shipping terms are f.o.b. Cleveland, Ohio.

LOSS

In the event of complete loss, claim will be handled in the same manner as for Shipping Damage or Shortage.

1.2 (Cont.) **SHIPPING DAMAGE OR SHORTAGE**

TRUCK SHIPMENT

The original destination freight bill bearing notation of damage or shortage by the carrier and the inspector's report, attached to a certified copy of the original* bill of lading of the transportation company at point of origin, must be available to support claim. All claims will be initiated at point of destination.

EXPRESS SHIPMENT

Should there be damage or shortage, claim must be supported by a certified copy of the original* paid express receipt (whether issued at point of origin or destination) bearing the agent's notation of damage or shortage, or the inspector's report of same attached.

AIR EXPRESS

Claim must be initiated at point o f destination. The express agent at point of destination will fill out a "Bad Order Report" which will be returned to party submitting claim. The original invoice, original* air express receipt, "Bad Order Report" and a letter of transmittal , must be submitted in support of claim.

RAIL FREIGHT

Claim will be initiated at point of destination. However, inspection papers filled out by the consignee and endorsed by the freight office of destination along with paid freight bill, original* bill of lading, original invoice or certified copy of same , plus a bill to the freight agent for claim charges, must be forwarded to the Freight Agent at point of origin in support of claim. Shipping charges reimbursed will be those prorated over total weight of shipment involved in the claim.

AIR FREIGHT

Claim must be initiated at point of destination. Claim must be filed by submitting a letter on company stationery with an explanation of the extent of damage or loss and forwarded with a copy of the original* air bill, and original invoice or Photostat of same, to the airline having carried the shipment .

* Upon request certified photostatic copies of original papers held by Ohio Magnetics, Inc. required in support of claims, will be made available.

1.3 **CHECKING BEFORE INSTALLATION**

If damage is not incurred in shipping, proceed checking the nameplate data of the equipment against the nameplate data, and inquiry sheet in this section of the manual. The two should agree, The nameplate is located on the door.

Before installing equipment, it is recommended that a thorough visual inspection be made. All terminal connections should be checked for loose connections that could have occurred in transit. Careful check should be made for any frayed wiring or cracked insulation.

1.4 **NAMEPLATE - INQUIRY SHEET**

PRODUCT: BATTERY BACK-UP

B/M: _____ S/N: _____

PRODUCT DESCRIPTION

CURRENT: _____ A CHARGE: _____

TIME: _____ min NEMA/IEC 529: _____

BATTERY TYPE: _____

OPTIONS: _____

_____

_____

CUSTOMER: _____

_____

REMARKS: _____

_____

_____

_____

_____

_____

2. **INSTALLATION**

2.1 INTRODUCTION

The Battery Backup system is composed of a variety of enclosures. The battery and control enclosure(s) vary in size depending on the size of the system and the type of batteries used. The batteries and control electronics are contained in separate enclosures. In some applications, the batteries are mounted in open racks.

In addition to the battery and control enclosure, the battery back-up contains a separate system status indicator enclosure, a separate audio alarm unit that can be mounted anywhere convenient to the system operations personnel, and a disconnect switch used to disconnect the batteries from the rest of the system. The interconnection diagram and schematic will detail the location of all components.

In some systems, a separate battery charger is used to charge depleted batteries, in systems that do not contain a separate charger, the main rectifier acts as the battery charger.

2.2 MOUNTING - LEVELING

All components must be mounted in an upright position for proper operation The batteries are in the enclosure resting on racks and are held down by a battery clamp . The enclosures should be situated in a leveled position and bolted to the wall or to the floor as the situation demands. Install components in a location suited to their NEMA or IEC 529 rating. Punch holes in the bottom or side of enclosure for input/output as well as control cables, as the location requires.

2.3 INTERCONNECTION OF COMPONENTS

Reference the interconnection diagram supplied as part of your document package for proper connection of system components. Use approved wire and cables and make sure all enclosures are properly grounded Batteries are disconnected from each other before shipment from the factory and must be reconnected before the system can be used.

For operation of the rectifier power supply and/or the battery charger (if applicable) see separate operators manuals for these units.

3.1 **INTRODUCTION**

The Battery Back-up system is designed to provide emergency DC power in the event the main power to the magnet fails. The failure can be due to either the main 3 phase power to the rectifier failing or a fault in the rectifier itself. The batteries are configured to provide a nominal 220 V dc service, down to a minimal 180 V dc, at a specified load current for a specified time. The status of the system can be monitored by use of the indicator enclosure, as well as an audible alarm.

3.2 **SYSTEM FUNCTION**

ATTENTION! DANGER OF ELECTRIC SHOCK!! DO NOT TOUCH THE BATTERY TERMINALS WHILE SERVICING THIS UNIT!! 220 V dc PRESENT!!

After the system has been properly connected, close the Battery Disconnect and then turn on the Main Power Rectifier, as well as the separate battery charger (if supplied). You should have 240 V to 245 V dc (magnet(s) not energized) at the output of the Main Rectifier terminals El(+) and E2(-). Also, the voltage meter located in the status indicator enclosure should read from 200 to 220 V dc. The meter will read the actual voltage of the batteries when the disconnect switch is closed. If you do not read any voltage on the battery meter, check all the connections to the batteries. If everything is OK, the batteries will go into a momentary charge to assure the batteries are full. During this time the system is interlocked and a lift can not be made. Also the yellow `BATTERIES CHARGING' light illuminates. When the battery charging is complete and no other problems exist, then the green `SYSTEM OPERABLE' light should illuminate, indicating the system is ready to operate.

If your system has a separate battery charger, see section 3.26!

If you experience any trouble in the startup or the operation of the battery system, refer to the TROUBLESHOOTING guide in the next section.

If the green `SYSTEM OPERABLE' light does not illuminate, then the you can not initiate a lift. Check the TROUBLESHOOTING guide for possible solutions.

If the main rectifier power has been off for any length of time, then once power is restored, the system will first go into a charging cycle. At this time, the magnet function will be interlocked out. If the rectifier is turned off and then back on, the charging cycle will resume. Charging must be complete before the `SYSTEM OPERABLE' light and an OK to lift can occur.

Once the system has come up and the green `SYSTEM OPERABLE' light has come on, allow the system to stabilize by waiting about 30 min before operating. Also, allow 30 min if the system has been off for a long period of time.

3.21 **BATTERIES DISCHARGING / CHARGING:**

In the event of a power failure during a lift cycle, the batteries will provide current to the magnet through one-half of the Blocking Diode DM1. If the voltage from the rectifier has fallen below 200 V dc , the PLS low trip sensor will disengage. The red trip light is on when everything is normal. This will cause the CRL relay to disengage also. This will shut off all power to the following relays: BRH (Battery Voltage High), BRL (Battery Voltage Low), PR3 (High Rate Charge Power Relay), CR3 (High Rate Charge Control Relay), CR6 (Float Charge Enable), TR1 (Float Charge Cycle Timer), CR2 (Fault Pilot Relay), PR2 (Fault Power Relay) , CR7 (Float Charge Cycle off), and PR1 (Float Charge Power Relay). When the relay CRL is off, the red `POWER LOSS - CHARGER FAULT' indicator lamp will illuminate. Also, with CR2 off, and CR4 on (magnet in lift), the alarm will sound, as well as the yellow `BATTERIES DISCHARGING' indicator light will illuminate. The horn and light will blow continuously until either the battery voltage falls low enough to where they will not operate, or the magnet is taken out of lift.

With PR2 off, the ability to make a lift is prevented. But, when the system is already in a lift, the PR4 relay will keep the controller coil energized until the lift switch is deactivated or the battery voltage falls below the minimum operating voltage of the coils.

Please note: The system is designed to operate only until the batteries have fallen to 180 V dc. Anything less that this voltage introduces a degree of uncertainty. If the horn should become weak sounding or stop completely, it means the batteries have become severely drained. If the batteries are allowed to drop below 150 V dc, the operation of the controller will begin to become unstable. There will be insufficient voltage to hold the lift coil in, so the controller will automatically become deactivated and the remaining load will dribble and/or drop off. So, it is advisable that once the discharge alarm sounds, to proceed immediately to drop the load in a safe place. The alarm and the yellow `BATTERIES DISCHARGING' light will go out if the lift cycle is terminated at any time. A battery back-up system is an emergency power system and is not intended to take the place of the main power source.

If your main power has failed, and you are not in a lift, the green `SYSTEM OPERABLE' light will go out and the red `MAIN POWER LOSS - RECT/CHRG FAULT' light will illuminate. You will not be able to initiate a lift. You must wait for power to be restored and the green `SYSTEM OPERABLE' light to illuminate before you can resume operations.

After the main power has been restored, the batteries must be recharged before a lift cycle can be initiated. In units with a separate battery charger, see section 3.25!

When power from the rectifier is restored, and the PLS, senses there is more than 200 V present at Terminals E1 (+) and E2 (-), the CRL relay will engage. This will automatically apply power through the normally closed CR4 and CR6 contacts to energize CR3 and PR3. The PR3 contact will close switching in the R1-B resistor (1 W resistance) between the main line and the batteries. The CR3 contact will also close energizing the yellow `BATTERIES CHARGING' indicator light. The batteries will begin to charge (High Rate) and continue to do so until the BCS sensor detects a voltage greater than 232 V dc on the batteries. This will close the BCS-H contact

energizing the BRH relay. Once energized, this will allow the CR6, TR1, CR2 and PR2 relays to energize. Once CR6 energizes, PR3 and CR3 will disengage. This will stop the high rate charging.

When the CR2 becomes engaged, it will light the green `SYSTEM OPERABLE' light, and release the lift interlock, allowing magnets lifts to be made.

When TR1 (24 min cycle timer) becomes engaged, PR1 is engaged through the normally closed CR7 contact. The R1-A resistor is switched in between the main line and the batteries. The batteries will trickle charge every 24 min, in a 12 min on/ 12 min off type cycle.. This will not effect the operation of the magnet when in lift, nor prevent a lift from being made.

If within the first 12 min of the charging cycle, the battery voltage exceeds 232 V, the BCS high trip sensor will become engaged and activate the BRH relay. This will engage CR7, which will deactivate PR1, thus preventing charging until the next on cycle. With the batteries on trickle charge, the battery voltage should never exceed 232 V dc or fall below 210 V dc. If the batteries are charging normally, they will produce a voltage drop across the R1 trickle charge resistor, and the charging voltage across the Batteries (E3+ to E2-) should fall within the range specified above. If charging is weak or has failed, no voltage drop will develop across R1. With PR1 active, the voltage at E3 would exceed 232 V dc. This high voltage will overcharge the batteries if allowed to be applied to the batteries for a long period of time. If the voltage exceeds 232 V at once, then refer to the troubleshooting guide for possible solutions.

Even though the batteries maybe fully charged, they will continue to draw a trickle charge as long as the main rectifier and/or optional battery charger are on. It is advisable, that the main rectifier or separate battery charger be kept on even when the magnet system is not in use in order to keep a full charge on the batteries.

If the battery voltage falls below 180 V dc, the BCS low trip sensor will become active, and attempt to high rate charge the batteries. Should the batteries try to high rate charge at times other than after a discharge, or after batteries have been off a trickle charge for a long time, a potential problem exists. See troubleshooting guide for possible solutions.

For optimum charging of the batteries, the rectifier output should range from 245 V (no load) to 240 V (full load). If the voltage is significantly below this voltage, the batteries will be under charged, and thus the system will either have to be derated in output, or the rectifier/supply voltage will have to be increased. If on the other hand, the supply voltage is too high, above 245 V, then the voltage fed to the batteries will also be high. The charging system prevents overvoltaging of the batteries during the charging cycle. But, high voltage on the system can do damage to other components and to the magnets themselves. Over time they can burn up from excessive voltage. To correct this problem, try changing the taps on your rectifier in order to reduce the rectifier output. The no load voltage should never exceed 250 V dc.

If the batteries are heavily drained, and depending on their size, they can take anywhere up to 2.5 hours to recharge.

3.22 **DISCONNECT SWITCH:**

The function of the disconnect switch, that is a part of the battery backup system, is to disable the battery power from the magnet system. Disabling the battery voltage from the magnet system is necessary when the magnet system is being serviced. This is necessary to prevent the possibility of shock hazard or electrocution that could result if power is left supplied to the magnet system while servicing. Shutting off the disconnect will also isolate the battery system from the main power source, when servicing of the battery system is required. There is always 220 V dc in the battery enclosure even though the disconnect switch is open.

The Disconnect Switch has provisions to sense the existence of a blown fuse or if the disconnect switch is opened. A fault in the disconnect switch will be indicated by a red `DISCONNECT FAULT' light on the indicator enclosure being illuminated. The fault will interlock the lift cycle out, so therefore, it must be corrected first, before a lift cycle can be initiated.

If the Disconnect Switch is opened or a fuse is blown, while the Main Rectifier is on, the CR5 relay will be off and prevent the system from operating. The red `DISCONNECT FAULT' light on the indicator enclosure will be illuminated. To correct this, turn the Disconnect Switch to the on position.

3.23 **POWER LOSS SENSOR (PLS):**

The purpose of the Power Loss Sensor (PLS) is to indicate a fault if a complete loss of the main dc power or if the main dc power supply has fallen below 200 V dc on a 230 V power system. Any fault detected by the PLS will interlock out the lift cycle. If a PLS fault occurs when the lift cycle is engaged, the pilot relay (PR4) will hold the lift cycle in. If a PLS fault occurs and the lift cycle was not engaged, the power loss interlock will prevent the lift cycle from being initiated. The restoration of main power clears the fault. The existence of a power loss fault can be indicated by a red `MAIN POWER LOSS-RECT/CHRG FAULT' indication on the display enclosure. When normal voltages are present, the green and red LED's will be illuminated on the sensor. If the green and/or red LED's are not illuminated, either the rectifier or the sensor are not functioning. See the TROUBLESHOOTING GUIDE for possible solutions.

3.24 **DISPLAY ENCLOSURE:**

The purpose of the display enclosure is to indicate the status of the battery backup system. There are five main push-to-test lamps and a voltmeter as standard. The two red lamps indicate system faults; the faults being Main Power Loss (in systems with a separate battery charger, this light will illuminate if there are also problems with the battery charger as well as the rectifier.) and a fault in the disconnect switch. The two amber lights indicate the status of the batteries: as to whether they are charging or discharging. The green light indicates the system is operable. When ever the green light is illuminated a lift cycle can be initiated; and when ever the green light is out, a lift can not be initiated. In most cases, whenever the green light is out, one of the

other lamps will be illuminated. It is possible for all lights to be out if the batteries are weak or dead; or if one or more of the indicating lamps are burned out.

Each of the lamps can be tested to see if the bulbs are operational by pressing in each of the colored lens one at a time. Each of the lights should illuminate (When the yellow `BATTERIES DISCHARGING' lens is depressed the audio horn will also sound). A lamp that fails to illuminate during this test, indicates a possibly burned out bulb.

3.25 **SYSTEMS USED WITH VARIABLE VOLTAGE RECTIFIERS:**

Battery Back-up Systems used with Variable Voltage Rectifier Systems operate slightly different from Battery Back-up Systems connected to Fixed Voltage Rectifier Systems. The difference is that the Battery System must be DEACTIVATED while the Output of the Rectifier is deliberately reduced from full voltage. If the Battery System was deactivated during this cycle, then the Batteries would discharge the Load as if there had been a Power failure and thus prevent the reduced voltage feature from operating properly.

To achieve the correct operation of the Variable Volt System and the Battery Back-up, the Variable Voltage potentiometer is set to the desired voltage and is activated only by depressing a push-button. The push-button also deactivates the Battery-Back-up System as long as the push-button is depressed. When this feature is activated, the yellow 'RED VOLT ACTIV/BATT SYS DEACT' located on the Pendant along with the Potentiometer and the Reduced Voltage Push-button, will illuminate.

The Battery System is also set up to provide interlock connections for the operation of the Crane. An auxiliary Normally Closed contact on each Crane Main Contactor must be wired in series as an interlock so as to deactivate the Reduced Voltage function while the Crane is in motion. Each time any of the Axes motion Buttons is depressed, its Contactor is activated and thus opens the Normally Closed Auxiliary Contact, thus opening the Reduced Voltage Circuit, preventing its operation. If your Crane does not have a Normally Closed contact attached to each Contactor, then inquire of your Crane manufacturer as to how it can be added. This feature is important, because it will prevent accidental operation of the Reduced Voltage function while the Crane is in motion.

A second interlock is provided as part of the Battery Back-up System and is to be connected in series with the control circuit of the Cranes Main Contactors. This is to prevent accidental Crane Movement while the Reduced Voltage function is Active.

These interlocks are a safety feature and must not be by-passed. Refer to the interconnection Diagram for proper connection of these interlocks.

Lead Acid Battery Back-up Systems connected to Variable Volt Systems have a separate Fixed Output Rectifier of low Capacity for charging the Batteries. This assures that the Batteries are receiving a full charge, even when the Main Rectifier is in a reduced voltage condition. This is not the same charger described in section 3.26

For Battery Charger information on Battery Chargers used with Ni-Cad Battery Systems, please refer to section 3.26!

3.26 **SEPARATE BATTERY CHARGER (NI-CAD SYSTEMS):**

In systems that have Ni-Cad batteries, a separate battery charger is provided to charge the batteries. The charger is connected to the same power main as the power rectifier. When the main power is applied to the system, the battery charger will come on, and if the main disconnect switch is closed, will begin charging the batteries. If the batteries are lightly drained, charging will cease in less than one minute. If, however, the batteries are heavily drained, charging will take longer.

The battery charger provides four alarm signals to the main sensing unit: LVA (Low Voltage Alarm); HVA (High Voltage Alarm); RPF (Rectifier Power Failure); and CLA (Current Limit Alarm). The LVA is used to indicate low battery voltage. If the battery voltage is less than 200 V, the this alarm will signal a fault. alarm is a common fault alarm with the HVA alarm described below. is tied, into the display panel `MAIN POWER LOSS-RECT/CHRG FAULT' indicating lamp. A lift can not occur if this fault exists! If the battery voltage is low, the charger should be charging the batteries. If it is not, then there is a fault in the charger. Refer to the separate manual for the charger for troubleshooting information. Note: When the batteries have been drained, and their voltage is less than 200 V do, and the system is in a charge mode, it is possible that on the display panel, that both the `MAIN POWER LOSS-RECT/CHRG FAULT' and the `BATTERIES CHARGING' lights be illuminated simultaneously. This is normal. once the battery voltage has exceeded 210 V dc, the red fault light will go out, and the yellow light should be the only one left on.

HVA is used to indicate high battery voltage. If the battery voltage is to high, the alarm will signal a fault. This alarm is a common fault alarm with the LVA alarm described above. It is tied into the display panel `MAIN POWER LOSS-RECT/CHRG FAULT' indicating lamp. A lift can not occur if this fault exist! If the battery voltage is high, refer to the separate manual for the charger for troubleshooting information.

The RPF is used to indicate that the battery charger has failed. If this alarm is indicated, the `MAIN POWER LOSS-RECT/CHRG FAULT' on the main panel will be illuminated. A lift can not occur if this fault exists! This fault can occur if the main power to the Battery Charger has failed, or if a component in the Charger has failed.

If a MAIN POWER LOSS light has illuminated, your fault can be either in the rectifier and/or the charger. If you have main power and you have ruled out the main rectifier as the cause, then the problem lies in the Battery Charger. You can determine whether the problem is a low voltage or a high voltage alarm by the fault indicator lamps located on the battery charger. See separate battery charger manual for an indication of charger fault lamps.

The CLA alarm is used to indicate that the Battery Charger is in the charging mode. This alarm is tied into the display panel `BATTERIES CHARGING' indicating lamp. That means this lamp will illuminate when the Battery Charger is in current limit as well as when the Battery Charger is in high rate charge state (manual or automatic high rate charging mode).

When the batteries begin to charge, limit mode, this will activate the CLA alarm: If the charger stays in current limit for more than 30 s, the charger will automatically enter a high rate charge. The high rate charge will stay on for 6 to 12 hours. The batteries will usually fully charge in less than 12 hours. If the system is still in high rate, even though the current limit is no longer active, the CLA alarm will still be active and the system will be interlocked to prevent a magnet lift operation. When the high rate is completed, the alarm will end, and a the `SYSTEM READY' light will illuminate. At this time a lift operation can be initiated.

Should you have any questions on the operation of function of the battery charger, consult the separate manual for the battery charger.

3.27 **ALL DC SYSTEMS:**

In the systems described above, the use of a Rectifier provides either 120 V or 240 V single phase control voltage to operate the relays in the charging system, as well as the PLS and BCS sensors. However, in areas where only 230-250 V dc is available, a slight modification to the system is provided. In this case, a switching power supply, designed to output 24 V dc, when the input is available in the range of 100 to 350 V dc, is utilized to provide operating power for those units normally running on 120 or 240 V ac. Components normally running at 120 or 240 V ac are replaced with ones that function at 24 V dc. These parts can not be interchanged.

The switching power supply is a heavy duty unit capable of providing 2.5 A for use by the relays and sensors. The input of the power supply is connected directly across the input line. There are some suppressors connected across the input to provide some protection to the power supply from voltage spikes. Yet, if the spikes are excessive, they can damage the supply and other components operating from the power supply. Care should be taken not to connect the system to a dc bus that is extremely unstable.

The switching power supply is equipped with a 2.5 A 5 x 20 mm quick blow fuse (Radio Shack P/N: 270-1053). If this fuse is open or blown, there will be no output and the fault relays PR2/CR2 will prevent the system from allowing a lift to occur.

4.1 TROUBLESHOOTING CHART

PROBLEM:	PROBABLE CAUSES:	CORRECTIONS:
1.) NO BATTERY VOLTAGE OR INSUFFICIENT BATTERY VOLTAGE	A.) BATTERY JUMPERS OR LEADS DISCONNECTED	RECONNECT JUMPERS; CHECK ALL BATTERY CONNECTIONS
	B.) BATTERY CONNECTIONS CORRODED OR BROKEN	REPLACE CORRODED CONNECTIONS. CHECK ALL BATTERIES FOR GOOD CONNECTIONS
	C:) DEAD BATTERIES	SEE SECTION 4.3 - SYSTEM MAINTENANCE
	D:) WEAK BATTERIES - WILL NOT CHARGE	REPLACE DEAD AND/OR WEAK BATTERIES
	E.) DISCONNECT FAULT.	REFERENCE #6 FOR POSSIBLE CAUSES AND SOLUTIONS
2.) BATTERIES WON'T CHARGE	A.) CHARGE LIMIT RESISTOR OPEN	REPLACE RESISTOR
	B.) CHARGE BLOCKING DIODE OPEN	REPLACE DIODE
	C.) DISCONNECT FAULT.	REFERENCE #6 FOR POSSIBLE CAUSES AND SOLUTIONS
	D.) CHARGER INOPERABLE (WHERE APPLICABLE)	REFERENCE CHARGER MANUAL
	E.) DEAD OR WEAK BATTERIES	SEE PROBLEM # 1 ABOVE
	NOTE: SEE ALSO PROBLEM #1 ABOVE FOR POSSIBLE CAUSES/SOLUTIONS	
3.) BATTERIES WON'T DISCHARGE	A.) DISCHARGE BLOCKING DIODE OPEN	REPLACE DIODE
	B.) DEAD OR WEAK BATTERIES	SEE PROBABLE # 1 ABOVE
4.) SYSTEM OPERABLE LIGHT WON'T ILLUMINATE	A.) BULB IS BURNED OUT	REPLACE BULB
	B.) CR2 RELAY IS NOT ENERGIZED	CHECK FOR POWER TO CR2 RELAY COIL IF NO VOLTAGE TRACE BACK THROUGH CIRCUIT TO DETERMINE WHICH OTHER COMPONENT WON'T ALLOW VOLTAGE TO PASS.
	C.) OTHER SYSTEM LIGHTS ILLUMINATED	RED LIGHTS REFLECT A SYSTEM FAULT, YELLOW LIGHTS REFLECT CHARGE/DISCHARGE CONDITION OF BATTERIES
5.) CAN NOT INITIATE A LIFT	A.) SYSTEM FAULT EXISTS (NO VOLTAGE AT TERMINAL 56)	SEE 4B ABOVE.
	B.) NO VOLTAGE AT TERMINAL U; VOLTAGE AT TERMINAL 56 OK	FAULTY LIFT/DROP SWITCH OR POOR SWITCH CONNECTIONS. REPLACE BAD PARTS
6.) DISCONNECT SWITCH FAULT	A.) OPEN OR BLOWN FUSES	REPLACE FUSES
	B.) SWITCH IS OPEN	CLOSE SWITCH
	C.) FAULTY RELAY	REPLACE RELAY
	D.) BLOWN FUSE INDICATOR IS TRIPPED	REPLACE BLOWN FUSE INDICATOR
	NOTE: BLOWN FUSE INDICATOR CAN NOT BE RESET. THEY MUST BE REPLACED EACH TIME THEY ARE BLOWN ANY FAULT IN THE DISCONNECT WILL CAUSE A SYSTEM TO INTERLOCK	
7.) BATTERIES ALWAYS BEING DISCHARGED; MAIN POWER OK SYSTEM OPERABLE OK	A.) DIODE DM1 SHORTED	REPLACE DIODE
	B.) LOW INPUT VOLTAGE AT E1(+) TO E2(-)	CHECK FOR PROBLEM IN POWER SOURCE
8.) POWER LOSS SENSOR (PLS) NOT FUNCTIONING	A.) SENSOR IS OUT OF CALIBRATION	RECALIBRATE SENSOR TO DROP OUT WHEN MAIN VOLTAGE IS < 100 OR 200 V dc
	B.) SENSOR IS DEFECTIVE	REPLACE SENSOR UNIT
	NOTE: REFER TO CALIBRATION PROCEDURE BEFORE MAKING ANY ATTEMPTS TO RECALIBRATE SENSOR UNIT	
9.) HEATERS NOT WORKING (WHERE APPLICABLE)	A.) DEFECTIVE TEMPERATURE SWITCH	REPLACE SWITCH
	B.) DEFECTIVE HEATER RESISTOR	REPLACE HEATER RESISTOR
	C.) DEFECTIVE HEATER RELAY	REPLACE HEATER RELAY
	NOTE: HEATER WILL ONLY FUNCTION WHEN INTERNAL TEMPERATURE FALLS BELOW 20°C	

4.2 **TROUBLESHOOTING**

The Display Indicator Enclosure contains a set up lights used to indicate the status of the battery back-up system. Under normal operation, the green 'SYSTEM OPERABLE' light should always be illuminated. If it is not, then one of the other lamps on the display will be illuminated, indicating the status of the system. Red lights indicate that a fault has occurred, and yellow indicates that the batteries are either in a charge or discharge mode.

If the green light is not on; and no others lights are on, then a system problem has occurred. The problem could range from an indicator bulb being burned out, a loose or corroded wire connections, up to and including component failure.

Using the Display Indicator as a guide; Observe the voltmeter. It will show the voltage that is present on the batteries. That voltage must be present to operate the indicator lamps and the relays. If there is no voltage, use the TROUBLESHOOTING CHART of section 4.l to help locate the reason for the meter not indicating voltage.

Using a multimeter, determine if there is about 240 V-dc present at the rectifier output (El to E2), and no more than 225 V-dc from B16+ to B1- (E3 to E2) of the batteries. You may also easily determine if each indicator lamp is operating properly. Each lamp is a PUSH-TO-TEST type lamp, and the light of each button will illuminate each time the colored plastic lens is pressed in. If the bulb does not light, then the bulb might be burned out. Replace the old bulb with a new bulb and re-test. If the new bulb fails to light, the switch itself could be defective, or 240 V is not present at the switch. Determine the reason the bulb will not light using proper troubleshooting techniques and replace or repair all defective components. Test all indicator lamps in this fashion.

Refer to the schematic diagram and the system interconnection diagram and follow the TROUBLESHOOTING GUIDE to easily locate and correct problems that might occur.

To help prevent problems from occurring, refer to section 4.3 SYSTEM MAINTENANCE.

Battery charging: If there is a fault in the battery charging system, check all of the wiring to the batteries and all of the connections to the batteries and elsewhere. If the continuity of the circuit is broken, the batteries will not charge properly. There is no method to checking a bad battery, so it is advisable to conduct testing of the system at least every two weeks.

Battery Discharging: If the discharging of the batteries appears weak, or the batteries appear to discharge to less than 180 V in the specified time, there could be shorted cells in one or more of the batteries. The battery back-up system can not detect this kind of fault, because this fault will generate a normal charging condition If this fault should occur, it will be necessary to change the faulty batteries.

4.2 **TROUBLESHOOTING** (cont.)

The life and performance of the batteries and the system will be reduced greatly if the system is exposed to extremes in temperature. If the environment is too cold, then regulated heating units will have to added to the enclosures in order to maintain a optimal operating temperature of about 20°C.

If the environment is too hot, then a regulated air conditioning system will have to be added to the enclosures in order to maintain an optimal operating temperature of about 40°C.

Lead acid batteries normally have a life expectancy of 3 to 5 years. It is advisable to change out the batteries every 3 years to assure an optimal operating system.

Should you experience problems, that you are not able to repair then please contact the factory for help.

4.3 **SYSTEM MAINTENANCE**

Maintenance of the Battery Backup system plays a very important roll in the life and the function of the system. It is very important that the system be regularly inspected for possible problems. The main power should be deliberately interrupted at least twice per month and the battery completely cycled. If there are any problems they can be corrected at this time.

Take special care when maintaining or repairing the system because dangerously high voltage is present at all times. Take the necessary safety steps to insure that shock or electrocution danger is eliminated. Do not use water as a cleaning agent. When cleaning the system make sure the main power is off and the battery isolation disconnect switch is opened.

Make sure that the components are as free of dust and dirt as possible. Dirt and moisture can cause contacts to corrode and thus reduce the efficiency of the battery system. If you see signs of corrosion, replace the corroded parts at once.

Loose and or broken connections can cause a malfunction of the system and therefore should also be repaired.

There are two different types of batteries that can be used in the battery backup system: Lead Acid or Ni-Cad. Lead Acid are a dry type and are sealed. They are maintenance free. When new, they will improve their efficiency after a few cycles of charging and discharging. They have a life of about 3 to 5 years before they must be replaced. Ni-Cad batteries are a wet type and require a electrolyte solution to be maintained in order to operate properly. Never allow the liquid level to drop below the manufactures' recommended minimum level; as the efficiency of the system will be severely reduced and/or the batteries can be damaged. Ni-Cads also produce gasses when charging and discharging and therefore must be properly vented. Failure to allow the gasses to escape can result in an explosion. NEVER block the vents in the enclosure. A Ni-Cad battery can have a field life from 15 to 25 years.

All sensing relays are factory adjusted for optimum performance, but in time some of the adjustments might drift and the system may not function efficiently. Check the operation of each sensor relay to make sure that it pulls in during the time that it is suppose to. *Note:* In units with a separate battery charger, the discharge sense relay is complimented with a transfer switch . Once the transfer switch becomes active, the discharge sense relay drops out . The electronic sense relays are adjustable via DIP switches and a calibration potentiometer. There is a precise procedure for calibration of these relays. Even though the various electronic sensors might look the same, they are calibrated differently depending on their intended operation and thus can not be interchanged unless they have the same part number. If you attempt to service one of the sensors, it must be done per a proper written procedure. If this procedure is not followed then the unit can be destroyed or the battery system will not function properly.

5.0 DRAWINGS:

SCHEMATIC: _____

INTERCONNECTION: _____

BATTERY CHARGER: _____

_____: _____

_____: _____

WIRE & ASSEMBLY DRAWINGS:

CONTROL UNIT PANEL: _____

DIODE HEATSINK ASSEMBLY: _____

DISCONNECT SWITCH ENCLOSURE; _____

DISCONNECT SWITCH PANEL; _____

DISPLAY ENCLOSURE: _____

BATTERY ENCLOSURE: _____

BATTERY CHARGER: _____

_____: _____

OUTLINE DRAWINGS:

CONTROL UNIT: _____

BATTERY ENCLOSURE: _____

DISCONNECT SWITCH: _____

DISPLAY ENCLOSURE: _____

BATTERY CHARGER: _____

OTHER:

_____: _____

_____: _____

_____: _____

_____: _____

6.0 **REPLACEMENT PARTS & COMPONENTS**

Refer to the appropriate wiring diagram(s) located in the previous section for the list of parts pertaining to each assembly. The part numbers are listed in the upper right corner of the drawing and number balloons refer to the specific part.