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INDUSTRIAL BATTERY CHARGER

OWNER'S MANUAL

INDUSTRIAL BATTERY CHARGER

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GENERAL INFORMATION

SAFETY

Safety First! Please take time to study this manual before installing, operating or troubleshooting. Special attention should be given to WARNING and CAUTION labels on the charger and in this manual.

Battery chargers are safe when properly operated under intended use and by trained operators. Untrained operators and service personnel risk the possibility of serious injury to themselves and others.

Improper application of battery chargers can also result in extensive and costly damage to batteries and equipment. Only trained operators and service personnel that are familiar with this manual should install, operate, or troubleshoot the battery chargers.

WARNING: EXPLOSION

Connect or disconnect the battery plug only when the AC line is disconnected or the charger is in the "OFF" position. Failure to follow this instruction may result in arcing and burning of the DC connector contacts. Arcing contacts may ignite a mixture of oxygen and hydrogen, which is produced during battery charging. **Do not smoke, weld, grind, or use torches around batteries.**

DANGER: ELECTRIC SHOCK

Do not touch uninsulated portion of output connector or uninsulated battery terminal. Do not operate charger unless connected to battery.

Before maintenance or troubleshooting, make sure all circuits are de-energized in the following manner:

1. Make sure charger is in "OFF" position
2. Disconnect charger plug from battery.
3. Make sure no AC power can be supplied to the charger from breaker or disconnect switch.
4. Short circuit capacitors with insulated screwdriver.

Avoid operating or troubleshooting in damp or wet locations. Use insulating gloves and shoes in such environments.

Replace defective cord or wires immediately.

GENERAL SAFETY PRECAUTIONS

When servicing battery chargers the main power supply switches, or other switches from which power could enter the circuit, should be locked in an open position and tagged e.g.

"Open Circuit for Repairs - DO NOT Tamper".

If it is impractical to open the main power switch **use extreme caution working on energized circuits.** Even though power circuits may be off, certain control circuits may still be energized. To take voltage readings on energized components, turn off the charger and attach alligator clips before turning the charger back on. This procedure will avoid sticking both hands with meter probes into a live charger, which is extremely dangerous.

Do not work alone. Have someone capable of rendering first aid nearby. Do not wear loose clothing or jewelry. Do not use bare hands to remove live parts, such as fuses. Think before you act.

RECEIPT AND INSTALLATION

Equipment Identification

Chargers are identified with a model number, which appears on the charger nameplate.

Certain information contained in this manual may be superseded by specific operating instructions, and schematic addendums.

	Charger Model Designation e.g. 18M650TJG35
18	Battery Cells
M	Magnum II
650	Amp Hour Capacity
T	Three Phase
J	AC Voltage Range
G	Case Type
35	Controller Type

For a full range of model designations see the sales literature.

Receiving

Check the charger nameplate against packing lists and purchase orders to verify receipt of proper equipment. If there are any discrepancies notify the shipper immediately.

All shipments leaving manufacturing have been carefully inspected. If a shipment arrives with the crating or packing damaged, have the carrier note the condition on the receipt. Check as soon as possible for concealed damage. If damage has occurred, notify and file a claim with the carrier at once. Do not return the unit to the shipper. Failure to follow this procedure may result in refusal by the carrier to honor any claims.

Location

Operating life and performance will be influenced by charger location. Select a dry and well-ventilated location. Allow 6 inches from walls and other chargers for proper ventilation. Chargers should not be exposed to rain, high temperatures, dust, corrosive fumes, combustible materials, or explosive gases. Dusty environments may require more frequent maintenance to obtain maximum life and optimum performance.

Mounting

Some chargers may be stacked 3 high. Optional wall mounting brackets are available for various models to secure charger to wall. Contact factory for further information.

Moving and Transport

Care should be taken when lifting units with forklifts or pallet jacks. Forks should extend completely under charger so as to prevent accidents.

Grounding

Follow applicable local codes or National Electric Code revisions that may supersede the following instructions.

The battery charger must be grounded to prevent lethal injury. Route ground conductor through knockout on side of charger. Connect AC ground wire (green) to the ground terminal located next to fuses. The case is grounded once this connection is made.

If the AC supply cable does not include a ground conductor see table on pg. 3 for proper sizing of separate ground conductor or consult the National Electrical Code.

AC Line Voltage Changeover

Refer to page 15 of this manual for AC line voltage configurations. Check that jumpers are connected to the proper positions on each terminal block. On 3 phase units, check that all jumpers are positioned the same on each AC terminal block. Check the control transformer for proper AC connection. The control transformer AC voltage setting must match the setting of the AC terminal blocks.

Before making any reconnection, check the charger nameplate to make sure the disconnect switch and supply wiring are of sufficient size to carry the desired input voltage and amps.

Check the fuse label on inside of door to make

certain the input fuses are proper for input line voltage. **INCORRECT FUSING WILL VOID CHARGER WARRANTY.**

AC Line Connection

Follow applicable local codes or National Electrical Code revisions that may supersede the following instructions:

Make sure main power supply switches or other switches from which power could enter the circuit are locked in an open position.

Check that charger is connected for proper input voltage - jumpers on AC terminal blocks match incoming AC line voltage on main panel.

Refer to charger nameplate for input amps at incoming line voltage. See table on pg.3 for recommended disconnect switch, branch fuse size, power and ground cable size. Route appropriate conductor through AC knockout, which is provided on side of the charger case.

DC Cables and Plugs

When changing DC cables use the following table for up to 20 feet.

Max DC Amp	Wire Size A.W.G.
65	#6
75	#4
120	#2
180	1/0
240	2/0
270	3/0

For lengths over 20 feet use one size larger cable. Cable length over 35 feet is not recommended.

Make sure DC plug is connected for proper polarity e.g. positive on plug to positive charging lead, negative on plug to negative charging lead. Improper connections may result in dangerous arcing and blown DC fuses.

When changing or repairing connectors, make certain plug contacts are crimped and/or soldered properly.

A poor crimp/solder joint will overheat and drop output. Make sure the plug contacts are firmly seated in the plug housing.

Charger Fusing

The fuse label (inside door) is marked to show original factory set voltage and AC fuse size. The label is also marked to show proper fuse size for other voltages.

INCORRECT FUSING WILL VOID CHARGER WARRANTY.

Operation

See Pg.3 & 5 for specific operating features and additional information. Also refer to charger model number, which appears on charger nameplate.

Pre-Operation

Make sure the charger has been installed according to the directions in this manual. Failure to do so could result in personal injury and damage to the equipment.

Double check nameplate to verify charger is correct DC voltage for batteries being recharged. Ampere-hour capacity on nameplate should correspond to the battery ampere-hour capacity.

GENERAL OPERATING INSTRUCTIONS

WARNING EXPLOSION

Connect or disconnect the battery plug only when the AC supply is disconnected or the charger is in the "OFF" position. Failure to follow this instruction may result in arcing and burning of DC connector contacts. Arcing contacts can ignite a mixture of oxygen and hydrogen, which is produced during battery charging.

Operating Characteristics

The battery charger, when connected to a discharged battery and energized, delivers maximum rated output current. As battery voltage rises, output charge current decreases in proportion to increasing battery voltage. When the battery becomes nearly full, the charger reduces output current to a pre-established finish rate. This ensures proper mixing of the battery electrolyte.

SERVICE

Maintenance

Observe all safety instructions presented in the front of this manual before attempting any maintenance or service.

The charger is designed to provide years of trouble free service. Routine maintenance checks will prevent potential problems and ensure maximum performance.

Cleaning

Keep the charger free from accumulated dirt and dust buildup. Wipe or blow dirt and dust deposits from the charger interior at least twice a year or as the situation demands. Clean components will keep

the charger running cooler and more efficiently.

Connections

Make sure all connections are clean and tight. Look for discolored connections and broken or loose wires.

All DC connections are especially critical. Loose DC connections create high resistance hot spots that reduce charger output and impair efficiency. Inspect the DC cables to make sure the cable insulation is not damaged. Check charger connector for damage and check to make sure plug contacts are properly seated. See pages 9-13 for troubleshooting information.

Specific Information by Case Type and Control

See specific charge control & case type on following pages for more information.

AC SUPPLY WIRING				
MAX Line Amps	Disconnect Switch Amps	Branch Fuse Size (Amps)	Copper Cable Power	Size No. Ground
2.5	30	5	14	14
4.5	30	7	14	14
7.5	30	10	14	14
12.0	30	15	14	14
16.0	30	20	12	12
18.0	30	25	10	12
22.0	30	25	10	10
24.5	60	35	10	10
32.5	60	40	8	8
40.0	60	50	6	8
45.0	60	60	6	8
57.5	100	80	4	8
78.0	100	100	2	8
102.5	200	125	1/0	6
135.0	200	150	3/0	4

The above table is based on 60 deg. C (140 deg. F) rated conductors and 40 deg. C (104 deg. F) ambient temperatures. Refer to National Electrical Code Tables 310-16 corrected to 40 deg. C (140 deg. F).

Quantum II and Magnum II Industrial Battery Chargers

DESCRIPTION OF EQUIPMENT

The battery charger is designed to recharge lead acid batteries. The easy access steel case is constructed to protect internal components, and provide adequate cooling plus component accessibility. The charger is equipped with the **3500 Control**. The enclosure is designed in 4 standard case types: F, G, H, and J. Page 14 of this manual shows the dimensions of each case type.

Just connect the battery to the charger and the **3500 Automatic Charge Control** takes control of the charge operation. The **3500 Control** determines the state of charge of the battery by accessing the rate of change of battery voltage (dv/dt) and actively compensating the dv/dt results with the rate of change of charge current (di/dt). This algorithm is based on the fact that the voltage of a lead acid battery increases as the battery becomes charged and charger current has an effect on the battery voltage.

The **3500 Control** uses rate of change of voltage and current information in addition to the temperature data to verify the operating characteristics of the battery and to validate the state of charge of the battery. This assures a fault free charge cycle.

When a charger with a **3500 Control** is connected to a battery, the **3500 Control** delays the start of charge for five seconds to ensure all connections have been completed. This prevents dangerous electric arcing that could be hazardous around charging batteries. The **3500 Control** identifies the battery as having the correct number of cells before the charger is energized. Once the charger is running, the **3500 Control** continuously monitors the voltage and current conditions to quickly identify battery and charger faults that may occur. If all operation guidelines are functioning correctly, the **3500 Control** continues the charging process until the battery is completely charged.

FEATURES OF THE QUANTUM II AND MAGNUM II INDUSTRIAL BATTERY CHARGER

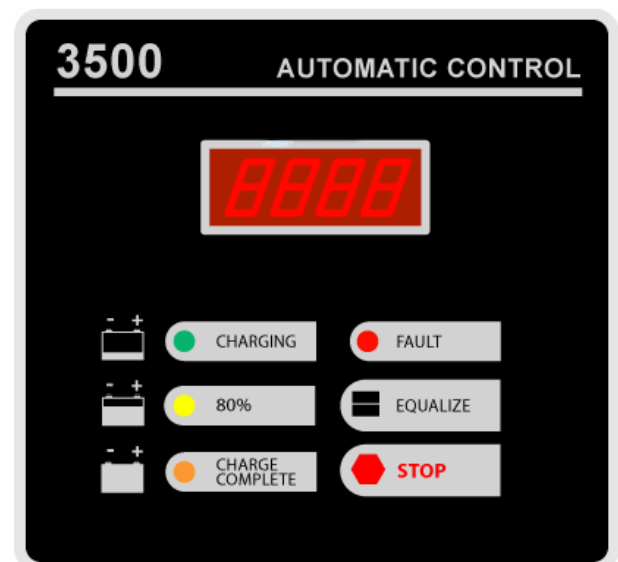
3500 CONTROL

3500 AUTOMATIC MICROPROCESSOR CONTROL FEATURES:

- Automatic five second delayed start upon connection of a proper sized, good battery.
- Battery voltage sensing determines if there is a proper sized battery connected to the 3500 Control. This prevents charging if there is a bad battery connected, no battery connected, bad battery to 3500 Control or battery voltage and control mismatch.
- Battery voltage and current are continuously monitored.
- Automatic dv/dt-di/dt charge termination. (Voltage slope detection is current compensated).
- Negative battery voltage slope termination to prevent overcharge/thermal runaway.
- Digital Ammeter/display displays charging current, fault diagnostics, delay start, cool down, amp-hours returned and equalize.
- Selectable 3 hour Equalize Charge at end of the normal charge cycle. **(not available with Opportunity Charge feature)**
- Automatic 12-hour “REFRESH” charge adds a top off charge to a fully charged battery.
- Back-up Timers prevent extended charging of a damaged battery.
- Automatic Shutdown Lock-out will not allow a charge to start after a manual or problem shutdown occurs. Automatic Shutdown Lock-out is cleared after the “Shutdown” battery is disconnected. This allows a charge to begin upon connection of a good, proper sized battery.
- Automatic shutdown occurs for any of six failure conditions:
 - a) High Volts/Cell
 - b) Low Current
 - c) Back-up timer expiration (Charge time exceeded)
 - d) Battery Disconnection
 - e) Low Volts/Cell
 - f) Hot Battery (with optional temperature sensor)

3500 MANUAL CONTROL FEATURES:

- One to seven hour programmable delayed start.
- Manual STOP button
- Equalize button **(not available with Opportunity Charge feature)**
- Low volts per cell override
- View amp-hours returned to battery



3500 CONTROL DIAGNOSTIC FEATURES:

- LED Indicators show CHARGE IN PROCESS, BATTERY IS 80% CHARGED, CHARGE COMPLETED, charge has been SHUTDOWN.
- AMMETER/TIMER display diagnostic indicators revealing high volts/cell, low current, charge time exceeded, battery disconnected during charge, low volts/cell, manual shutdown, equalizing, cool down time and hot battery (With optional temperature sensor).

3500 CONTROL OPERATING PROCEDURES

PRELIMINARY SET-UP:

When A.C. power has been applied to the charger, a “dash” segment will sequence across the display on the front panel. This indicates the 3500 Controlled charger is in the “STANDBY MODE” of operation, awaiting a battery to be connected.

IMMEDIATE/DELAY START:

The 3500 Control may be programmed to delay the start of the charge from one to seven hours as well as an immediate start of the charge upon connection of battery to charger.

The 3500 Control is shipped from the factory set for immediate start (0 hour delay).

If a power failure occurs, no damage will occur to the battery or the charger. The 3500 control will automatically start once power returns. If a battery is still connected when power returns, the 3500 control will override any delayed start setting and initialize an immediate start of the charge. Once the charge has been terminated, the delay start will again function normally.

CHANGING IMMEDIATE/DELAY START TIME:

***** WARNING *****

HIGH VOLTAGE MAY BE PRESENT WITHIN THE CHARGE CABINET. DISCONNECT AC POWER FROM THE CHARGER BEFORE OPENING THE CABINET DOOR.

- Remove AC power from the charger
- Open the charger cabinet door.
- Locate the DELAY START switch behind the front panel or door on the right side of the 3500 Control board. Adjust the DELAY START switch until the NUMBER INDICATOR on the switch yields the number of delay hours desired.
- Close and secure the cabinet door.
- Reapply AC power to the charger. The time delay that the 3500 Control is set for may be viewed on the digital display by pressing the POWER OFF switch without a battery connected.
- When a good, proper sized battery is then connected to the charger, the display will indicate the amount of time before the charge is initiated and the 3500 Control will begin a countdown to charge.

CHARGING THE BATTERY:

Compare the number of cells and amp-hour capacity of the battery to be charged with the charger rating found on the charger nameplate. The number of cells on the battery to be charged **MUST** match the nameplate data. The amp-hour ratings should also match to ensure that the battery would be charged in a timely manner.

Once battery and charger ratings have been verified, connect the battery to the charger. The 3500 Control will measure the average volts/cell of the connected battery.

Once the 3500 Control verifies the connection of a good battery (between 1.7 and 2.7 volts/cell), the display will show a countdown to charge initialization. When the countdown reaches zero, the 3500 Control will turn on the charger.

If the average volts/cell reading is less than 1.7 volts, the charge will not begin and the red FAULT LED will turn on and the display will indicate **Lo U**. To start the charger and override low volts per cell, push and hold the stop button for more than 10 seconds. The charger will start. Continue to hold the stop button in until the battery voltage increases to greater than 1.7 volts per cell, then, deactivate the stop button.

If the average volts/cell is greater than 2.7 volts, the red FAULT LED will turn on and the display will indicate **.Hi U**. Again, the charge will not begin. Check charger and battery for proper voltage match.

Once the charge begins, the display will show the output charging current in amperes. The green CHARGING LED will be on. The yellow 80% CHARGED LED will be on if the average volts/cell of the battery is greater than 2.37 volts/cell.

TERMINATION OF CHARGE:

There are three ways in which the charge may be terminated. These three termination methods are CHARGE COMPLETED TERMINATION, MANUAL TERMINATION and PROBLEM SHUTDOWN TERMINATION.

- CHARGE COMPLETED TERMINATION occurs when a battery reaches full charge. The 3500 Control monitors the battery charge characteristics. The 3500 Control utilizes di/dt current compensation to obtain an accurate battery voltage charging slope, dv/dt, measurement. Once the 3500 Control has verified the battery charge slope has reached the industry standard for full charge, the charge is terminated automatically. Once the charge is completed and terminated, the amber CHARGE COMPLETE LED will turn on and the display will be in the IDLE MODE.
- MANUAL TERMINATION, while charging, is accomplished by pressing the STOP BUTTON located on the front panel or door. To remove a charging battery from the charger, it is important to press the STOP BUTTON first before disconnecting the battery from the charger. Failure to do this may damage the charger.
When the charge has been terminated by MANUAL TERMINATION, the red FAULT LED will be on continuously (until the battery is removed). The display will indicate **OFF**.
- PROBLEM SHUTDOWN occurs when the 3500 Control senses an abnormality in the charge. There are six situations that will cause a PROBLEM SHUTDOWN termination. The six conditions are HIGH VOLTS/CELL, LOW CURRENT, CHARGE TIME EXCEEDED, CABLE DISCONNECTION, LOW VOLTS/CELL and HOT BATTERY (With optional temperature sensor)
Each of the PROBLEM SHUTDOWN terminations are indicated by a flashing red FAULT LED along with a

display indicator. After the battery is removed, the red FAULT LED will remain flashing for one hour. The display indicator will remain on until another battery is connected to the charger. Refer to the TROUBLESHOOTING SECTION for a more complete explanation of the diagnostics.

EQUALIZE CHARGE

An equalize charge of three (3) hours beyond normal charge termination can be selected by pressing the equalize button on the front panel or door. An “E” appears in the display indicating that the equalize charge will occur at the end of the charge cycle. The ‘E’ will flash when the charger is equalizing. The equalize charge can be cancelled by pressing the equalize button again before the equalize charge actually begins. **Equalize is not available with optional Opportunity Charge Control.**

REFRESH CHARGE:

The 3500 Control will automatically turn on every 12 hours after the charge cycle is completed, provided the battery remains connected to the charger. The charge rate of the battery will be monitored with dv/dt termination occurring typically within 20 -30 minutes. The refresh charge tops off the battery during weekends and when batteries are not used for extended periods of time. The amber LED will flash and the green charging LED will be on when the charger is in refresh mode.

COOL DOWN TIMER

The 3500 Control displays the amount of time that has accumulated from the end of a successful charge. If the charge cycle is not successful, a fault code will be displayed.

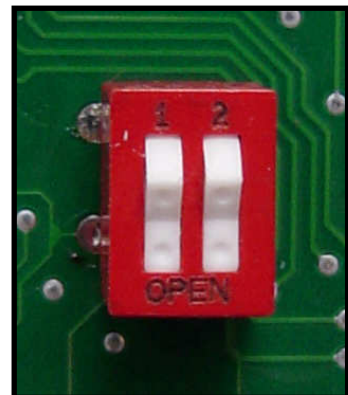
AMPERE HOURS RETURNED:

At the end of the charge cycle, the amount of ampere hours returned to the battery can be displayed by pressing the stop button. This feature is only active when the charge process has stopped and the charging LED is not illuminated. Pressing the stop button during the charge cycle will manually terminate the charge.

OPPORTUNITY CHARGE:

The opportunity charge feature is selectable using the two-position DIP switch located on the back of the main display board. When enabled, the opportunity charge feature allows the charger to fill the battery to 80%. When the battery reaches this point, the charger goes into a 3-hour hibernation mode. Once the 3-hour hibernation mode has elapsed, the charger will restart and complete a normal charge cycle.

To enable the opportunity charge feature both switches must be in the up position or depressed toward “1 & 2”. When the opportunity charge feature is enabled, the lower right decimal point on the main display will illuminate. When the two switches are in the “OPEN” or down (shown) position, the charger operates normally and the opportunity charge feature is disabled.



HOT BATTERY INDICATER (OPTIONAL):

When using the optional temperature sensor, the charger will terminate if the battery temperature has reached 135° F. The fault is indicated by a display error code **Hot**.

TROUBLESHOOTING GUIDE

GENERAL SERVICE INFORMATION

WARNING: Observe all safety instructions presented in the front of this manual before attempting any service.

DANGER: Electric Shock Hazard - Disconnect AC Power and battery plug before any service is performed. Discharge capacitors with insulated screwdriver.

NOTE: If testing requires energized circuits, observe all safety precautions in the front of this manual. Disconnect all AC power. Apply alligator clips so that you do not have to touch any probes or part of the equipment before turning the power back on to take a reading. Follow the sequence of this troubleshooting manual step by step, as each successful procedure will aid in isolating the problem.

This troubleshooting guide deals with the Quantum II and Magnum II 3500 CONTROLLED charger. Each subsection is titled with a symptom. Locate the symptom your charger is experiencing and follow the step by step troubleshooting procedure to determine the cause of the problem. (Refer to schematic/wiring diagrams located in the back of this manual)

SYMPTOM - POWER IS APPLIED BUT THE DISPLAY IS NOT ON

AC POWER CONNECTION

- Make sure the AC input line, located at the AC Contactor, is connected to the AC power outlet. Measure the voltage at the Contactor and verify that AC power is at the charger.

CONTROL TRANSFORMER

- Locate the Control Transformer inside the charger. Measure the AC input voltage at the Control Transformer primary. If there is no voltage measured, repair open circuit.
- Measure the Control Transformer secondary voltage across two (2) orange leads. The AC voltage should be approximately 24 volts rms. If no voltage was measured, then the Control Transformer is defective and should be replaced. Check to ensure that the AC line input is connected to the proper terminals of the Control Transformer.

MICROCONTROLLER/CELL SELECT CONNECTIONS

- Locate the Microcontroller board on the front panel or door and the Cell Select board inside the charger. Verify the proper connection and polarity of the board and cables.

MICROCONTROLLER BOARD

- If there is the appropriate voltage level across the Control Transformer, disconnect AC power. Then, reapply AC power. This action will reset the Microprocessor.

SYMPTOM - POWER IS APPLIED. DISPLAY IS IN IDLE MODE BUT CHARGER WILL NOT START OR CHARGE STARTS BUT IS TERMINATED IMMEDIATELY

PROPER BATTERY

- Verify that the number of cells of the battery to be charged matches the charger. Also, check the diagnostic voltage indicators.

GOOD BATTERY

- Measure the total battery voltage. Divide the voltage value measured by the number of battery cells. This will yield an average volts per cell value. If the average volts per cell value is less than 1.7 volts or greater than 2.7 volts, then the battery is bad and should not be used.

AC & DC FUSES

- Disconnect the battery and AC input power from the charger. Verify that the fuses are not open. Replace any defective fuses and check the following:
 - a) Make sure that the battery to charger connector cables connect the battery to the charger with the proper polarity.
 - b) Verify that both AC power and battery have been disconnected from the charger. Locate the rectifier diodes on the heatsink. Remove the connecting wires from the diodes. Test the diodes and replace if faulty. (See Pg. 13 for diode checkout procedure)
 - c) Make sure all connections are tight.

CONTROL TRANSFORMER

- Check the control transformer fuse and verify that it is not open.
- Apply AC power to the charger and measure the AC voltage across the two (2) orange leads on the Control Transformer secondary. The secondary voltage should be approximately 24 volts rms. If there is no voltage measured at the secondary, the Control Transformer is defective and should be replaced. If the voltage measured is extremely high or low, verify the AC input is connected to the proper Control Transformer terminals.

MAIN TRANSFORMER(s)

- Test main transformer(s) for shorted winding. Look for burned windings. Replace if defective.

SYMPTOM - CHARGE TERMINATES EARLY

- **HIGH VOLTS/CELL:**

DISPLAY INDICATOR = 

If this indicator is on, then the 3500 Control measured the average volts/cell to be greater than 2.7 volts.

- a) Verify that the battery connected to the charger has the correct number of cells.
- b) If the battery has the appropriate number of cells, measure the battery voltage. Divide the measured voltage value by the number of battery cells. This value is the average volts per cell of

the battery. If the average volts per cell of the battery is between 1.7 and 2.7 volts/cell, then the battery is good.

- **LOW CURRENT:**

DISPLAY INDICATOR = 

If this indicator is on, the battery on charge was not receiving current.

- a) Disconnect the battery and AC input power from the charger.
- b) Check the AC and DC fuses. Verify that the fuses are not open. Replace any faulty fuses.
- c) Verify the Magnetic Amplifier is not open. Check for continuity between the Magnetic Amplifier and Cell Select Board. Repair any bad connections. Replace the Magnetic Amplifier if faulty.
- d) Verify the AC Resonant Capacitor is not open. Replace the Capacitor if defective. (See Pg. 13 for capacitor test procedure)
- e) Verify that diodes are not open. Replace any defective diode if defective. (See Pg. 13 for diode test procedure)

- **CHARGE TIME EXCEEDED:**

DISPLAY INDICATOR = 

This indicates that the battery did not reach 80% of full charge (approximately 2.37 vpc) within nine hours or that the battery did not charge from 80% charged to full charge within six hours.

Verify that the charger amp-hour rating matches the battery amp-hour rating.

Disconnect the battery and AC input power from the charger. Verify that the AC and DC fuses are not open. Replace any defective fuses.

- **CABLE DISCONNECTION:**

DISPLAY INDICATOR = 

This indicator will be on whenever the battery to 3500 Controlled charger charging cable is disconnected while the battery is being charged. Although the 3500 control will automatically terminate the charge when the charging cable is disconnected, always make sure to manually shutdown the charger before disconnecting the cables.

- **LOW VOLTAGE:**

DISPLAY INDICATOR = 

Having a flashing red FAULT LED with **Lo U** showing in the display indicates that the 3500 control measured the average volts/cell to be less than 1.7 volts while the battery was being charged.

Verify that the charger DC output rating matches the battery DC voltage rating.

To start the charger and override low volts per cell, push and hold the stop button for more than 10 seconds. The charger will start. Continue to hold the stop button in until the battery voltage increases to greater than 1.7 volts per cell. Then, deactivate the stop button.

DIODE AND CAPACITOR CHECKOUT PROCEDURE

QUICK TIP - A shorted diode can be diagnosed by checking for continuity at the positive and negative contacts of the DC plug. If test shows open, DC fuse is probably blown - check for continuity. To bypass open DC fuse, check continuity for shorted diode at positive and negative lugs behind DC fuse. Reverse the ohmmeter probes. A shorted diode will show continuity on both tests.

To isolate defective diode, unbolt connection at end of flexible lead to isolate from circuit. Set ohmmeter to RX100 range.

TEST #1 Place one ohmmeter probe on aluminum heatsink and the other probe at end of loose flexible lead.

TEST #2 Reverse the position of the ohmmeter probes.

GOOD DIODE - The ohmmeter needle should deflect on either test #1 or #2 - not both.

SHORT DIODE - The ohmmeter needle will deflect on both tests #1 and #2. Replace diode.

OPEN DIODE - The needle will not deflect in either tests #1 or #2. Replace diode.

CAPACITOR CHECKOUT PROCEDURE

CAUTION: Short out capacitors with insulated screwdriver before performing test. Disconnect leads. Set ohmmeter to RX100 scale. Connect meter probes to capacitor terminals.

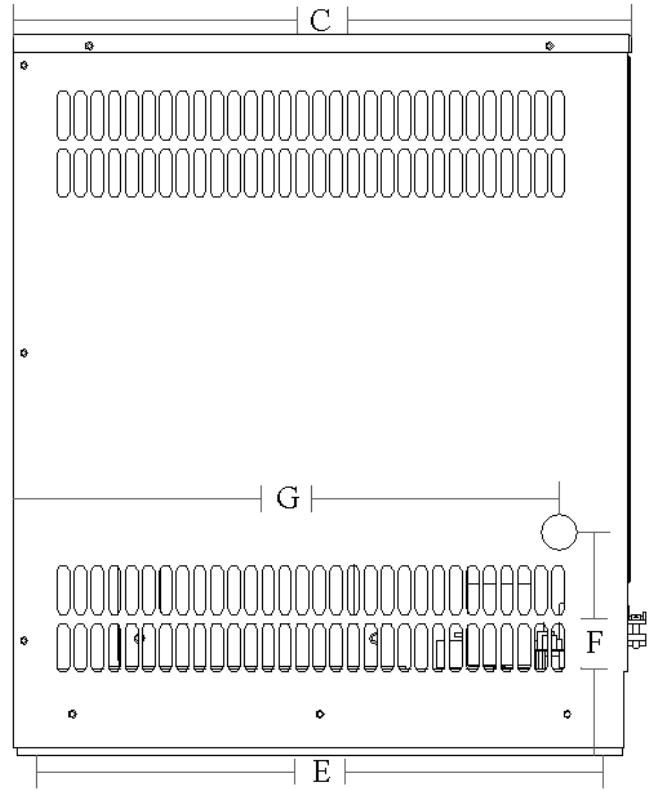
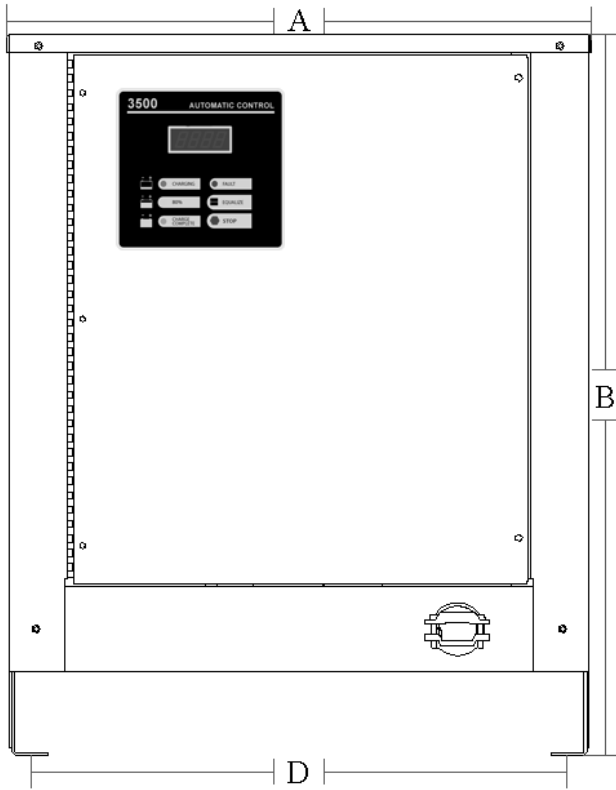
GOOD CAPACITOR - Needle will deflect toward right and then be followed by a deflection in the opposite direction. Reverse ohmmeter probes to validate test accuracy.

SHORTED CAPACITOR - Needle deflects toward right and remains. Replace.

OPEN CAPACITOR - No needle deflection. Replace.

BATTERY VOLTAGE TABLE (INDUSTRY STANDARD)					
CELLS	DC VOLTS	DEAD @1.9	DISCH W/LOAD @1.70	START RATE @2.133	FIN RATE @2.55
6	12	11.4	10.2	12.8	15.3
12	24	22.8	20.4	25.6	30.6
18	36	34.2	30.6	38.4	45.9
24	48	45.6	40.8	51.2	61.2
36	72	68.4	61.2	76.8	91.8
40	80	76	68.0	85.3	102.0

MECHANICAL CONFIGURATIONS

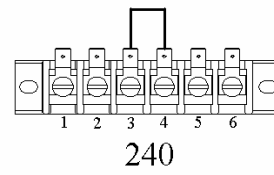
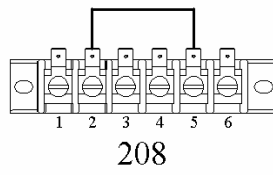
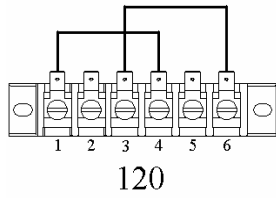


CASE TYPE	"A" DIM	"B" DIM	"C" DIM	"D" DIM	"E" DIM	"F" DIM	"G" DIM
F CASE	14.156	22.563	14.234	12.625	12.000	5.125	13.000
G CASE	20.312	25.063	21.484	18.750	19.105	7.750	19.000
H CASE	27.156	25.062	24.236	25.625	21.790	9.625	20.000
J CASE	32.812	32.000	24.750	30.500	21.274	9.750	22.039

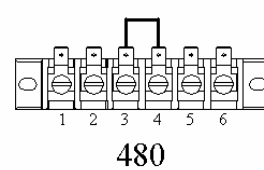
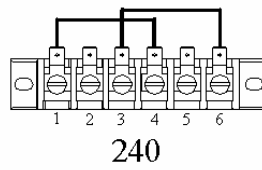
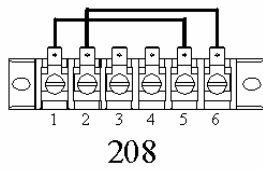
*Note: All dimensions are in inches

AC VOLTAGE CHANGE OVER

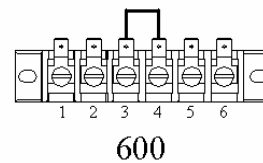
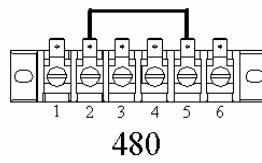
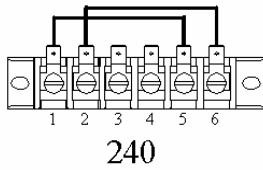
AC VOLTAGE SELECTOR BLOCKS



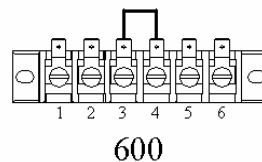
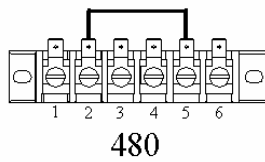
120/208/240 VOLT UNITS



208/240/480 VOLT UNITS



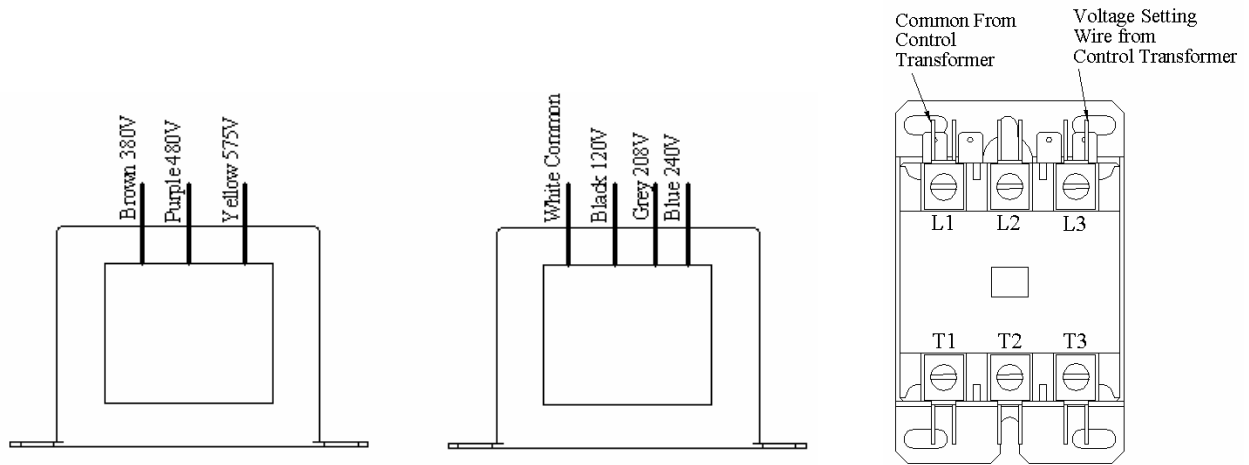
240/480/600 VOLT UNITS



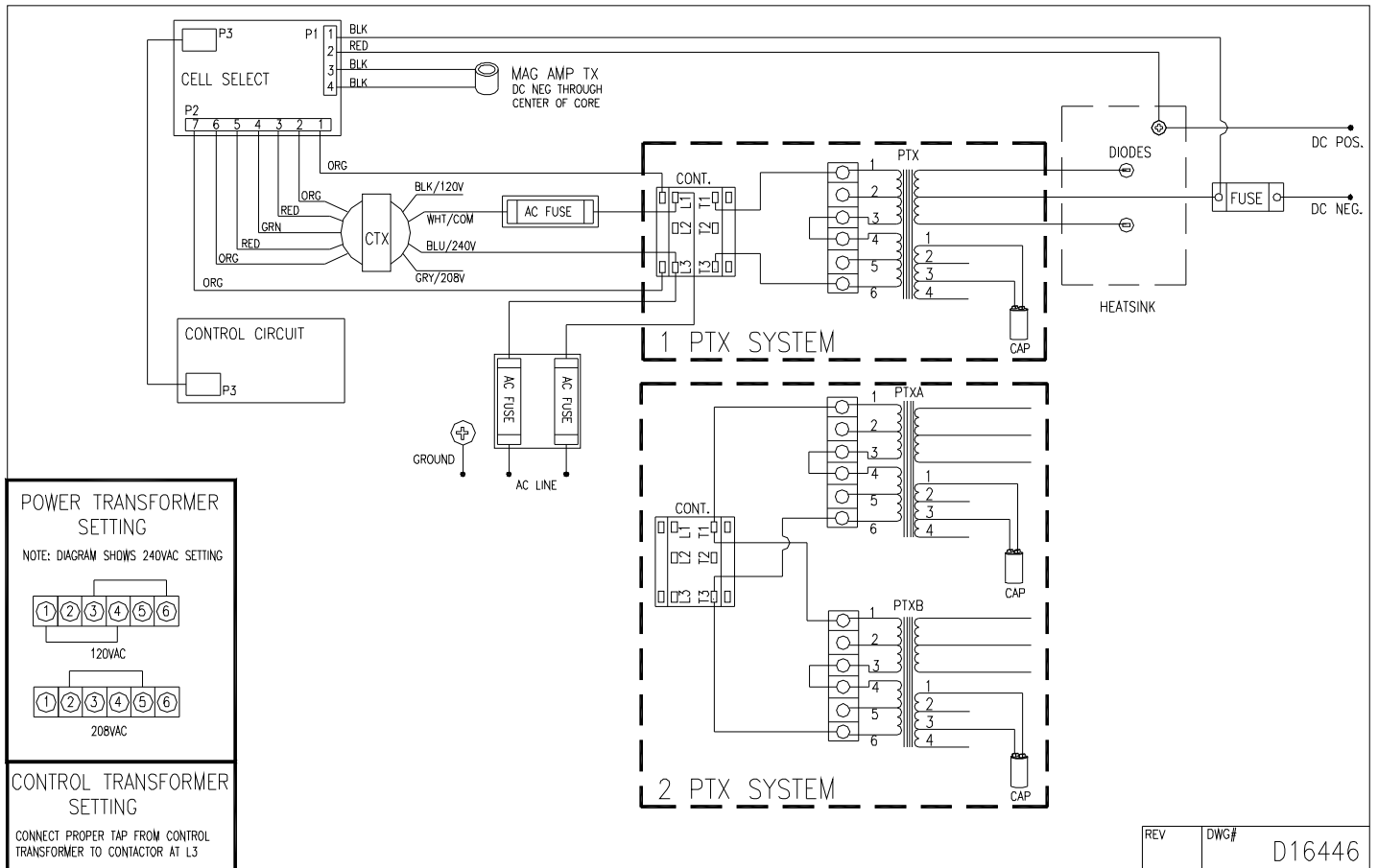
480/600 VOLT UNIT

AC VOLTAGE CHANGE OVER

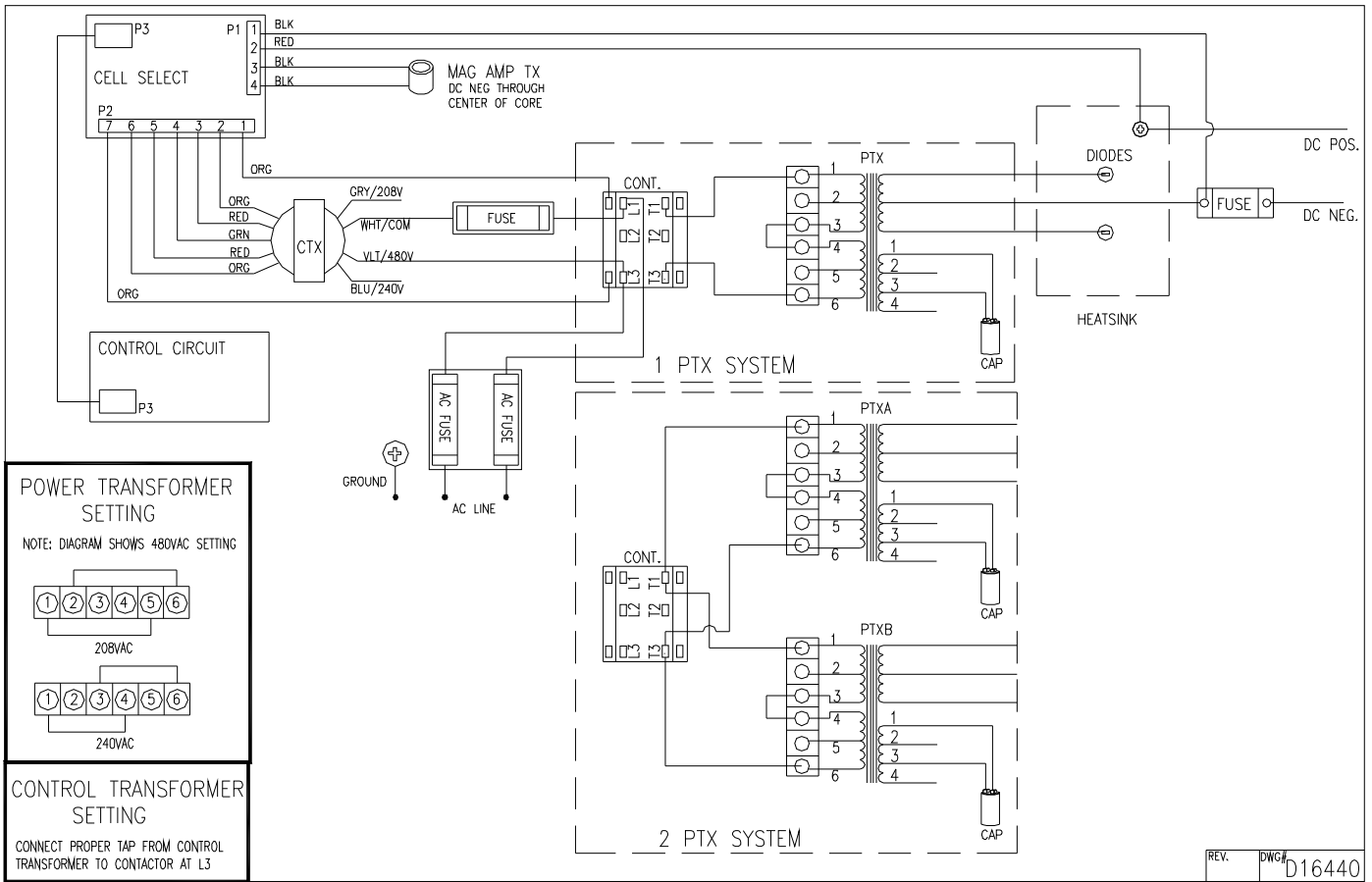
AC VOLTAGE SELECTION FOR CONTROL TRANSFORMER/CONTACTOR



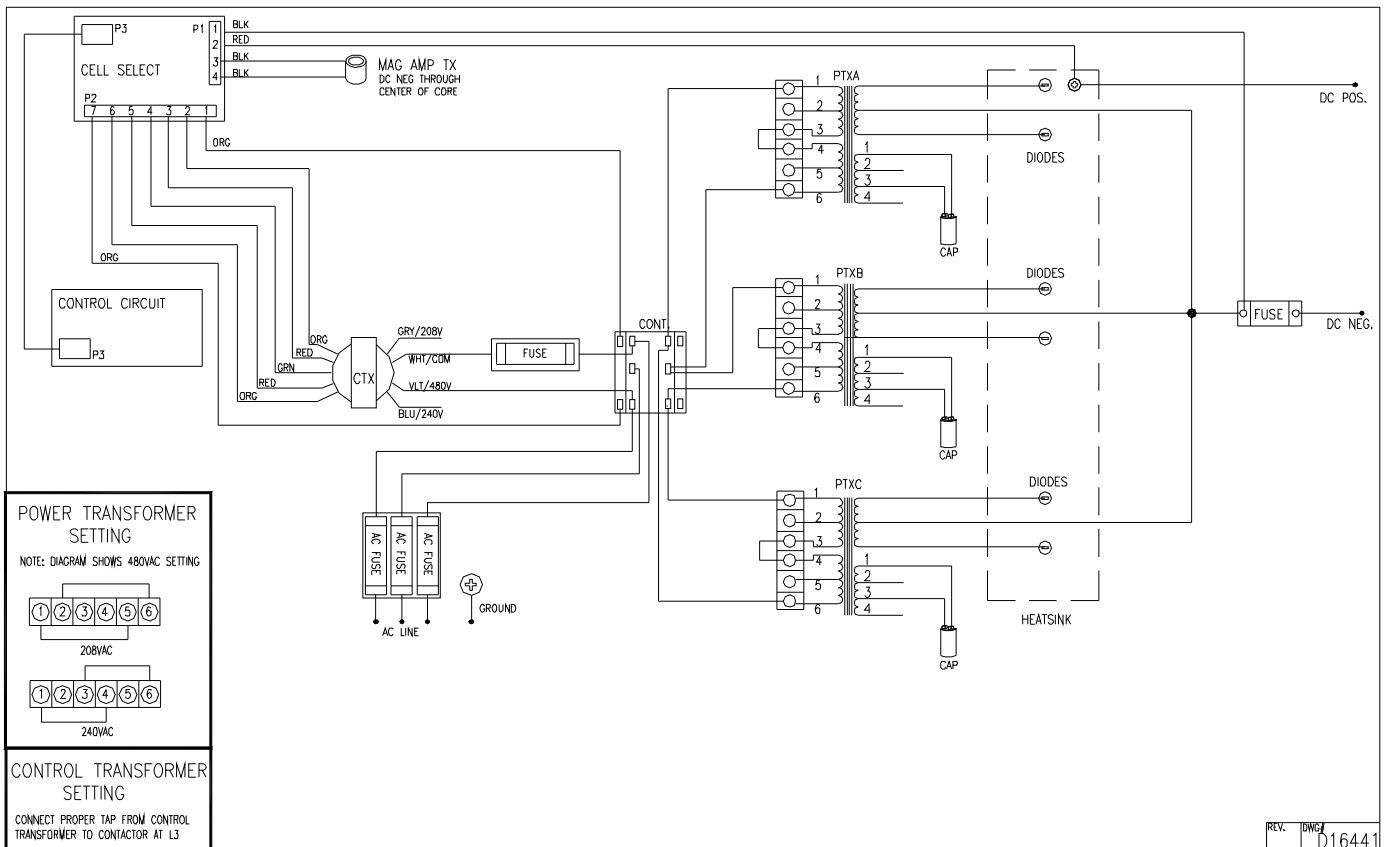
SCHEMATICS/WIRING DIAGRAMS



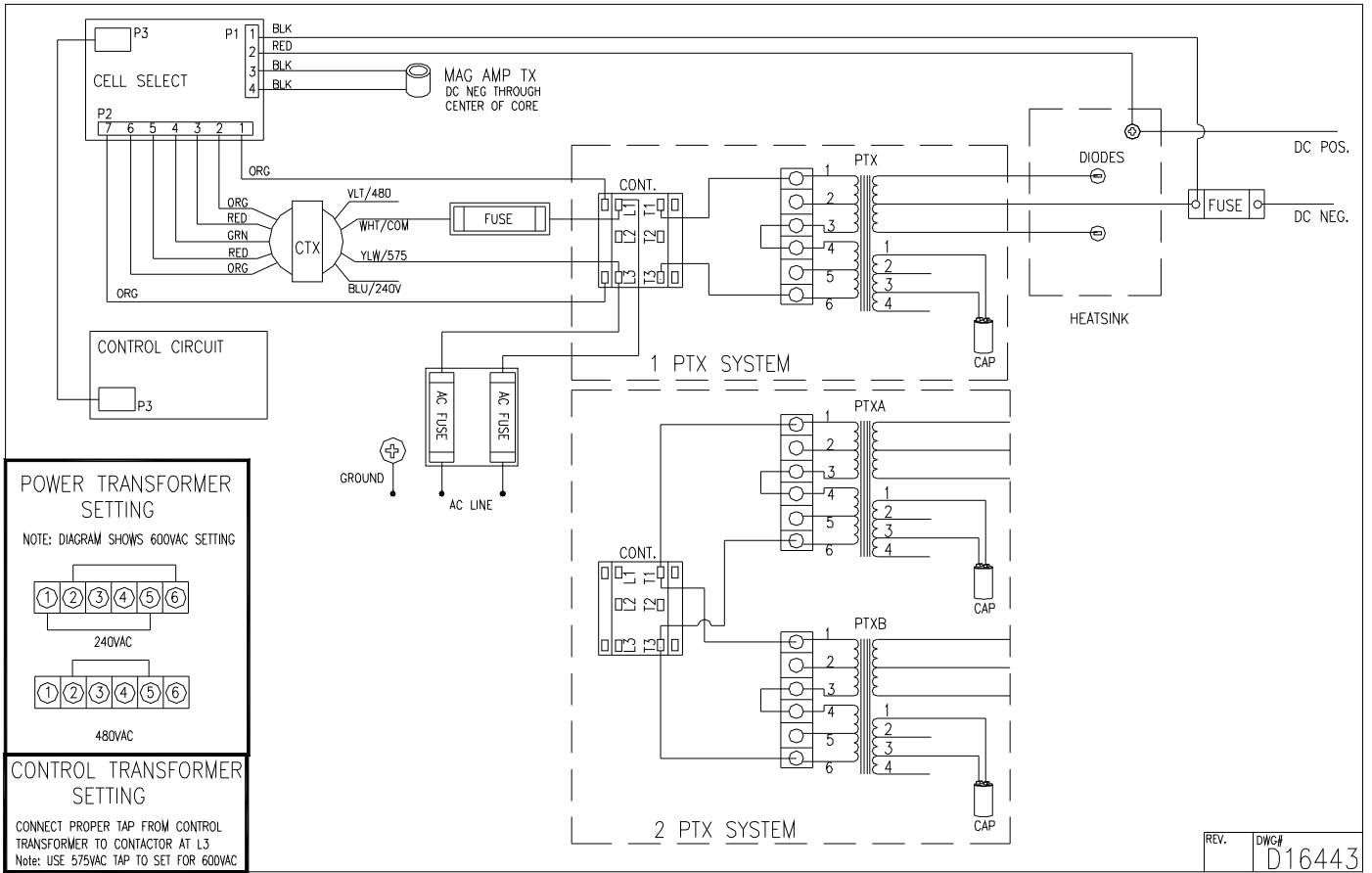
120/208/240 SINGLE PHASE



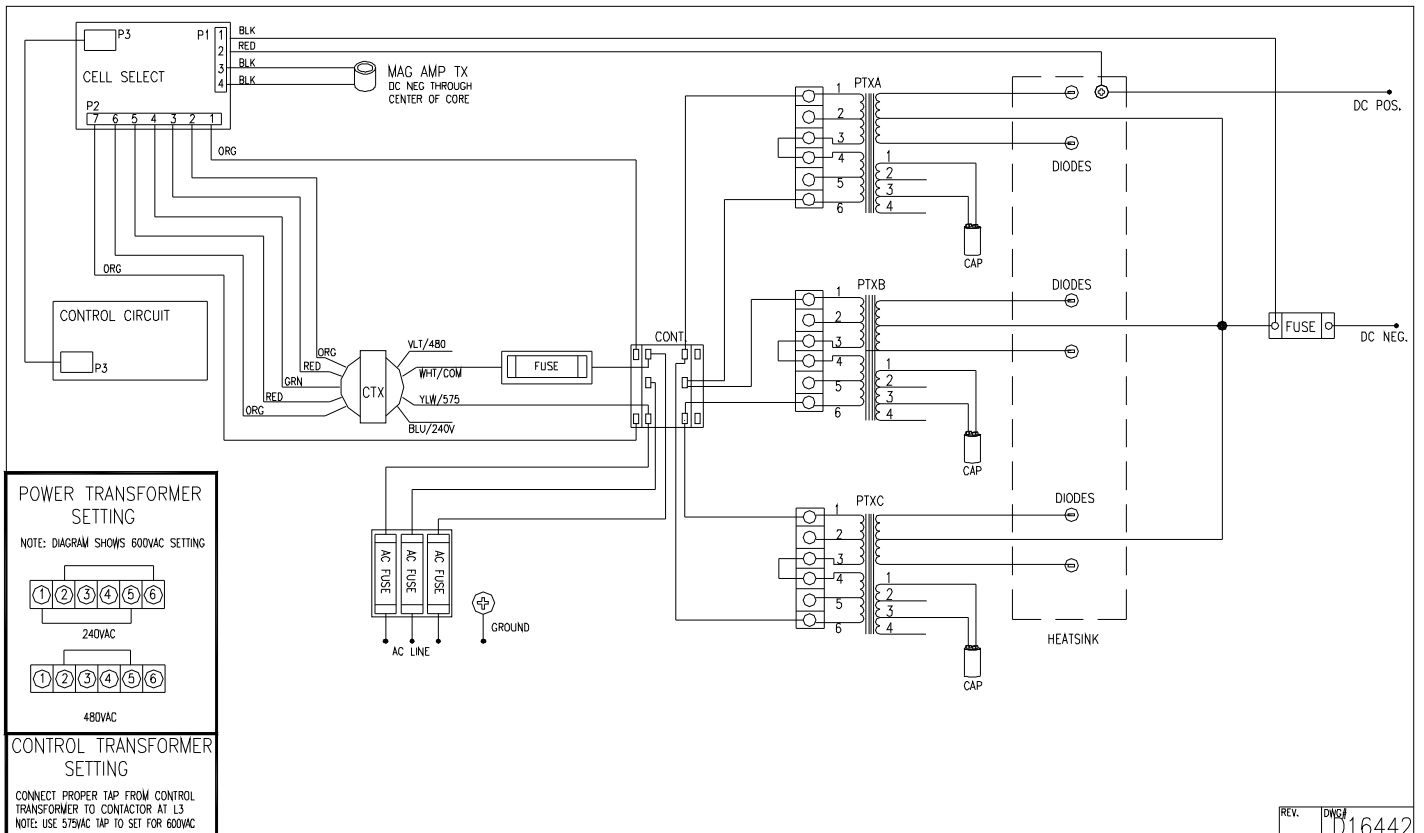
SINGLE PHASE 208/240/480 VAC



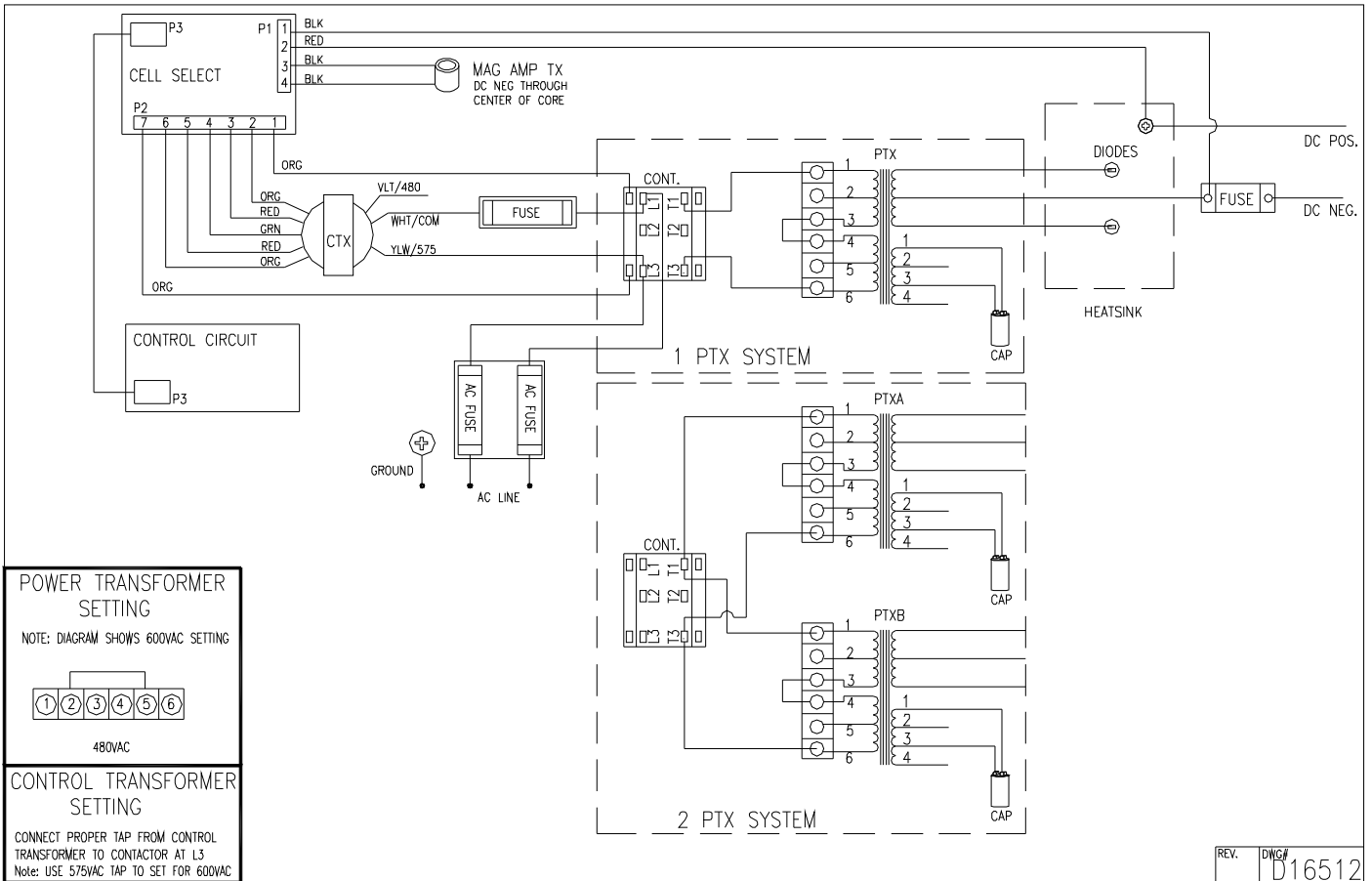
THREE PHASE 208/240/480



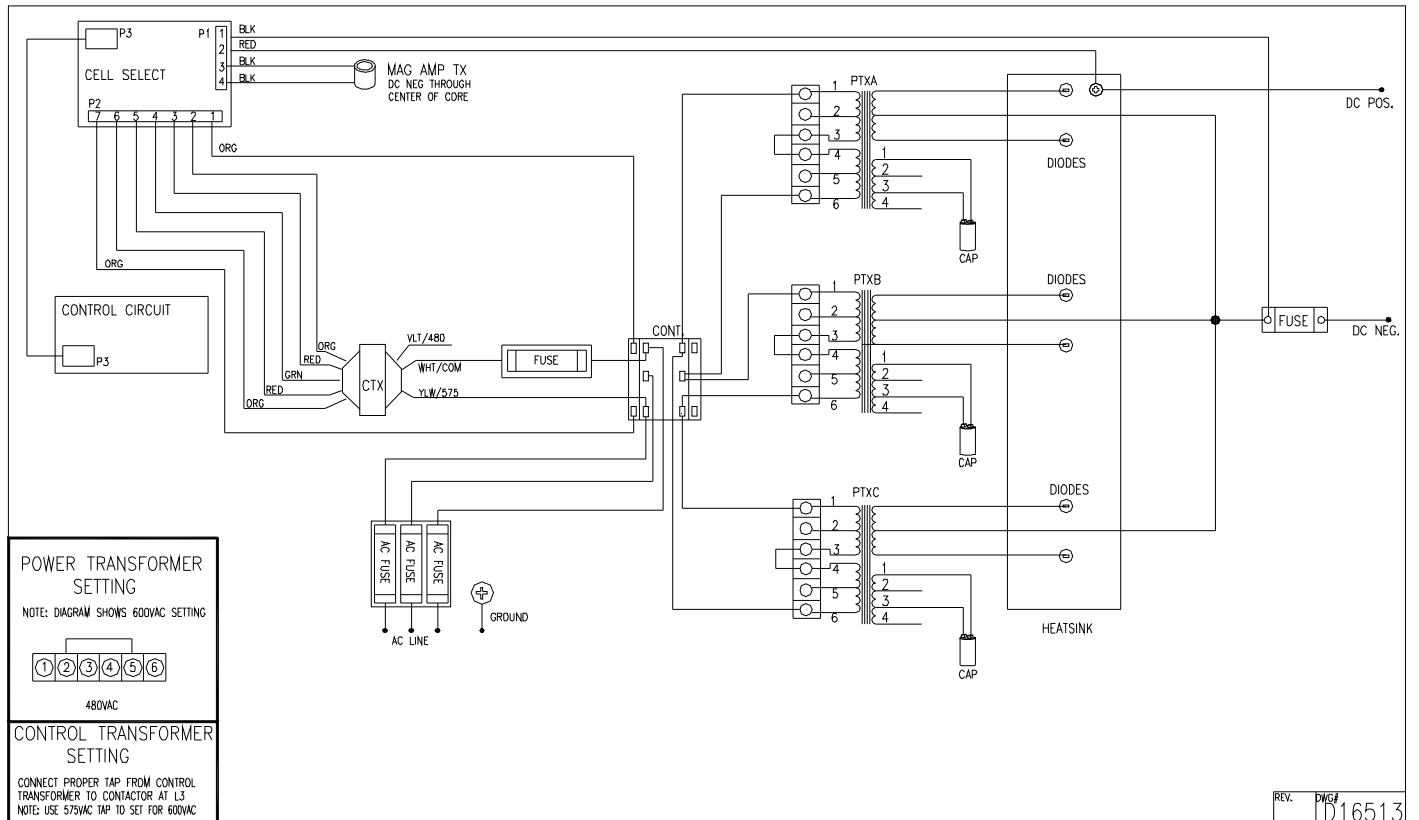
SINGLE PHASE 240/480/600



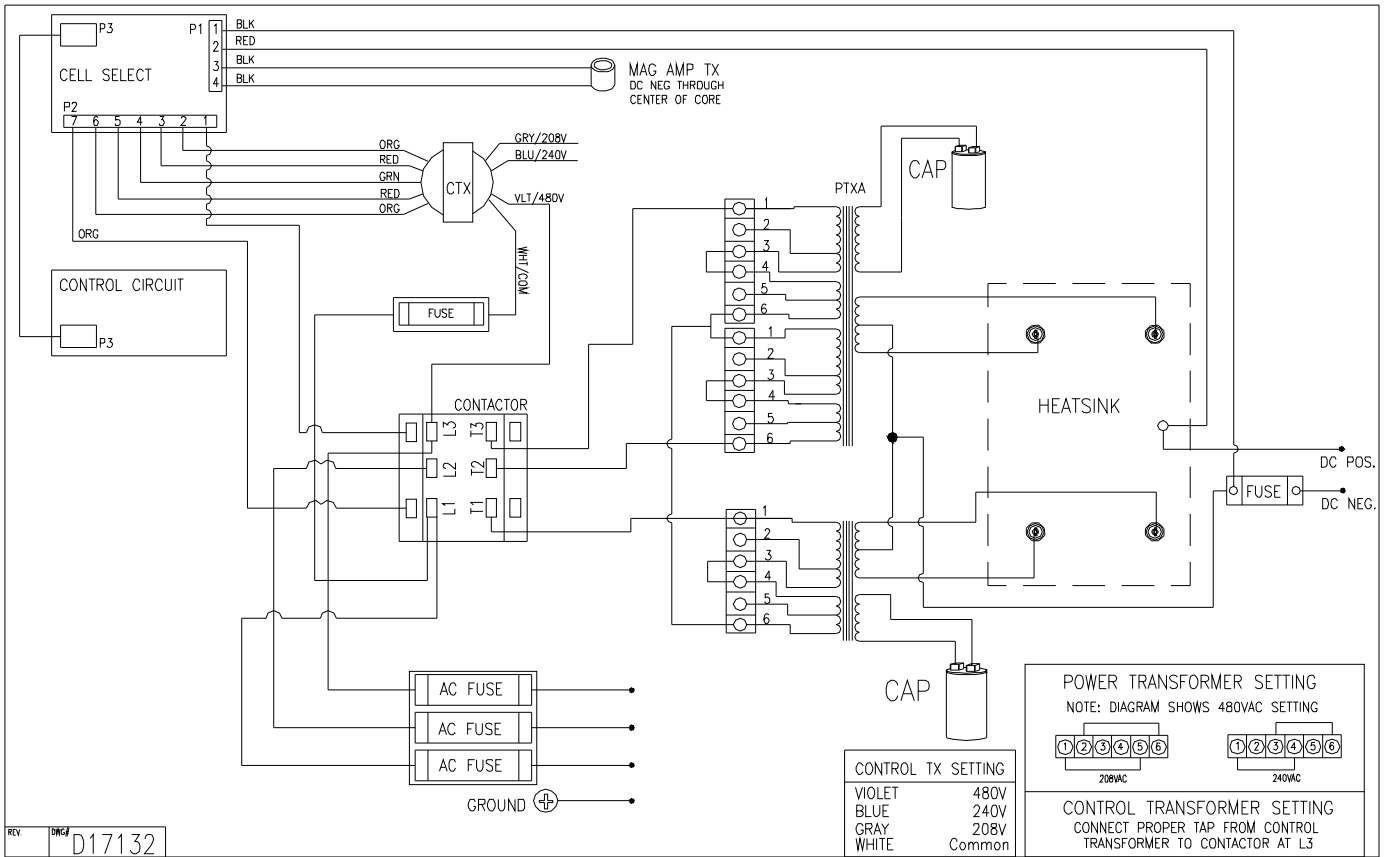
THREE PHASE 240/480/600



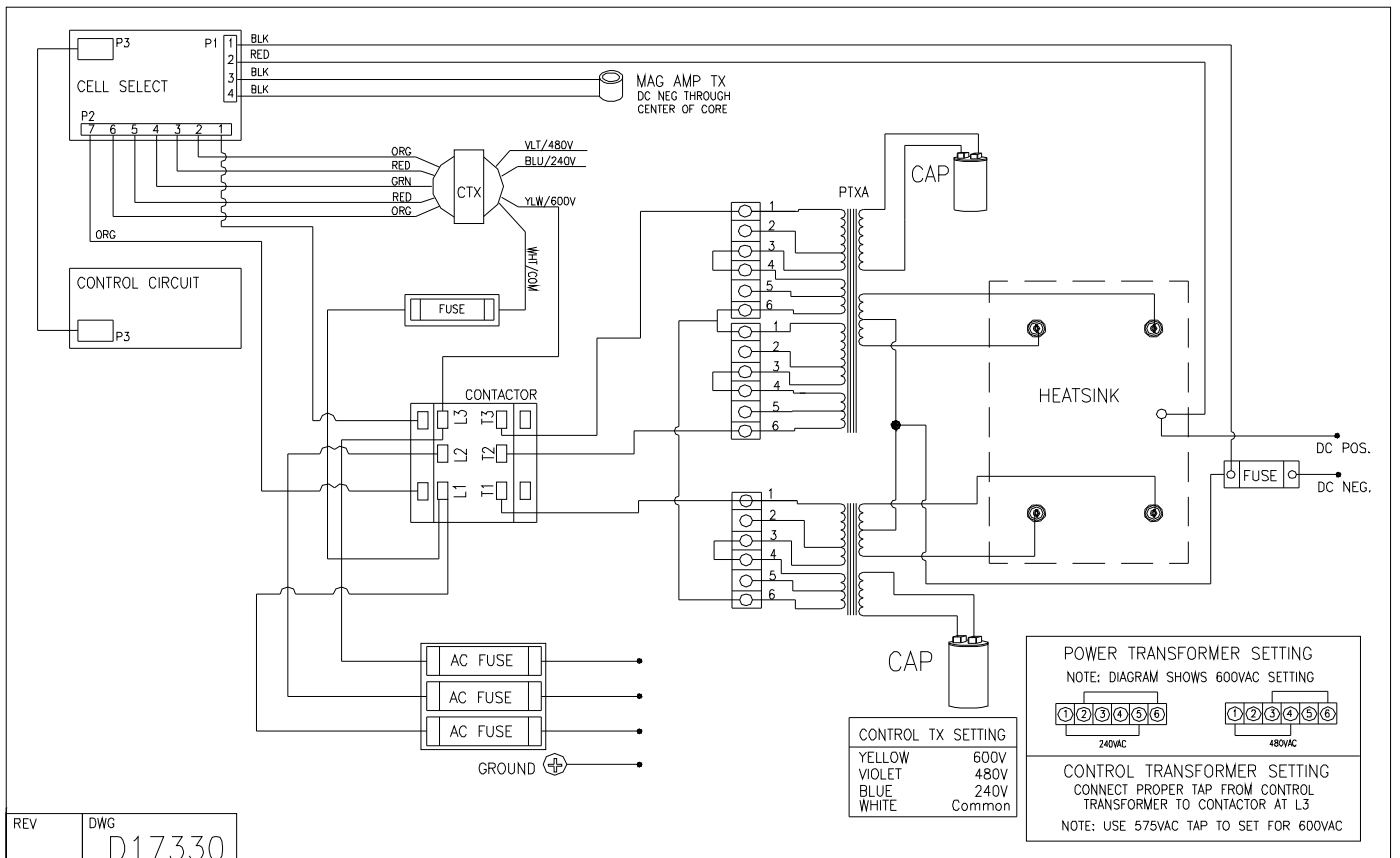
SINGLE PHASE 480/600



THREE PHASE 480/600



THREE PHASE 208/240/480 2 TX



THREE PHASE 240/480/600 2 TX

AC LINE COMPENSATION FOR QUANTUM II AND MAGMUM II MODELS ONLY

The AC line voltage delivered to the charger may vary occasionally from nominal voltage. Each Quantum II and Magnum II Battery Charger has multiple taps on the resonant capacitor winding of each transformer. These can be adjusted to increase or decrease the output of the battery charger to compensate for high or low AC line voltage.

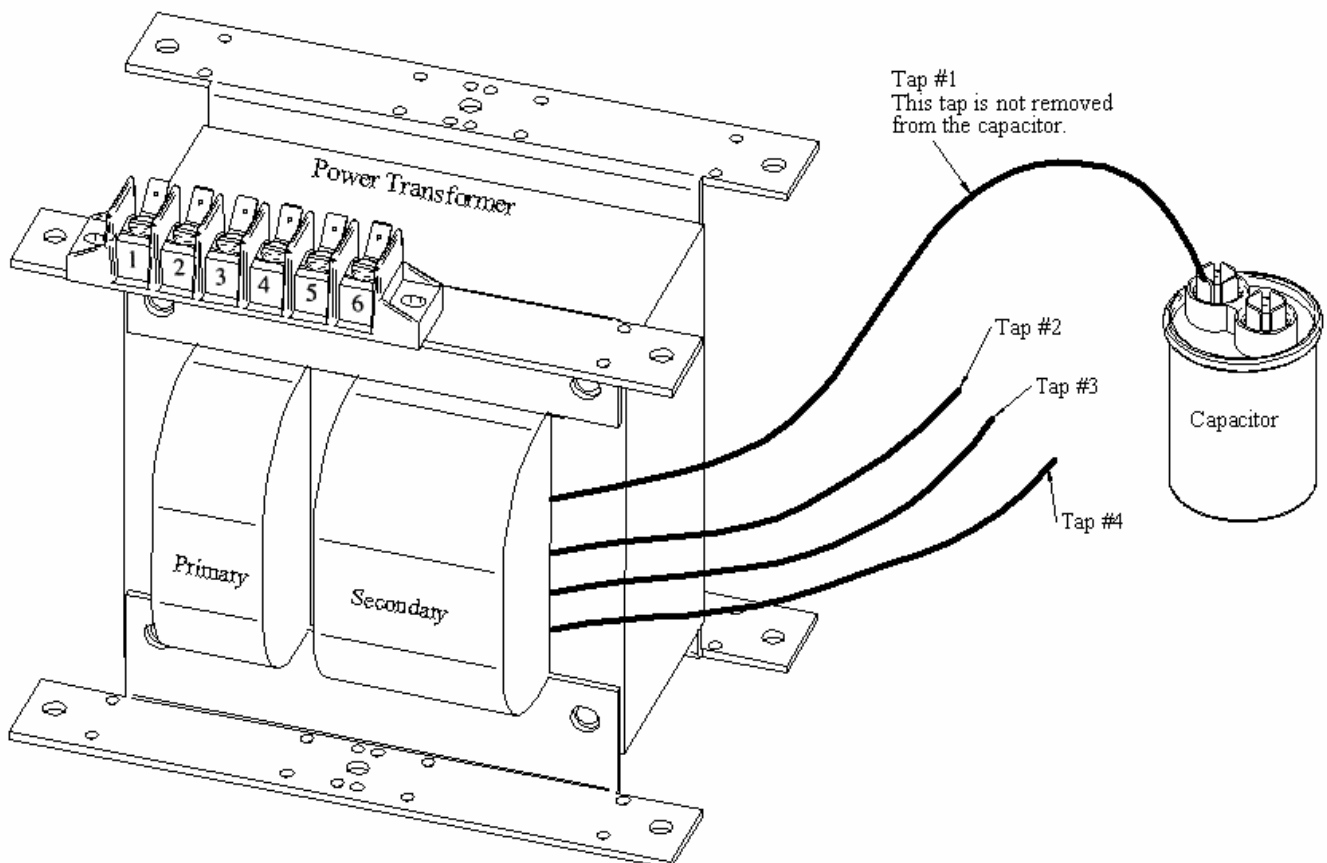
The taps are numbered leads located on each transformer. Two of these leads are connected to the capacitor(s) of each transformer. Note: Lead #1 must always remain connected to the capacitor. The lead on the other capacitor post is a jumper to which one of the numbered taps is connected. If it is necessary to adjust the output of the battery charger, the jumpers can be adjusted as follows:

Jumper Position	Percentage change of output Voltage
1 and 2	Minus 10%
1 and 3	Nominal
1 and 4	Plus 10%

All chargers are factory set with jumper(s) in position 1 and 3 for nominal output.

Note: Always insulate the leads and connections with electrical tape or heat shrink sleeving after making any adjustments.

Warning: High voltage may be present within the battery charger. Changing output taps should be performed by qualified personnel.



NOTE: The capacitor leads are numbered.

PARALLEL AND SERIES OUTPUT CABLES

Parallel Charging Output Cables are an extra set of DC cables which permit two (2) batteries with the same number of cells and amp-hour capacity to be charged at the same time in parallel.

The number of cells of each battery to be charged must equal the number of cells indicated on the charger nameplate. The combined amp-hour capacity of the two (2) batteries must fall in the range of the charger.

E.g.: Two (2) 36 volt - 18 cell - 240 amp-hour batteries, connected in parallel, can be charged with one (1) 36 volt - 18 cell - 510 amp-hour charger.

Series Charging Output Cables are an extra set of DC cables which allows two (2) batteries with the same number of cells and amp-hour capacity, which are at the same state of discharge, to be charged at the same time in series.

The total number of battery cells must be equal to the number of cells noted on the battery charger nameplate. The amp-hour capacity of each battery must fall in the range of the charger rating.

E.g.: two (2) 24 volt - 12 cell - 510 amp-hour batteries connected in series can be charged with one (1) 48 volt - 24 cell - 510 amp-hour charger.

JIC SAFETY INTERLOCK SWITCH

The JIC Safety Interlock Switch option is a lock out/tag out type safety feature which consists of a fused interlock disconnect switch positioned on the cabinet door. In order to open the door, the JIC Safety Interlock Switch must be actuated. Actuation of the switch disconnects AC power from the charger circuitry thus rendering the charger in-operable if the charger door is open.

This option is available upon request.