SIEMENS

50 Hz LC-Type
L-828 Constant Current Regulators
(4, 7.5, and 10 kW/6.6 A)

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ETL Certified to FAA Specifications
AC 150/5345-10E

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RECORD OF CHANGES

Page	Rev.	Description	Chkd	App'd
	A	Manual release		
8	B	ECO 00880. Revised Table 1-7 to update input current.	MH	WT

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

SAFETY NOTICES

The operating and maintenance personnel should refer to FAA Advisory Circular AC 150/5340-26, "Maintenance of Airport Visual Aids Facilities" for instructions on safety precautions. Personnel must observe the safety regulations at all times. While every practicable safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS

Operating and maintenance personnel must at all times observe all safety regulations. To avoid casualties, always remove power prior to making any wire connections and touching any parts. See FAA Advisory Circular AC 150/5340-26 concerning safety.

RESUSCITATION

Operating and maintenance personnel should familiarize themselves with the technique for resuscitation found in the First Aid Instruction Manual.

GUARANTEE

ADB-ALNACO, Inc. guarantees that the 4, 7.5 and 10 kW L-828 "LC-Type" Constant Current Regulators described herein, when sold by ADB-ALNACO, Inc. or its approved representatives, will perform in accordance with FAA specification AC 150/5345-10, L-828, and that any defect in design, materials or workmanship which may occur during proper and normal use during a period of one (1) year from date of installation or a maximum of two (2) years from date of shipment will be corrected by replacement by ADB-ALNACO, Inc., f.o.b. factory. Damage resulting from improper installation does not constitute proper and normal use and is not covered by the warranty. Such corrections shall constitute the limit of all ADB-ALNACO, Inc. liabilities for the 4, 7.5 and 10 kW L-828 "LC-Type" Constant Current Regulators.

SECTION 1. GENERAL INFORMATION AND REQUIREMENTS

1.1 INTRODUCTION.- The ADB-ALNACO, Inc. 4, 7.5 and 10 kW L-828 "LC-Type" Constant Current Regulators are designed to supply either three or five precision output current levels (6.6 amp maximum) for series lighting circuits on airport runways and taxiways*. The regulators are air cooled and designed to accurately regulate the output current to within ±3% of the adjustable nominal level from no load to full load and with input voltage variations of -5% to +10% of nominal (-40°C to +55°C). (Optional input voltages available for the regulators: 208/220/240 or 480 V ac.) The nominal output current levels are maintained even when 50 percent of the isolation transformers in the series lighting circuit supplied by the regulator have open secondaries. The ADB-ALNACO, Inc. "LC-Type" regulators have the exclusive feature of being the only true output "soft-start" current regulators available (see Figure 8-7). Also, the on/off circuitry in the LC-Type regulators eliminates the need for special "slow acting" circuit breakers on the input power supply lines.

The regulators may be operated manually or by 120 V ac or +48 V dc remote control signals from a distant location (10,000 feet round-trip using AWG #19 control cable). The universal remote control used in the LC-Type CCR requires no circuitry changes between 120 V ac and +48 V dc remote control signals. Both 120 V ac and +48 V dc remote control source signals (CCI) are provided.

Protective circuits automatically shut down the regulators if an over-current or open-circuit occurs in the series lighting circuit. After an input power loss, operation automatically resumes at the same brightness level within 5 seconds after input power is restored. Output lightning and current-surge protection is provided on all units.

1.1.1 Scope.- This manual covers 4-10 kW L-828 "LC-Type" Constant Current Regulators (CCRs) manufactured in accordance with FAA specification AC 150/5345-10. Operation outside the design limitations of this specification may result in degradation of performance, damage or failure of regulator components or hazardous conditions.

1.1.2 Purpose.- This manual describes procedures for the installation, operation, and maintenance of ADB-ALNACO, Inc. manufactured 4-10 kW L-828 "LC-Type" Constant Current Regulators.

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*NOTE: The LC-Type CCR should not be used to power an L-849 REIL system unless the CCR is at least half loaded with steady burning lights.

1.3 EQUIPMENT DATA.- Table 1-1 gives the part numbers for the 4-10 kW "LC-Type" regulators manufactured by ADB-ALNACO, Inc. Reference data pertinent to the equipment is listed in Table 1-2. Table 1-3 list equipment and accessories supplied. Information on items not supplied but which might be required for installation is given in Table 1-4. Table 1-5 gives the FAA-approved output current levels and tolerances, while Table 1-7 gives the input current. Recommended input power supply wire for the regulators is listed in Table 1-6.

1.4 PROTECTIVE DEVICES.- The following protective devices are provided on each regulator:

a. Output open-circuit protection

b. Output overcurrent protection

c. Input power-line undervoltage protection

d. Lightning protection on output terminals

e. Fuse protection: remote control supply voltage (48 V dc and 120 V ac), and power supply for printed circuit board

f. Input breaker for supply voltage

g. W VA (load wattage in excess of maximum available volt-amperes)

1.5 REGULATION.- Current regulation is obtained under the following conditions:

a. Load variations of zero (short circuit) to full load with input voltage variations of -5% to + 10%, at -40°C up to +55°C (-40°F to +131°F) ambient temperature.

b. With up to 50% of the series isolation transformers open-circuited.

1.6 INDICATORS.-

a. A true-rms-reading ammeter mounted on the front panel indicates the output current. The screw of the face of the ammeter is for zeroing the indicator needle.

b. W VA output LED (load wattage in excess of maximum available volt-amperes)

c. Regulator On (green) LED (system in normal operation)

d. Overcurrent LED

e. Open-circuit LED

1.7 INPUT VOLTAGE.- The standard power transformer for the L-828 regulators is designed for an input voltage of either 208/220/240 V ac (using field-adjustable tap) or 480 V ac. See the nameplate on the regulator for the input voltage rating.

TABLE 1-1. PART NUMBERS

PART NUMBERS: 44D216X - X

Style (Brightness Step)

1 = 3 Step

2 = 5 Step

Rating/Input Voltage

4 = 4 kW; 208, 220, 240 V ac

5 = 4 kW; 480 V ac

6 = 7.5 kW; 208, 220, 240 V ac

7 = 7.5 kW; 480 V ac

8 = 10 kW; 208, 220, 240 V ac

9 = 10 kW; 480 V ac

TABLE 1-2. EQUIPMENT DATA

FAA Type: L-828 ("LC-Type" CCR)

Rating: 4, 7.5 and 10 kW

Class (Maximum Output Current): Class 1 (6.6 A)

Style (Brightness Steps): Style 1: 3 step (4.8, 5.5 & 6.6 amp)
Style 2: 5 step (2.8, 3.4, 4.1, 5.2 & 6.6 amp)

Nominal Input Voltages: 208, 220, 240 V ac (field-adjustable tap)
480 V ac

Minimum Power Factor: 0.90

Minimum Efficiency: 90%

Maximum Safe Overload: 8.5% (4340 W for 4 kW CCR; 8137 W for 7.5 kW CCR; 10,850 W for 10 kW CCR)

Air-Cooled: Allows more efficient transfer of heat from the power core

Soft-Start Feature: The only true output "soft-start" current regulators produced by any manufacturer (see Figure 8-7).

Control:

Local Operation: Front panel rotary switch S1

Remote Operation: Universal remote control using either +48 V dc or 120 V ac signals. Both +48 V dc or 120 V ac remote control source signals (CCI) are provided, but only one may be used.

On/Off Switching: Under any load

Built-In True-RMS-Reading Ammeter: 10 A (maximum scale)

Protection: Overcurrent, open-circuit, lightning and transient protection; output current-surge limitation (protects series incandescent lamps); power-supply current is self-limited

After input power loss, operation resumes within 5 seconds after power is restored

TABLE 1-2. EQUIPMENT DATA (CONTINUED)

Output Current Level: Maintained within ± 0.1 ampere at any intensity step

Reactive Loading: The CCRs maintain the current within the limits of Table 1-5 for all brightness steps when the load is connected via isolating transformers, and the secondaries of 50% of these transformers become open-circuited. The load before the isolation transformer secondaries are opened may be any value from half to full load. The current remains below 6.8 amps for the 100% brightness step.

Optional Input Lightning Protection Assemblies:

Input Voltage	ADB-ALNACO Part Number
208/220/240 V ac	94B0011-2
480 V ac	94B0011-1

Terminal Blocks: Pressure-type for external remote control wiring

Compatible with L-847 circuit selector switches

The LC-Type CCR should not be used to power an L-849 REIL system unless the CCR is at least half loaded with steady burning lights.

Environmental Operating Conditions:

Temperature Range: -40^{o} to $+55^{o}C$ (-40^{o} to $+131^{o}F$)
Relative Humidity: 0 to 100%
Altitude: sea level to 6,600 ft. (2000 m)

Dimensions: 25.5 x 21.88 x 22.25 in (H x L x D)

Footpad: 16 x 13.5 in (L x D)

NOTE: Dimensions compatible with similar regulators manufactured by Crouse-Hinds, Inc.

Weight: 287 lb

TABLE 1-3. EQUIPMENT AND ACCESSORIES SUPPLIED

Description	Quantity
L-828 "LC-Type" Constant Current Regulator	1
Instruction Manual	1

TABLE 1-4. EQUIPMENT REQUIRED BUT NOT SUPPLIED

Description	Quantity
Wire, Input Power (see Table 1-6)	A/R
Wire, Remote Control (AWG 19 min., AWG 12 max.)	A/R
Wire, Ground (AWG 6 min.)	A/R
Wire, Output Load (AWG 8, 5000 V ac, type L-824)	A/R
Wire, Shorting Jumper (AWG 8 minimum)	A/R
Disconnect Switch or Main Circuit Breaker	1
Input Lightning Arrestor	A/R

Optional Input Lightning Protection Assemblies:

Input Voltage	ADB-ALNACO Part No.
208/220/240 V ac	94B0011-2
480 V ac	94B0011-1

Circuit Breaker for Input Power Lines*	1
Screwdriver	1
Voltmeter (600 V ac scale)	1

Table 1-4. Equipment Required But Not Supplied *(contd.)*

Description	Quantity
Voltmeter (60 Vdc full scale)	1
Ammeter, (true –rms-reading; 10 A maximum scale	1
Ohmeter	1
Mounting bolts and washers	As required

NOTE: The soft-start feature eliminates the need for a special slow-trip circuit breaker on the input power lines.

Table 1-5. FAA Output Current Levels and Tolerances

Step	Position	Nominal Output Current	Allowable Current Range
3-Step	B100	6.6 A	6.40-6.70 A*
3-Step	B30	5.5 A	5.33-5.67 A
3-Step	B10	4.8 A	4.55-4.94 A
5-Step	B5	6.6 A	6.40-6.70 A
5-Step	B4	5.2 A	5.04-5.36 A
5-Step	B3	4.1 A	3.98-4.22 A
5-Step	B2	3.4 A	3.30-3.50 A
5-Step	B1	2.8 A	2.72-2.88 A

*6.40-6.70 A is for 10 kW CCR only.

TABLE 1-6.
RECOMMENDED INPUT POWER SUPPLY WIRE
FOR LESS THAN 100 FEET (90°C, 600 V MINIMUM)*
BETWEEN CCR AND POWER SOURCE

Rating	208 Vac	220 Vac	240 Vac	480 Vac
4 kW	AWG 12	AWG 12	AWG 12	AWG 16
7.5 kW	AWG 8	AWG 10	AWG 10	AWG 14
10 kW	AWG 8	AWG 8	AWG 8	AWG 12

*For 100 to 250 ft, use the next larger (even) gage wire

It is recommended that the circuit breaker on the input power supply lines have a rating of 125% of the CCR's input current, as given in Table 1-7, unless local codes require a different rating technique. (See CCR's nameplate for the kW rating and input voltage to determine the input current from Table 1-7.) If no standard-size circuit breaker exists at the 125% value, use the next larger standard-size circuit breaker.

TABLE 1-7. INPUT CURRENT FOR L-828 CCRS

Rating	208 Vac	220 Vac	240 Vac	480 Vac
4 kW	23 A	22 A	20 A	10 A
7.5 kW	43 A	40 A	37 A	19 A
10 kW	57 A	54 A	50 A	25 A

SECTION 2. THEORY OF OPERATION

2.1 INTRODUCTION.- Current regulation is obtained by using SCRs to switch the supply power (varying the "on" duration of the AC cycle) to the power transformer and by using feedback circuitry to monitor the transformer's output. The brightness level is selected from one of three or five preset values. When the load varies, the feedback circuit changes the control-voltage level, which changes the conduction angle of the AC voltage to the SCRs to allow power to flow into the power transformer. This changes the supply power flow to the main transformer to compensate for the load variation and maintain the output current at the preset level.

2.2 THE SCRs.- See Figure 8-9 (Schematic 43B0736). When power is applied to the constant current regulator (CCR) at TB3 terminals 1 to 3 and the contactor K1 and circuit breaker CB1 are closed, no current will flow in the primary of the power transformer T1 until the SCRs receive a triggering pulse. When this pulse occurs, the SCRs turn on, allowing current to flow into the primary of the power transformer T1 until the SCR is switched off by the zero crossing (+ to -) of the input power. The path of the current flow is from TB3-3 through the circuit breaker CB1, contactor K1, SCR1 terminals 1 and 3 to L2, L1 and primary of T1, and back to K1, CB1 and TB3-1. Since alternating current is used for the regulator operation, after zero-crossing the current flows in the opposite direction using the other SCR (see SCR1 terminals 1 and 2).

The power level in the primary of the power transformer is controlled by varying the phase of the conduction angle. If very low output current is desired, the conduction angle would be near zero degrees, i.e., the SCR is not triggered until the input voltage is near zero-crossing. Little power is then available to power transformer T1.

For maximum power to occur in the primary of the power transformer T1, the conduction angle will be near 180 degrees. Immediately after zero-crossing of the input-power sine wave, the SCR is triggered and operates continuously throughout the 180-degree duration of the input sine wave.

For 67% power from the power transformer, the conduction angle will be nearly 90 degrees. This occurs approximately at the voltage peak of the sine wave when the SCR switches into conduction. Switching the transformer on-line at this time creates a rather abrupt rise time, since the input sine wave is at its peak voltage. Choke L1 slows this rapid rise time from the conduction of the SCRs.

2.3 CONTACTOR.- In the event of an SCR failure, the contactor provides a means to break the current driving the primary of the power transformer T1. The contactor K1 (see Figure 8-9) has no making or breaking current across it, since the SCR is off when the contactor is opening and closing. This is accomplished by the coil-control circuitry and provides increased life for the contactor.

2.4 TRANSFORMERS.- Transformer T6 provides 120 V ac remote-control source voltage at TB2 terminal 8 through fuse F3.

Transformers T3 and T4 provide AC voltage to the Control PCB. T3 provides 120/60 V ac. T4 provides 36/18 V ac.

SECTION 3. OPERATION

3.1 CONTROL.- The rotary switch S1 on the front panel is used for local control of the regulator. This control switch has either five (for 3-step CCR) or seven positions (for 5-step CCR) labeled: REM (remote), OFF, and brightness steps 1(10), 2(30), 3(100), 4 and 5. For regulator operation by +48 V dc or 120 V ac remote control signals, rotary switch S1 must be set to REM. Remote control is disengaged when switch S1 is set to any position other than REM.

3.1.1 Local Control.-

a. Rotary switch (S1), positions 1 through 5 (or 10, 30 and 100 for a 3-step CCR), provides local control of the CCR's output current level. For a three-step CCR, positions 10, 30 and 100 give an output current of 4.8, 5.5 and 6.6 amps, respectively. For a five-step CCR, positions 1 through 5 give an output current of 2.8, 3.4, 4.1, 5.2 and 6.6 amps, respectively.

THREE-STEP CONSTANT CURRENT REGULATOR					
S1=	REM	OFF	10	30	100
RESULT	Operation by remote control signals	CCR off	4.8A	5.5A	6.6A

FIVE-STEP CONSTANT CURRENT REGULATOR							
S1=	REM	OFF	1	2	3	4	5
RESULT	Operation by remote control signals	CCR off	2.8A	3.4A	4.1A	5.2A	6.6A

b. When rotary switch S1 is set to the OFF position, the regulator is deenergized and cannot be remotely turned on.

c. When switch S1 is set to REM, operation of the regulator is by remote control signals.

3.1.2 Remote Control.-

a. When the rotary switch S1 is set to position REM and remote control wiring is connected to remote control terminal block TB2 on the regulator, the output current of the regulator will correspond to the brightness setting energized by remote 120 V ac or +48 V dc control signals. When switch S1 is set to OFF, remote control signals will not operate the regulator, i.e., turn the regulator on to a particular brightness setting or turn the regulator off. Switch S1 must be set to REM for operation of the regulator by remote control.

b. When there are no remote control connections on terminal block TB2, the position REM becomes an additional OFF position, i.e., the regulator is deenergized when switch S1 is set to REM.

c. If more than one remote intensity is accidently selected, the highest intensity will be selected.

3.1.3 Circuit Breaker CB1.- The circuit breaker CB1 is provided to interrupt power when a malfunction occurs.

WARNING

When installing and servicing unit, do not rely on CB1 for safety. When CB1 is turned off, line voltage is still present on the input terminals and on the CB1 terminals. Always remove power to the regulator using the external circuit breaker or disconnect switch before installing or servicing regulator.

3.2 SHUTDOWN PROCEDURE.- Set rotary switch S1 to position OFF. Power to the output terminals is now off, and the regulator cannot be energized by remote control signals. Power is still present on the input power terminals TB3. To remove input power, disengage disconnect switch or external circuit breaker.

SECTION 4. PREVENTIVE MAINTENANCE

4.1 GENERAL.- This section establishes the maintenance procedures required for the constant current regulators. The maintenance tasks must be performed on a recurring basis to insure optimum performance, minimize service interruptions and avoid major breakdowns.

WARNING

Only personnel authorized to work on high-voltage equipment should perform maintenance on the regulator.

Operate regulator under local control (using rotary switch S1) when performing maintenance tasks on the regulator. This will prevent the regulator from accidently being turned on and causing serious injury or death.

Always deenergize regulator by turning rotary switch S1 to OFF, and remove input power to regulator by turning off disconnect switch or main circuit breaker before opening access door to service regulator.

4.2 PREVENTIVE MAINTENANCE.- The preventive maintenance checks for the regulator are listed in Table 4-1.

4.3 SHORT-CIRCUIT TEST.-

WARNING

Since high open-circuit voltages may result by opening the primary of a series lighting circuit, only personnel authorized to work on high-voltage equipment should be allowed to perform the short-circuit test.

a. Remove input power to regulator (turn off disconnect switch or main circuit breaker) and turn rotary switch S1 to OFF.

b. Remove leads from output terminals (TB1), and short output terminals using AWG #8 or larger wire.

c. Energize regulator and turn rotary switch S1 to the lowest brightness step 1(10) and then to the remaining brightness steps. Check the output current on a true-rms-reading ammeter at each step. The output current should be within the tolerance given below.

	S1 POSITION	ALLOWABLE RANGE (PANEL AMMETER) AMPERES
3-STEP	10	4.55 - 4.94
CCR	30	5.33 - 5.67
	100	6.40 - 6.80*
5-STEP	1	2.72 - 2.88
CCR	2	3.30 - 3.50
	3	3.98 - 4.22
	4	5.04 - 5.36
	5	6.40 - 6.80*

d. If the output current is not within the above specified limits, check the input voltage to regulator. The supply voltage should be within -5% to +10% of the nominal input voltage shown on the regulator nameplate. If supply voltage is correct, readjust output current per Section 7.5.2.

e. Turn off disconnect switch or main circuit breaker to remove input power to regulator.

f. Disconnect the shorting jumper and reconnect output cables.

g. Close input-power disconnect switch or main circuit breaker.

*6.50-6.70 amps for 10 kW CCR only

4.4 OPEN-CIRCUIT TEST.-

WARNING

Since high open-circuit voltages may result by opening the primary of a series lighting circuit, only personnel authorized to work on high-voltage equipment should be allowed to perform the open-circuit test.

a. Remove input power to regulator (turn off disconnect switch or main circuit breaker) and turn rotary switch S1 to OFF.

b. Disconnect cables from the output terminals (TB1).

c. Turn on input power to regulator.

d. Turn rotary switch S1 to the lowest brightness position 1(10). The open-circuit protective device should automatically deenergize the regulator in less than 2 seconds.

e. Turn rotary switch S1 to OFF. The open-circuit protective device should reset.

f. Turn rotary switch S1 to position 1(10). The regulator should turn on and then deenergize in less than 2 seconds.

g. If regulator operation is satisfactory, turn rotary switch to OFF, and turn off disconnect switch or main circuit breaker before reconnecting the load.

h. After the load has been reconnected, turn on input power to the regulator.

TABLE 4-1. PREVENTIVE MAINTENANCE TASKS

Interval	Maintenance Task	Action
Daily	Check all control equipment for proper operation	Check local and remote control (if used) on each brightness step.
Monthly	Check input voltage	If input voltage is not within -5% to +10% of the nominal value specified on the regulator nameplate, notify power company to correct voltage.
	Check and record output current on each brightness step	Use a true-rms-reading instrument. Adjust current levels if out of tolerance (see Table 1-5).
Annually	Check wiring	Make sure input and output connections are tight and that there are no damaged wires and frayed or burned insulation.
	Inspect housing for rust spots and damage	Clean and touch up rust spots with paint.
	Inspect lightning arrestor connections	Tighten any loose connections. Replace charred or burnt wiring or broken arrestor.
	Perform a short-circuit test	See paragraph 4.3.
	Perform an open-circuit test	See paragraph 4.4.
Unscheduled	Check regulator load	At installation and subsequent load changes make sure that the output voltage times the output current does not exceed the rated load given on the regulator nameplate.

SECTION 5. TROUBLESHOOTING

5.1 TROUBLESHOOTING TABLE.- Preliminary troubleshooting information is given in Section 5.2. The troubleshooting guide for the L-828 constant current regulators is given in Table 5-2.

WARNING

Only personnel qualified to work on high voltage systems should be permitted to troubleshoot on the regulator.

Deenergize regulator by turning rotary switch S1 to OFF and turn off disconnect switch or main circuit breaker. Set circuit breaker CB1 to the OFF position. Ground output terminals by using a grounding rod prior to touching any parts.

If regulator deenergizes suddenly, the output current could be interrupted by an overcurrent, open-circuit, or undervoltage condition. Before inspecting the output circuit, place rotary switch S1 in the OFF position, and turn off circuit breaker CB1 and the external disconnect switch or main circuit breaker. Without this precaution, a dip in the power line may produce an on-cyclying and reenergize the regulator, resulting in an output voltage of several hundreds or thousands of volts which can cause serious injury or death.

5.2 PRELIMINARY TROUBLESHOOTING.- The following is a check list of steps to perform:

a. Check all LED indicators, fuses and circuit breakers. See Table 5-1.

b. Visually examine all areas of the CCR. Are there any burnt or loose connections or parts?

c. Is the input voltage present and within +10% to -5% of nominal? (Is Regulator On (green) LED lit?)

d. If CCR works in local but not in remote, check voltage on remote control lines. Check fuse F3 if 120 V ac or fuse F4 if +48 V dc remote-control source voltage is used. If correct, replace Control PCB.

e. Can the CCR be reenergized by turning rotary switch S1 from OFF to brightness step B1 (B10)? If it can be, the problem is due to open circuit (Open-circuit LED lit?) or overcurrent (Overcurrent LED lit?).

f. Short the output of the CCR with an AWG 10 (2000 V, minimum) wire, and turn the CCR on. If CCR operates normally, problem may be load related.

Table 5-1. Fuses and Circuit Breaker

Circuit Breaker CB1:	Protects contactor K1 (contacts), SCR1, L1, L2 and main transformer T1.
Fuse F1, F2 (1A, Slo-Blo for 480 V CCR; 2A, Slo-Blo for 208, 220 and 240 V CCRs):	Protects transformers T3 and T4, contactor K1 (coil), triac Q21 and DC power supplies on Control PCB.
Fuse F3 (1/4A, 250 V, Slo-Blo):	Protects the internal 120 V ac CCI source and transformer T6.
Fuse F4 (1/4A, 250 V, Slo-Blo):	Protects the internal +48 V dc CCI source circuitry on the Control PCB.

g. If CCR turns on for a few seconds before shutting off and the ammeter indicates zero amps, the problem is either an open circuit (Open-circuit LED lit?) or the current transformer T2 is open. The current transformer T2 can be checked by comparing the primary and secondary current readings.

h. If the CCR turns on and then shuts off after a few seconds and there is a high current reading on the ammeter, the problem is an overcurrent (Overcurrent LED lit?). Adjust the output current. If this does not work, replace the Control PCB and then SCR1.

i. If the CCR does not energize at all (Regulator On (green) LED lit?), check for undervoltage. If correct, replace Control PCB.

TABLE 5-2. TROUBLESHOOTING GUIDE

PROBLEM: REGULATOR DOES NOT TURN ON USING CONTROL SWITCH S1

TEST	REPAIR
(a) Turn off CCR using local control switch S1. Then turn CCR on. Verify that nothing happens and that green LED labeled "REGULATOR ON" is unlit.	Circuit breaker CB1 is tripped. Reset CB1 by switching breaker on. If CB1 trips again, check and replace fuses F1 and F2.
(b) Use an AC voltmeter to probe signals. Connect black lead on meter (common) to earth ground lug on CCR.	
Probe J3 terminals 4 and 6. Each should read approximately 60 V ac.	Replace T3.
(c) Using the AC voltmeter, probe J3 terminals 1 and 3. Each should read approximately 18 V ac.	Replace T4.
(d) If these voltages are normal, failure is in Control PCB, ribbon cable or Switch PCB.	Replace Control PCB, ribbon cable or Switch PCB, in that order.

TABLE 5-2. TROUBLESHOOTING GUIDE (CONTINUED)

PROBLEM: REGULATOR DOES NOT TURN ON USING REMOTE CONTROL BUT OPERATES USING LOCAL CONTROL SWITCH S1

NOTE: When remote control signals enter TB2, green LEDs #1 to #5 will light -- indicating operation of remote inputs CC, B2, B3, B4 and B5. On a 3-step CCR, LED #2 stays off and LEDs #1 and #3 will light with a CC input signal.

TEST	REPAIR
(a) Test signals to remote control TB2	Repair external remote control switch or wiring
(b) Is CCI is connected to TB2 terminal 1 for +48 V dc remote control signals?	Check and replace F4 (on Control PCB) with new 1/4-amp slow-blow fuse.
(c) Is CCI is connected to TB2 terminal 8 for 120 V ac remote control signal?	Check and replace F3 (on panel) with new 1/4-amp slow-blow fuse.
(d) Check to see if the LEDs (#1 to #5) for a 5-step CCR or LEDs #1 and #3 for a 3-step CCR are lit and there still is no remote operation.	If none of the LEDs (#1 to #5) for 5-step CCR or LEDs #1 and #3 for a 3-step CCR are lit, replace Control PCB.

TABLE 5-2. TROUBLESHOOTING GUIDE (CONTINUED)

PROBLEM: REGULATOR REPEATEDLY TRIPS CIRCUIT BREAKER CB1 ON START-UP

TEST	REPAIR
(a) Turn control switch S1 to OFF position. Reset circuit breaker CB1. While observing the CCR's output ammeter, turn CCR on. If meter moves, go to TEST "(b)". If meter does not move, feedback transformer T2 or main transformer T1 may have failed.	(a) Replace feedback transformer T2/main transformer T1.
(b) With CB1 and control switch S1 off, remove connector J4 (by pulling) from PC board. Then turn on CB1 and then control switch S1. If circuit breaker CB1 still trips, SCR1 is probably shorted.	Replace SCR1.
(c) If circuit breaker CB1 does not trip after J4 is removed, Control PCB has failed.	Replace Control PCB.

TABLE 5-2. TROUBLESHOOTING GUIDE (CONTINUED)

PROBLEM: REGULATOR SHUTS DOWN FROM OVERCURRENT PROTECTION (RED LED LIT)

TEST	REPAIR
(a) Test the operation of the overcurrent protection (red LED on). With CCR off, connect a jumper across TP7 to TP9 (see Figure 8-6). Turn on CCR to an output of 6.6 amps, and time how long it takes for the overcurrent protection to shut the CCR off. Green "REGULATOR ON" LED will turn off when the overcurrent circuitry operates. The time period will be 20 ±10 s for proper operation. If time period is less than 10 s or more than 30 s, CCR may be improperly calibrated. If CCR will not calibrate properly, then with CB1 and control switch S1 off, remove connector J4 (by pulling) from Control PC board. Then turn on CB1 and then control switch S1.	See calibration instructions in Section 7.5.
(b) If overcurrent indicator (red LED) does not light, then SCR1 is good and Control PCB has failed.	Replace SCR1.
(c) If overcurrent indicator (red LED) lights, then SCR1 or Control PCB has failed.	Replace Control PCB and/or SCR1.

TABLE 5-2. TROUBLESHOOTING GUIDE (CONTINUED)

PROBLEM: REGULATOR SHUTS DOWN FROM OPEN-CIRCUIT PROTECTION (RED LED LIT)

TEST	REPAIR
(a) Test load for open-circuit condition. Also, short CCR's output TB1 and check for normal operation. See calibration instructions in Section 7.5.	Repair lighting loop.
(b) Inspect contacts of contactor K1.	Replace contactor K1 if defective.
(c) Inspect transformer T5 and R5 (on panel).	Replace T5 or R5.
(d) Turn CCR on and off repeatedly. If green LED indicator for "REGULATOR ON" lights but contactor K1 does not click on, coil of contactor K1 has failed.	Replace contactor K1.
(e) If turning CCR on and off will not light "REGULATOR ON" LED, then Control PCB has failed.	Replace Control PCB.

PROBLEM: INCORRECT CCR OUTPUT CURRENT

TEST	REPAIR
(a) CCR may be improperly calibrated.	See calibration instructions in Section 7.5.
(b) If CCR will not calibrate properly, then Control PCB may have failed.	Replace Control PCB.

TABLE 5-2. TROUBLESHOOTING GUIDE (CONTINUED)

PROBLEM: W VA-INDICATOR (RED) LED LIT

NOTE

The W VA-Indicator (red) LED is not intended to show a regulator failure. It is a warning that the load demand has exceeded the CCR's output current (as adjusted), and a lower than normal output current may result from an excessive load being present.

TEST	REPAIR
(a) The lighting loop has too many burned-out lamps.	Replace burned-out lamps.
(b) The load demand is greater than 4% over -5% input voltage and 12% of nominal input voltage on a 4 kW or 7.5 or 10 kW CCR.	Reduce load or obtain a CCR with a higher kW rating.
(c) The half-power tap was selected on TB6 terminal 2, and the load demand requires more than 1/2 of the CCR's rated output power.	Move wire #200 from TB6 terminal 2 to TB6 terminal 1.
(d) The input voltage is low for the required voltage, as selected on the CCR's TB5. Measure voltage at input of CCR TB3 with CCR in operation.	Provide required voltage to CCR.
(e) CCR's output current may be improperly calibrated.	See calibration instructions in Section 7.5.

TABLE 5-2. TROUBLESHOOTING GUIDE (CONTINUED)

PROBLEM: W VA-INDICATOR (RED) LED LIT (CONTINUED)

TEST	REPAIR
(f) If input voltage is normal, observe wires on TB5. Compare to DWGs #43B0767 (see Figure 8-8) and #43B0736 (see Figure 8-9).	(f) If CCR's TB5 is wired to wrong voltage, correct as shown in DWG #43B0736 (Fig. 8-9) for 208-240 V ac CCRs or DWG #43B0767 (Fig. 8-8) for 480 V ac CCRs. If 480 V connection has been made for 208-240 V CCR input, or vice-versa, contact ADB-ALNACO Sales Department. **WARNING** A CCR wired for 480 V ac must not be changed to 240, 220 or 208 VAC. A CCR wired for 240, 220 or 208 V ac must not be changed to 480 V ac.

SECTION 6. PARTS LIST

6.1 PARTS LIST.- Table 6-1 provides all replaceable parts for each repairable or replaceable component or assembly.

NOTE

Substitution of electronic components may be done only if the substitution is the exact physical equivalent (body or case size) and equal, or better electrical characteristics with respect to tolerance, failure rate and/or reliability.

TABLE 6-1. PARTS LIST

Item No. See Fig. 8-4/8-5	Description: Final Assembly (44D2164-X) 4 kW, 208-240 V ac	Mfrs. Part No.	ADB-ALNACO Part No.
1	4-kW Power Transformer		35A0134
3	Breaker, 30 A, 277/480V, Short Delay	Airpax 209-2-1-61-4-8-30	57A0035
6	Fuse, 2 A, 250 V, S.B.	Buss FNM2	47A0113
8	Fuseblock, 600 V		49A0084
9	Contactor, 15A, 50 Hz, 120V, Coil	Telemechanique LC1-D163F	53A0222
11	Inductor, 4 kW, 50 Hz		33A0022
13	Control PCB Assembly		44D1475
14	Switch PCB Assembly		
	for 3-Step CCR		44B1476-1
	for 5-Step CCR		44B1476-2
15	Ammeter, 10 A Scale		52A0103
16	Fuse, 1/4 A, 250 V, S.B.	Buss MDA 1/4	47A0117
17	Transformer, Dual 120 V/36 V (CT)		35A0225
18	Transformer, Dual 240 V/120 V (CT)		35A0226
19	Current Transformer, 6.6A/55mA		35C0270
20	Voltage Ratio Transformer, 6:1 (T5)		35A0269
21	Varistor, 750 V	GE V660HE600	32A0025
22	SCR, Dual	Semikron SKKT 91/12D	28A0011
24	Coil, Air Choke		44B1712
25	Capacitor, 1 uF, 630 V, Type E		23A0080
26	Capacitor, .1 uF, 630 V, Type E		23A0086
27	Resistor, 22 ohm, 2 W, MF		14A0025
29	Resistor, 47 kilohm, 2 W, MF		14A0017
30	Resistor, 33 ohm, 2 W, MF		14A0016
32	Varistor	GE V275LA40B	32A0034
34	Transformer, Dual 115 V/230 V		35A0277

TABLE 6-1. PARTS LIST

Item No. See Fig. 8-4/8-5	Description: Final Assembly (44D2165-X) 4 kW, 480 V ac	Mfrs. Part No.	ADB-ALNACO Part No.
1	4-kW Power Transformer		35A0314
5	Breaker, 15 A, 277/480V, Short Delay	Airpax 209-2-1-61-5-8-15H	57A0037
7	Fuse, 1 A, 500 V, S.B.	Littelfuse FLQ1	47A0108
8	Fuseblock, 600 V		49A0084
9	Contactor, 15A, 50 Hz, 120V, Coil	Telemechanique LC1-D163F	53A0222
11	Inductor, 4 kW, 50 Hz		33A0022
13	Control PCB Assembly		44D1475
14	Switch PCB Assembly		
	for 3-Step CCR		44B1476-1
	for 5-Step CCR		44B1476-2
15	Ammeter, 10 A Scale		52A0103
16	Fuse, 1/4 W, 250 V, S.B.	Buss MDA 1/4	47A0117
17	Transformer, Dual 120 V/36 V (CT)		35A0225
18	Transformer, Dual 240 V/120 V (CT)		35A0226
19	Current Transformer, 6.6A/55mA		35C0270
20	Voltage Ratio Transformer, 6:1 (T5)		35A0269
21	Varistor	GE V660HE600	32A0025
22	SCR, Dual	Semikron SKKT 91/12D	28A0011
24	Coil, Air Choke		44B1712
26	Capacitor, 0.1 uF, 630 V, Type E		23A0086
28	Resistor, 100 ohm, 2 W, MF		15A0080
30	Resistor, 33 ohm, 2 W, MF		14A0016
31	Varistor	GE V575LA80B	32A0033
34	Transformer, Dual 115 V/230 V		35A0277
35	Capacitor, 0.1 uF, 1250 V, Type E		23A0081
36	Resistor, 100 kilohm, 2 W, MF		14A0023

TABLE 6-1. PARTS LIST

Item No. See Fig. 8-4/8-5	Description: Final Assembly (44D2166-X) 7.5 kW, 208-240 V ac	Mfrs. Part No.	ADB-ALNACO Part No.
2	7.5-kW Power Transformer		35A0315
4	Breaker, 50 A, 277/480V, Short Delay	Airpax 209-2-1-61-5-8-50H	57A0036
6	Fuse, 2 A, 250 V, S.B.	Buss FNM2	47A0113
8	Fuseblock, 600 V		49A0084
10	Contactor, 32A, 50 Hz, 120V, Coil	Telemechanique LC1-D254FA60	53A0223
12	Inductor, 7.5 kW, 50 Hz		33A0023
13	Control PCB Assembly		44D1475
14	Switch PCB Assembly		
	for 3-Step CCR		44B1476-1
	for 5-Step CCR		44B1476-2
15	Ammeter, 10 A Scale		52A0103
16	Fuse, 1/4 A, 250 V, S.B.	Buss MDA 1/4	47A0117
17	Transformer, Dual 120 V/36 V (CT)		35A0225
18	Transformer, Dual 240 V/120 V (CT)		35A0226
19	Current Transformer, 6.6A/55mA		35C0270
20	Voltage Ratio Transformer, 6:1 (T5)		35A0269
21	Varistor	GE V660HE600	32A0025
23	SCR, Dual	Semikron SKKT-131/12D	28A0015
24	Coil, Air Choke		44B1712
25	Capacitor, 1 uF, 630 V, Type E		23A0080
26	Capacitor, .1 uF, 630 V, Type E		23A0086
27	Resistor, 22 ohm, 2 W, MF		14A0025
29	Resistor, 47 kilohm, 2 W, MF		14A0017
30	Resistor, 33 ohm, 2 W, MF		14A0016
32	Varistor	GE V275LA40B	32A0034
34	Transformer, Dual 115 V/230 V		35A0277

TABLE 6-1. PARTS LIST

Item No. See Fig. 8-4/8-5	Description: Final Assembly (44D2167-X) 7.5 kW, 480 V ac	Mfrs. Part No.	ADB-ALNACO Part No.
2	7.5-kW Power Transformer		35A0315
3	Breaker, 30 A, 277/480V, Short Delay	Airpax 219-2-1-61F-5-9-30	57A0035
7	Fuse, 1A, 500 V, S.B.	Littelfuse FLQ1	47A0108
8	Fuseblock, 600 V		49A0084
9	Contactor, 15A, 50 Hz, 120V, Coil	Telemechanique LC1-D163F	53A0222
12	Inductor, 7.5 kW, 50 Hz		33A0023
13	Control PCB Assembly		44D1475
14	Switch PCB Assembly		
	for 3-Step CCR		44B1476-1
	for 5-Step CCR		44B1476-2
15	Ammeter, 10 A Scale		52A0103
16	Fuse, 1/4 A, 250 V, S.B.	Buss MDA 1/4	47A0117
17	Transformer, Dual 120 V/36 V (CT)		35A0225
18	Transformer, Dual 240 V/120 V (CT)		35A0226
19	Current Transformer, 6.6A/55mA		35C0270
20	Voltage Ratio Transformer, 6:1 (T5)		35A0269
21	Varistor	GE V660HE600	32A0025
23	SCR, Dual	Semikron SKKT-131/12D	28A0015
24	Coil, Air Choke		44B1712
26	Capacitor, 0.1 uF, 630 V, Type E		23A0086
28	Resistor, 100 ohm, 2 W, MF		15A0080
30	Resistor, 33 ohm, 2 W, MF		14A0016
31	Varistor	GE V575LA80B	32A0033
34	Transformer, Dual 115 V/230 V		35A0277
35	Capacitor, 0.1 uF, 1250 V, Type E		23A0081
36	Resistor, 100 kilohm, 2 W, MF		14A0023

TABLE 6-1. PARTS LIST

Item No. See Fig. 8-4/8-5	Description: Final Assembly (44D2168-X) 10 kW, 208-240 V ac	Mfrs. Part No.	ADB-ALNACO Part No.
2	10-kW Power Transformer		35A0348
4	Breaker, 70 A, 277/480V	Airpax 219-2-1-61F-5-9-70	57A0052
6	Fuse, 2 A, 250 V, S.B.	Buss FNM2	47A0113
8	Fuseblock, 600 V		49A0084
10	Contactor, 70 A, 50 Hz, 120V, Coil	Telemechanique LC1-D503K	53A0252
12	Inductor, 10 kW, 50 Hz		33A0025
13	Control PCB Assembly		44D1475
14	Switch PCB Assembly		
	for 3-Step CCR		44B1476-1
	for 5-Step CCR		44B1476-2
15	Ammeter, 10 A Scale		52A0103
16	Fuse, 1/4 A, 250 V, S.B.	Buss MDA 1/4	47A0117
17	Transformer, Dual 120 V/36 V (CT)		35A0225
18	Transformer, Dual 240 V/120 V (CT)		35A0226
19	Current Transformer, 6.6A/55mA		35C0270
20	Voltage Ratio Transformer, 6:1 (T5)		35A0269
21	Varistor	GE V660HE600	32A0025
23	SCR, Dual	Semikron SKKT-131/12D	28A0015
24	Coil, Air Choke		44B1712
25	Capacitor, 1 uF, 630 V, Type E		23A0080
26	Capacitor, .1 uF, 630 V, Type E		23A0086
27	Resistor, 22 ohm, 2 W, MF		14A0025
29	Resistor, 47 kilohm, 2 W, MF		14A0017
30	Resistor, 33 ohm, 2 W, MF		14A0016
32	Varistor	GE V275LA40B	32A0034
34	Transformer, Dual 115 V/230 V		35A0277

TABLE 6-1. PARTS LIST

Item No. See Fig. 8-4/8-5	Description: Final Assembly (44D2169-X) 10 kW, 480 V ac	Mfrs. Part No.	ADB-ALNACO Part No.
2	10-kW Power Transformer		35A0348
3	Breaker, 35 A, 277/480V	Airpax 219-2-1-61F-5-9-35	57A0051
7	Fuse, 1A, 500 V, S.B.	Littelfuse FLQ1	47A0108
8	Fuseblock, 600 V		49A0084
9	Contactor, 32 A, 50 Hz, 120V, Coil	Telemechanique LC1-D254FA60	53A0223
12	Inductor, 10 kW, 50 Hz		33A0025
13	Control PCB Assembly		44D1475
14	Switch PCB Assembly		
	for 3-Step CCR		44B1476-1
	for 5-Step CCR		44B1476-2
15	Ammeter, 10 A Scale		52A0103
16	Fuse, 1/4 A, 250 V, S.B.	Buss MDA 1/4	47A0117
17	Transformer, Dual 120 V/36 V (CT)		35A0225
18	Transformer, Dual 240 V/120 V (CT)		35A0226
19	Current Transformer, 6.6A/55mA		35C0270
20	Voltage Ratio Transformer, 6:1 (T5)		35A0269
21	Varistor	GE V660HE600	32A0025
23	SCR, Dual	Semikron SKKT-131/12D	28A0015
24	Coil, Air Choke		44B1712
26	Capacitor, 0.1 uF, 630 V, Type E		23A0086
28	Resistor, 100 ohm, 2 W, MF		15A0080
30	Resistor, 33 ohm, 2 W, MF		14A0016
31	Varistor	GE V575LA80B	32A0033
34	Transformer, Dual 115 V/230 V		35A0277
35	Capacitor, 0.1 uF, 1250 V, Type E		23A0081
36	Resistor, 100 kilohm, 2 W, MF		14A0023

TABLE 6-2. RECOMMENDED SPARE PARTS

Recommended Spare Parts for 4 kW (208-240 V ac) CCR

Fuse, 2 A, 250 V, S.B.	47A0113
Control PCB Assembly	44D1475
Switch PCB Assembly	
for 3-Step CCR	44B1476-1
for 5-Step CCR	44B1476-2
Fuse, 1/4 A, 250 V, S.B.	47A0117
Varistor	32A0025
SCR, Dual	28A0011

Recommended Spare Parts for 4 kW (480 V ac) CCR

Fuse, 1 A, 500 V, S.B.	47A0108
Control PCB Assembly	44D1475
Switch PCB Assembly	
for 3-Step CCR	44B1476-1
for 5-Step CCR	44B1476-2
Fuse, 1/4 A, 250 V, S.B.	47A0117
Varistor	32A0025
SCR, Dual	28A0011

Recommended Spare Parts for 7.5 kW (208-240 V ac) CCR

Fuse, 2 A, 250 V, S.B.	47A0113
Control PCB Assembly	44D1475
Switch PCB Assembly	
for 3-Step CCR	44B1476-1
for 5-Step CCR	44B1476-2
Fuse, 1/4 A, 250 V, S.B.	47A0117
Varistor	32A0025
SCR, Dual	28A0015

Recommended Spare Parts for 7.5 kW (480 V ac) CCR

Fuse, 1A, 500 V, S.B.	47A0108
Control PCB Assembly	44D1475
Switch PCB Assembly	
for 3-Step CCR	44B1476-1
for 5-Step CCR	44B1476-2
Fuse, 1/4 A, 250 V, S.B.	47A0117
Varistor	32A0025
SCR, Dual	28A0015

TABLE 6-2. RECOMMENDED SPARE PARTS

Recommended Spare Parts for 10 kW (208-240 V ac) CCR

Fuse, 2 A, 250 V, S.B.	47A0113
Control PCB Assembly	44D1475
Switch PCB Assembly	
for 3-Step CCR	44B1476-1
for 5-Step CCR	44B1476-2
Fuse, 1/4 A, 250 V, S.B.	47A0117
Varistor	32A0025
SCR, Dual	28A0015

Recommended Spare Parts for 10 kW (480 V ac) CCR

Fuse, 1A, 500 V, S.B.	47A0108
Control PCB Assembly	44D1475
Switch PCB Assembly	
for 3-Step CCR	44B1476-1
for 5-Step CCR	44B1476-2
Fuse, 1/4 A, 250 V, S.B.	47A0117
Varistor	32A0025
SCR, Dual	28A0015

SECTION 7. INSTALLATION

7.1 INTRODUCTION.- This section provides instructions for the installation of the L-828 LC-Type Constant Current Regulators. Refer to the airport project plans and specifications for the specific installation instructions.

7.2 UNPACKING.- Unpack crate upon receipt and examine regulator to insure that no damage has occurred during shipment. Note any exterior damage to crate which might lead to detection of equipment damage. When handling the regulator, care should be taken to maintain the unit in an upright position.

7.2.1 Damage.- If damage to any equipment is noted, a claim form should be filed with the carrier immediately. Inspection of equipment by the carrier may be necessary.

7.3 INSTALLATION.- The regulator can be lifted using a forklift on the bottom of the regulator or with a portable hoist using the two 3/8-inch I.D. eyebolts on top of cabinet. Place regulator inside a well ventilated room with sufficient clearance for personnel to inspect and maintain the unit. The ambient temperature of the room must be between -40°C and +55°C (-40° to +131°F). The regulator can be floor mounted or mounted on a rack or shelf. Figure 8-1 provides dimensional requirements for rack or shelf installation. Hardware recommended for mounting the regulator is given in Table 7-1.

TABLE 7-1. RACK/SHELF MOUNTING HARDWARE
(See Figures 8-2 and 8-2.1)

RACK/SHELF MOUNTING

ITEM #	Description	QTY	MFR Part No.
1	Channel(1 5/8 X 1 5/8")	2/Bank	UNISTRUT #P1000
2	Shelf Support Bracket	2	UNISTRUT #P2543
3	Hex Head Cap. Screw (1/2 x 1 3/16")	8	UNISTRUT #HHCS050119EG
4	Nut with Spring (1/2"-13)	8	UNISTRUT #P1010

FLOOR MOUNTING

The regulator can be placed directly on the floor without the use of bolts. However, if the regulator must be bolted to the floor, the contractor should drill holes in the bottom 2 channels and use bolts and lead molies to secure regulator to the floor

7.4 WIRING CONNECTIONS AND STARTUP.- See Figures 8-3, 8-4 and 8-10. The regulator is delivered ready to operate when properly connected and should not require any electrical adjustments. The contractor responsible for installation will be required to supply all necessary wire, conduit, connectors, mounting hardware, etc.

WARNING

Installation and operation of the CCR should be performed by personnel qualified to work on high voltage equipment. The high voltage involved with the unit makes it potentially dangerous and may be lethal if contacted by operating personnel.

1. Verify the input supply voltage corresponds to the voltage rating on the nameplate of the regulator.

2. Make sure the rotary switch S1 on the front panel is set to the OFF position.

3. Ground the regulator by making an adequate ground wire (AWG 6 or larger) connection to the earth ground lug on the regulator.

4. An appropriate disconnect-type fuse cutout or circuit breaker shall be provided for the input power supply lines. For installations requiring load switching during regulator operation, the regulator may be connected to an L-847 circuit selector switch.*

5. Install appropriate external lightning arrestors (see note below and Table 1-2 on page 5 for ADB-ALNACO part numbers for input lightning arrestors) on the input power supply lines as close as possible to the CCR input terminal block TB3. Note: If optional lightning arrestors are ordered with regulator, they are factory installed.

*Do not use the LC-Type CCR to power an L-849 REIL system unless the CCR is at least half loaded with steady burning lights.

NOTE

Since lightning is a phenomenon that varies in intensity and frequency with geographical locations, it is recommended that each installation evaluate the need for additional lightning protection.

6. Short-circuit the output terminals (on TB1) using AWG 10 (minimum) wire.

7. Connect the voltage supply lines (see below for recommended input wire) from the disconnect switch or main circuit breaker to the CCR input terminal block TB3. Tighten all connections.

RECOMMENDED INPUT POWER SUPPLY WIRE FOR LESS THAN 100 FEET BETWEEN CCR AND POWER SOURCE (90°C, 600 V MINIMUM)*

Rating	208 Vac	220 Vac	240 Vac	480 Vac
4 kW	AWG 12	AWG 12	AWG 12	AWG 16
7.5 kW	AWG 8	AWG 10	AWG 10	AWG 14
10 kW	AWG 6	AWG 6	AWG 6	AWG 12

*For 100 to 250 ft, use the next larger (even) gage wire

NOTE

Do not route output cable in the vicinity of other wiring sensitive to EMI or RFI.

8. Energize regulator (engage main circuit breaker or disconnect switch). Turn regulator's circuit breaker CB1 to the on position, and turn rotary selector switch S1 to all brightness steps. Verify current values on the panel ammeter correspond to those below for each brightness step.

	S1 POSITION	NOMINAL OUTPUT	ALLOWABLE RANGE (PANEL AMMETER) AMPERES
3-STEP	10	4.8 A	4.55 - 4.94
CCR	30	5.5 A	5.33 - 5.67
	100	6.6 A	6.40 - 6.80*
5-STEP	1	2.8 A	2.72 - 2.88
CCR	2	3.4 A	3.30 - 3.50
	3	4.1 A	3.98 - 4.22
	4	5.2 A	5.04 - 5.36
	5	6.6 A	6.40 - 6.80*

9. Deenergize regulator (disengage main circuit breaker or disconnect switch) and turn rotary switch S1 to the OFF position.

10. Connect remote control lines, if required, to remote control terminal block TB2 (use AWG 19, 300 V wire or larger) as indicated in Table 7-2 for +48 V dc control signals or in Table 7-3 for 120 V ac control signals. See Figure 8-10 for remote control connections.

NOTE

Tables 7-2 and 7-3 give the necessary connections for remote control. Terminal B1 (or B10) does not need to be wired. Brightness step B1 (or B10) occurs when the regulator is switched on.

*6.40-6.70 A on 10 kW CCR only

TABLE 7-2. REMOTE CONTROL CONNECTIONS

Terminal Block TB2 Label	Function
N	Remote Control Common
CCI	Remote Control Power
CC	Remote On-Command Voltage
B10, B30, B100	Brightness Control (3-Step CCR)
B1, B2, B3, B4, B5	Brightness Control (5-Step CCR)

11. Make sure efficiency-adjustment wire #200 on TB6 is set to terminal 1 for full output load or terminal 2 when the load on the output is up to 1/2 the rated load.

12. Make sure all wiring connections are tight and no wires are shorting across each other.

CAUTION

Incorrect wiring can damage the regulator. Double check all connections.

13. Energize regulator and set circuit breaker CB1 to the ON position. Set rotary switch S1 to the REM position and operate the CCR by remote control. Verify correct current levels are obtained on all brightness steps.

14. Turn rotary switch S1 to OFF and deenergize regulator (disengage disconnect switch or main circuit breaker). Remove short-circuit link from the output terminals of TB1.

TABLE 7-3. REMOTE 120 V AC CONTROL CONNECTIONS

	REMOTE INTENSITY STEP	CONNECT CCI TO:
3-Step CCR	HIGH (6.6 A)	CC, B100
	MEDIUM (5.5 A)	CC, B30
	LOW (4.8 A)	CC, B10
	OFF	Nothing

	REMOTE INTENSITY STEP	CONNECT CCI TO:
5-Step CCR	6.6 A	CC, B5
	5.2 A	CC, B4
	4.1 A	CC, B3
	3.4 A	CC, B2
	2.8 A	CC, B1
	OFF	Nothing

15. Connect the 6.6 A series lighting circuit to the output terminal block TB1 and tighten all connections.

NOTE

Do not route output cable in the vicinity of other wiring sensitive to EMI or RFI.

16. Check if the input current x input voltage x CCR efficiency (CCR efficiency = .90) is larger than the kilowatt rating on the CCR nameplate. If it is, either reduce the load or replace the CCR with one having a larger kilowatt rating.

17. Check current output on regulator in all steps in both remote and local control.

NOTE

The regulator has been preset at the factory to the calibrated values given in Section 7.4, par. #8. If the regulator is not providing the correct current, it will have to be calibrated as given below in Section 7.5.

7.5 CALIBRATION.-

A separate true-rms-reading ammeter (minimum accuracy of 1%, such as a Beckman "Tech 360" multimeter with model CT-231 current clamp or equivalent) is required to carry out the calibration of the regulator. Do not use the ammeter on the front panel of the regulator.

7.5.1 Set-Up Procedure.- The following initial steps are required prior to proceeding with the calibration of the regulator.

1. Check to insure the proper input voltage is supplied to CCR at terminal block TB3.

2. Make sure that the efficiency-adjustment connection (wire #200) is connected to TB6-1. This is for full output power.

3. On the output terminal block TB1 connect a true rms-reading ammeter, such as a Bechman "Tech 360" multimeter, and a lamp load equal to 1/2 of the CCR's rated load. If the load is greater than 1/2 of the CCR's rated load, short terminals 1 and 2 on terminal block TB1.

4. Set CCR's local control switch, S1, to the highest intensity step (S1 position fully clockwise), B5 for 5-step CCR or B100 for a 3-step CCR.

5. Turn the overcurrent-adjustment potentiometer, R48, (see Figure 8-6) on the Control Printed Circuit Board (Control PCB) fully counterclockwise.

6. Turn CCR on. Observe normal operation for a minimum of 2 minutes during which time the the output should not vary and only the green LED marked "REGULATOR ON" should be lit. No red alarm LEDs should be lit.

7.5.2. Adjustment of Output Current.- After set-up procedure in Section 7.5.1 has been completed, proceed with the following steps to set the output current adjustment level of the CCR.

1. Turn CCR on and set the local control switch, S1, to the highest intensity step, B5 for 5-step CCR or B100 for a 3-step CCR. The external true-rms ammeter should read 6.60 ±0.1 amps. If reading is outside of this range, adjust potentiometer R47 (see Figure 8-6) on the Control PCB to obtain 6.60 amps.

NOTE

Potentiometer R47 is the master reference adjustment. Changing this potentiometer changes the adjustment of potentiometers R48, R46, R45, R44, and R43.

2. Set switch S1 to next lowest brightness step, and verify that the true-rms ammeter reading corresponds to Table 7-4. If reading is not in the current value range given in Table 7-4, adjust the appropriate potentiometer listed in the table until the correct current value is obtained.

3. Repeat Step 2 for the remaining lower brightness step(s).

NOTE

Potentiometers R43, R44, R45, R46 have independent circuits, so any adjustments made on these potentiometers will not effect the adjustment of the other three potentiometers.

4. When the output current adjustment has been completed, turn the CCR off. Remove shorting cable on output terminals, if used.

TABLE 7-4. POTENTIOMETERS FOR SETTING OUTPUT CURRENT LEVELS

See Figure 8-6

3-STEP CCR*

S1 Position	Ammeter Reading	Adjustment Potentiometer
B30	5.50	R46
B10	4.80	R45

5-STEP CCR

S1 Position	Ammeter Reading	Adjustment Potentiometer
B4	5.20	R46
B3	4.10	R45
B2	3.40	R44
B1	2.80	R43

*Note: Potentiometers R44 and R43 are used only on 5-step CCRs. R44 and R43 have no function on a 3-step CCR.

7.5.3 Overcurrent Adjustment.- Complete the steps in Sections 7.5.1 and 7.5.2 before proceeding with the overcurrent adjustment.

Overcurrent Adjustment Steps:

1. With power off, connect a test lead across TP7 and TP9 (see Figure 8-6) on the Control PCB. This will move the trip level for the overcurrent detection threshold from the normal operating point of 6.93 amps to 6.6 amps.

2. Turn switch S1 to the highest brightness step, B5 for 5-step CCR or B100 for a 3-step CCR. Ammeter should read 6.60 amps.

NOTE

Do not change the adjustment of R47, since this not only will affect the output current of the CCR but the potentiometer adjustment levels for all other current levels.

3. Physically center the overcurrent potentiometer R48 (see Figure 8-6). While viewing the red overcurrent LED on the Control Panel, slowly turn R48 clockwise until the LED begins to glow. Then quickly turn control switch S1 to the next lower intensity step. This will turn the LED off because the current level is less.

NOTE

If the potentiometer R48 is turned too far, the CCR will shut down. If this should occur, return potentiometer R48 to the centered position and reset the CCR by momentarily turning the CCR off and then back on.

4. While watching the overcurrent LED, return S1 to the highest intensity step, and time how long it takes for the overcurrent LED indicator to start to glow. It should take 3 ±1 s.

NOTE

If the LED comes on in less than 2 seconds, turn potentiometer R48 a slightly counterclockwise. If more than 4 seconds are required for the LED to light, turn R48 slightly clockwise. Repeat step 4 until the correct time period (3 ±1 s) is obtained.

5. Turn off the CCR and remove test leads from TP7 and TP9. The trip level for the overcurrent threshold is now calibrated for 6.93 amps.

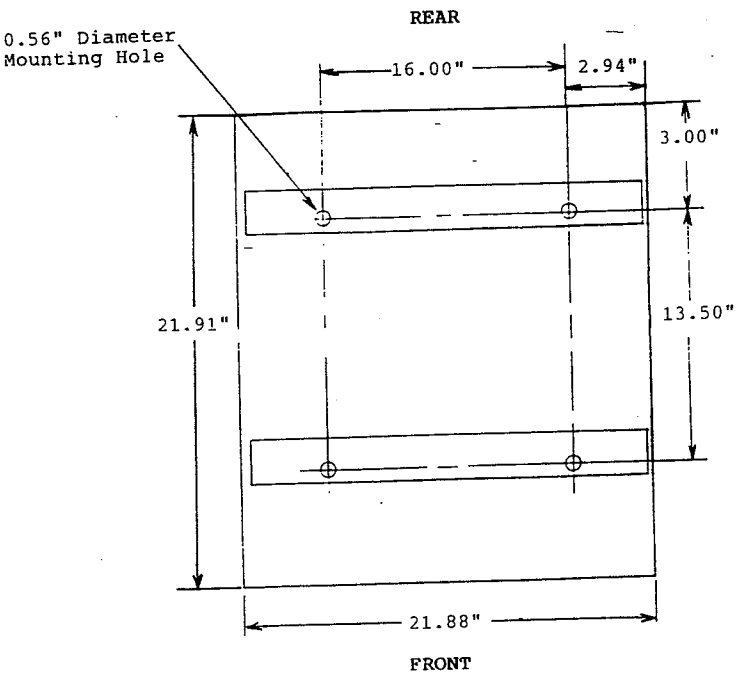


FIGURE 8-1. BOTTOM VIEW OF REGULATOR FRAME SHOWING MOUNTING HOLES

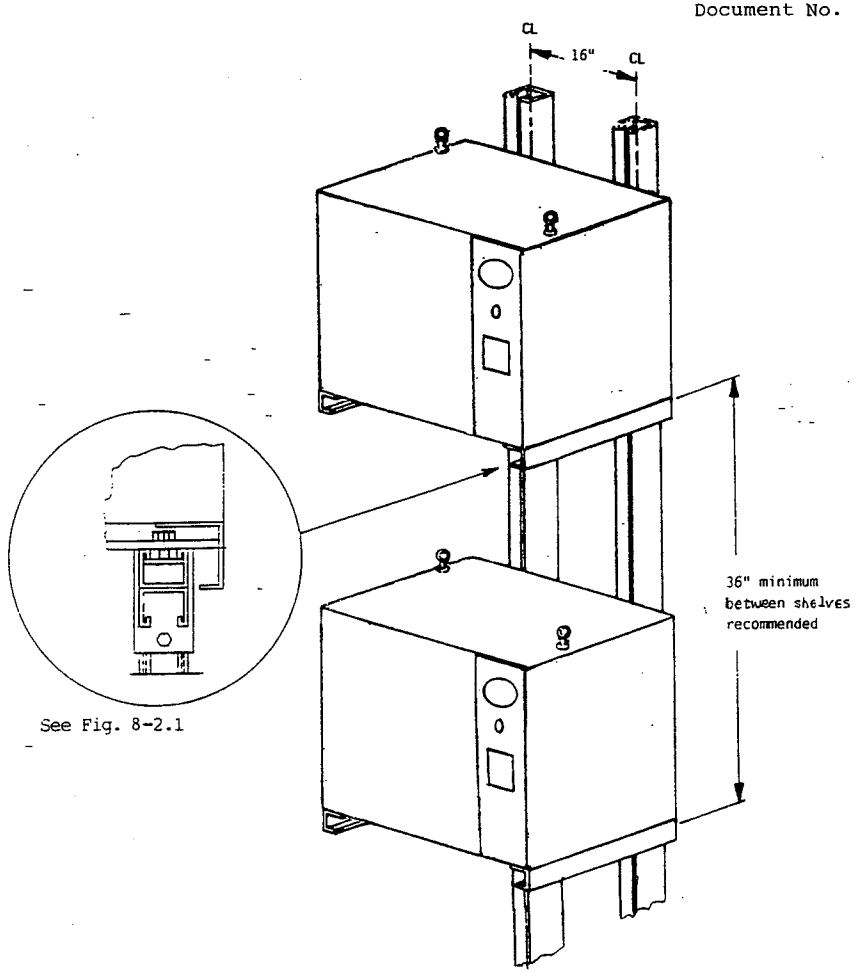


FIGURE 8-2. RACK MOUNT INSTALLATION

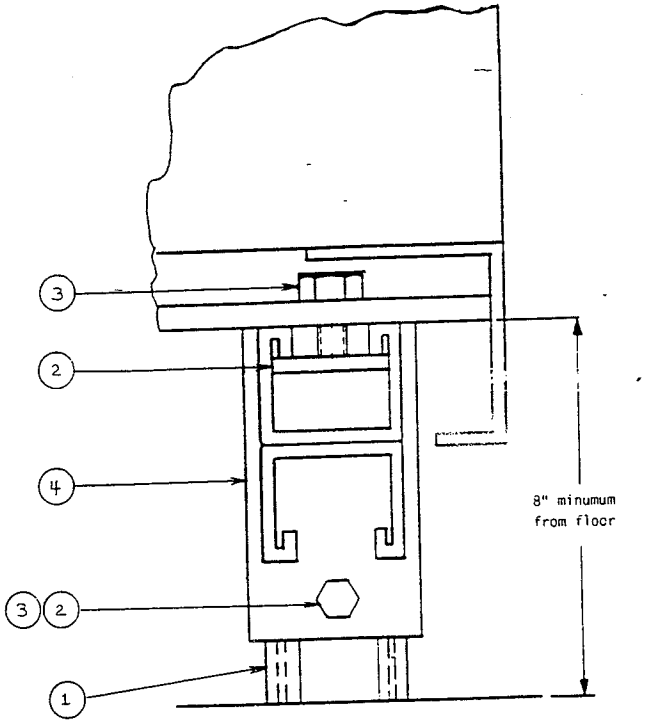
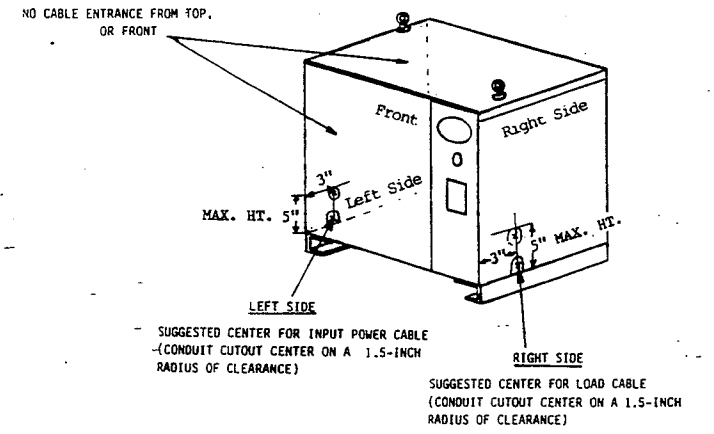


FIGURE 8-2.1. RACK MOUNT HARDWARE DETAILS



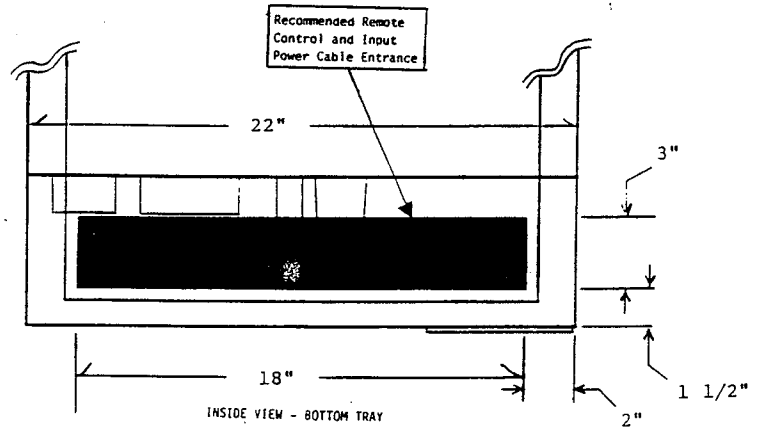
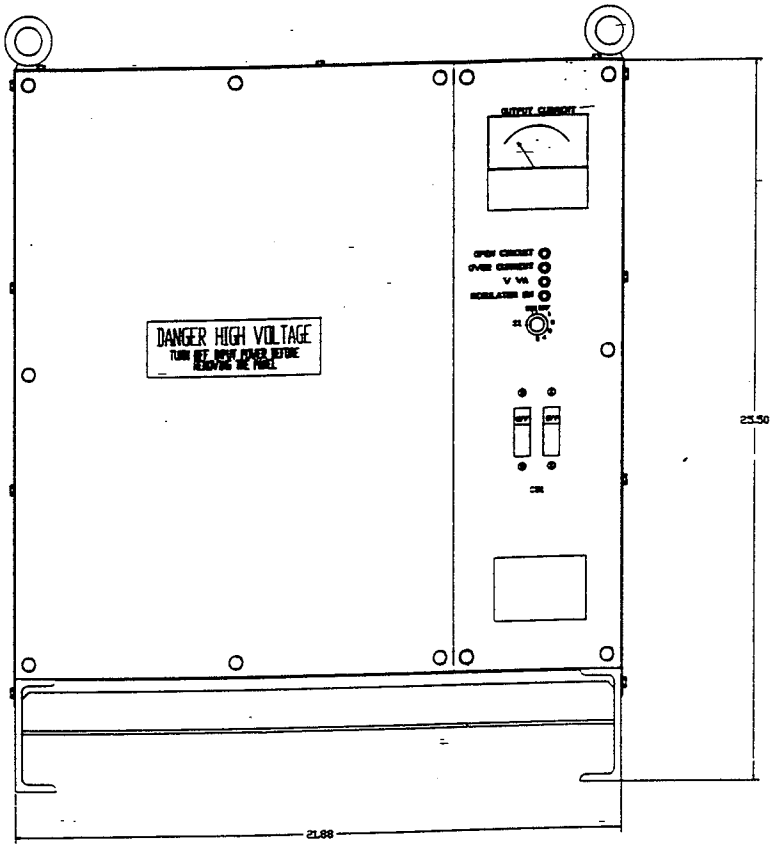
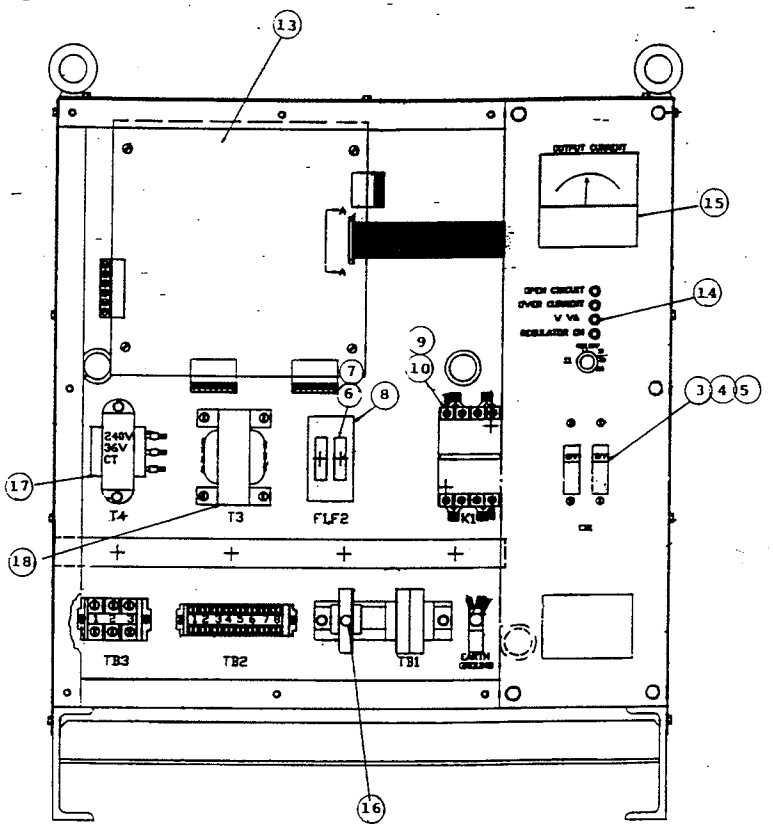


FIGURE 8-3. RECOMMENDED INPUT AND OUTPUT CABLE ENTRANCE LOCATIONS

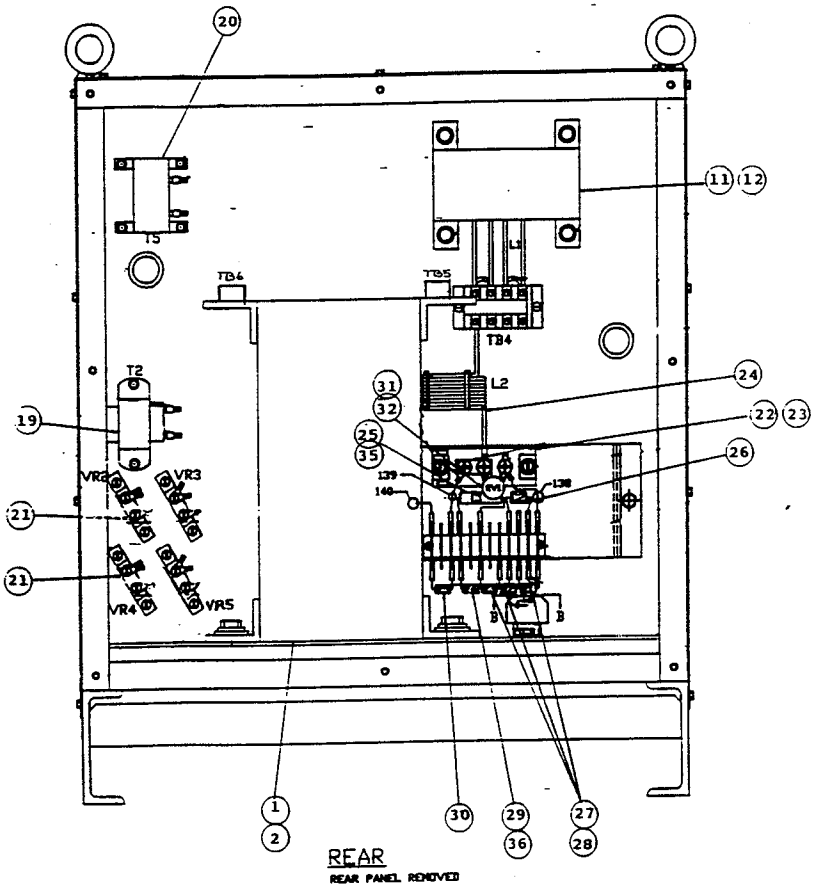


FRONT



FRONT
FRONT PANEL REMOVED

FIGURE 8-4. GENERAL ASSEMBLY (FRONT VIEW)



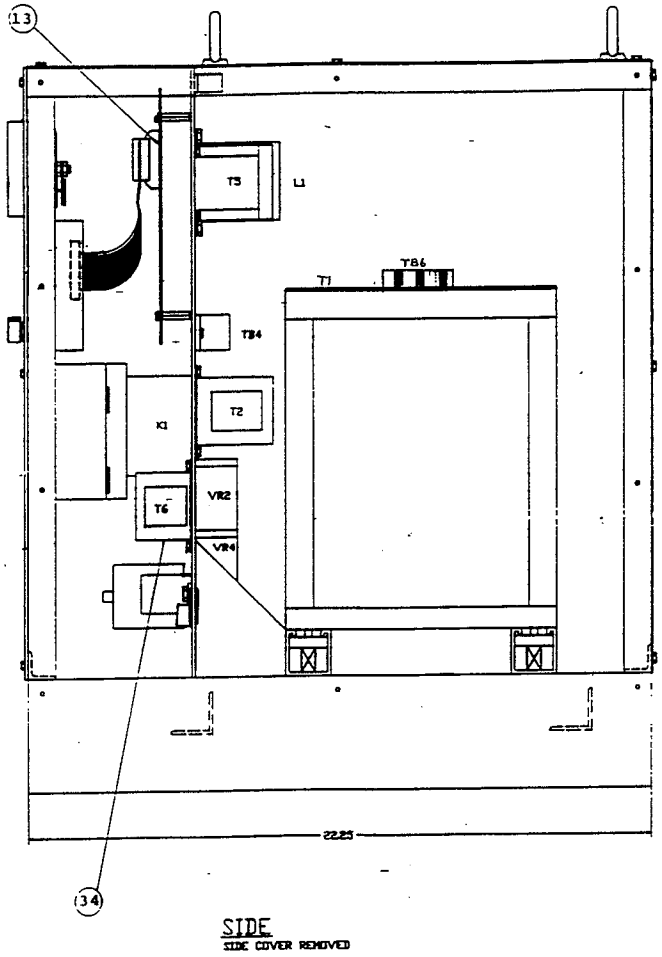


FIGURE 8-5. GENERAL ASSEMBLY
(SIDE & REAR VIEW)

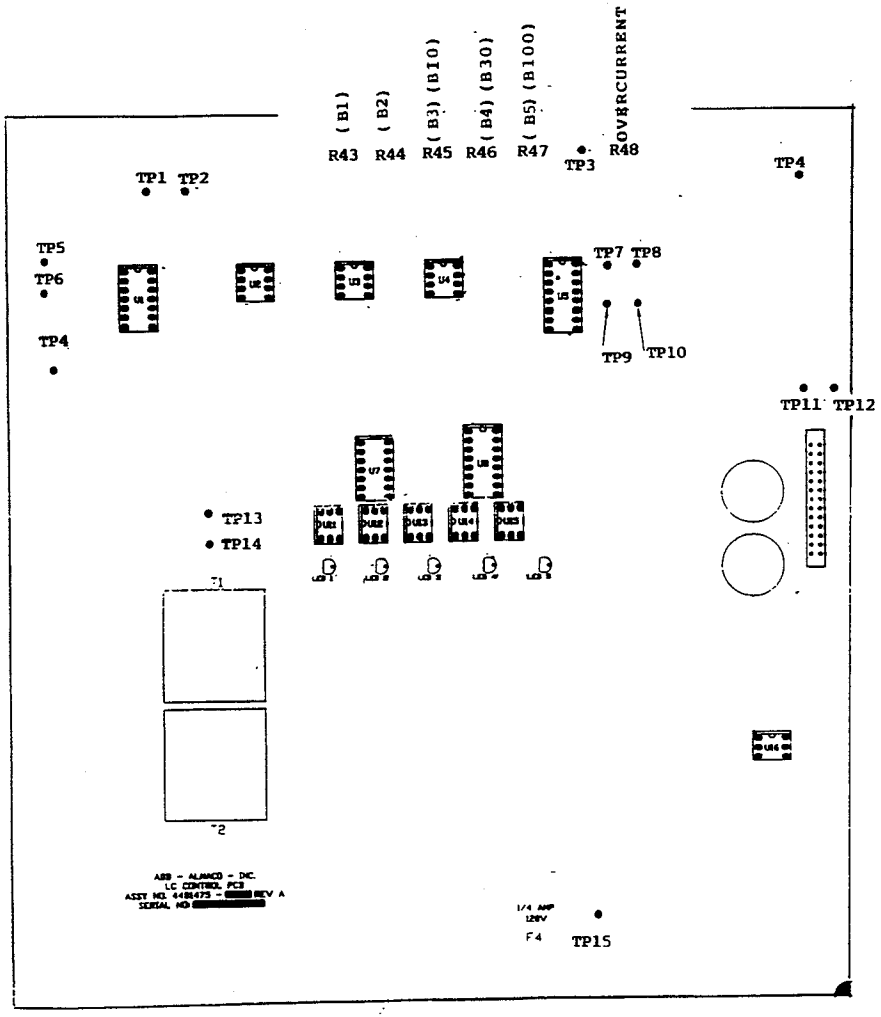
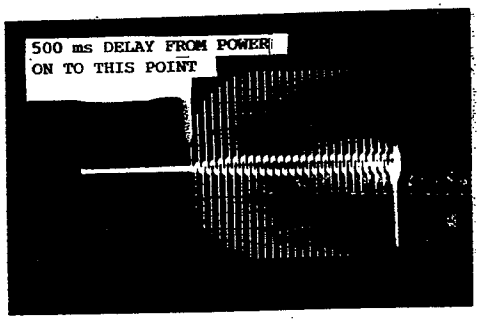


FIGURE 8-6. CONTROL PCB



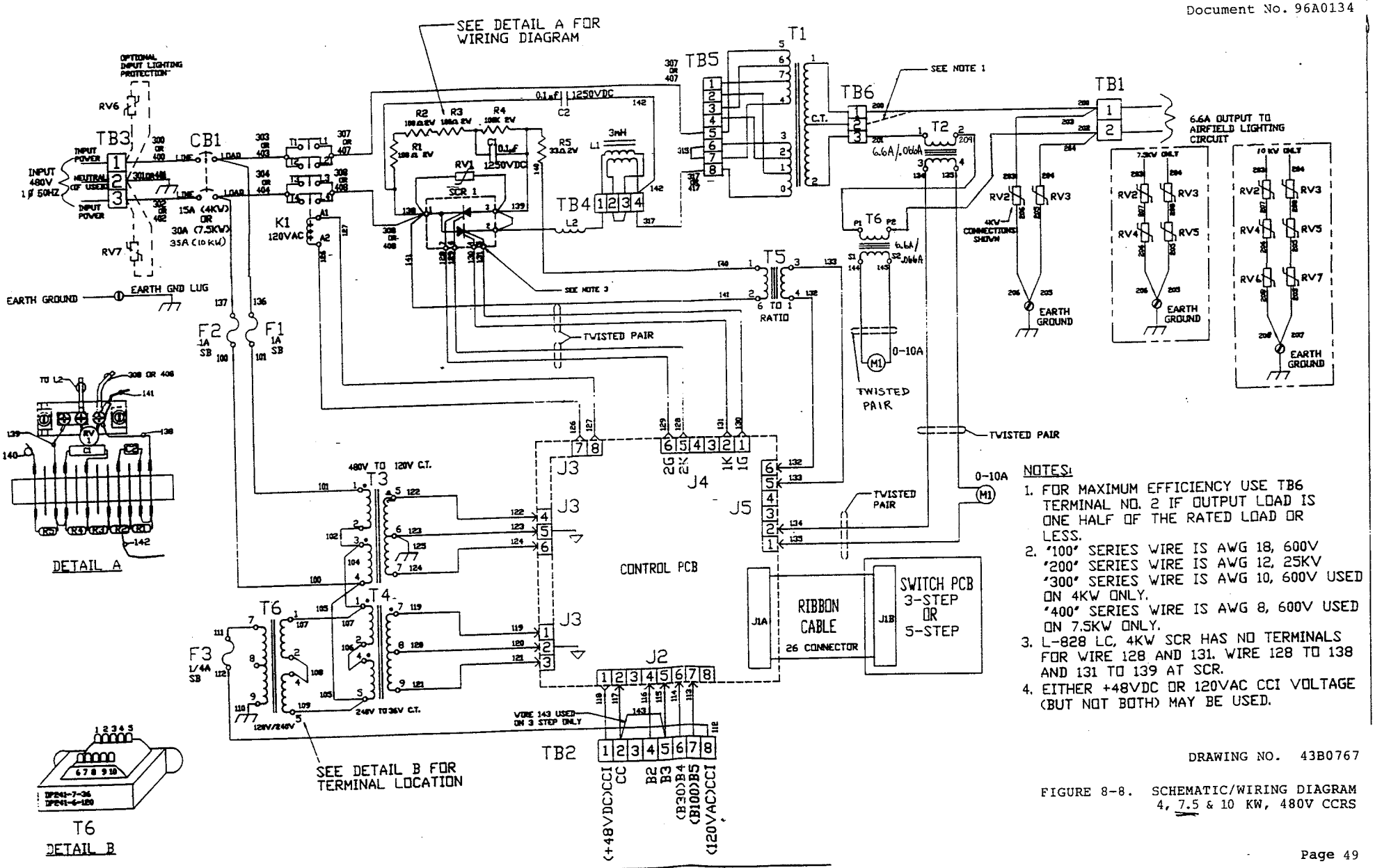
LC CCR

6.6 A OUTPUT CURRENT

5A/DIV, 67 ms/DIV

NOTES: Waveform shows CCR being turned from OFF to ON.
CCR's input voltage is 240 V ac.

FIGURE 8-7. REGULATOR'S OUTPUT SOFT-START WAVEFORM

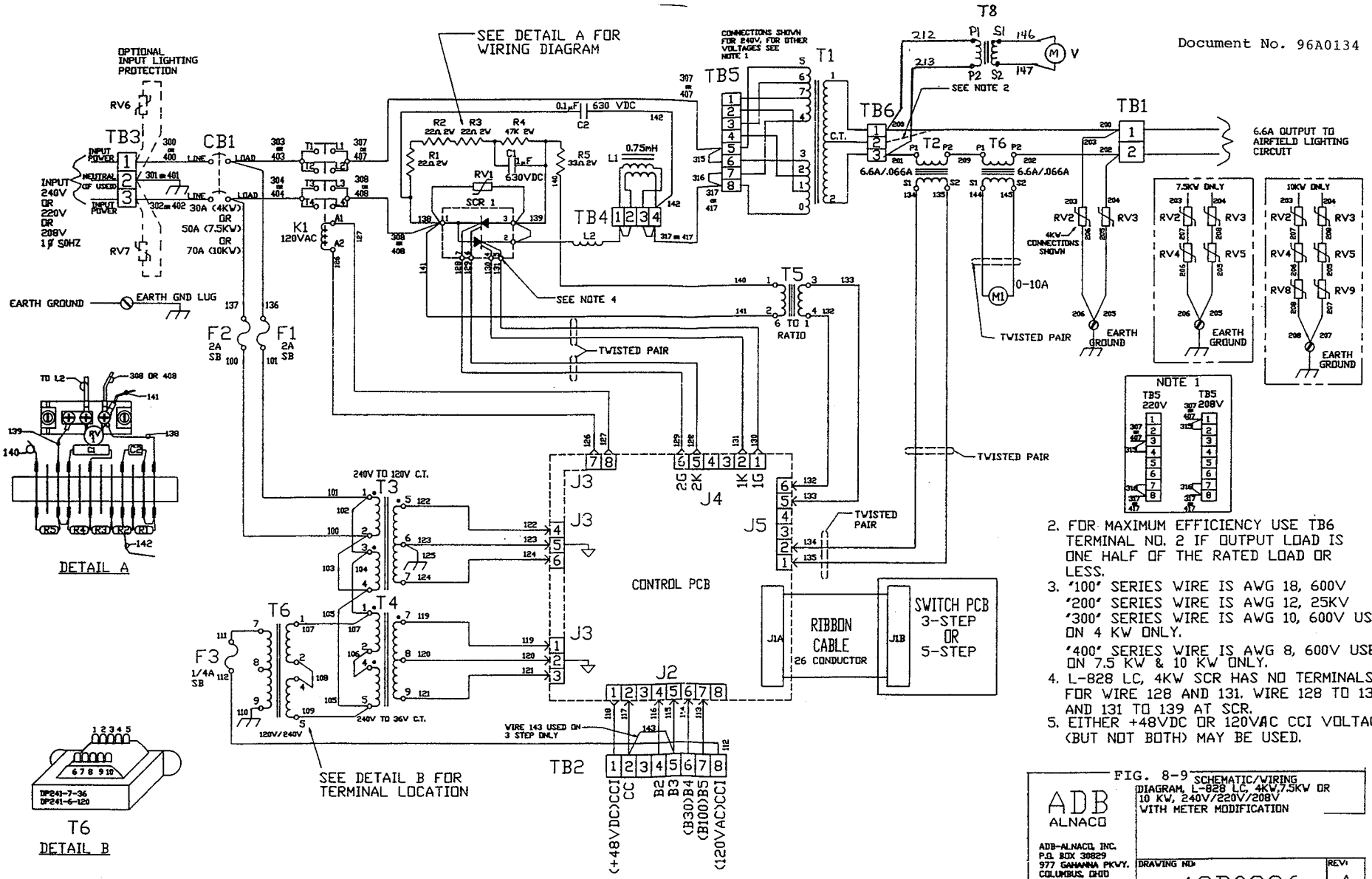


NOTES:

1. FOR MAXIMUM EFFICIENCY USE TB6 TERMINAL NO. 2 IF OUTPUT LOAD IS ONE HALF OF THE RATED LOAD OR LESS.
2. '100' SERIES WIRE IS AWG 18, 600V
   '200' SERIES WIRE IS AWG 12, 25KV
   '300' SERIES WIRE IS AWG 10, 600V USED ON 4KW ONLY.
   '400' SERIES WIRE IS AWG 8, 600V USED ON 7.5KW ONLY.
3. L-828 LC, 4KW SCR HAS NO TERMINALS FOR WIRE 128 AND 131. WIRE 128 TO 138 AND 131 TO 139 AT SCR.
4. EITHER +48VDC OR 120VAC CCI VOLTAGE (BUT NOT BOTH) MAY BE USED.

DRAWING NO. 43B0767

FIGURE 8-8. SCHEMATIC/WIRING DIAGRAM 4, 7.5 & 10 KW, 480V CCRS



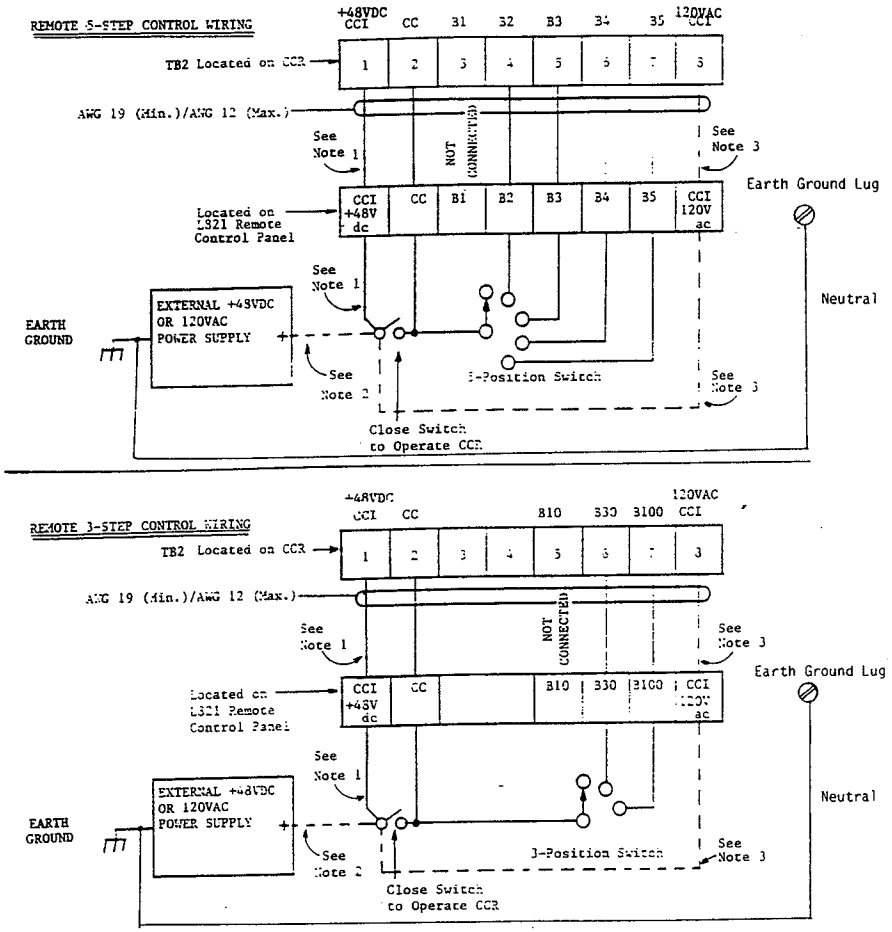
2. FOR MAXIMUM EFFICIENCY USE TB6 TERMINAL NO. 2 IF OUTPUT LOAD IS ONE HALF OF THE RATED LOAD OR LESS.
3. '100' SERIES WIRE IS AWG 18, 600V
   '200' SERIES WIRE IS AWG 12, 25KV
   '300' SERIES WIRE IS AWG 10, 600V USED ON 4 KW ONLY.
   '400' SERIES WIRE IS AWG 8, 600V USED ON 7.5 KW & 10 KW ONLY.
4. L-828 LC, 4KW SCR HAS NO TERMINALS FOR WIRE 128 AND 131. WIRE 128 TO 138 AND 131 TO 139 AT SCR.
5. EITHER +48VDC OR 120VAC CCI VOLTAGE (BUT NOT BOTH) MAY BE USED.

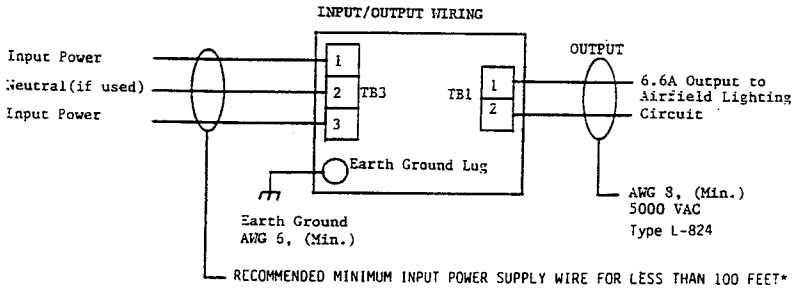
FIG. 8-9 SCHEMATIC/WIRING DIAGRAM, L-828 LC, 4KW,7.5KW OR 10 KW, 240V/220V/208V WITH METER MODIFICATION

ADB ALNACO

ADB-ALNACO, INC.
P.O. BOX 30829
977 GAHANNA PKWY.
COLUMBUS, OHIO
43230

DRAWING NO. 43B0886 REV. A





Rating	208 Vac	220 Vac	240 Vac	480 Vac
4 kW	AWG 12	AWG 12	AWG 12	AWG 16
7.5 kW	AWG 8	AWG 10	AWG 10	AWG 14

*For 100 to 250 ft. use the next larger (even) gage wire

NOTES:

(1) Wire connected only if using internal +48 VDC power supplied by CCR (CCI +48VDC, TB2-1)

(2) Wire connected only if using external +48 VDC or 120 VAC power supply in place of CCR's internal supply

(3) Wire connected only if using internal 120 VAC power supplied by CCR (CCI 120VAC, TB2-8)

(4) When more than one remote control inputs from LC-type regulators are to be connected to a common switch, it is suggested that the internally supplied CCI +48 VDC TB2-1 be used, or an external +48 VDC supply. It is not recommended that a 120 VAC supply be used.

CAUTION

EITHER +48 V DC OR 120 VAC CCI MAY BE USED, BUT NOT BOTH.

FIGURE 8-10. EXTERNAL WIRING DIAGRAM