A36F
SINGLE PHASE

BATTERY CHARGER

INSTRUCTIONS FOR TELECOMMUNICATION APPLICATIONS

ECN/DATE

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INSTRUCTION DRAWING NUMBER:
P25-**LA36F1PHASE-1**

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important safety and operating instructions for the La Marche Power Conversion Equipment.

Before using this equipment, read all instructions and cautionary markings on (1) unit, (2) battery, and (3) product using the battery.

CAUTION: To reduce risk of injury, use only the type of batteries specified on nameplate. Other types of batteries may burst causing personal injury and damage.

Do not expose equipment to rain or snow.
Do not operate equipment if it has received a sharp blow, been dropped, or otherwise damaged in any way; take it to a qualified serviceman.
Do not disassemble this unit; take it to a qualified serviceman when service or repair is required. Incorrect re-assembly may result in a risk of electric shock or fire.

To reduce risk of electric shock, disconnect this unit from the a.c. supply, or batteries and loads before attempting any maintenance or cleaning. Turning off controls will not reduce this risk.

WARNING - RISK OF EXPLOSIVE GASSES WORKING IN VICINITY OF A BATTERY IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL BATTERY OPERATION. FOR THIS REASON, IT IS OF UTMOST IMPORTANCE THAT EACH TIME BEFORE USING THIS UNIT, YOU READ THIS MANUAL AND FOLLOW THE INSTRUCTIONS EXACTLY.

To reduce risk of battery explosion, follow these instructions and those published by the battery manufacturer and manufacturer of any equipment you intend to use in the vicinity of the battery.

Review cautionary marking on all products.

PERSONAL PRECAUTIONS:

1. Someone should be within range of your voice or close enough to come to your aid when you work near a battery.
2. Have plenty of fresh water and soap nearby in case the battery electrolyte contacts skin, clothing, or eyes.
3. Wear complete eye protection and clothing protection. Avoid touching eyes while working near a battery.
4. If the battery electrolyte contacts skin or clothing, wash immediately with soap and water. If the electrolyte enters the eye, immediately flood the eye with running cold water for at least ten (10) minutes and get medical attention immediately.
5. Never smoke or allow a spark or flame in vicinity of a battery.
6. Be extra cautious to reduce risk of dropping a metal tool onto a battery. It might spark or short-circuit the battery or other electric part that may cause an explosion.
7. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a battery. A battery can produce a short-circuit current high enough to weld a ring or the like to metal, causing a severe burn.
8. NEVER charge a frozen battery.

PREPARING TO CHARGE

1. If necessary to remove the battery connections, always remove grounded terminal from the battery first. Make sure all loads are disconnected and unit is off, so as not to cause an arc.
2. Be sure the area around the battery is well ventilated while the battery is being charged.
3. When cleaning battery terminals, be careful to keep corrosion from coming in contact with eyes.
4. Study all the battery manufacturer's specific precautions such as removing or not removing cell caps while charging, recommended rates of charge, and maintenance procedures.

UNIT LOCATION

- Never place this unit directly above the battery. Gases from the battery will corrode and damage equipment.
- Never allow the battery electrolyte to drip on this unit when reading the specific gravity or filling the battery.
- Do not operate this unit in a closed-in area or restrict ventilation in any way.
- Do not set a battery on top of this unit.

D.C. CONNECTION PRECAUTIONS

Connect and disconnect d.c. output cables only after setting all of this unit's switches to off position and removing a.c. input supply.

GROUNDING INSTRUCTIONS

This battery charger should be connected to a grounded, metal, permanent wiring system; or an equipment grounding conductor should be run with circuit conductors and connected to equipment-grounding terminal or lead on battery charger. Connections to battery should comply with all local codes and ordinances.

CAUTION: DO NOT PULL ON OUTPUT CABLES WHEN DISCONNECTING CHARGER FROM BATTERY

RECEIVING INSTRUCTIONS AND GENERAL EQUIPMENT INFORMATION

CAUTION: To ensure safe installation and operation, the information given in the instruction manual should be read and understood before installing or using the equipment.

RECEIVING INSTRUCTIONS

Unpacking and Inspection: Examine the shipping crate upon arrival. If there is obvious damage, describe on the receiving documents. Within a few days after delivery, the equipment should be uncrated and carefully inspected for hidden damages. When removing packaging material, be careful not to discard any equipment, parts, or manuals. If any damage is detected you should:

1. File a claim with the carrier within five (5) days.
2. Send a copy of the claim to La Marche Mfg. Co.
3. Call La Marche Mfg. For a RETURN MATERIAL AUTHORIZATION NUMBER.

Failure to properly file a claim for shipping damages, or provide a copy of the claim to La Marche Mfg., may void warranty service for any physical damages reported for repair.

HANDLING

WARNING: Equipment can be very heavy, and top-heavy. Use adequate manpower or equipment for handling. Until the equipment is securely mounted, care must be used to prevent the equipment from being accidentally tipped over.

NOMENCLATURE PLATES

Each piece of La Marche Mfg. Equipment shipped is identified by part number on the nomenclature plate.

ADJUSTMENTS

All equipment is shipped from the factory fully checked and adjusted. Do not make any adjustments unless the equipment has been powered-up and the settings have been determined to be incorrect.

SPARE PARTS

To minimize downtime during installation or normal service, it is advisable to purchase spare fuses, circuit boards and other recommended components. Please refer to the list of recommended spare parts and their La Marche Mfg. Part numbers included with the instruction manual. It is recommended that spare fuses be ordered for all systems.

To order spare parts, please contact La Marche Mfg. (847)-299-1188 during business hours and ask for the Parts Department.

1.0 GENERAL

The La Marche Model A36F is a filtered controlled ferroresonant float charger designed to power a load while charging a battery in telecommunication applications and may be used without a battery and connected as a battery eliminator.

The all solid state electronic control circuit provides excellent line-load voltage regulation, current limiting, and alarm contacts with status indicators.

The Model A36F is available in a wide range of single and three phase a.c. input voltages, with 12 volt, 24 volt, and 48 volt d.c. outputs in output currents ranging from 10 to 400 amps.

2.0 OUTPUT RATINGS

2.1 D.C. VOLTAGE

The A36F series rectifiers provide separate voltages for floating or equalizing lead or nickel cadmium cells.

The float or equalize mode of operation is selected by a switch located on the front of the rectifier.

The factory settings are as follows:

Float voltage

2.25 volts/cell (Lead)
1.40 volts/cell (N.C.)

Equalize voltage

2.35 volts/cell (Lead)
1.55 volts/cell (N.C.)

2.2 VOLTAGE RANGE

Float

2.12 - 2.3 volts/cell +/- .1 volts (Lead)
1.39 - 1.45 volts/cell +/- .1 volts (N.C.)

Equalize

2.25 - 2.40 volts/cell +/- .1 volts (Lead)
1.50 - 1.60 volts/cell +/- .1 volts (N.C.)

2.3 OUTPUT CURRENT

Single Phase Output

10, 12, 15, 20, 25, 30, 50, 75, 100, 150, 200 amps
12 Vdc or 24 Vdc or 48Vdc

2.4 REGULATION

Steady state output voltage remains within +/- 1/2% of rated voltage for any load current from no load to full load and for input voltages within the rated range.

2.5 FILTERING

For all conditions of input voltage and output load, output noise is less than 32 dbrn "C"-message weighting and output ripple does not exceed 30 millivolts (rms), on batteries rated in ampere-hours at four (4) times the rated charger current. Less than 22 dbrn measured in accordance with REA form 524.

The model A36F has less than 32 dbrn "C" message weighted with no battery connected.

2.6 MEAN TIME BETWEEN FAILURE

The mean time between failure (MTBF) as tested per Bell Communications Standard TR-TSY-000332 is 225,000 hrs. at 50 C.

3.0 INPUT RATINGS

3.1 A.C. VOLTAGE

Taps are provided for nominal single phase a.c. input voltages of 120/208/240 v.a.c., with an a.c. input voltage range of +/- 10% of nominal. The 10, 12,15, 20, 25 and 30 amp 12 volt, the 10, 12, 15, and 20 amp 24 volt, and the 10, 12, and 15 amp 48 volt models are 120 v.a.c. input only. The 150, and 200 amp, 48 volt models are rated for 208/240 v.a.c. only.

3.2 INPUT FREQUENCY RANGE

57 to 63 Hz. (60 HZ nominal)
47 to 57 HZ. (50 HZ nominal)

3.3 INPUT CURRENT

(Refer to TABLE 1) (Based on 100% load)

4.0 TYPICAL ELECTRICAL SPECIFICATIONS

(Refer to TABLE 1)

5.0 STANDARD FEATURES

5.1 INPUT PROTECTION:

A two-pole circuit breaker opens both sides of the a.c. service for 208 or 240 or the phase side of 120 v.a.c. service on single phase units. Three phase units have three pole a.c. breakers for inputs 240 Vac and lower and four pole breakers for over 240 Vac.

5.2 OUTPUT PROTECTION:

Current limiting

A circuit adjustable from 90% to 115% of rated load, limits the d.c. output current. Factory set at 115% of rated output. Short Circuit A "NON " type fuse with rating listed in Table 1 is located in the negative output leg of the rectifier, on a positive ground system. On a negative ground system, the fuse is located in the positive output leg.

5.3 HIGH-VOLTAGE SHUTDOWN

A circuit provided for load protection which causes the rectifier to shut down should its output voltage exceed a preset value.

5.4 REMOTE SENSING

The point of output d.c. voltage sensing may be moved to battery or power board terminals to compensate for voltage drops in cables (See Section 8.3)

MODEL #	DC AMPS	AC INPUT VOLTS	120 AMP	208 AMP	240 AMP	WGT.	CASE #
15-12V-A1	15	120	2.4	--	--	42	39
20-12V-A1	20	120	3.2	--	--	50	39
25-12V-A1	25	120	4.0	--	--	54	39
30-12V-A1	30	120	5.0	--	--	60	4D
50-12V-ABD1	50	120/208/240	8.4	4.8	4.2	90	4D
75-12V-ABD1	75	120/208/240	12.6	7.3	6.3	110	4D
100-12V-ABD1	100	120/208/240	16.8	9.7	8.4	130	9D
150-12V-ABD1	150	120/208/240	25.2	14.5	12.6	145	9D
200-12V-ABD1	200	120/208/240	33.6	19.4	16.8	180	9D
10-24V-A1	10	120	3.3	--	--	50	39
12-24V-A1	12	120	4.0	--	--	54	39
15-24V-A1	15	120	5.0	--	--	58	39
20-24V-A1	20	120	6.7	--	--	64	39
25-24V-ABD1	25	120/208/240	8.4	4.8	4.2	99	4D
30-24V-ABD1	30	120/208/240	10.0	5.8	5.0	115	4D
50-24V-ABD1	50	120/208/240	16.8	9.7	8.4	130	4D
75-24V-ABD1	75	120/208/240	25.2	14.5	12.6	145	4D
100-24V-ABD1	100	120/208/240	33.6	19.4	16.8	180	9D
150-24V-ABD1	150	120/208/240	50.5	29.1	25.2	280	9D
200-24V-ABD1	200	120/208/240	67.0	38.8	33.6	310	9D
10-48V-A1	10	120	6.7	--	--	64	39
12-48V-A1	12	120	8.0	--	--	70	39
15-48V-A1	15	120	10.0	--	--	110	4D
20-48V-ABD1	20	120/208/240	13.4	7.7	6.7	118	4D
25-48V-ABD1	25	120/208/240	16.8	9.7	8.4	125	4D
30-48V-ABD1	30	120/208/240	20.0	11.6	10.0	133	4D
50-48V-ABD1	50	120/208/240	33.6	19.4	16.8	160	4D
75-48V-ABD1	75	120/208/240	50.4	29.1	25.2	260	9D
100-48V-ABD1	100	120/208/240	67.2	38.8	33.6	286	9D
150-48V-BD1	150	208/240	--	58.2	50.4	528	72
200-48V-BD1	200	208/240	--	77.6	67.3	572	72

TABLE 1

5.5 STATUS/ALARM INDICATORS

Alarm Relays

Single Form "C" contacts are rated for 28 v.d.c. at 2 amperes for the low current and rectifier failure alarms.

A.C. "ON" Indicator

A green light emitting diode (LED) indicator illuminates to indicate a.c. voltage is present to the rectifier.

High-Voltage Alarm Indicator

A red LED indicator illuminates to indicate that rectifier output has exceeded the preset high-voltage set point. This alarm condition will also trigger the rectifier "failure" alarm contacts.

Low-Voltage Alarm Indicator

A red LED indicator illuminates to indicate that the rectifier output has dropped below a preset voltage set point. This alarm will also trigger the rectifier "failure" alarm contacts.

Low-current Alarm Indicator

A red LED indicator illuminates to indicate that the rectifier output current has fallen below .5% of rectifier rated d.c. output. A form "C" contact is also provided for connection of a remote alarm. This alarm will also trigger the rectifier "failure" alarm contacts provided DS-4 is in the "ON" position. (S2A-86)

Rectifier Fail Alarm Indicator

A red LED illuminates to indicate that a failure has occurred which may disable the rectifier. The conditions which will pro duce a rectifier failure indication include: low current*, low output voltage or high output voltage. A form "C" contact is provided for connection of external alarms.

* - DS-4 must be "ON". (ON S2A-86)

Float Indicator

A green LED illuminates to indicate that the rectifier is in the float mode of operation.

Equalize Indicator

A yellow LED illuminates to indicate that the rectifier is in the equalize mode of operation.

D.C. Blown Fuse Indicator

A red LED illuminates to indicate that the main d.c. output fuse has opened.

Adjustments are provided for high voltage, low voltage, low current, and high voltage shutdown.

See Section 10 "ADJUSTMENTS". Also, Section 11.3 "S2A-86".

5.6 PARALLELING

This rectifier will parallel with any other La Marche Model A36F Charger.

5.7 LOAD SHARING

A load sharing terminal is provided on the alarm interface board (S2A-86). When connected, two (2) or more La Marche units are forced to share the load equally within +/- 5%. Individual unit outputs must be greater than 10% of rated output.

5.8 CURRENT WALK IN

Output current will gradually increase after the rectifier is initially turned on reducing current surges.

5.9 D.C. TEST TERMINALS

Terminals are located on the front panel of the rectifier to allow connection of a portable voltmeter.

5.10 EMERGENCY RESTORATION

This rectifier may be connected to a battery which is heavily discharged and recharge it without clearing any protective devices while powering d.c. loads.

5.11 METERS

Single phase units are equipped with taut-band d.c. ammeter and voltmeter, with accuracy of +/-2% of full scale. Three phase units are equipped with a digital ammeter/voltmeter.

5.12 MOUNTING

Case numbers 39, 4D and 9D units are designed to mount in a 19-inch or a 23-inch wide relay rack with EIA standard mounting centers spaced 1-3/4 inches apart. Case numbers 72, 43, and 44 are designed for floor installation.

6.0 ENVIRONMENTAL RATINGS

6.1 OPERATING AMBIENT TEMPERATURE

0-50 degrees C (32-122 degrees F)

6.2 STORAGE TEMPERATURE

-40 to +85 degrees C (-40 to +185 degrees F)

6.3 HUMIDITY

This rectifier is capable of operating in an ambient relative humidity range of 0-95% (non-condensing).

6.4 SHOCK

The rectifier in its shipping container, withstands shock developed when one edge of the container is dropped six (6) inches while the opposite edge is resting on the ground, or it is dropped two (2) inches on any surface without any physical damage or degradation of the electrical performance.

6.5 VIBRATION

The rectifier in its shipping container, withstands vibration encountered in shipping without physical damage or degradation of the electrical performance.

HEAT LOSSES (based on 85% eff. & .9pf at rated load)

MODEL #	WATTS IN	WATTS OUT	WATTS LOST	BTU/HR.
A36F-15-12V	324	198	126	429
A36F-20-12V	378	264	114	388
A36F-25-12V	432	330	102	347
A36F-30-12V	594	396	198	674
A36F-50-12V	864	660	204	695
A36F-75-12V	1296	990	306	1043
A36F-100-12V	1680	1320	360	1227
A36F-150-12V	288	1980	900	3068
A36F-200-12V	2600	2624	960	3272
A36F-10-24V	310	264	46	150
A36F-12-24V	372	316	56	191
A36F-15-24V	466	396	70	241
A36F-20-24V	621	528	93	321
A36F-25-24V	776	660	116	402
A36F-30-24V	932	792	140	482
A36F-50-24V	1553	1320	233	803
A36F-75-24V	2329	1980	349	1205
A36F-100-24V	3106	2640	466	1606
A36F-150-24V	4659	3960	699	2410
A36F-200-24V	6212	5280	932	3213
A36F-10-48V	621	528	93	312
A36F-12-48V	745	633	112	383
A36F-15-48V	932	792	140	382
A36F-20-48V	1242	1056	186	643
A36F-25-48V	1553	1320	233	803
A36F-30-48V	1864	1584	280	964
A36F-50-48V	3106	2640	466	1606
A36F-75-48V	4659	3960	699	2410
A36F-100-48V	6212	5280	932	3213
A36F-150-48V	9318	7920	1398	4819
A36F-200-48V	12424	10560	1864	6426

TABLE 1A

6.6 ALTITUDE

This rectifier is capable of operation at altitudes to 10,000 feet at an ambient temperature of up to +40 degrees C.

6.7 HEAT DISSIPATION - Refer to TABLE 1A.

6.8 VENTILATION

The unit should be mounted so that ventilating openings are not blocked and air entering the cabinet does not exceed +50 degrees C (122 degrees F).

Heat Baffles

It may be necessary to use a baffle plate between the rectifier and other heat producing equipment.

6.9 AUDIBLE NOISE

Audible noise is not greater than 55 DBA measured at 5 feet from any surface on the unit enclosure.

7.0 INSTALLATION INFORMATION

7.1 MINIMUM WIRE SIZES

Table 2 lists the a.c. input and the d.c. output minimum wire size requirements. At distances exceeding 10 feet, the d.c. wire size should be chosen to keep the voltage difference between the units d.c. output

terminals and the battery at less than 1/2 volt when the unit is fully loaded. See Section 7.6 for "POWER CABLING FORMULAS". The total loop length is twice the distance from the wiring point to the unit.

7.2 WIRE SIZE TABLE

(Refer to TABLE 2)

FUSE SIZE	WIRE SIZE REQUIREMENT CUSTOMER CONNECTION	EQUIPMENT GROUNDING CONDUCTOR MINIMUM	FUSE SIZE	WIRE SIZE REQUIREMENT CUSTOMER CONNECTION	EQUIPMENT GROUNDING CONDUCTOR MINIMUM
1	#14	#14	150	#1	#6
3	#14	#14	175	#1/0	#6
4	#14	#14	200	#2/0	#6
5	#14	#14	225	#2/0	#4
6	#14	#14	250	#4/0	#4
10	#14	#14	300	250-MCM	#4
15	#12	#12	350	350-MCM	#2
20	#12	#12	400	400-MCM	#2
25	#10	#12	450	500-MCM	#2
30	#10	#10	500	600-MCM	#2
35	# 8	#10	600	900-MCM	#1
40	# 8	#10	700	1500-MCM	1/0
45	# 8	#10	800	2/500-MCM	1/0
50	# 8	#10	1000	2/800-MCM	4/0
60	# 6	#10	1200	2/1000-MCM	4/0
70	# 6	# 8	1600	2/2000-MCM	4/0
80	# 4	# 8	2000		250-MCM
90	# 4	# 8	2500		350-MCM
100	# 4	# 8	3000		400-MCM
110	# 2	# 6	4000		500-MCM
125	# 2	# 6	5000		700-MCM
130	# 2	# 6	6000		800-MCM

TABLE 2

7.3 NATIONAL CODES

These wire sizes are based on those recommended in the National Electric Code Table 310-16 for copper wire at 90 degrees C conductor temperature operating in an ambient of 30 degrees C. For higher operating temperatures refer to the derating factors in the National Electric Code Table 310-16.

7.4 FIELD GROUND TERMINAL

This terminal should be connected to an earth ground. The size of the conductor is based on National Electric Code Table 250-95 for copper wire at 75 degrees C. (See Table #2 for recommended wire sizes.)

7.5 MOUNTING

Install the rectifier so that the flow of air through the ventilators is not obstructed.

7.6 POWER CABLING FORMULAS

The following section may be used to calculate the wire size requirements for wire lengths in excess of 10 ft. (Refer to TABLE 3)

CMA= CROSS SECTION OF WIRE IN CIRCULAR MILS.

A = CURRENT DRAIN IN AMPERES.

LF= CONDUCTOR LOOP FEET.

MAX AMP= MAXIMUM ALLOWABLE CURRENT FOR A GIVEN VOLTAGE DROP (IN AMPERES).

AVD = ALLOWABLE VOLTAGE DROP.

K = 11.1 CONSTANT FACTOR FOR COMMERCIAL (TW TYPE)

COPPER WIRE (KS5482-01)

WIRE SIZE REQUIRED

CMA= (A*LF*K) / AVD

CURRENT CAPACITY (IN AMPS)

MAX AMPS= (CMA* AVD)/(LF*K)

SIZE AWG.	AREA CIR. MILS	SIZE AWG.MCM	AREA CIR. MILS	SIZE MCM	AREA CIR. MILS
18	1620	1	83690	600	6000
16	2580	0	105600	700	7000
14	4110	0	133100	750	7500
12	6530	0	167800	800	8000
10	10380	0	211600	900	9000
8	16510	250	250000	1000	10000
6	26240	300	300000	1250	12500
4	41740	350	350000	1500	15000
3	52620	400	400000	1750	17500
2	66360	500	500000	2000	20000

TABLE 3

8.0 ELECTRICAL CONNECTIONS & FIELD WIRING

Make sure that a.c. power is off at main a.c. breaker box before installation begins. Terminal blocks are provided for connecting the a.c. input and d.c. output. A ground wire must be connected to the units' case ground.

8.1 A.C. INPUT

Make sure that the input source is the same voltage and frequency as that which is marked on the nameplate of the rectifier.

The wire size and distribution fusing should be adequate for the nameplate input current of the rectifier plus the overload current (usually 10%-15% higher than the nominal rating).

An adequate earth ground lead should be connected to the terminal marked "GROUND" or "GND".

Be sure the transformer taps are set for the correct a.c. input. An a.c. input tap setting card is located inside the unit.

8.2 D.C. OUTPUT

Make sure that the battery voltage, which is being connected to the rectifier, matches the rectifiers output voltage.

OBSERVE PROPER POLARITY!

The negative wire from the battery must be connected to the terminal marked "NEGATIVE" or "NEG" and the positive wire from the battery must be connected to the terminal marked "POSITIVE" or "POS" on the rectifier.

To prevent the d.c. output fuse from blowing when connecting the battery, connections to the power supply and battery should be done in the following order (single power supply).

1. Connect a.c. input line to the terminal block provided. Be sure the a.c. circuit breaker is off.

2. Observe the polarity of the battery cables, rectifier output, and relay rack terminals. Connect the proper battery cable to the ground bar or battery rectifier output terminal.

3. Energize the unit by turning the a.c. breaker to the "ON" position. This will charge the capacitors inside the power supply and eliminate heavy arcing when the remaining battery cable is connected. After approximately one (1) minute, turn off the power supply and immediately connect the remaining battery cable.

4. Connect the loads.

5. Turn the a.c. breaker to the "ON" position again and the rectifier will commence charging the batteries and powering the load. (NOTE: For units equipped with a low-voltage disconnect panel, the "Load On" switch must be put in the "Load ON" position.)

8.3 REMOTE VOLTAGE SENSING

Provisions for remote d.c. voltage sensing are provided. The sensing circuit is activated when the dip switch DS-2 and DS-3 are in the "Off" position on the alarm interface board (S2A-86). Wires from the remote battery or load must be brought back to Terminals 3 and 4 of the TS-2 circuit board for the remote sensing to operate properly. Positive must be connected to Terminal 3, negative to Terminal 4. The positive sense lead should contain an external 1-amp fuse for negative ground system. The negative sense lead should be fused for positive ground system.

When remote sensing is wired in and DS-2 and DS-3 are off , the unit output will have to be readjusted to compensate for the protection diodes on the S2A-86 alarm interface circuit board. The diodes were added to prevent damage from reverse polarity of the sense lines on S2A-86 TS2-3 and TS2-4.

CAUTION: The polarity of the sensing terminals is critical. Check and verify the polarity carefully.

8.4 REMOTE EQUALIZE TERMINALS

Terminals are provided on the alarm interface circuit board (S2A-86) for a remote equalize function. With the float / equalize switch(s) in the equalize position, the unit(s) may be remotely forced into the float mode by shorting terminals 1 and 2 of TS-2 on the alarm interface circuit board. Conversely, the unit will go to the equalize mode when terminals 1 and 2 are open circuited. This is done when a remote equalize timer is used.

Caution: Damage to the unit will result if the Remote Equalize Terminals are shorted to ground or any other a.c. or d.c. voltage source.

8.5 LOAD SHARING

When the load sharing Terminal 5 on TS-2 alarm interface board (S2A-86) are connected together, multiple units are forced to share the load current within +/- 5%. Individual unit outputs must be greater than 10% of the rated current output.

Caution: Damage to the unit will result if the Load Sharing Terminals are shorted to ground or any other a.c. or d.c. voltage source.

NOTE: If only one unit picks up the load, momentarily put the unit with no load into the equalize mode, and then back to the float mode. The units should share load equally.

8.6 ALARM CONNECTIONS

Low Current Alarm Contacts:

Form “C” contacts are provided at terminals 4-5-6 on TS-1 of the alarm interface circuit board assembly (S2A-86) for customer external alarm circuits. If the current output of the rectifier falls to zero (within .5% of rated output), the low current contacts will transfer after a 2-5 second time delay.

Rectifier Failure Alarm Contacts:

Form “C” contacts are provided at terminals 1-2-3 on TS-1 of alarm interface circuit board assembly (S2A-86) for customer external alarm circuits. These contacts will transfer after a 2-5 second delay if either a low current*, high voltage, or low voltage condition exists.

Provided DS-4 is in the “ON” position on the alarm interface S2A-86.

9.0 OPERATION

9.1 START UP

When all connections have been made, place the units’ a.c. breaker in the “on” position. If there is an optional d.c. breaker place it in the “ON” position.

Verify the output voltage, output current, and the alarm and status lights to be sure the unit is operating properly.

If the unit is not operating correctly check the connections again and read Section 12 , "TROUBLE SHOOTING".

10.0 ADJUSTMENTS

10.1 Alarm Lights

Six (6) alarm lights are located on the front of the unit. (See Figure 1).

A.C. "On":

The LED illuminates when a.c. power is applied to rectifier and a.c. breaker is in the "ON" position.

Blown D.C. Fuse:

The LED illuminates when d.c. fuse opens. Blown fuse indicator should also be replaced.

Rectifier Failure:

The LED illuminates on low voltage, high voltage, or low d.c. current. (Provided DS-4 is in the "ON" position.)

Float-Equalize Light:

The proper LED will illuminate, indicating which charge mode the rectifier is operating in.

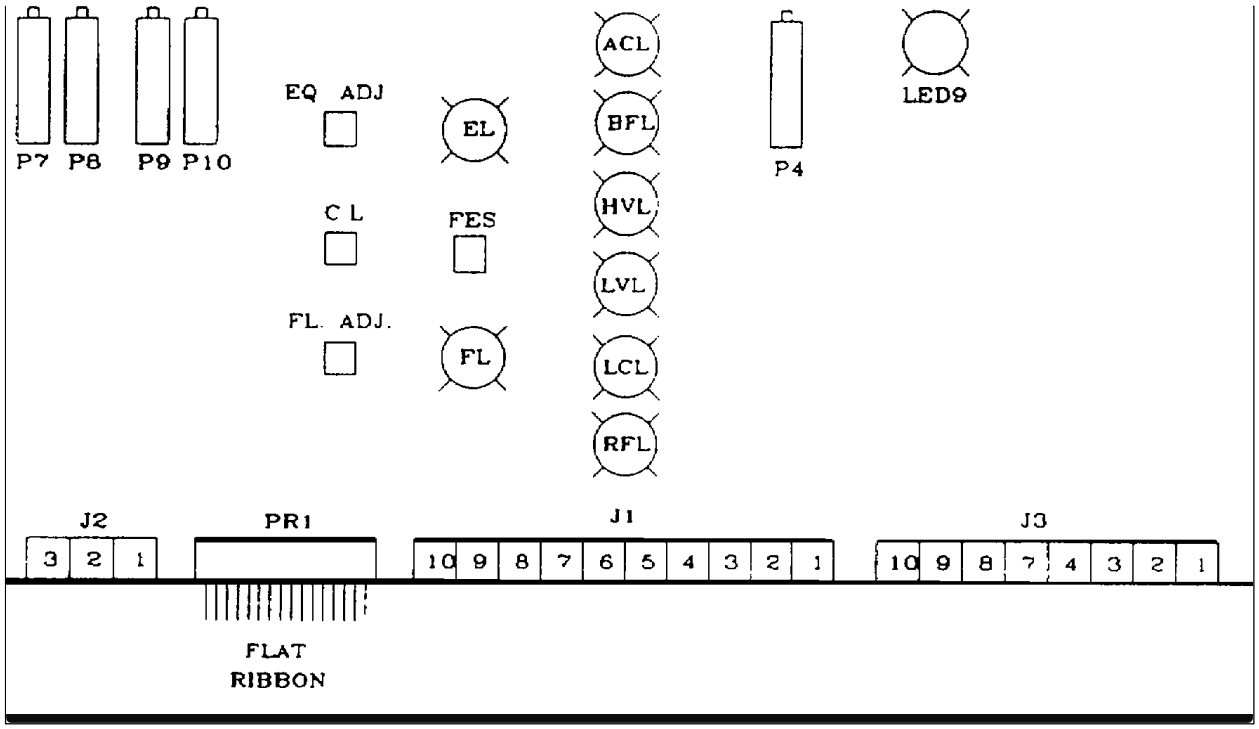


FIGURE 1

10.2 HIGH VOLTAGE

An LED illuminates when rectifier or battery voltage exceeds a predetermined adjustable level. The factory setting is 2.45 volts/cell (Lead) or 1.6 volts/cell (N.C.).

High Voltage Adjustment:

To reset the high voltage alarm, disconnect all loads and batteries from rectifier output terminals. The high-voltage adjustment is set by potentiometer P8 located on the regulator circuit board assembly. Increase the rectifier output voltage to the desired set. point. Adjust P8 until the high voltage LED comes on.

10.3 HIGH VOLTAGE SHUTDOWN

The high-voltage shutdown adjustment is set by Potentiometer P7 located on the regulator circuit board assembly. This adjustment is factory set at 2.5 volts/cell (Lead) or 1.65 volts/cell (N.C.). It will be necessary to have a d.c. load or battery on the rectifier's output.

CAUTION: Do not exceed the system voltage . Increase the rectifier's output voltage to the desired set point. Adjust P7 until the small LED #9 (located on S2A-151) comes on. When the rectifier output reaches the predetermined setting, the high voltage shutdown will activate the shunt trip on the a.c. circuit breaker causing the breaker to trip which turns off the unit.

10.4 LOW VOLTAGE

The LED illuminates when rectifier or battery voltage falls below a predetermined adjustable

level. The factory setting is 2 volts/cell (Lead) or 1.2 volts/cell (N.C.).

Low Voltage Adjustment:

To reset the low voltage alarm, disconnect all loads and batteries from rectifier output terminals. Turn Low Voltage adjustment located on potentiometer P9 of regulator circuit assembly fully counterclockwise, and apply voltage to rectifier output terminals equal to the desired low voltage setting. Adjust clockwise until low voltage LED turns on.

10.5 LOW CURRENT

The L.E.D. illuminates when the rectifier output current falls to zero or within .5% or less than rectifier rated d.c. output.

Low Current Adjustment:

To reset low current alarm light, disconnect all batteries and customer load from rectifier output terminals. The low current adjustment is set by potentiometer p10 located on the regulator circuit board assembly. Adjust P10 until the low current LED just comes on.

10.6 CURRENT LIMIT ADJUST

The current limit adjustment is factory set at approximately 115% of rated d.c. output current. The adjustment provides a means of changing the rectifier current limit between 90-115% of rated output. Turning the adjustment, which is located on the unit front panel, clockwise lowers the current limit; turning counterclockwise raises the current limit.

CAUTION: CURRENT LIMIT MUST NOT EXCEED 115%. OF RATED OUTPUT CURRENT.

10.7 FLOAT ADJUSTMENT:

Turning the adjustment, which is located on the front door of the unit, clockwise raises the float voltage (the F/E switch must be in the float position). For adjustable range see Section 2.2.

Float-Equalize Switch:

This switch is located on the unit front panel. When it is in the float position, the rectifier will maintain the battery at the voltage level which was preset by the "Float" potentiometer adjustment and at the same time maintain the load up to the rectifier's rated output.

10.8 EQUALIZE ADJUSTMENT:

Turning the adjustment, which is located on the front panel of the unit, clockwise raises the equalize voltage (the F/E switch must be in the equalize position). For adjustable range see Section 2.2.

In the equalize position, the rectifier will maintain the battery at the voltage level preset by the "Equalize" potentiometer adjustment and at the same time maintain the load up to the rectifier's rated output.

11.0 CIRCUIT DESCRIPTIONS

11.1 CIRCUIT OPERATION

The Model A36F rectifier circuit design is a controlled ferroresonant converter. The power transformer PT provides a.c. to d.c. isolation , voltage step down, and inherent magnetic current limit.

The secondary circuit of PT & capacitor C2 form a resonant tank circuit. The secondary voltage of the transformer is controlled by the shunt control which consists of choke L1 and the a.c. switch TR-1. The semiconductor TR-1 is a triac.

The triac is phase controlled by the regulator assembly S2A-151. As the unit output voltage rises, the triac is turned on for more time and vice versa. This switches the choke L1 across the resonating winding of PT which reduces the transformer output and lowers the unit output voltage.

In the current limit mode, the triac is also fired to regulate the unit output current in the same manner. In this case, however, the unit d.c. current is being monitored, compared against the current limit set point and control is applied to the triac.

The silicon diodes SD1 rectify the a.c. output of the transformer PT into pulsating d.c. and the filter components C3 and L2 smooth this output and reduce ripple.

11.2 S2A-151 REGULATOR ASSEMBLY

The regulator assembly contains the circuits which sense the d.c. output changes and fire the (triac) TR-1 to make the necessary corrections. The triac is timed from the a.c. output of the transformer PT. This assembly also produces the current limit and the current walk-in features.

The regulator board includes the circuitry for the status lights and alarm settings and the output to the shunt trip circuit for the a.c. input breaker which is used for the high voltage shutdown.

The Float/Equalize switch and alarm lights are arranged so that they may protrude through the front panel of the unit.

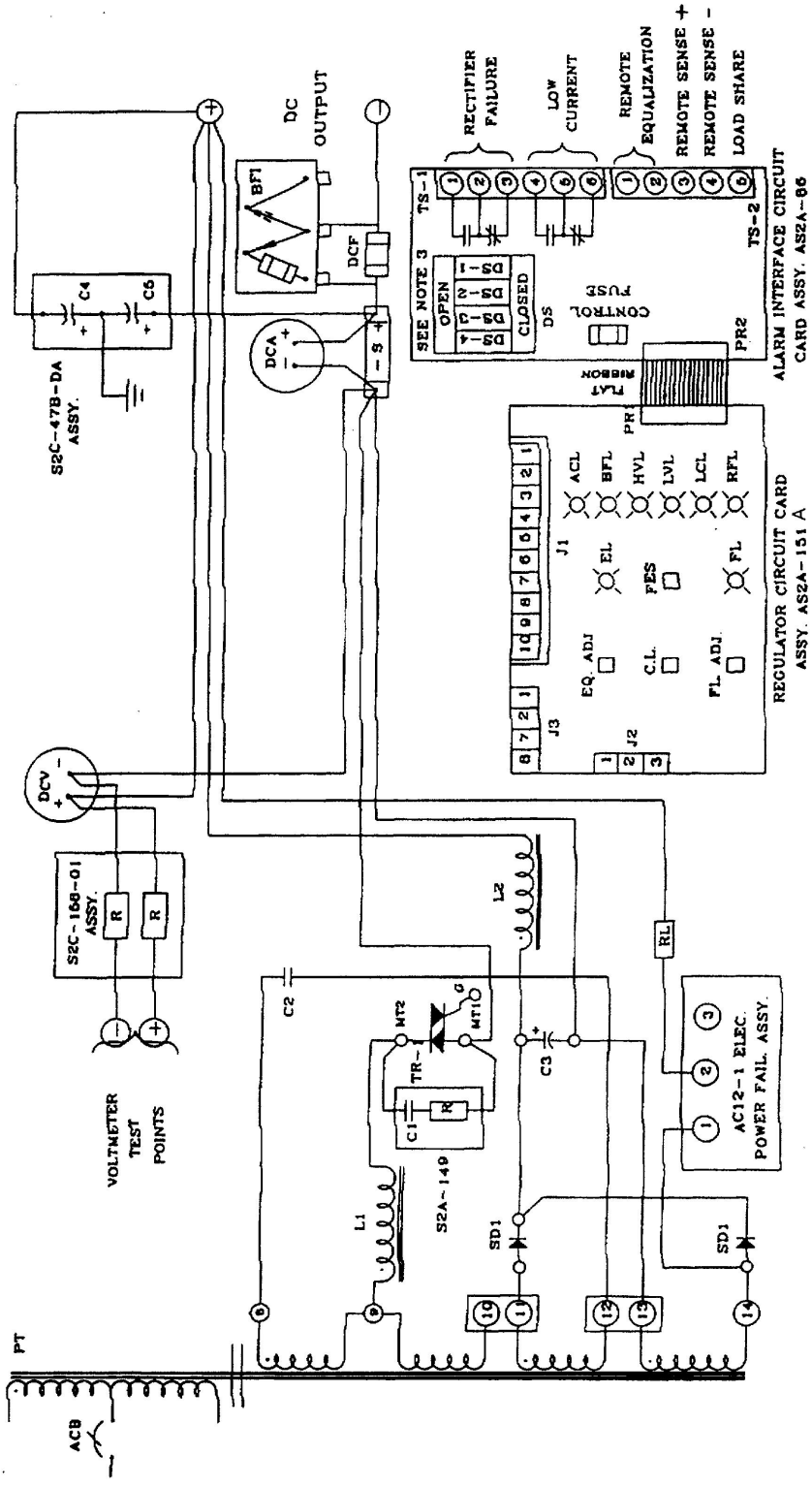

DC OUTPUT
RECTIFIER FAILURE
LOW CURRENT
REMOTE EQUALIZATION
REMOTE SENSE +
REMOTE SENSE -
LOAD SHARE
TS-1
TS-2
SEE NOTE 3
OPEN
CLOSED
DS
CONTROL FUSE
PR2
PR1
RIBBON
ALARM INTERFACE CIRCUIT CARD ASSY. AS2A-86
REGULATOR CIRCUIT CARD ASSY. AS2A-151 A
ACL
BFL
HVL
LVL
LCL
RFL
EL
FES
FL
EQ. ADJ
C.L.
FL ADJ
J1
J2
J3
BF1
DCF
DCA
DCV
S2C-47B-DA ASSY.
S2C-168-01 ASSY.
VOLTMETER TEST POINTS
C1
C2
C3
C4
C5
R
RL
TR-1
MT2
MT1
G
L1
L2
S2A-149
SD1
AC12-1 ELEC. POWER FAIL. ASSY.
PT
ACB

FIGURE 2

11.3 S2A-86 ALARM INTERFACE BOARD

The alarm interface board contains the relays for low current and rectifier failure alarm circuits. The voltage regulators and reference circuits are also located on this board.

The interface board contains the dip switches (DS-1-4) to activate the remote sensing circuits and float operation only circuits and rectifier failure on low current, if required.

Terminals are provided on this board for remote sensing, remote equalize, and load share wiring, along with customer alarm contacts for low current, rectifier failure.

The control fuse for the regulator assembly is also located on this board.

11.4 AC12-1 POWER FAILURE SWITCH

This assembly is used to electronically switch off the bleeder resistor RL during periods of a.c. failure. This prevents the battery from being discharged back through unit circuitry.

11.5 S2A-149 SNUBBER

This circuit is used to provide DV/DT voltage suppression for the triac switch TR-1. It prevents false firing and voltage transients.

11.6 BLOWN FUSE INDICATOR

The BFI fuse is an indicator fuse of a small value across the main d.c. output fuse. If the main fuse opens it will clear the BFI fuse which will close a set of contacts and light the "Blown D.C. Fuse" light on the unit front cover.

11.7 S2A-158 RESISTOR ASSEMBLY

This assembly contains the resistors which limit the current to the voltage test points on the unit front cover.

12.0 TROUBLESHOOTING

Troubleshooting should be performed only by trained service personnel or experienced electricians.

CAUTION: Hazardous a.c. and d.c. voltages are present within the rectifier cabinet.

Equipment: The only equipment required is a multimeter and analog ohmmeter for voltage readings.

12.1 GENERAL INSPECTION

On servicing new equipment, before setting up any complicated testing or jumping to any conclusions, give the unit a general inspection.

Check the following:

1. Check d.c. output cables, connections, battery type, and number of battery cells with rectifier rating.
2. Check unit specifications with customer order.
3. Check input connections, input voltage and line breaker size.
4. Check for shipping damage, loose connections, broken wires, etc.

5. Certain failures can be caused by defective batteries and customer loads; make sure batteries and loads are free from defects.

NOTE: If the problem is found to be located in the printed circuit boards, the board should be replaced.

No attempt should be made to repair circuit boards in the field.

12.2 SERVICE INFORMATION

Information you should have when calling in for troubleshooting assistance:

1. Equipment model number and serial number.
2. The actual a.c. input voltage.
3. The d.c. output voltage with and without the battery.
4. Result of the check of a.c. breaker and d.c. output fuse.
5. The actual d.c. output current and voltage when measured with battery and load connected to rectifier.

12.3 SYMPTOMS & CAUSES

12.3.1 A.C. Breaker trips.

Possible Cause:

1. Wrong a.c. input voltage.

2. The a.c. input taps on power transformer set incorrectly.

   (See schematic wiring diagram)

3. An a.c. to d.c. short or a.c. or d.c. short to ground (see ground short circuit test).

4. High d.c. output voltage.

   A. Check battery voltage for proper number of cells.

   B. Check control fuse on alarm interface board.

   C. Float/Equalize voltage potentiometers not set properly. (See Float/Equalize adjustment procedure for proper voltage setting.)

   D. Disconnect battery and loads from rectifier output terminals, put F/E switch in the float position, and apply a.c. input voltage to rectifier. If d.c. voltage raises above 2.5 v.p.c., circuit regulator assembly or alarm interface board may be defective.

5. Check for shorted power diodes or diode modules (SD1). (See diode troubleshooting page)

6. H.V. shutdown improperly set, too low.

Open gate or wire on triac TR-1.

12.3.2 Open D.C. Fuse.

Possible Cause:

1. Shorted power diode or diode module (repair/replace as required).

2. Shorted battery cells or customer equipment.

3. Shorted output cables.

4. Capacitors not precharged.

5. Shorted C3 capacitors.

6. Loose connections on the d.c. fuse.

12.3.3 Charger operates but output voltage/current is low.

Possible Cause:

1. Float/Equalize voltage potentiometers not set correctly (see float/equalize adjustment procedure for proper voltage setting).

2. Check power diodes or diode modules and triac (see diode and triac troubleshooting procedure).

3. Regulator assembly or alarm interface board is defective. (replace as required)

4. Defective d.c. voltmeter/ammeter.

5. Unit in current limit.

6. Resonating capacitor open.

7. Defective shunt.

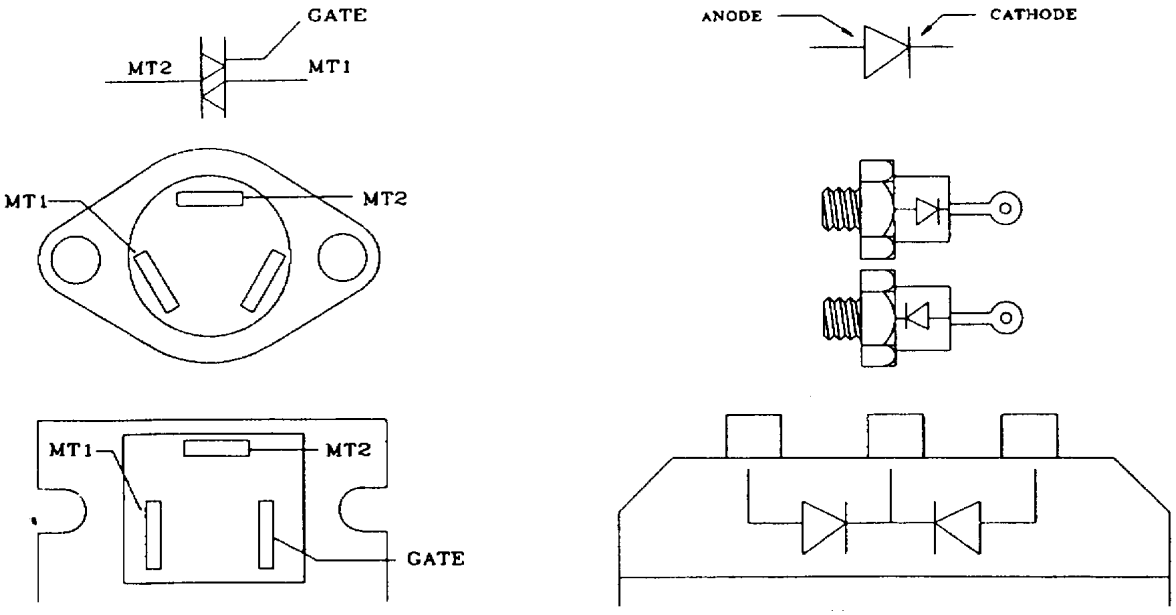
12.3.4 Charger operates but output voltage is high.

Possible Cause:

1. Float/Equalize voltage pots not set correctly (see float/equalize adjustment procedure for proper voltage setting).

2. Circuit regulator assembly S2A-151 or alarm interface board S2A-86 is defective or defective fuse on the interface board. (replace as required)

3. Open gate on triac TR-1.



FIGURES 3 AND 4

12.3.5 Ground and short circuit test.

A simple ohmmeter check can be performed to check the unit for a short to ground, primary to secondary breakdown, a.c.- d.c. short, or d.c. ground. Before installation of a new unit, the above checks should be made before installing. If a short of this type is suspected on a unit in service, check as follows:

1. Disconnect a.c. input power to the unit. Disconnect the d.c. battery and loads from the rectifier.

2. Set ohmmeter scale on ohms scale RX100.

3. Measure from one terminal of the input to one terminal of the output. Meter should not indicate. If the meter reads full scale deflection, this indicates an a.c. - d.c. short. During shipping, an a.c. wire may rub against the d.c. lugs, terminals, etc. and cause a short. These problems may be eliminated by very carefully inspecting the wiring to make certain the a.c. wires are not touching the d.c. wiring.

4. Check the input terminals to ground and check the output terminals to ground. If the meter indicates full scale deflection, a wire is touching a metal part of the rectifier. Look for wires that are near any metal part and inspect for possible breakdown caused by shipping. The heatsink of the diodes and the control unit are insulated from ground through the mounting legs.

12.4 TROUBLESHOOTING AND REPLACING THE TRIAC

The procedure for checking the triac is as follows:

1. On the analog ohmmeter, set the switches on “ohms”, “d.c.”, and “Rx10,000” scale.

   (Refer to Figure 3)

2. Disconnect the triac to be checked. Using an ohmmeter, measure the resistance between main terminals, MT1 and MT2 in both directions. A good device will indicate open circuit in both directions, a low resistance indicates a shorted device.
3. Set analog ohmmeter to Rx100 scale.

To check for a shorted triac gate lead, measure the resistance between gate (GATE) lead and main terminal MT1. A reading of zero ohms in both directions indicates a shorted gate. A reading of infinity in both directions indicates an open gate and the triac should be replaced. A good device should have resistance in both directions, but not zero ohms.

12.5 TROUBLESHOOTING AND REPLACING POWER SILICON DIODES / MODULES

The procedure for checking a silicon diode is as follows:

On the analog ohmmeter, set the switches on “ohms”, “d.c.”, and “Rx100” scale. (Refer to Figure 4)

1. Isolate one end of the diode by disconnecting the wires attached to the nipple (or pigtail) end of the diode (only one end of the diode must be disconnected). On a diode module, both of the outside leads must be disconnected.
2. Clip one lead of the ohmmeter to the anode lead of the diode. Clip the other ohmmeter lead to the cathode.
3. Note the ohmmeter reading. Then reverse the leads to the diode. Again, note the ohmmeter reading. If the diode is good, the meter will indicate a high resistance in one direction, and a low resistance with the leads reversed. If the diode is shorted, the meter will read full scale, or zero (“O”) resistance with the leads in either direction. If the diode is “open”, the ohmmeter needle will not indicate or it will show infinite resistance in either direction, indicating an open circuit.
4. All diodes must be checked in the event that more than one diode is defective.
5. If the diode is defective, remove the defective diode from the heatsink and replace with a new diode.

12.6 CHECKING CAPACITORS

When checking capacitors be sure all power is turned off. Make sure battery is disconnected and check capacitor bank to see that caps are at -0-volts or near -0- before shorting capacitor leads. Momentarily short circuit the capacitor leads to assure complete discharge. Connect the meter test leads to the capacitor leads or terminals and observe indicated resistance.

A good capacitor will indicate an initial low resistance and gradually increase as the capacitor charges. The final resistance of a good capacitor is usually several hundred thousand ohms approaching a megohm.

Initial high resistance approaching infinity indicates an open capacitor. Initial and continued low resistance readings indicate a shorted capacitor.

When ordering replacement parts, drawings, or schematics, always give model number, serial number and a.c. input voltage.

CAPACITOR PRE-CHARGE INSTRUCTIONS

WARNING: READ INSTRUCTIONS BEFORE CONNECTING BATTERYTo prevent the d.c. output fuse from blowing when connecting the battery, connections to the power supply and batteries should be done in the following order (single power supply).

Connect a.c. input line to the terminal block provided. Be sure the units' a.c. circuit breaker is off.

- Observe the polarity of the battery cables, charger output, and relay rack terminals. Connect the proper battery cable to the ground bar or battery charger output terminal.
- No energize the power supply by turning on the units' a.c. breaker. This will charge the capacitors inside the power supply and eliminate heavy arcing when the remaining battery cable is connected. After approximately one (1) minute, turn off the power supply and immediately connect the remaining battery cable.
- Connect loads.

Now turn on the power supply again and the charger will commence charging the batteries and powering the load. (NOTE: For units equipped with a low-voltage disconnect panel, the "Load On" switch must be put in the "Load On" position.)

MANUFACTURER'S WARRANTY

All La Marche Manufacturing Co. equipment has been thoroughly tested and found to be in proper operating condition upon shipment from the factory and is warranted to be free from any defect in workmanship and material that may develop within one year from date of purchase.

Any part or parts of the equipment that prove defective within a one year period shall be replaced without charge after examination at our factory, providing such defect in our opinion, is due to faulty material or workmanship and not caused by tampering, abuse or misapplication. All such adjustments are made F.O.B. Des Plaines, Illinois.

Contact your local sales representative for minor parts replacement or equipment adjustments.

Should a piece of equipment require major component replacement or repair, these can be handled in one of two ways:

1. The equipment can be returned to the La Marche factory to have the inspections, parts, replacements and testing performed by factory personnel. Should it be necessary to return a piece of equipment or parts to the factory, the dealer from whom the equipment was purchased will obtain authorization from the factory. If upon inspection at the factory, the defect was due to faulty material or workmanship, all repairs will be made at no cost to the customer.

2. If the purchaser elects not to return the equipment to the factory and wishes a factory service representative to make adjustments and repairs at the equipment location, La Marche's field service labor rates will apply. A purchase order to cover the labor and transportation cost is required prior to the deployment of the service representative.

In accepting delivery of the equipment, the purchaser assumes full responsibility for proper installation, installation adjustments and service arrangements. Should minor adjustments be required, the local La Marche Sales Office should be contacted to provide this service.

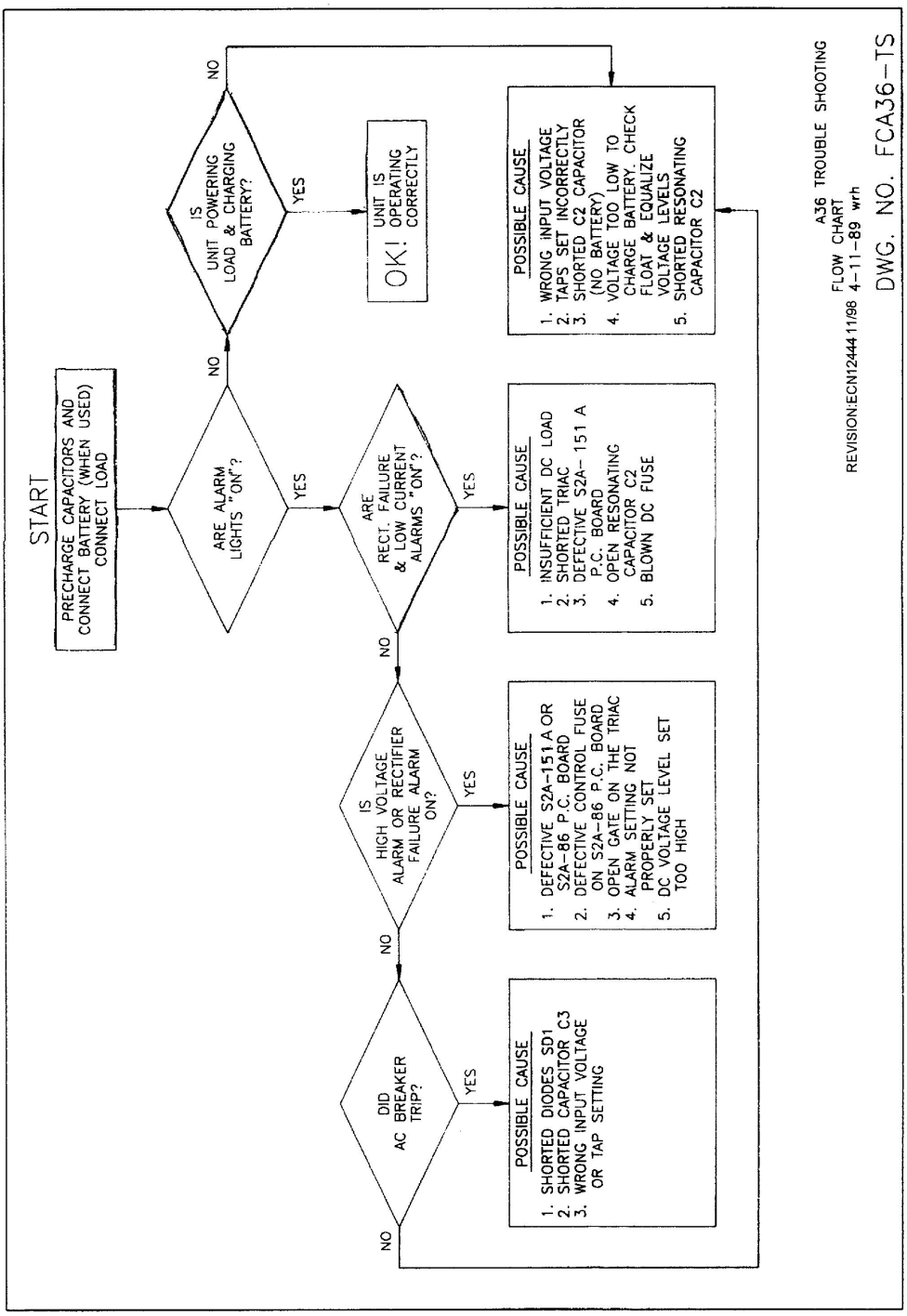
All sales are final. Only standard La Marche units will be considered for return. A 25% restocking fee is charged when return is factory authorized. Special units are not returnable.

In no event shall La Marche Manufacturing Co. have any liability for consequential damages, or loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause. In addition, any alterations of equipment made by anyone other than La Marche Manufacturing Co. renders this warranty null and void.

La Marche Manufacturing Co. reserves the privilege of making revisions in current production of equipment, and assumes no obligation to incorporate these revision in earlier models.

The failure of La Marche Manufacturing Co. to object to provisions contained in customers' purchase orders or other communications shall not be deemed a waiver of the terms or conditions hereof, no acceptance of such provisions.

The above warranty supersedes and is in lieu of all other warranties, expressed or implied, and no person, agent or dealer is authorized to give any warranties on behalf of the Manufacturer, nor to assume for the Manufacturer any other liability in connection with any of its products unless made in writing and signed by an official of the manufacturer.


START
PRECHARGE CAPACITORS AND CONNECT BATTERY (WHEN USED) CONNECT LOAD
ARE ALARM LIGHTS "ON"?
YES
NO
ARE RECT. FAILURE & LOW CURRENT ALARMS "ON"?
YES
NO
IS HIGH VOLTAGE ALARM OR RECTIFIER FAILURE ALARM ON?
YES
NO
DID AC BREAKER TRIP?
YES
NO
IS UNIT POWERING LOAD & CHARGING BATTERY?
YES
NO
UNIT IS OPERATING CORRECTLY
OK!
POSSIBLE CAUSE
1. SHORTED DIODES SD1
2. SHORTED CAPACITOR C3
3. WRONG INPUT VOLTAGE OR TAP SETTING
POSSIBLE CAUSE
1. DEFECTIVE S2A-151A OR S2A-86 P.C. BOARD
2. DEFECTIVE CONTROL FUSE ON S2A-86 P.C. BOARD
3. OPEN GATE ON THE TRIAC
4. ALARM SETTING NOT PROPERLY SET
5. DC VOLTAGE LEVEL SET TOO HIGH
POSSIBLE CAUSE
1. INSUFFICIENT DC LOAD
2. SHORTED TRIAC
3. DEFECTIVE S2A-151A P.C. BOARD
4. OPEN RESONATING CAPACITOR C2
5. BLOWN DC FUSE
POSSIBLE CAUSE
1. WRONG INPUT VOLTAGE
2. TAPS SET INCORRECTLY
3. SHORTED C2 CAPACITOR (NO BATTERY)
4. VOLTAGE TOO LOW TO CHARGE BATTERY. CHECK FLOAT & EQUALIZE VOLTAGE LEVELS
5. SHORTED RESONATING CAPACITOR C2
A36 TROUBLE SHOOTING FLOW CHART
REVISION:ECN12444 11/98 4-11-89 wrh
DWG. NO. FCA36-TS