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RCS^{Plus} SPECIFICATION

RCS^{Plus} Series Rectifier/Battery Charger Specification

1.0 INTRODUCTION

This specification describes a solid-state Rectifier/Battery Charger. The Rectifier/Charger shall operate in conjunction with the existing building/plant electrical systems to provide high quality power to the load. The designed Rectifier/Charger shall be designed for either stand-alone applications, or for use with an inverter.

2.0 APPLICABLE STANDARDS, CODES AND REGULATIONS

Unless noted otherwise, the design, fabrication, testing, and performance of the system shall be in accordance with the standards and codes, where applicable, of the following agencies:

National Electrical Manufacturers Association (NEMA)
American National Standards Institute (ANSI)
National Electric Code (ANSI/NFPA 70-1993)
Institute of Electrical and Electronic Engineers (IEEE)
International Electrotechnical Commission (IEC)
U.L. 1564

3.0 ENVIRONMENTAL CONDITIONS

3.1 Operating Temperature

The system shall operate at rated output without any adverse affects in an ambient temperature of 0°C to 40° C (32° F to 104° F), except batteries.

3.2 Relative Humidity

The system shall operate at a relative humidity of 5% to 95% non-condensing for a temperature range of 10° C to 40° C.

3.3 Operating Altitude

The system shall operate at any altitude from sea level up to 2500 meters (8,200ft) above sea level without de-rating.

4.0 SYSTEM DESCRIPTION

4.1 Each Charger system shall consist of the following major components: (Refer to Figure 1)

Input/Output Circuit Breakers
Isolation Transformer
Rectifier Bridge
Control Board

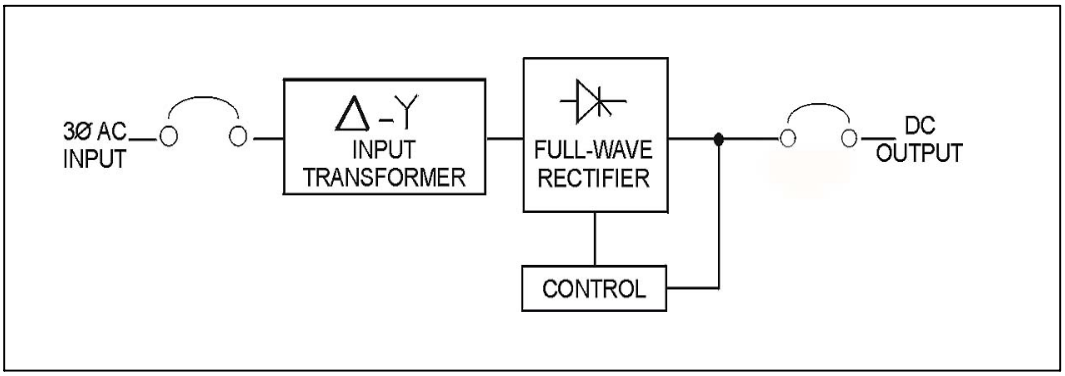

Figure 1.0: One-Line Diagram

5.0 SYSTEM OPERATION

5.1 Start-Up

- Close the AC input Circuit Breaker
- Close the DC Output Circuit Breaker

At this point, a check of the DC Output Voltmeter will verify that the correct voltage is present at the charger output.

5.2 Shut-Down

- Open the DC Output Circuit Breaker
- Open the AC Input Circuit Breaker

5.3 Float/Equalize

Upon pressing the equalize push-button, the charger shall automatically initiate the equalize voltage for the pre-set time on the equalize timer.

Pressing the float push-button any time during the equalize mode shall return the charger to the float voltage.

6.0 RECTIFIER/CHARGER

6.1 General

Incoming AC power shall be converted to regulated DC output by the rectifier/charger. The rectifier/charger shall be a constant potential, phase-controlled (6-pulse), solid-state type with constant voltage and current control circuitry.

6.2 Capacity

The rectifier/charger shall have sufficient capacity to support the total connected load and to recharge the battery at the equalize condition to 90% of full capacity within 8-10 times the discharge rate.

6.3 Input Voltage

The primary AC input voltage and frequency shall be 208, 240, or 480 VAC, 3-phase , 60 Hz; 220, 380, or 415 VAC, 3=phase, 50 Hz, or as specified by the user.

6.4 Input Power Factor

The input power factor shall be a minimum power factor of 0.75 at nominal input voltage, frequency, and at full-rated load.

6.5 Reflected Harmonics

Charger design shall limit the harmonics reflected back onto the incoming AC source to less than 25-30%.

6.5.1 When specified, in order to reduce the level of reflected harmonics to ≤ 15%, an ***optional*** 12-pulse rectifier design, or other suitable means, shall be provided.

6.6 Input Voltage Range and Frequency Variations

Input voltage range:	± 10% (+10%, -15% without discharging battery)
Input frequency tolerance:	± 5% (50 or 60 Hz)

6.7 Rectifier/Charger Output Voltage

Nominal Float Voltage: 130 VDC, adjustable +/-5%
Nominal Equalize Voltage: 140 VDC, adjustable +/-5%

Note: based on 60 cell configuration with Lead-Calcium battery; other cell configurations, and battery types available)

6.8 Voltage Regulation

The charger output steady state voltage shall not change more than +/-1% (worst case) at the battery bank, for a cable length less than 10 ft., from no load to full-rated load, with input voltage variation of +10% to-10% and input frequency variation of +/-5%.

6.9 Output Ripple

The output ripple shall be less than 2% RMS when connected to a battery bank having an eight hour, ampere hour rating of at least four (4) times the full load ampere rating of the battery charger.

6.10 Current Limit

The charger shall be capable of supplying 115% rated full load current at float voltage and -10% input. This shall not cause damage to the charger/rectifier, tripping of circuit breakers, or blown fuses. The current limit shall be adjustable from 50% to 115% of rated output.

6.11 Locking Float Adjustment

An internal screw-type adjustment shall be provided to adjust the float voltage +/-5%.

6.12 Locking Equalize Adjustment

An internal screw-type adjustment shall be provided to adjust the equalize voltage +/-5%.

6.13 Float/Equalize Timer

An internal 0-100 Hour electronic timer shall be provided to manually place the charger into a high voltage equalize mode for a specific amount of time and then automatically return it to its normal float mode when the time has elapsed; or if the Float pushbutton is pressed.

6.14 Isolation

A dry type isolation transformer shall be supplied on the input to the rectifier with surge/transient protection on the secondary side.

The delta-wye three phase transformer shall be wound with copper wire and use a UL recognized 200°C insulation system.

An epoxy based insulating varnish shall be applied with a VPI (Vacuum Pressure Impregnation) system to insure a low temperature rise over the 30 year design life of the transformer.

6.15 Rectifier/Charger Operation

The AC input to the Rectifier/Charger shall be insensitive to phase rotation. The AC input shall be completely isolated from the static bypass circuit.

The Rectifier/Charger shall be capable of supplying 66% of its rated load with the loss of one of its three phase inputs.

When specified for capacity or redundancy purposes, the Rectifier/Charger shall be capable of having its DC output terminals paralleled with other chargers and maintain control stability and voltage regulation.

7.0 ACCESSORIES

7.1 Controls

All controls specified below shall be accessible on the front panel unless specified.

Float - A momentary push button shall be provided to manually select the float mode on the charger.

Equalize - A momentary push button shall be provided to manually select the float mode on the charger.

7.2 Meters

At a minimum the front panel shall be equipped with the following 3.5 inch scale analog meters (2% accuracy) for the following functions:

DC Output Voltmeter
DC Output Ammeter

7.2.1 Other, ***optional*** meters shall be available, to include:

- AC Input Voltmeter (1 meter w/switch to monitor all 3phases)
- AC Input Ammeter (1 meter w/switch to monitor all 3phases)

7.3 Mimic Panel/Indicator Lights and Alarms

The rectifier/charger shall be equipped with an operational (lighted) mimic panel (See Figure 1.0), displaying the following front-replaceable LEDs. A form "C" contact (SPDT) rated 3amps @120 VAC/28 VDC, shall be furnished for each specified alarm when specified.

7.3.1 Low DC Voltage

An indicator (Red) and alarm contact shall be provided when the charger DC output voltage is less than 120 VDC. The relay shall be normally energized.

7.3.2 Fan Failure (if applicable)

An indicator (Red) shall be provided when any fan has failed.

7.3.3 AC Available

An indicator (Green) shall be provided when the input voltage is present and available.

7.3.4 Common (Summary)

A Form 'C' alarm contact (only) shall be provided that will activate for any alarm condition. The relay shall be normally energized.

7.3.5 Float

An indicator (Green) shall be provided to show that rectifier/charger is operating in the "Float" mode.

7.3.6 Equalize

An indicator (Amber) shall be provided to show that rectifier/charger is operating in the "equalize" mode.

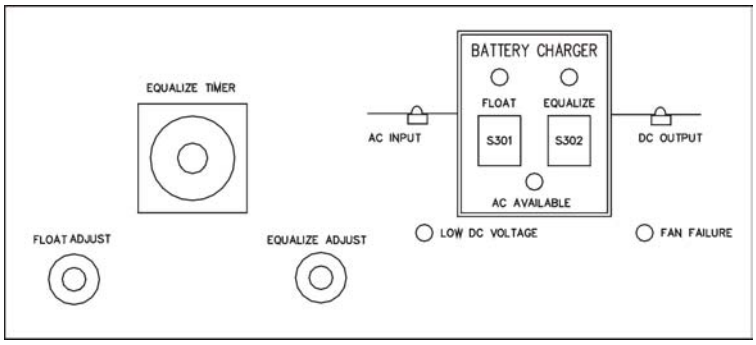

Figure 2.0 Mimic Panel

7.4 Optional Indicating Lights and Alarms

7.4.1 Alarm/Indicator Group 'A'

This group of alarms shall be provided to indicate the following alarm conditions:

- Negative DC to Ground: An indicator (Red) shall be provided when the voltage between positive DC and ground exceeds 65% of nominal DC output voltage. This alarm is used in conjunction with the Positive DC Ground Detect as a voltage divider.

- Positive DC to Ground: An indicator (Red) shall be provided when the voltage between negative DC and ground exceeds 65% of nominal DC output voltage. This alarm is used in conjunction with the Negative DC Ground Detect as a voltage divider.

- Over Temperature: An indicator (Red) shall be provided when the ambient temperature is excessive (>65° C).

- Rectifier/Charger Failure: An indicator (Red) shall be provided when the DC output voltage drops below 95% of nominal value while the AC input is available.

7.4.2 Alarm/Indicator Group 'B':

This group of alarms shall be provided to indicate the following alarm conditions:

- High DC Voltage: An indicator (Red) shall be provided when the DC output voltage is 110% higher than nominal float voltage.

- AC Power Failure: An indicator (Red) shall be provided when the AC input power fails.

7.4.3 Alarm/Indicator Group 'C':

This group of alarms shall be provided to indicate the following alarm conditions:

- Charger Fuse Blown: An indicator (Red) shall be provided when any one of the power fuses are blown.

- Low AC Input Voltage: An indicator (Red) shall be provided when the AC input voltage drops below 90% of nominal value.

7.4.4 Alarm Contacts

This option shall provide one Form 'C' alarm contact for each larm/indictor provided on the mimic display panel.

7.4.5 Audible Alarm

An audible alarm (horn) with silence pushbutton shall be provided in conjunction with the Common (Summary) alarm.

7.4.6 Latching Alarms

A means to latch each alarm shall be provided to require that each alarm activated must be reset.

7.4.7 DC Ripple Filter

Provisions shall be made to accommodate the addition of a factory supplied ***optional*** 0.1% output ripple filter.

7.4.8 Blocking Diode

Blocking diode(s) shall be provided when required on dual, or parallel, chargers for proper sensing of alarms.

8.0 GENERAL REQUIREMENTS

8.1 Charger Efficiency

The overall AC to DC efficiency shall be greater than 91% with the Charger at full rated load and nominal input voltage.

8.2 Overload/Over-current Protection

The following protective devices shall be provided as a standard. They shall not be activated when the system is started under any normal operating conditions.

8.2.1 AC Input Circuit Breaker

A three pole, molded- case breaker shall be provided for charger/rectifier disconnection and overload protection. The A.I.C. rating of the breaker shall be 10KA minimum.

8.2.2 DC Output Circuit Breaker

A molded case breaker shall be provided for charger output disconnection and overload protection. The A.I.C. rating of the breaker shall be 10KA minimum.

8.2.3 Semiconductor Fuses

Power semiconductors shall be protected from excessive overloads, including faults and reverse currents, with fast acting fuses.

8.2.4 High Interrupt Circuit Breakers

When specified, high interrupt capacity circuit breakers (high KAIC) shall be provided to protect against high fault currents and short circuits.

8.3 Audible Noise

The audible noise generated by the unit under rated operating conditions shall not exceed 60dBA at 5 feet away from any side of the enclosure and 3 feet above ground. The sound levels shall be measured with the unit operating at rated load, voltage and frequency.

8.4 Cooling

Forced-air cooling shall be provided when necessary to ensure that all components are operating at below their specified operating temperature.

8.5 Wiring

Manufacturer shall utilize NEC, bulletin 70 (US National Electric Code) and NEMA-PE-1 and PE-5 wiring practices where applicable.

Printed Circuit Board control wire shall be 22 AWG UL 3266 cross-linked Polyolefin (XLPE) 300 Volts, 105°C rated.

Control wire and Power wire shall be either SIS or XLPE, depending on the ampacity required.

Power wiring 10AWG through 4/0 AWG shall be SIS UL, CSA listed VW-1, 90°C, 600 V.

Power wiring 262 MCM through 777 MCM shall be DLO 90°C, 600 Volt Ethylene Propylene Rubber (EPR) inner jacket, with a Hypalon outer jacket.

All wiring and bus-work shall be copper throughout the system.

8.6 EMI Suppression

Electromagnetic effects shall be minimized to ensure that computer systems, or other similar electronic systems, shall neither adversely affect nor be adversely affected by the system.

8.7 Transformers

All power transformers or chokes shall be designed using copper windings for reliability and efficiency. The insulation type shall have a temperature rating of at least 200° C (UL 1446, Class N).

An epoxy based insulating varnish shall be applied with a VPI (Vacuum Pressure Impregnation) system to insure a low temperature rise over the 30 year design life of the transformer.

8.8 Nameplate Markings

The nameplate shall be located on the front inside display door and the following minimum information shall be provided on the nameplate:

a. Model # and Serial #
b. AC Input Voltage, Phase and Frequency
c. Rated AC Input Current
d. Rated DC Output Voltage and Current

9.0 MECHANICAL SPECIFICATIONS

9.1 Enclosure

The enclosure shall be a NEMA-1(IP-20), free standing, with minimum 12GA framework. Door panels shall be a minimum of 14GA steel and side panels shall be a minimum of 18GA.

The enclosure shall be mounted on channels with a 3 inch lifting base open at the front and back to facilitate moving with a fork lift and to provide an entrance area for air movement through the enclosure.

The enclosure shall be designed with blank plates on the sides and rear for installation against a wall. The equipment shall be designed to allow replacement or maintenance of all components from the front.

One or more hinged doors shall be provided in the front with door locks on each. Hinged panels, 36" and larger, shall be provided with a 2 point latching system for holding the panels securely. Removable covers shall be attached with machine screws.

9.1.2 Drop and Drip Shields

When required, “drop” shields, which protect the enclosure from debris and foreign objects falling into the cabinet; or “drip” shields which protect the enclosure by preventing dripping water from entering the cabinet from above, shall be provided on the top of the enclosure.

9.1.3 Fungus and Moisture Proofing

When specified, a protective coating on components inside the UPS enclosure shall be provided when the unit is installed in environments where the ambient air is extremely humid, or is heavily laden with salt content or other contaminants.

9.2 Ventilation

Air inlets and outlets shall be protected by screens or perforated metal guards to prevent the entrance of a rod having a diameter of 0.5 inches or longer.

9.3 Cable Entry

Cable entry shall be through the top or bottom of the cabinet. On UL units, bottom cable entry is recommended.

9.4 Power Connections

Power connections to the AC output or DC input shall be made to copper bus bars connected directly to circuit breakers, and shall be sized for full load service.

9.5 Alarm Connections

Alarm connections hall be sized to allow connection of 14AWG wire maximum. The alarm terminal boards shall be rated for 300 VAC.

9.6 Parts Placement

The system shall be designed to permit front access to modules, fuses, and assemblies. Parts, test points, and terminals shall be placed so they are accessible for circuit checking, adjustment, and maintenance without removal of any adjacent assembly or component or pose a shock hazard.

9.7 Wire Supports

Permanent wire supports shall be used, no adhesive backed wire supports shall be used.

9.8 Wire Marking

All point-to-point wires shall be marked with a permanent marking system on both ends of each wire.

9.9 Component Marking

All PCB's, indicator lights, meters, controls, semiconductors, and fuses shall be clearly marked with the component designation for ease of serviceability.

9.10 Personnel Safety

The cabinet shall be constructed so that all controls, except float/equalize, are operable with the doors closed, preventing exposure to high voltage terminals. High voltage warning labels shall be visible when any of the cabinet doors are opened.

9.11 Painted Surfaces

All external painted surfaces shall be ANSI 61 Gray enamel with a minimum of 2.0 mil thickness and shall be smooth with no runs, sags, or graininess. All internal mounting plates shall be galvanized steel.

10.0 Shop Testing

The system testing shall be in conformance with IEEE 944-1986 section 7.0, and IEC-146-4. Certified test data shall be supplied to verify test results. The manufacturer shall have type-test data available to demonstrate system performance with switch-mode type power supplies.

11.0 Documentation

11.1 Cabinet Outline and Interconnect Drawings

Shall be dimensioned and scaled, and include the following information:

- Location of any removable plates for Owner's conduit entry.
- Location and size of all terminal blocks for Owner's connections.
- Location and size of ventilation openings.
- Location of cabinet grounds.
- Block diagram including currents for customer cable sizing, breaker locations and sizes, and meter locations.
- Size and weight of equipment.
- Front panel identification chart.
- Nominal heat loss for the specified equipment.

11.2 Schematic type Drawings

Shall include the following information:

- System schematics shall include item designations for all electrical components.
- Relay contacts diagrams shall be shown in the de-energized position.
- Wire sizes and numbers shall have the same designations that appear in the equipment.

12.0 PREPARATION FOR SHIPMENT

12.1 Preparation for shipment shall be in accordance with the manufacturer's standard shipping procedure.

12.2 One complete set of instruction manuals and "as-built" drawings shall be included with the equipment when shipped. Additional manuals shall be available when required.

12.3 To facilitate site access, shipment of individual cabinets, rather than complete lineups, may be necessary.