

Single Phase Battery Charger Specification

Application Note: AN-

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1.0 General

- a) The battery charger shall be sized to supply required dc current to the connected load and recharge a fully discharged battery in the specified time. It shall maintain the battery on proper float charge after the recharge.
- b) The battery charger shall provide regulated DC output continuously from an AC source. Charger shall have the capability of accepting an AC source voltage of +10% or – 12% of its rated nameplate input voltage. The output shall be filtered in order to properly maintain the battery in a fully charged state, while supporting voltage sensitive connected DC loads.
- c) The battery charger shall have the ability to automatically or manually provide an equalizing charge as required for recharging the battery after discharge. Equalize time shall be user adjustable.
- d) The battery charger shall be of a design that employs a controlled ferroresonant transformer power train with microprocessor technology to provide control and define all operational, regulation, reporting and alarm functions.

2.0 Specifications

Battery chargers shall be designed to supply rated output continuously. Chargers shall be sized to re-charge the batteries in the required time period and supply the constant DC load of the system. The charger shall maintain the battery on float charge after recharge has occurred. The charger shall be designed to the most recent NEMA PE5 standard, 1997.

3.0 Operation

- a) Battery charger shall automatically supply the required DC output current for the connected battery and load while maintaining the proper output voltage either to factory default settings or user re-

programming via charger's touch panel control.

- b) DC output float voltage regulation shall be +/- 0.5% for input voltage, frequency and temperature variations as set by the latest NEMA PE5 standard.
- c) DC output equalize voltage regulation shall be +/- 1.0% for input voltage, frequency and temperature variations as set by the latest NEMA PE5 standard.
- d) Power factor of the charger shall be a minimum of 0.88 at rated output.
- e) The battery charger shall automatically report alarms, equalize and current limit.
- f) The battery charger shall display all parameters of operation and alarm functions without the need for codes on an LCD display with membrane controls. The LCD display shall be 2 lines x 20 characters, with green LED backlighting. Two LED indicators shall denote normal operation, green LED AC present and any alarm condition, red LED.
- g) During float operation, the digital display shall simultaneously indicate float voltage, output current and Float operation.
- h) During equalize operation, the digital display shall simultaneously indicate equalize voltage, output current, Equalize operation and time remaining for the equalize charge.
- i) All alarms and operating conditions shall be shown on the digital display.
- j) All alarms shall have adjustable time delays from 1 second to 300 seconds to avoid spurious reporting.
- k) The charger shall monitor the DC output terminals for ground faults to Earth ground. The charger shall provide for user adjustable ground fault sensitivity adjustability in ohms between 500 and 20,000 ohms.
- l) Audible noise while in operation shall not exceed 65dB weighting at any point of operation at a distance of five feet away from any vertical surface.
- m) Charger's digital display shall have accuracy to within 1%.

- n) Charger shall have an equalize timer with a minimum range of 0-150 hours.

4.0 Control

- a) The charger shall utilize a microprocessor-based control.
- b) All control and alarming functions shall be performed by the microprocessor.
- c) The control board shall be common for all voltage models.
- d) The charger shall have an independent AC fail alarm.

5.0 Protective Devices

- a) The charger shall incorporate circuit breakers as standard for AC input and DC output protection as well as for disconnect purposes.
- b) Optional transient over voltage protection on the DC output shall be via an MOV (metal oxide varistor) connected on the DC output terminals of the battery charger.
- c) The charger shall be protected against damage in the event that the battery is connected in reverse.
- d) Protection from oscillatory surges (SWC) as defined by ANSI C37.90 1978. Battery charger shall operate correctly during and after application of oscillatory surges.
- e) Output current limit shall be adjustable from 80% to 110% of charger rated output.
- f) The battery charger shall be self-protecting from a short circuit on the output by operating in current limit down to a short on the output. The charger shall return to normal operation when the short is removed. The charger shall indicate operation in current limit that shall be self-extinguishing when the charger drops below the current limit setting.
- g) Transformers shall be designed for Class N operation (rated to 200°C).

6.0 Front Panel Displays and Operator Panel

The following displays and controls shall be located on the front panel, using touch sensitive pads to initiate all adjustments. All parameters shall be menu driven with a home screen display as the default setting. Controls and alarms may be protected by a user assignable password.

Specifications:

- a) Control panel shall consist of an LCD display, 2 lines x 20 characters, a 4-button Key Pad and two indicating LEDs.
- b) One LED shall indicate AC power available and shall be green.
- c) The second LED shall indicate that an alarm is present and shall be red. The LED will flash if there are unacknowledged alarms.
- d) Manual float / equalize, shall be changeable via touch pad and shall be capable of canceling Automatic Equalize.
- e) Home screen: the LCD display indicates voltage, current, equalize time remaining if in equalize, any unacknowledged alarms, all shown automatically. There shall be no need to scroll to obtain these readings.
- f) Select key: initiates function to be adjusted.
- g) Up/Down keys: moves through the menu for all operating parameters and provides for adjustments when Select mode is initiated.
- h) Escape key: moves to the home screen and aborts changes when in the select mode.
- i) Temperature compensation slope adjustment from -0.1 to -10.0 mV / cell / deg C (when temp comp option is used).
- j) Time delay adjustments for all alarms. Adjustment range 1 second to 300 seconds.
- k) AC circuit breaker.
- l) DC circuit breaker.
- m) LED, alarm and display self-test function.
- n) Load share active.
- o) High voltage shutdown with time delay adjustment. Adjustment range 1 second to 30 seconds.

7.0 Current Limit

Current limit shall be factory set at 110% of the charger rating. This shall also be the limit available from the battery charger. User adjustments via the touch pad may be made over a range from 80% to 110% of rating. The current limit shall be displayed directly in amperes and be adjustable in 0.1A increments.

8.0 Parallel Operation

Random parallel operation of two or more chargers with the same DC voltage rating shall be a standard feature.

9.0 Load Sharing

Load sharing of chargers of the same design with the same DC voltage shall be a standard feature and be enabled via the touch pad adjustment. When in load sharing mode chargers shall share the load within +/- 5% from 10% to 100% of their output rating. No adjustments shall be required, as the microprocessor shall automatically control the load sharing.

10.0 Environmental

Operating environment shall be 0^o C to 50^o C, storage at -40^oC to 85^oC, relative humidity 0 to 95% non-condensing, elevation to 1,000 meters. Charger shall be natural convection cooled, no fans allowed.

11.0 Filtering

The charger shall incorporate an output filter as standard and shall maintain its operating parameters when the battery is removed. There shall be no additional filtering or controls required. Filter shall limit the output voltage ripple to 30mV or less without battery connected for 24V and 48V models and 100mV or less for 130V models. Filter shall be pye design consisting of input capacitor(s) - choke- output capacitor(s).

12.0 Construction

- a) DC output terminal blocks shall accept 16 – 10 AWG for 24V-6A through 130V-16A models, 12 – 6 AWG for 130V-25A and 130V-35A models, and 12 – 4 AWG for the 130V-50A model.
- b) Alarm function connections shall consist of one pluggable 3 – position terminal block per alarm, compression style wire clamp for 12-28AWG.
- c) All connections shall be front accessible and positioned at the top front of the cabinet. Knockouts shall be provided at the top front for conduit entry.
- d) Enclosure shall be NEMA1, all 14ga. frame, front, sides, bottom and door. The back panel shall be 10ga. and the top shall be 18Ga.

- e) Cabinet front shall be recessed to prevent accidental actuation of the AC and DC breakers or damage to the control/ LCD display and breakers.
- f) Finish shall be gray, baked epoxy powder coat finish.
- g) Cabinets shall be designed for wall, relay rack or floor mounting. Chargers shall be supplied standard with reversible brackets that can be used for wall or relay rack mounting. A floor- mounting bracket is optional.
- h) The AC and DC breakers shall be fixed mounting to eliminate cable harness movement when the cabinet door is opened.
- i) Bottom and top of cabinet shall be screened to provide for bottom to top ventilation.
- j) Internal wiring shall be kept to a minimum to eliminate potential points of failure.

13.0 Service

No special tools shall be required. AC input changeover, temperature compensation, alarm connections and controls shall be able to be field performed by a technician using standard hand tools.

14.0 Alarms and Reporting

The charger shall have an integrated alarm board capable of automatically detecting and indicating all alarms by name on the LCD display.

- a) Alarm sensing shall be standard and provided for all of the following:
 - Loss of AC (AC Failure)
 - Rectifier failure
 - High voltage shutdown
 - No charge (low output current, set range 0 to 5% of rating)
 - High voltage
 - Low voltage
 - Positive ground fault detection
 - Negative ground fault detection
 - Summary
 - Charger in current limit
 - Charger in equalize

- b) One set of form C contacts shall be standard for loss of AC, Rectifier failure and high voltage shutdown.
- c) Ground fault detection sensitivity shall be user adjustable in 500 ohm increments from 500 to 20,000 ohms.

15.0 Safety

- a) The chargers shall be UL and cUL listed.
- b) The chargers shall be equipped with a redundant high voltage shutdown circuit, one factory set and one user adjustable that will safely shutdown the charger in the event of loss of control to protect the connected load and battery.
- c) There shall be a capacitor discharge button incorporated as a safety function.

16.0 Options

- a) Blocking Diode.
- b) Lightning protection device.
- c) Ground cutoff switch.
- d) Alarm board with individual form C contacts for the summary, GND+, GND-, LVA, HVA and NCA relays.
- e) Individual LED Alarms for quick visual reference.
- f) SIS control wiring.
- g) Remote temperature probe.
- h) Fungicide treatment.
- i) High Interrupt DC breaker.
- j) Export packing.
- k) Certified test data.
- l) Custom drawing sets.
- m) High interrupt AC breaker.
- n) Drip top

17.0 Documentation

- a) A charger product manual shall be provided. The manual shall include Receiving Instructions, Introduction, Installation, Commissioning, Configuration and Operation, Circuit Description, Maintenance and Programming Flow Chart sections.
- b) Charger cabinet outline drawings, assembly drawings, wiring diagrams and parts list shall be included in the product manual.

18.0 Input Specifications

Charger shall be designed for AC input voltages of 120, 208 and 240V, single phase, 60Hz with AC taps field changeable for DC output currents of 6A, 12A, 16A, 25A and 35A. For 130V models, 12A, 16A, 25A and 35A, a 480V single-phase option shall be available.

The 130V, 50A charger shall be designed for AC input voltages for 208V, 240V and 480V single-phase, 60Hz with AC taps field changeable.

19.0 Identification

Charger shall have an identification nameplate that includes model number, serial number, part number, Input AC Volts design, frequency, phase, AC Amps, number of lead acid cells capability, DC volts, DC Amps.

20.0 Manufacturer

The battery chargers shall be C&D Technologies *Micro ARE (ARE-M) Series Float Chargers* or approved equal.