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Product: **Standard DCT, 48-volts**

1. DESCRIPTION OF CHARGER

1.1 Charger description

Charger is a fully regulated, constant voltage, current limited unit designed for heavy-duty industrial service and is capable of full rated output over its entire specified operating envelope. Charger is capable of recharging a fully discharged VRLA, flooded lead-acid or nickel cadmium battery while powering a parallel connected load.

Charger topology is single phase, full wave, SCR type with a current limiting and single or two-stage output LC filter to provide low ripple DC.

1.2 Charger operation and application

The charger provides fully automated recharge and maintenance of the system battery. The charger automatically determines the need for boost (high rate) charging based on the battery's state of charge. Standard temperature compensation system automatically adjusts charge voltage based on ambient temperature. A remote temperature sensor can be connected to the battery to ensure that battery temperature sense is precise. This reduces the need for battery maintenance and increases battery life. Precision electronic components are used in the charger's control and alarm circuits to prevent drifting of values over time and temperature.

1.3 Safety isolation

Electrical isolation from input AC mains to output DC is maintained through the use of power transformers that meet the isolation requirements of UL 1012. Power transformers meet the construction requirements of UL approved Class H (180 C) insulation system. Transformers are de-rated to operate within UL specified temperature limits.

2. INDUSTRY TECHNICAL STANDARDS

2.1 Charger is designed and built in accordance with UL 1012, general requirements of NEMA PE-5 and best commercial practice for industrial and utility grade rectifier/chargers. Models marked "UL listed" are listed to UL 1012.

3. AC MAINS SUPPLY

NOTE: The dual-input DCT chargers are designed to operate from either 50 Hz or 60 Hz AC mains. To determine compliance to specification use only the information under the mains frequency and input voltage the customer will be using.

3.1 Standard input supply; 48V, ≤ 50A
Rating: 115/230 volts, 50/60 Hz

- 60 Hz input, low voltage input (115 volt)
  115 volts –13%, +14.5% (100 to 132 volts), 57-63 Hz
- 60 Hz input, high voltage input (230 volt)
  230 volts –13%, +14.5% (198 to 264 volts), 57-63 Hz
- 50 Hz input, low voltage input (115 volt)
  115 volts –13%, +5.2% (100 to 121 volts), 47-63 Hz
- 50 Hz input, high voltage input (230 volt)
  230 volts –13%, +5.2% (198 to 242 volts), 47-63 Hz

3.2 Standard input supply; 48V, > 50A

Rating: 230 volts, 50/60 Hz

- 60 Hz input
  230 volts –13%, +14.5% (198 to 264 volts), 57-63 Hz

- 50 Hz input
  230 volts –13%, +5.2% (198 to 242 volts), 47-63 Hz

3.3 Non-standard single-voltage input

- 60 Hz input
  208 volts ± 10% (187 to 229 volts) 57-63 Hz

  277 volts ± 10% (249 to 305 volts) 57-63 Hz

  480 volts ± 10% (432 to 528 volts) 57-63 Hz

- 50 Hz input
  240 volts ± 10% (216 to 264 volts) 47-63 Hz

4 POWER FACTOR AND EFFICIENCY

4.1 Power factor
Input power factor is typically 0.8 at full load, nominal input voltage.

4.2 Efficiency
Throughput efficiency is typically 85% at full load, nominal input voltage.

5 OUTPUT

5.1 Output voltage rating and adjustment
48 volts DC nominal. Float voltage is adjustable from 100% of nominal to 120% of nominal (48 volts to 57.6 volts). Boost voltage is adjustable up to 15% above float voltage.

5.2 Battery compatibility
The standard output voltage is compatible with (i.e. the charger will meet all its published specifications) with the following battery configurations:

	Lead-acid		
	VRLA	Flooded	Ni-Cd
Cells	22-24	22-24	34-38

5.3 Float/boost/automatic mode control
Two modes of voltage operation are supplied, float mode and boost mode (also known as "equalize".) Three selector switch positions allow manual selection of float mode or boost mode. The third position places the charger in automatic boost mode. Automatic boost mode causes the charger to operate in boost mode only when current demanded exceeds about 70% of the charger's maximum rated current. When current demand drops to about 50% of the charger's rating the charger resumes float mode operation where it remains until the next high demand from the battery.

5.3.1 Optional boost mode timer
The optional boost timer replaces the standard float/boost/automatic mode switch. The charger operates in float mode unless the timer is manually set. The charger operates in boost mode for the number of hours set on the boost timer after which it reverts to float mode until the next manual setting of the boost timer.

5.3.2 Optional boost mode timer plus Autoboost
The boost timer is added to the standard float/boost/automatic mode switch. When the timer is not manually set the charger operates as described under the "Float/boost/automatic mode control" section above. When the float/boost/automatic mode switch is in the float position the charger operates as indicated under the "Optional boost mode timer" section above.

5.4 Output current limit
Current limit is of the rectangular type (full current is available regardless of

load) and prevents overstress of charger components or operation of overcurrent protective devices. Current limit provides protection from overload and output short circuit. Current limit is factory set at between 100% and 105% of rated output current.

5.5 Output regulation
Static output voltage regulation in float mode is ±1% of the correct temperature compensated voltage from no load to full load over the factory-specified AC mains input envelope.

The same voltage regulation is guaranteed in boost mode except when the input voltage is at low line in which case the output current capability is reduced slightly. This design feature is used to increase input power factor under normal operating conditions.

5.5.1 Output voltage temperature compensation
Temperature compensation increases battery life and reduces the frequency of battery maintenance. The charger's output voltage is temperature compensated to minus 0.18% per degree Celsius. The temperature compensation curve is linear until +10 degrees C, below which the output voltage stops increasing. Battery temperature sensing is accomplished by a sensor located on the control card. Connection of a remote temperature sensor overrides the local sensor, allowing sensing of the temperature at the battery. In case of a remote sensor failure or disconnection, sensing automatically reverts to a sensor located on board the control card.

5.6 Output stability
The charger will operate in a stable fashion when driving a DC load either with parallel connected battery or without battery (battery eliminator operation).

5.7 Output ripple
Less than 30-mV rms on battery rated in ampere-hours four times the charger's output ampere rating. Ripple without battery is less than 100-mV rms.

5.8 Voltage sensing point
Voltage sense is at the output terminals of the charger

6 PROTECTION

6.1 Soft Start (current walk-in)
Upon application of AC mains, charger output increases over a period of approximately ten seconds to full power, or to a lesser amount as demanded by the load.

6.2 Surge suppression – AC input
MOV surge suppression is fitted to the secondary side of the input isolation transformer.

6.3 Surge suppression – DC output
High value inductance and capacitance in the output filter offers robust protection against high-energy transients.

6.4 Current limit
(See "current limit" section under "Output" above

6.5 Input overcurrent protection device (units rated 240 VAC input or lower)
Thermal magnetic two-pole circuit breaker with UL-listed amp interrupting rating of 10,000 amps at 240 volts AC, 50 or 60 Hz.

6.6 Output overcurrent protective device

6.6.1 Output current ≤ 50 amps
Thermal magnetic two pole circuit breaker with UL-listed interrupting rating of 5,000 amps or greater at 48 volts DC or higher.

6.6.2 Output current > 50 amps
Thermal magnetic two pole circuit breaker with supplemental single-pole

fuse with UL-listed interrupting rating of 5,000 amps or greater at 48 volts DC or higher

6.7 High Voltage Shutdown (HVS)
HVS activates if output voltage exceeds a preset value. After shutdown, the charger restarts after battery voltage drops below nominal. HVS deactivates SCR drive.

7 STATUS INDICATORS & ALARMS

7.1 AC on indicator
Green LED indicates that AC mains is present, and that the input breaker is turned on.

7.2 AC fail indicator and alarm
Red LED and a single Form C contact, double-pole, double-throw (DPDT) indicate that the AC power has failed, or that the AC input breaker is open.

7.3 Low battery voltage indicator and alarm
Red LED and a single Form C contact (DPDT) indicate that the battery voltage has dropped below an adjustable threshold. The low battery voltage indicator is not temperature compensated. As long as reasonable settings for low battery voltage and charger output voltage are maintained there will be no false alarms. There is a delay of approximately 20 seconds after onset of the alarm condition and activation of the relay contact. The LED illuminates immediately upon onset of the alarm condition.

7.4 High battery voltage indicator and alarm
Red LED and a single Form C (DPDT) contact indicate that the battery voltage has risen above an adjustable threshold. The high battery voltage indicator is not temperature compensated. As long as reasonable settings for high battery voltage and charger output voltage are maintained there will be no false alarms. There is no delay circuit in this alarm.

7.5 Charge fail indicator and alarm
Red LED and a single Form C contact (DPDT) indicate that the charger is not producing the current demanded by the battery and/or load. This alarm activates when the AC has failed or when a charger malfunction has occurred. This alarm measures output current. If there is current demanded but no output produced, the alarm is activated. The alarm does not activate if no current is demanded to prevent false alarms.

7.6 High volt shutdown indicator and alarm
Red LED and a single Form C contact (DPDT) indicate when charger has shut down due to excessive output voltage.

7.7 Ground fault alarm
Two red LEDs, one for each output polarity, and a single Form C contact (DPDT) indicate insulation breakdown between either the positive or negative polarities and earth ground. The ground fault detector is fully electronic, with typical sensitivity of 100 micro amps of fault current. The ground fault alarm system is fully solid-state, is active at all times, and requires no manual test switch operation, analog meter or incandescent light bulbs. A jumper is provided to disable the ground fault alarm if the user requirement is for one DC polarity to be intentionally tied to earth ground.

7.8 Summary alarm
A single Form C (DPDT) contact operates if any alarm condition except high voltage shutdown has occurred.

7.9 Remote contact ratings
One set of Form C remote contacts is provided for each alarm. Contacts are non-latching, and automatically reset after the fault condition ends. Contact rating is 2A @ 26 VDC or 0.5A @117 VAC

7.10 DC voltmeter
Precision DC meter of 3.5" width, 2% accuracy is provided to indicate charger output voltage.

7.11 DC ammeter
Precision DC meter of 3.5" width, 2% accuracy is provided to indicate charger output current.

8 CONTROLS & ADJUSTMENTS

8.1 Controls
- 2-pole AC input breaker
- 2-poleDC output breaker
- Output charge mode
- Alarm LED test

All controls are accessible with the front door closed

8.2 Adjustments
Float mode potentiometer is located on the control printed circuit board assembly (PCBA). Boost mode potentiometer is located on the control PCBA. Current limit adjustment is located on the control PCBA. DC alarm voltage potentiomenters are located on the alarm PCBA. High voltage shutdown voltage potentiometer is located on the control PCBA

All adjustments require the front door to be opened. All adjustments are protected with tamper-evident sealing.

9 ENVIRONMENTAL

9.1 Ambient
- Temperature: -20C to +50C
- Humidity: 5% to 95%, non-condensing
- Altitude: 0-10,000 ft; no derating

9.2 Cooling
Convection cooled

10 MECHANICAL

10.1 Installation
Designed for installation on a wall or bulkhead, or in 19" or 23" relay rack (depending on size of unit). Minimum 12 inches free space above and 6 inches below unit required for proper flow of cooling air.

10.2 Cabinet type
NEMA-1.

10.3 Power connections
Input and output connections are made direct to the input and output DC circuits breaker compression terminals. Maximum wire sizes vary by charger rating, and are indicated on charger drawings.

10.4 Alarm connections
All alarm connections except high voltage shutdown are made to compression terminals on a dedicated terminal board inside the charger. Connection to the compression-type high voltage shutdown alarm is made direct to the control board. Maximum wire size for all connections is #14 AWG.

10.5 Housing material
- Charger output ≤ 35 amps: .125" 5052 H32 aluminum, heavy clear anodized.

- Charger output >35 amps: .090 steel chassis, zinc plated with gold chromate conversion. Side, front, top and bottom skins: .125" aluminum, 5052 H32, heavy clear anodized

10.6 Metal finish
Corrosion protection is inherent in the metal plating. Anodized aluminum housing can be scratched or otherwise cosmetically damaged without requiring touch-up paint to maintain corrosion protection.

11 STANDARD NAMEPLATE DATA

11.1 The standard permanent adhesive nameplate contains the following data:
- Supplier name, city and state
- Product description
- Model number
- Serial number
- Input voltage rating
- Input frequency rating
- Input current rating
- Nominal output voltage rating
- Output current rating

12 DRAWINGS AND DOCUMENTS

12.1 A final test report is supplied with each charger. In addition, one user manual per charger is supplied, and contains the information described below. Drawings and documents reflect the manufacturer's standard, cataloged product, which is not custom-built and which contains no customer-specific data.

12.2 Documents and drawings are created to good commercial practice, and are supplied on standard 11" x 17" paper, or on 8.5" x 11" paper.

12.3 User manual text with embedded drawings
- Safety instructions
- Product description
- Mechanical installation instructions, with drawings
- AC input ratings and terminal configurations
- Electrical connections
- Operation instructions with explanation of operating modes and controls
- Output adjustments, along with standard factory settings and description and chart of temperature compensation operation
- Troubleshooting table
- Component diagnostic tests
- Detailed theories of operation for all circuits

12.4 Drawings, appended to user manual
- Detailed dimensional drawing
- Connections drawing, with maximum wire sizes shown
- Power circuit schematic
- Control board schematic, with component values
- Alarm board schematic, with component values

12.5 Extra cost documentation items
- Customer-specific information (e.g. P.O. number, company name, job number) is not included as part of the standard document package. Addition of this information to charger documents adds lead-time and cost at prevailing shop rate to the charger.
- Customer drawing "approval", if required, adds lead-time, and cost at prevailing shop rate depending on the number of changes requested.
- Extra copies of documentation beyond one copy per charger are supplied at the list price prevailing at time of order.

13 QUALITY ASSURANCE, INSPECTION AND TEST

13.1 Quality assurance

The following quality assurance steps are included in the manufacturer's ISO 9000 registered standard procedure:
- Source control documents are maintained on all purchased parts
- A master list of all approved purchased components and vendors is maintained
- All assembly personnel are trained in the manufacture of the product
- Bills of material, drawings, procedures, photographs, visual method sheets and other documents affecting the manufacture and test of the product are controlled so that

engineering changes are immediately incorporated.
- Inspection is performed at every step of the assembly process. (Quality is "built-in" rather than "inspected in")

13.2 Standard factory assembly and test procedure

The standard assembly process prescribes the tests and calibration that are performed on the product. These activities include, but are not limited to the following:
- Insulation breakdown test using a "hipot" device to the standards prescribed in UL 1012.
- Performance testing to insure that critical performance specifications are met. These include operation at low and high AC line voltage, output ripple and regulation.
- Calibration to the correct output, alarm and shutdown voltages

Burn-in is not a standard test procedure for this class of product. If burn-in is required the set-up is billed at the prevailing hourly shop rate. If full-power burn-in is required then additional charges may be added if power usage is significant.

13.3 Witness of standard factory procedures

Customers are welcome at any time to witness the assembly of products. The manufacturer makes a reasonable effort to inform the customer of the date on which his product will be built. Any special inspections that are out of the ordinary will be billed to the customer at the prevailing shop rate.
If the customer desires a certain date and time reserved for inspection of final test then a fee for reservation of that specific time is required.

14 WARRANTY

Manufacturer warrants its products to be free of defects in material or workmanship for a period of two years from date of shipment. Contact manufacturer for a complete statement of warranty.

END OF SPECIFICATION