

SECTION 26 33 05 – DC POWER SUPPLY/BATTERY CHARGER

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide the single-phase heavy-duty industrial battery charger and all accessories required, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 26 05 00 – Electrical Work, General, apply to the WORK of this Section.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. The charger is to be designed and built in accordance with UL 1012, the general requirements of NEMA PE-5 and best commercial practice for industrial and utility grade rectifier/chargers. Models marked “UL listed” are to be listed to UL 1012.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings and catalog data in accordance with MASS Section 10.05 Article 5.6. Submit sufficient information to indicate the scope and quality of the battery charger installation.
 - 1. Equipment arrangement, outlet devices, and special mounting details.
 - 2. Wiring diagrams showing terminal identification for field-installed wiring.
 - 3. Catalog literature.

1.4 QUALITY ASSURANCE

- A. Industrial battery charger system components shall be manufactured by firms that are regularly engaged in the production of such systems, including auxiliary equipment similar to that required by this Contract, and that have been in satisfactory service for at least 10 years.

PART 2 - PRODUCTS

2.1 SCADA PANEL DC POWER SUPPLY/BATTERY CHARGER

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

2. Charger topology is to be single phase, full wave, SCR type with a current limiting and single or two-stage output LC filter to provide low ripple DC.
- B. Charger Operation and Application: The charger is to provide fully automated recharge and maintenance of the system battery. The charger shall automatically determine the need for boost (high rate) charging based on the battery's state of charge. A standard temperature compensation system is to automatically adjust charge voltage based on ambient temperature.
- C. Safety Isolation: Electrical isolation from input AC mains to output DC is to be maintained through the use of power transformers that meet the isolation requirements of UL 1012. Transformers are to be de-rated to operate within UL specified temperature limits.
- D. AC Mains Supply
1. The charger is to be designed to operate from 120-volt \pm 10%, 60 Hz \pm 5%, AC mains.
- E. Output
1. Output Voltage Rating and Adjustment: 24 volts DC nominal. The float voltage is to be adjustable from 100% of nominal to 120% of nominal (24 volts to 28.8 volts). Boost voltage is to be adjustable up to 15% above float voltage.
 2. Battery Compatibility: The standard output voltage is to be compatible with (i.e., the charger will meet all its published specifications) the following battery configurations:

	Lead-acid		
	<u>VRLA</u>	<u>Flooded</u>	<u>Ni-Cd</u>
Cells	11-12	11-12	17-19
 3. Float/Boost/Automatic Mode Control: Two modes of voltage operation are to be provided, float mode and boost mode (also known as "equalize".) A three-position selector switch is to allow manual selection of float mode or boost mode. The third position is to place the charger in automatic boost mode. Automatic boost mode is to cause the charger to operate in boost mode only when the current demanded exceeds about 70% of the charger's maximum rated current. When the current demand drops to about 50% of the charger's rating the charger is to resume float mode operation where it is to remain until the next high demand from the battery.
 4. Output Current Limit: The current limit is to be of the rectangular type (full current is to be available regardless of load) to prevent overstress of charger components. Current limit is to provide protection from overload and output short circuit. Current limit is to be factory set at between 100% and 105% of rated output current. Current limit is to be adjustable up to 110% of rated output.
 5. Output Regulation: The static output voltage regulation in float mode is to be +1% of the correct temperature compensated voltage from no load to full load for rated AC input.
 - a. Output Voltage Temperature Compensation: The charger's output voltage is to be temperature compensated to minus 0.18% per degree Celsius. The temperature compensation curve is to be linear until +10 degrees C, below

which the output voltage is to stop increasing. Battery temperature sensing is to be accomplished by a sensor located on the control card.

6. Output Stability: The charger is to operate in a stable condition when driving a DC load either with parallel connected battery or without battery.
7. Output Ripple: To be less than 30-mV rms when connected to a battery rated in ampere-hours four times the charger's output ampere rating, the ripple without battery is to be less than 100-mV rms.
8. Voltage Sensing Point: Voltage sense is to be at the output terminals of the charger.

F. Protection

1. Surge Suppression – AC Input: MOV surge suppression is to be fitted to the secondary side of the input isolation transformer.
2. Surge Suppression – DC Output: The output filter is to have high value inductance and capacitance to provide robust protection against high-energy transients.
3. Input Overcurrent Protection Device is to be provided by a thermal magnetic two-pole circuit breaker with UL-listed amp interrupting rating of 10,000 amps at 240 volts AC, 60 Hz.
4. Output Overcurrent Protective Device is to be provided by a thermal magnetic two pole circuit breaker with UL-listed interrupting rating of 5,000 amps at 48 volts DC.
5. High Voltage Shutdown (HVS): HVS is to activate if the output voltage exceeds a preset value. After shutdown, the charger is to restart after the battery voltage drops below nominal. HVS is to deactivate the SCR drive.

G. Status Indicators and Alarms

1. AC On Indicator: A green LED is to indicate that an AC main is present, and that the input breaker is turned on.
2. AC Fail Indicator and Alarm: A red LED and a Form C contact, double-pole, double-throw (DPDT) is to indicate that the AC power has failed, or that the AC input breaker is open.
3. Low Battery Voltage Indicator and Alarm: A red LED and a Form C contact (DPDT) is to indicate that the battery voltage has dropped below an adjustable threshold. There is to be a delay of approximately 20 seconds after onset of the alarm condition and activation of the relay contact.
4. High Battery Voltage Indicator and Alarm: A red LED and a Form C (DPDT) contact is to indicate that the battery voltage has risen above an adjustable threshold.
5. Charge Fail Indicator and Alarm: A red LED and a Form C contact (DPDT) is to indicate that the charger is not producing the current demanded by the battery and/or load. This alarm is to activate when the AC has failed or when a charger malfunction has occurred. This alarm is to be based on measured output current. If there is current demanded but no output produced, the alarm is to be activated. The alarm must not activate if no current is demanded, thus preventing false alarms.

6. High Volt Shutdown Indicator and Alarm: A red LED and a Form C contact (DPDT) is to indicate when the charger has shut down due to excessive output voltage.
7. Summary Alarm: A Form C (DPDT) contact is to operate if any alarm condition except high voltage shutdown has occurred.
8. Remote Contact Ratings: One set of Form C remote contacts is to be provided for each alarm. Contacts are to be non-latching, and automatically reset after the fault condition ends. Contact rating is to be 2A @ 26 VDC or 0.5A @117 VAC.
9. DC Voltmeter: A precision DC meter of 3.5" width, with 2% accuracy is to be provided to indicate charger output voltage.
10. DC Ammeter: A precision DC meter of 3.5" width, with 2% accuracy is to be provided to indicate charger output current.

H. Controls and Adjustments

1. Controls
 - a. 2-pole AC input breaker
 - b. 2-pole DC output breaker
 - c. Output charge mode
 - d. Alarm LED test
2. All controls are to be accessible with the front door closed

I. Environmental Requirement

1. Ambient
 - a. Temperature: -20C to +50C
 - b. Humidity: 5% to 95%, non-condensing
 - c. Altitude: 0-10,000 ft; no derating
2. Cooling: Convection cooled.

J. Mechanical

1. Installation: The unit is to be designed for installation on a wall or bulkhead, or in a 19" relay rack. A maximum of 12 inches of free space above and 6 inches below the unit is required for proper flow of cooling air.
2. Cabinet Type: NEMA-1.
3. Power Connections: Input and output connections are to be made direct to the input and output DC circuit breaker compression terminals.
4. Alarm Connections: All alarm connections are to be made to compression terminals inside the charger. The wire size for all connections is to be #14 AWG.
5. Housing material is to be 0.125" 5052 H32 aluminum, heavy clear anodized.
6. Metal Finish: Corrosion protection is to be inherent in the metal plating.

2.2 DESCRIPTION OF PUMP ENGINE BATTERY CHARGER

A. Charger Description

1. The charger shall be designed for heavy-duty industrial service and be capable of full-rated output indefinitely at temperatures between -10°C and +50°C. The charger shall be capable of recharging a fully discharged battery of the

maintenance-free lead acid, conventional (wet) lead acid or nickel-cadmium type. The charger shall maintain the battery automatically and minimize the need for battery electrolyte replenishment. Conservatively rated SCRs and diodes in full-wave bridge shall be used. A crank disconnect relay shall not be required to protect the charger from overload. The charger shall be wall mounted and natural convection cooled. The housing shall be constructed of rustproof metal (e.g., aluminum) and treated with a protective coating.

B. Battery Charger Input

1. The charger shall operate from: 120 V \pm 10%, 60 Hz \pm 3% AC mains.
2. The charger shall incorporate a soft-start feature in which the output is gradually increased from zero to full, required output within 5 to 10 seconds. Input protection shall consist of fuses or circuit breakers. Proven surge suppression devices shall be fitted.

C. Battery Charger Output

1. General Characteristics
 - a. Output voltage shall be 24 volts nominal. Float voltage shall be adjustable from 100% to 120% of nominal. Equalize voltage shall be adjustable up to 15% above float voltage. Output voltage adjustments shall be on separate potentiometers in the charger. The charger shall incorporate automatic current limiting with a rectangular current limit characteristic, and shall be capable of operating into a short circuit or dead battery indefinitely without damage or overheating. The charger shall be equipped with output fuses or circuit breakers.
2. Regulation and Temperature Compensation
 - a. Voltage regulation shall be within \pm 1 of the correct temperature-compensated value from no load to full load with simultaneous variations of \pm 10% input voltage and \pm 5% input frequency. The DC output shall be constant voltage and current limited. The charger's current limit shall be fixed between 100% and 110%. Input transient protection shall be provided. The charger shall be protected against damage by reverse connection of the battery.
 - b. The charger shall be equipped with an automatic high rate (equalize) charge facility operating in response to the battery's state of charge. The charger shall operate at the high rate until the battery is fully charged, then revert to float voltage to prevent overcharging. High rate operation shall be governed by the requirement of the battery. Mechanical or electronic timers shall not be used.
 - c. The charger shall incorporate automatic ambient temperature compensation to maximize battery performance and life. Temperature coefficient shall be (0.18%) per degree C to assure correct charging in all temperatures.
 - d. The charger shall automatically compensate for voltage drop in the charging leads to prevent charging errors due to long cable runs.
3. Float/Equalize Control
 - a. The charger shall include an automatic equalize feature that is activated when the battery's state of charge is reduced. Individual adjustment potentiometers shall be provided for float voltage, boost voltage and alarm voltages.

4. Indicators and Optional Alarms
 - a. Meters for output amperes and voltage shall be provided.
 - b. The battery charger shall incorporate an alarm system providing indication of charger and battery status by LED displays and form C contacts. Separate contacts for low-battery voltage and charger fail shall be provided. An LED shall indicate input power on.

2.3 STANDARD NAMEPLATE DATA

- A. A standard permanent adhesive nameplate is to contain the following data:
 1. Supplier name, city and state
 2. Product description
 3. Model number
 4. Serial number/date code
 5. Input voltage rating
 6. Input frequency rating
 7. Input current rating
 8. Nominal output voltage rating
 9. Output current rating

2.4 DRAWINGS AND DOCUMENTS

- A. A final test report is to be supplied with each charger. In addition, one user manual per charger is to be supplied that contains the information described below. Drawings and documents are to reflect the manufacturer's standard, cataloged product.
- B. Documents and drawings are to be created to good commercial practice, and are to be supplied on standard 11" x 17" paper, or on 8.5" x 11" paper.
- C. The user is to provide:
 1. Safety instructions
 2. Product description
 3. Mechanical installation instructions, with drawings
 4. AC input ratings and terminal configurations
 5. Electrical connections
 6. Operation instructions with explanation of operating modes and controls
 7. Output adjustments, along with standard factory settings and description and chart of temperature compensation operation
 8. Troubleshooting table
 9. Component diagnostic tests
 10. Detailed theories of operation for all circuits
- D. The following drawings are to be appended to user manual:
 1. Detailed dimensional drawing
 2. Connections drawing, with maximum wire sizes shown

3. Power circuit schematic
4. Control board schematic, with component values
5. Alarm board schematic, with component values

2.5 QUALITY ASSURANCE, INSPECTION AND TEST

- A. Quality Assurance: The following quality assurance steps are to be included in the manufacturer's standard procedure:
 1. Source control documents are maintained on all purchased parts
 2. A master list of all approved purchased components and vendors is maintained
 3. All assembly personnel are trained in the manufacture of the product
 4. 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.
 5. Inspection is performed at every step of the assembly process. (Quality is "built-in" rather than "inspected in.")

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

2.6 WARRANTY

- A. The manufacturer is to warrant its products to be free of defects in material or workmanship for a period of two years from date of shipment.

2.7 MANUFACTURERS, OR EQUAL

- A. Full-size: SCADA panel DC power supply/battery chargers shall be **SENS model Q 024-025-T-L-511-C**, or equal.
- B. Compact: **SENS model NRG 24-10-RC**, or equal.
- C. Provide the following DC power supplies/battery chargers:

Facility	Full-size	Compact

2.8 BATTERY PROVISION

- A. Each SCADA panel DC power supply/battery charger is to be connected to a 24 V sealed lead acid battery rated at 103Ah at the 10-hour rate. Batteries are to be (2) units of the **Powersonic Battery model PS-121100**, or equal.
- B. The batteries are to be provided with a proprietary wall mounting bracket that is rated for MOA seismic zone requirements.

PART 3 - EXECUTION

3.1 GENERAL

- A. The industrial battery charger system shall be installed as indicated and shall conform to Section 26 05 00 – Electrical Work, General, and the equipment manufacturer's installation instructions.
- B. The CONTRACTOR shall receive, store, and assemble all sections of the battery charger system to form complete units. The CONTRACTOR shall make all internal wiring interconnections as required for complete assembly of the system. Where wiring connectors are not supplied by the manufacturer, the CONTRACTOR shall furnish the connectors required to complete internal wiring terminations.
- C. The CONTRACTOR shall take all necessary precautions to eliminate moisture and foreign material from the equipment at all times during storage and installation. Special care shall be taken to prevent corrosion of and damage to the battery charger system.

END OF SECTION 26 33 05