

SECTION 26 3323 - CENTRAL BATTERY EQUIPMENT [*for Evanston campus only*]

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes [**slow-transfer**] [**fast-transfer**] central battery inverters used for emergency or life safety lighting circuits with the following features:

**(Edit per project requirements)**

1. Output distribution section.
2. Internal maintenance bypass/isolation switch.
3. External maintenance bypass/isolation switch.
4. Multiple output voltages.
5. Emergency-only circuits.
6. Remote monitoring provisions.

1.3 DEFINITIONS

- A. LCD: Liquid-crystal display.
- B. LED: Light-emitting diode.
- C. THD: Total harmonic distortion.
- D. UPS: Uninterruptible power supply.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Electrical ratings, including the following:
    - a. Capacity to provide power during failure of normal AC.
    - b. Inverter voltage regulation and THD of output current.
    - c. Rectifier data.
    - d. Transfer time of transfer switch.
    - e. Data for specified optional features.
  2. Transfer switch.

3. Inverter.
4. Battery charger.
5. Batteries.
6. Battery monitoring.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, components, and location and identification of each field connection. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement.

1. Wiring Diagrams: Detail internal and interconnecting wiring; and power, signal, and control wiring.
2. Elevation and details of control and indication displays.
3. Output distribution section.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Source quality-control test reports.
- B. Field quality-control test reports.
- C. Warranty: Special warranty specified in this Section.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For central battery inverter equipment to include in emergency, operation, and maintenance manuals.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to the University Electric Shop.
  1. Fuses: One for every 10 of each type and rating, but no fewer than three of each.
  2. Cabinet Ventilation Filters: One complete set.
  3. One spare circuit board for each critical circuit boxed and labeled.

#### 1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by UL and marked for intended use.
- B. Central Battery Inverter System: UL 924 and UL 1778 listed.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with most current edition of the Northwestern University Design Standards.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment in fully enclosed vehicles.
- B. Store equipment in spaces having environments controlled within manufacturers' written instructions for ambient temperature and humidity conditions for non-operating equipment.

1.10 PROJECT CONDITIONS

- A. ***(Delete This Paragraph If Not Required)*** [Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by The University or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

- 1. **Notify the University's Chief Electrician no fewer than ten (10) business days in advance of proposed interruption of electric service.**
- 2. **Indicate method of providing temporary utilities.**
- 3. **Do not proceed with interruption of electrical service without the University's Chief Electrician's written permission.**
- 4. **The University Lock-out/Tag-out procedures shall be used with Contractor controlled locks and tags.**
- 5. **Comply with NFPA 70E. ]**

- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for equipment, including clearances between equipment and adjacent surfaces and other items. Comply with indicated maximum dimensions.

- C. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

- 1. Ambient Temperature: Not exceeding 40 deg C.
- 2. Altitude: Not exceeding 6600 feet (2010 m).

1.11 WARRANTY

- A. Comply with Division 1 requirements.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace batteries that fails in materials or workmanship within specified warranty period. Special warranty, applying to batteries only, applies to materials only, on a prorated basis, for period specified.

- 1. Warranty Period: Include the following warranty periods, from date of Beneficial Occupancy:

- a. Inverter and Battery Charger: Ten (10) years.
- b. Premium, sealed, lead-calcium batteries:
  - 1) Full Warranty: Ten (10) years.
  - 2) Pro Rata: Fifteen (15) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Chloride Systems.
  2. Cooper Industries, Inc.; Sure-Lites Division.
  3. Hubbell Incorporated; Hubbell Lighting.
  4. Lithonia Lighting; Emergency Lighting Systems.
  5. Myers Power Products.
  6. Thomas & Betts Corporation; Emergi-Lite Division.

2.2 INVERTER PERFORMANCE REQUIREMENTS (*select A or B below*)

- A. **[Slow-Transfer Central Battery Inverters: Automatically sense loss of normal AC supply and use an electromechanical switch to transfer loads. Transfer in one second or less from normal supply to battery-inverter supply.**
1. **Operation: Unit supplies power to output circuits from a single, external, normal supply source. Unit automatically transfers load from normal source to internal battery/inverter source. Retransfer to normal is automatic when normal power is restored.]**
- B. **[Fast-Transfer Central Battery Inverters: Automatically sense loss of normal AC supply and use a solid-state switch to transfer loads. Transfer in 0.004 second or less from normal supply to battery-inverter supply.**
1. **Operation: Unit supplies power to output circuits from a single, external, normal supply source. Unit automatically transfers load from normal source to internal battery/inverter source. Retransfer to normal is automatic when normal power is restored.]**
- C. Maximum Acoustical Noise: less than 50 dB, "A" weighting, emanating from any component under any condition of normal operation, measured 39 inches (990 mm) from nearest surface of component enclosure.

2.3 SERVICE CONDITIONS

- A. Environmental Conditions: Inverter system shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
1. Ambient Temperature for Electronic Components: 32 to 98 deg F (0 to 37 deg C).
  2. Relative Humidity: 0 to 95 percent, non-condensing.
  3. Altitude: Sea level to 4000 feet (1220 m).

## 2.4 INVERTERS

A. Description: Solid-state type, with the following operational features:

1. Automatically regulate output voltage to within plus or minus 5 percent.
2. Automatically regulate output frequency to within plus or minus 1 Hz, from no load to full load at unit power factor over the operating range of battery voltage.
3. Output Voltage Waveform of Unit: Sine wave with maximum 10 percent THD throughout battery operating-voltage range, from no load to full load.
  - a. THD may not exceed 5 percent when serving a resistive load of 100 percent of unit rating.
4. Output Protection: Current-limiting and short-circuit protection.
5. Output Protection: Ferroresonant transformer to provide inherent overload and short-circuit protection.
6. Surge Protection: Panelboard suppressors specified in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits."
7. Overload Capability: 125 percent for 10 minutes; 150 percent surge.
8. Brownout Protection: Produces rated power without draining batteries when input voltage is down to 75 percent of normal.

## 2.5 BATTERY CHARGER

A. Description: Solid-state, automatically maintaining batteries in fully charged condition when normal power is available. With LED indicators for "float" and "high-charge" modes.

## 2.6 BATTERIES

A. Description: Premium, maintenance free, sealed lead-calcium batteries.

1. Capable of sustaining full-capacity output of inverter unit for minimum of 90 minutes.

## 2.7 ENCLOSURES

A. NEMA 250, Type 1 steel cabinets with access to components through hinged doors with flush tumbler lock and latch.

B. Finish: Manufacturer's standard baked-enamel finish over corrosion-resistant prime treatment.

## 2.8 CONTROL AND INDICATION

A. Description: Group displays, indications, and basic system controls on common control panel on front of central battery inverter enclosure.

B. Minimum displays, indicating devices, and controls shall include those in lists below. Provide sensors, transducers, terminals, relays, and wiring required to support listed items. Alarms shall include an audible signal and a visual display.

C. Indications: Plain-language messages on a digital LCD or LED (typically for units >10 KVA).  
***(edit list for project requirements)***

1. Quantitative Indications:
  - a. Input voltage, each phase, line to line.
  - b. Input current, each phase, line to line.
  - c. System output voltage, each phase, line to line.
  - d. System output current, each phase.
  - e. System output frequency.
  - f. DC bus voltage.
  - g. Battery current and direction (charge/discharge).
  - h. Elapsed time-discharging battery.
  
2. Basic Status Condition Indications:
  - a. Normal operation.
  - b. Load-on bypass.
  - c. Load-on battery.
  - d. Inverter off.
  - e. Alarm condition exists.
  
3. Alarm Indications:
  - a. Battery system alarm.
  - b. Control power failure.
  - c. Fan failure.
  - d. Overload.
  - e. Battery-charging control faulty.
  - f. Input overvoltage or undervoltage.
  - g. Approaching end of battery operation.
  - h. Battery undervoltage shutdown.
  - i. Inverter fuse blown.
  - j. Inverter transformer overtemperature.
  - k. Inverter overtemperature.
  - l. Static bypass transfer switch overtemperature.
  - m. Inverter power supply fault.
  - n. Inverter output overvoltage or undervoltage.
  - o. System overload shutdown.
  - p. Inverter output contactor open.
  - q. Inverter current limit.
  
4. Controls:
  - a. Inverter on-off.
  - b. Start.
  - c. Battery test.
  - d. Alarm silence/reset.
  - e. Output-voltage adjustment.

D. Dry-form "C" contacts shall be available for remote indication of the following conditions:

1. Inverter on battery.
2. Inverter on-line.

3. Inverter load-on bypass.
4. Inverter in alarm condition.
5. Inverter off (maintenance bypass closed).

E. Include the following minimum array:

1. Ready, normal-power on light.
2. Charge light.
3. Inverter supply load light.
4. Battery voltmeter.
5. AC output voltmeter with minimum accuracy of 2 percent of full scale.
6. Load ammeter.
7. Test switch to simulate AC failure.

F. Enclosure: Steel, with hinged lockable doors, suitable for [wall] [floor] mounting. Manufacturer's standard corrosion-resistant finish.

## 2.9 MONITORING/CONTROL BY REMOTE COMPUTER

- A. Coordinate remote monitoring and control communication module package with the University's SCADA network for successful transmission and remote readout of monitoring data and UPS Control. Connect remote monitoring communication module to the University's SCADA network through appropriate network interface unit. The manufacturer shall wire between all communications capable devices within the equipment, including electronic meters with the same protocol and wire to a set of easily accessible terminal blocks.
- B. Description: Communication module in unit control panel provides capability for remote monitoring of status, parameters, and alarms specified in "Controls and Indications" paragraphs. The remote computer and the connecting signal wiring are not included in this Section. Include the following features:
1. SCADA interface units for data transmission via Modbus TCP/IP.

## 2.10 OPTIONAL FEATURES

- A. Multiple Output Voltages: Supply unit branch circuits at different voltage levels if required. Transform voltages internally as required to produce indicated output voltages.
- B. Emergency-Only Circuits: Automatically energize only when normal supply has failed. Disconnect emergency-only circuits when normal power is restored.
- C. Maintenance Bypass/Isolation Switch: Switch is interlocked so it cannot be operated unless static bypass transfer switch is in bypass mode. Switch provides manual selection among the following three conditions without interrupting supply to the load during switching:
1. Full Isolation: Load is supplied, bypassing central battery inverter system. Normal AC input circuit, static bypass transfer switch, and central battery inverter load terminals are completely disconnected from external circuits.
  2. Maintenance Bypass: Load is supplied, bypassing central battery inverter system. Central battery inverter AC supply terminals are energized to permit operational checking, but system load terminals are isolated from the load.

3. Normal: Normal central battery inverter AC supply terminals are energized and the load is supplied either through static bypass transfer switch and central battery inverter rectifier-charger and inverter or through battery and inverter.

#### 2.11 OUTPUT DISTRIBUTION SECTION

- A. Panelboard: Comply with Division 26 Section "Panelboards" except provide assembly integral to equipment cabinet.

#### 2.12 SYSTEM MONITORING AND ALARMS

- A. Remote Status and Alarm Panel: Labeled LED's on panel faceplate shall indicate five basic status conditions. Audible signal indicates alarm conditions. Silencing switch in face of panel silences signal without altering visual indication.

1. Cabinet and Faceplate: Surface or flush mounted to suit mounting conditions indicated.

- B. Provisions for Remote Computer Monitoring: Communication module in unit control panel provides capability for remote monitoring of status, parameters, and alarms specified in Part 2 "Control and Indication" Article. Include the following features:

1. Connectors and network interface units for data transmission to University's SCADA system.
2. Software shall be designed to control and monitor inverter system functions and to provide on-screen explanations, interpretations, diagnosis, action guidance, and instructions for use of monitoring indications and development of reports. Include capability for storage and analysis of power-line transient records.

- C. Battery Ground-Fault Detector: Initiates alarm when resistance to ground of positive or negative bus of battery is less than 5000 ohms.

1. Annunciation of Alarms: At inverter system control panel.

- D. Battery Monitoring: Battery Monitoring and Data Management System shall monitor the battery system. The system shall be capable of automatically monitoring, displaying, and recording all battery parameters described in this specification. The battery monitoring system shall transmit all battery data to a Remote Central Computer RCC via USB or RS-232, or be capable of being polled over a LAN/WAN connection using TCP/IP.

1. Basic Functional Performance: Automatically measures and records each discharge event, classifies it according to duration category, and totals discharges according to warranty criteria, displaying remaining warranted battery life on integral display.
2. Additional monitoring functions and features shall include the following:
  - a. Measuring and recording of total voltage at battery terminals; providing alarm for excursions outside proper float voltage level.
  - b. Monitoring of ambient temperature at battery and initiating an alarm if temperature deviates from normally acceptable range.
  - c. Alarm contacts arranged to alarm for battery discharge events, abnormal temperature, abnormal battery voltage or temperature.
  - d. Memory device to store recorded data in nonvolatile electronic memory.



- E. Factory test complete inverter system, including battery, before shipment. Include the following:
  - 1. Functional test and demonstration of all functions, controls, indicators, sensors, and protective devices.
  - 2. Full-load test.
  - 3. Transient-load response test.
  - 4. Overload test.
  - 5. Power failure test.
  
- F. Report test results. Include the following data:
  - 1. Description of input source and output loads used. Describe actions required to simulate source load variation and various operating conditions and malfunctions.
  - 2. List of indications, parameter values, and system responses considered satisfactory for each test action. Include tabulation of actual observations during test.
  - 3. List of instruments and equipment used in factory tests.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance.
  - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment will be installed, before installation begins.
  
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
  
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install wall mounted system components. Do not attach directly to walls. Attach by bolting to steel channels such as "Uni-Strut".
  
- B. Install floor mounted system components on concrete base and attach by bolting.
  - 1. Concrete Bases: 4 inches (100 mm) high, (Evanston: 6 inches east of Sheridan Rd.) reinforced, with chamfered edges. Extend base no more than 3 inches (75 mm) in all directions beyond the maximum dimensions of equipment unless otherwise indicated.
  - 2. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 4. Use 3000-psi (20.7-MPa) 28-day compressive-strength concrete and reinforcement as specified in Division 03 Sections.

- C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.
- D. Install remote mounted status panels where indicated.

### 3.3 CONNECTIONS

- A. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams, unless otherwise indicated.
  - 1. Provide wiring between unit and remote status monitoring panel.
- B. Provide all communications wiring between remote monitoring/control and communication modules and the University's SCADA system.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
  - 1. Separately Derived Systems: Make grounding connections to grounding electrodes and bonding connections to metallic piping systems as indicated; comply with NFPA 70.
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 IDENTIFICATION

- A. Identify equipment and components according to Division 26 Section "Identification for Electrical Systems."

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. Inspect interiors of enclosures for integrity of mechanical and electrical connections, component type and labeling verification, and ratings of installed components.
  - 2. Test manual and automatic operational features and system protective and alarm functions.
  - 3. Test communication of status and alarms to remote monitoring equipment.
  - 4. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specifications. Certify compliance with test parameters.
  - 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

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3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Verify that central battery inverter is installed and connected according to the Contract Documents.
- C. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections.
- D. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING AND CLEANING

- A. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- B. Install new filters in each equipment cabinet within 14 days from date of Substantial Completion.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train the University's maintenance personnel to adjust, operate, and maintain central battery inverters. Provide eight (8) hours of classroom and hands-on training.

**END OF SECTION 26 3323**

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