

## **SECTION 26 33 23.11 – CENTRAL BATTERY EQUIPMENT FOR EMERGENCY LIGHTING**

### **PART 1 – GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section includes interruptible (slow-transfer) central battery and power conversion equipment rated 600V and less for emergency lighting.

#### **1.3 DEFINITIONS**

- A. IBC: International Building Code.
- B. Interruptible: As used in Section Text, off-line, passive-standby or line-interactive, inverter-only unit, with intentional interruption of power to load until internal transfer switch picks up and transfers load to unit's inverter and internal battery source on loss of "normal" source, and then retransfers to "normal" source when it is restored.
- C. LED: Light-emitting diode.
- D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50V or for remote-control, signaling power-limited circuits.
- E. OCPD: Overcurrent protective device.
- F. PWM: Pulse-width modulated.
- G. TDD: Total demand (harmonic current) distortion (also listed as "THD" in catalog data by manufacturers).
- H. Uninterruptible: As used in Section Text, on-line, double-conversion (rectifier/inverter) unit, with no interruption of power to load on interruption and restoration of "normal" source.
- I. VRLA: Valve-regulated lead acid.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type and rating of central battery equipment unit. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, shipping splits, and furnished options, specialties, and accessories.
- B. Shop Drawings: For each type and rating of central battery equipment unit.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, ventilation requirements, method of field assembly, components, and location and size of each field connection.
3. Include system one-line diagram, internal and interconnecting wiring; and diagrams for power, signal, and control wiring.
4. Include elevation, details, and legends of control and indication displays.
5. Include -circuit current (withstand) rating of unit.

## **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For central battery equipment to include in emergency, operation, and maintenance manuals.
  1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include following:
    - a. Manufacturer's written instructions for testing central battery equipment.
    - b. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
    - c. Manufacturer's written instructions for selecting and setting field-adjustable controls and status and alarm points

## **1.6 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.
  1. Fuses: One for every 10 of each type and rating, but no fewer than 3 of each type.
  2. Output Circuit Breakers: One for every 10 of each type and rating, but no fewer than one of each type.
  3. Output Circuit Breaker Open/Tripped Alarm Contacts: One for every 10 supplied, but no fewer than one of each type.
  4. Cabinet Ventilation Filters: One complete set.
  5. Circuit Board: One spare circuit board for each critical circuit.

## **1.7 QUALITY ASSURANCE**

- A. Installer Qualifications: Entity that employs installers and supervisors who are trained and approved by manufacturer.

## **1.8 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.

## **1.9 FIELD CONDITIONS**

- A. Environmental Limitations: Rate equipment for continuous operation under following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Less than zero degrees F or exceeding 104 degrees F, with average value exceeding 95 degrees F over 24-hour period.
  - 2. Ambient Storage Temperature: Not less than minus 4 degrees F and not exceeding 140 degrees F.
  - 3. Humidity: More than 95 percent (condensing).

## **1.10 COORDINATION**

- A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.

## **1.11 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace central battery equipment that fails in materials or workmanship within specified warranty period. Special warranty, applying to batteries only, applies to materials only, on prorated basis, for period specified.
  - 1. Warranty Period: Include following warranty periods, from date of Substantial Completion:
    - a. Central Battery Equipment (excluding Batteries): Two years.
    - b. Standard VRLA Batteries:
      - 1) Full Warranty: One year.
      - 2) Pro Rata: Nine years.

## **PART 2 - PRODUCTS**

### **2.1 INTERRUPTIBLE (SLOW-TRANSFER) CENTRAL BATTERY EQUIPMENT**

- A. Interruptible (slow-transfer) central battery equipment shall be manufactured by Barron Lighting Group, Myers EPS, or approved equal.
- B. General Requirements for Interruptible (Slow-Transfer) Central Battery Equipment:
  - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by qualified testing agency, and marked for intended location and application.
  - 2. NRTL Compliance: Fabricate and label central battery equipment to comply with UL 924.
  - 3. Comply with IBC, NFPA 70, and NFPA 101.
  - 4. Source Limitations: Obtain central battery equipment, including batteries, overcurrent protective devices, components, and accessories, from single source from single manufacturer.

C. Performance Requirements:

1. Slow-Transfer Central Battery Equipment: Passive-standby (off-line) system. Automatically sense loss of normal alternating-current (ac) supply and use electromechanical transfer switch to transfer loads. Transfer in one second or less from normal supply to battery-inverter supply.
2. Automatic Operation:
  - a. Normal Conditions: Supply load with ac power flowing from normal ac power input terminals, bypassing inverter, with battery connected in parallel via rectifier/charger output.
  - b. Abnormal Supply Conditions: If normal ac supply deviates from specified voltage, transfer switch operates and battery supplies constant, regulated ac power through inverter to load, with momentary loss of power to load.
  - c. If normal power fails, transfer switch operates and battery supplies constant, regulated ac power through inverter to load, with momentary loss of power to load.
  - d. If fault occurs in system when being supplied by inverter and current flows in excess of overload rating of inverter, inverter automatically protects itself against damage from overloads and short circuits by shutting down.
  - e. When normal ac power is restored at input supply terminals of unit, controls automatically retransfer load back to normal ac supply, with momentary loss of power to load. Rectifier/charger then recharges battery.
  - f. If normal power failure is prolonged (more than 90 minutes), integral low-voltage battery protective circuit disconnects battery and prevents battery from damage due to deep discharge.
  - g. If battery becomes discharged, and when normal ac supply is again available, rectifier/charger recharges battery. When battery is fully charged, rectifier/charger automatically shifts to float-charge mode.
  - h. If battery is disconnected, and normal ac power is available, central battery equipment continues to supply power to load with no degradation of its regulation of voltage and frequency of output bus.

D. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 15 percent of central battery equipment input voltage rating.
2. Input Frequency Tolerance: Plus or minus 3 percent of central battery equipment frequency rating.
3. Synchronizing Slew Rate: one hertz per second, maximum.
4. Minimum Off-Line Efficiency: 95 percent at 60 hertz, full load.
5. Minimum Displacement Primary-Side Power Factor: 96 percent under load or operating condition.
6. Ambient Temperature Rating (Other Than Batteries): Not less than 68 degrees F and not exceeding 86 degrees F.
7. Ambient Storage Temperature Rating (Other Than Batteries): Not less than minus 4 degrees F and not exceeding 158 degrees F.

8. Ambient Temperature Rating (Batteries): Not less than 68 **degrees F** and not exceeding 86 **degrees F**.
  9. Ambient Storage Temperature Rating (Batteries): Not less than **zero degrees F** and not exceeding **104 degrees F**.
  10. Humidity Rating: Less than 95 percent (noncondensing).
  11. Off-Line Overload Capability: 1.1 times base load current for 60 seconds; minimum of 1.8 times base load current for 3 seconds.
- E. Inverter and Controls Logic: Microprocessor based, isolated from power circuits; provides complete self-diagnostics, periodic automatic testing and reporting; with alarms.
- F. Controls and Indication:
1. Status Indication: Door-mounted, labeled LED indicators or digital screen displaying following conditions:
    - a. Normal power available.
    - b. Status of system.
    - c. Battery charging status.
    - d. On battery power.
    - e. System fault.
    - f. External fault.
  2. Remote Signal Interfaces:
    - a. Remote Indication Interface: Minimum of one programmable (Form C) dry-circuit relay output (120V ac, 2A) for remote indication of following.
      - 1) Fault or status indication.
      - 2) On bypass.
      - 3) Low battery.
- G. Self-Protection and Reliability Features:
1. Input transient protection by means of SPDs to provide protection against damage from supply voltage surges as defined in IEEE C62.45, Category B and C.
  2. Integral, programmable, self-diagnostic and self-test circuitry; with alarms and logging.
  3. Battery deep-discharge and self-discharge protection; with alarms.
  4. Battery self-test circuitry; with alarms and logging.
- H. Integral Input Disconnecting Means and OCPD: Thermal-magnetic circuit breaker, complying with UL 489.
- I. Inverter:
1. Description: Solid-state, high-frequency, PWM type, with following operational features:
    - a. Automatically regulate output voltage to within plus or minus 3 percent, for load ranges and for maximum 25 percent step-load changes; regulation may increase to 8 percent for 100 percent step-load changes.

- b. Automatically regulate output frequency to within plus or minus one hertz, from no load to full load, at unity power factor, over operating range of battery voltage.
  - c. Output Voltage Waveform: Sine wave with maximum 3 percent TDD throughout battery operating-voltage range, for 100 percent linear load.
  - d. Load Power Factor: 0.5 lead to 0.5 lag.
  - e. Inverter Overload Capability: 115 percent for 10 minutes; 150 percent surge for 10 seconds.
- J. Rectifier/Battery Charger:
  - 1. Description: Solid state, variable rate, temperature compensated; automatically maintains batteries in fully charged condition when normal power is available.
  - 2. Maximum Battery Recharge Time from Fully Discharged State: 24 hours.
  - 3. Low-voltage disconnect circuit reduces battery discharge during extended power outages, monitors battery voltage, and disconnects inverter when battery voltage drops to no less than 85.7 percent of nominal voltage.
- K. Batteries:
  - 1. Description: Standard VRLA batteries. Capable of sustaining full-capacity output of inverter unit for minimum of 90 minutes.
  - 2. Battery Disconnect and OCPD: Manufacturer's standard.
- L. Maintenance Bypass Systems:
  - 1. Maintenance Bypass Mode: Internal; manual operation only; bypasses central battery equipment power circuits (inverter and transfer switch); requires local operator selection at central battery equipment. Transfer and retransfer shall be break-before-make, with temporary disrupting power to load.
  - 2. Bypass Overload Capability: 1.5 times base load current.
- M. Integral Output Disconnecting Means and OCPD: Single-Output OCPD: Thermal-magnetic circuit breaker, complying with UL 489; manufacturer's standard ratings based on unit output ratings.

## **2.2 ENCLOSURES**

- A. Central Battery Equipment Enclosures: NEMA 250, to comply with environmental conditions at installed location.
  - 1. Dry and Clean Indoor Locations: Type 1 steel cabinets with access to components through hinged doors with flush tumbler lock and latch.
  - 2. Finish: Manufacturer's standard baked-enamel finish over corrosion-resistant prime treatment.

## **2.3 OPTIONAL AND ACCESSORY FEATURES**

- A. Factory-Installed Options and Accessories: Audible alarm with silencer switch.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas, surfaces, and substrates to receive central battery equipment, with Installer present, for compliance with requirements for installation tolerances, structural support, ventilation, temperature, humidity, and other conditions affecting performance of Work. 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 equipment before installation. Reject equipment that is wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Coordinate layout and installation of central battery equipment with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Floor-Mounted Central Battery Equipment: Install central battery equipment on **4-inch** nominal-thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch** centers around full perimeter of concrete base.
  - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Comply with NECA 1.
- E. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

### **3.3 CONNECTIONS**

- A. Connections: Interconnect system components. Make connections to supply and load circuits per manufacturer's wiring diagrams unless otherwise indicated.
- B. Ground equipment per Section 260526 "Grounding and Bonding." Separately Derived Systems: Make grounding connections to grounding electrodes and bonding connections to metallic piping systems as indicated; comply with NFPA 70.
- C. Connect wiring per Section 260519 "Low-Voltage Power Conductors and Cables."

### **3.4 CONTROL WIRING INSTALLATION**

- A. Bundle, train, and support wiring in enclosures.

### **3.5 IDENTIFICATION**

- A. Identify central battery equipment, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label central battery equipment with engraved nameplates.
  - 3. Label each separate cabinet, for multi-cabinet units.
  - 4. Label each enclosure-mounted control and pilot device.
- B. Operating Instructions: Frame printed operating instructions for central battery equipment, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of central battery equipment units.

### **3.6 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Acceptance Testing Preparation:
  - 1. Inspect and Test Each Component:
    - a. Inspect wiring, components, connections, and equipment installations. Test and adjust components and equipment.
    - b. Test insulation resistance for external branch circuit, feeder, control, and alarm wiring connected to central battery equipment element and component.
    - c. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Inspect central battery equipment, wiring, components, connections, and equipment installation. Test and adjust components and equipment.



2. Test insulation resistance for external branch circuit, feeder, control, and alarm wiring connected to central battery equipment element and component.
  3. Test continuity of each circuit.
  4. Verify that input voltages and frequencies at central battery equipment locations are within voltage and frequency limits specified in Part 2. If outside this range, notify Construction Manager and Owner before closing input OCPDs.
  5. Perform each visual and mechanical inspection and electrical test stated in manufacturer's written instructions and in NETA Acceptance Testing Specification, including specifically those for batteries and battery chargers, regardless of type of central battery equipment provided. Certify compliance with test parameters.
  6. Perform load-duration test at rated voltage and rated output current to verify correct functional operation of unit under full-load stable operating conditions for minimum time limits required by UL 924. Monitor and record ambient temperature and temperatures within unit.
  7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  8. Perform following infrared (thermographic) scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared scan of central battery equipment. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform additional follow-up infrared scan of central battery equipment 11 months after date of Substantial Completion.
    - c. Instruments and Equipment: Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Central battery equipment will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports, including certified report that identifies central battery equipment and describes test results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

### **3.7 STARTUP SERVICE**

- A. Engage factory-authorized service representative to perform startup service. Complete installation and startup checks per manufacturer's written instructions.

### **3.8 ADJUSTING**

- A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and before Substantial Completion.

- B. Set field-adjustable switches, auxiliary relays, and other adjustable parts.
- C. Adjust trip settings of thermal-magnetic circuit breakers with adjustable, instantaneous-trip elements; install fuses if not factory installed.
- D. Set automatic system test parameters.
- E. Set field-adjustable, circuit-breaker trip ranges as specified in Section 260573.16 "Coordination Studies."

### **3.9 PROTECTION**

- A. Temporary Heating: Apply temporary heat to maintain temperature per manufacturer's written instructions until controllers are ready to be energized and placed into service.
- B. Replace central battery equipment whose interiors have been exposed to water or other liquids before Substantial Completion.

### **3.10 DEMONSTRATION**

- A. Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain central battery equipment, and to use and reprogram microprocessor-based control, monitoring, and display functions.

### **END OF SECTION**