

SECTION 26 09 11

~~~ PROJECT NOTE ~~~~~

ARCHITECT OF RECORD/ENGINEER OF RECORD IS RESPONSIBLE FOR REVIEWING THIS SPECIFICATION SECTION IN DETAIL FOR COORDINATION WITH THE PROJECT SCOPE OF WORK.

ALL "PROJECT NOTE" TEXT IS TO BE REMOVED FOLLOWING REVIEW OF THE CONTENT OF EACH NOTE BY THE ARCHITECT OF RECORD/ENGINEER OF RECORD.

EDIT THE DOCUMENT FOOTER TO INCLUDE THE PROJECT NAME AND NUMBER.

EDIT THE DOCUMENT HEADER TO INDICATE THE ARCHITECT OF RECORD PROJECT ISSUE" DATE. THE "CPS CONTROL" DATE SHOULD NOT BE EDITED.

ANY MODIFICATIONS TO THE TECHNICAL STANDARDS IN THIS SECTION - INCLUDING THE REMOVAL OR ADDITION OF MANUFACTURERS - MUST BE APPROVED BY CPS.

REQUESTS FOR MODIFICATION ARE TO BE SUBMITTED TO THE DESIGN MANAGER DURING THE DESIGN PHASE FOR REVIEW AND APPROVAL.

~~~ END OF PROJECT NOTE ~~~~~

BATTERY MONITORING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. complete and operational system to monitor a condition of the emergency lighting uninterruptible power supply batteries.

1.02 REFERENCE STANDARDS

- A. Chicago Electrical Code - Municipal Code of the City of Chicago, Building/Electrical Code Requirements; 2018.
- B. ISO 9001 - Quality management systems -- Requirements; 2015.
- C. UL 61010-1 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
 - 2. Include detailed technical description of the measurements performed and basis for the Battery condition analysis.
 - 3. Include installation requirements including operational temperature and cooling loads.
- B. Shop Drawings: For each system:
 - 1. Include dimensioned plans, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

- a. Each installed system type and details.
 - b. Nameplate legends.
 - c. Features, characteristics, and factory settings of the controllers.
 2. Wiring Diagrams: Wiring for the system installation. Generic wiring diagrams will not be considered. Provide schematic wiring diagram for each bank of batteries and control module.
 3. Describe all optional features, equipment and software.
- C. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around controller.
- D. Qualification Data: For manufacturer: Manufacturer shall be capable of supply and delivery of spare parts for the system up to seven years from the date of installation.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For Battery monitoring system, all installed components to include in emergency, operation, and maintenance manuals. In addition to items specified in Sections 01 77 00 - Closeout Procedures and 01 78 00 - Closeout Submittals, include the following:
1. Routine maintenance requirements for Battery monitoring system and all installed components.
 2. Manufacturer's written instructions.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
1. Currently registered and certified by National Quality Approval Agency to ISO 9001.
 2. Maintain, within 50 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Source Limitations: Obtain Battery monitoring controller, sensors and wiring through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Chicago Electrical Code Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with the City of Chicago Electrical Code.
- E. Comply with UL 61010-1.
- F. Comply with UL1015 for sensing harness cables.
- G. Product Selection for Restricted Space: Drawings indicate maximum dimensions for system controller, including clearances between controller, and for adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver Battery monitoring system components in original factory packaging.
- B. Store Battery monitoring system components indoors in clean and dry space with uniform temperature and relative humidity to prevent condensation.

- C. Cover Battery monitoring system components to protect them from exposure to weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials. Install electric heating of sufficient wattage to prevent condensation.
- D. Handle Battery monitoring system components to avoid damage.
- E.

~~~ PROJECT NOTE ~~~~~

**PROJECT CONDITIONS FOR RENOVATION AND ADDITION PROJECT SCOPES ONLY AND TO NOT BE USED FOR NEW CONSTRUCTION.**

~~~ END OF PROJECT NOTE ~~~~~

1.06 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Board or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Architect/Engineer of Record and Board's representative no fewer than seven days in advance of proposed interruption of electrical service.
 - 2. Indicate method of providing temporary electrical service.
 - 3. Do not proceed with interruption of electrical service without Architect's and Board's representative written permission.

1.07 COORDINATION

- A. Coordinate layout and installation of Battery Monitoring System with other construction including Batteries layout, conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.08 EXTRA MATERIALS

- 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.
 - 1. Spare Fuses: Furnish one spare for every five installed, but no fewer than three of each type and rating.
 - 2. Sensing harness: one for every ten installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - 1. BTECH, Inc.
 - 2. NDSL Cellwatch, Inc.

2.02 SYSTEM DESCRIPTION

- A. The system shall consist of sensors to monitor voltage, internal impedance, temperature and current of every individual cell and complete Battery.
- B. The system shall include all hardware, software, cabling and other necessary components to permit safe and reliable collection, processing and display of the Battery condition data and fault conditions.

- C. Functional features. Battery monitoring system shall:
 - 1. Conduct trend analysis of Battery performance using impedance measurements of each unit on the individual cell level.
 - 2. Conduct measurements with a test load current.
 - 3. Trigger alerts for a rise of impedance on comparisons with actual baseline measurements taken for each individual cell, unit or jar being monitored when first installed.
 - 4. Monitor, record data and provide alerts on Battery string voltage, cell/jar voltage; individual cell/jar temperature.
 - 5. Monitor ambient room temperature, float, and Battery string discharge currents.
 - 6. Conduct all tests while the Battery system is on line.
 - 7. Provide programmable Form C SPDT alarm contacts to transmit alarm data.
 - 8. Monitor DC plant discharges due to insufficient AC power, record and archive total Battery, unit voltage decay, and current during a discharge.
 - 9. Fully interface with a remote PC for data archiving and trending.
 - 10. Process all data digitally for enhanced accuracy and repeatability over time.
 - 11. Do not interfere in any way with the capability of the Battery to supply its full load at any time, including during a measurement cycle, and do not perform charge compensation on individual cells.
 - 12. Do not discharge the batteries in any form during the measurement cycle; i.e. do not bring the voltage of the cells below the Battery's defined open circuit voltage. Abort measurements if a voltage below this value is measured.
- D. The system shall be modular in design, and sized to the Battery by manufacturer.
- E. Include a factory designed wiring set with safety fuses on each voltage sensing lead to protect the equipment and service personnel.
- F. The system shall be self-contained and shall function and provide alarms, record and store all pertinent data without a personal computer or external memory devices. The system shall have an at-a-glance LED display.
- G. Provide factory configured text setup file covering all specific details related to the Battery system being monitored, including voltage settings recommended by the Battery suppliers. No field calibrations or dip switches shall be required. All module addressing shall be automatic with a self-learning function.

2.03 SYSTEM REQUIREMENTS

- A. Data Presentation
 - 1. Measurements shall be displayed as they are made. Battery site shall also be viewed in real-time in a graphical format for individual unit volts, total volts, and individual unit temperatures and current.
 - 2. Standard communications shall include provisions for data to be transmitted over a telephone line, Ethernet, hard wired short range modem, or direct RS232 serial connection, USB port, at the Board's option. The system shall provide six (6) user programmable dry contacts for user interface.
 - 3. System shall be capable of providing data via Modbus over TCP/IP.
 - 4. Four (4) digital inputs shall be available for integration of other binary alarms, with corresponding information included with the Battery monitoring data.
- B. Measurement Capability
 - 1. Voltage
 - a. Total Battery voltage: 0 to 600V.
 - b. Cell or unit voltage range: 1 to 16 Vdc.
 - c. System, individual cell/unit voltage and current out on discharge.
 - 2. Cell/unit Impedance: 100 microOm to 10 milliOm.

3. Temperature: Ambient and Pilot Cell
 - a. Present alarm thresholds, low 32°F; high 130°F.
 4. Event logging
 - a. Date, time of alarm.
 - b. UPS discharge current, system voltage.
 - c. Calculated power and individual unit cell voltage.
 - C. Measurement Accuracy
 1. Total Battery Voltage: $\pm 0.1V$
 2. Cell or Unit Voltage: $\pm 0.01V$
 3. Cell or Unit Impedance: ± 0.01 milliOM
 4. Temperature: $\pm 1F$
 5. Relative Humidity: 10-90% RH, non-condensing
 6. Date and Time: ± 1 second
 - D. Monitoring Capacity
 1. The Battery monitoring system shall be equipped with enough sensing inputs to monitor each Battery cell. In the case of multiple cell jars, connection of sensing inputs at the jar level is the required method.
 - E. Unit LED Indicators (TRI-MODE RG/R/Y)
 1. "Normal" - Power is On
 - F. System LED Indicators (TRI-MODE R/Y/R)
 1. Three summary alarm LED indicators to display MINOR, MAJOR and EQUIPMENT alarms.
 2. Flashing - performing a measurement cycle.
- 2.04 POWER REQUIREMENTS
- A. The system shall be powered by 120 Vac, 60 Hz.
- 2.05 SOFTWARE
- A. Software: "Windows" based software package.
 - B. Functional Features. Software shall:
 1. Communicate remotely with the controller via modem, or Ethernet, or locally via direct RS232 serial connection or USB on the front panel, to acquire and archive the measured data, recall and sort it, print and/or plot it, and facilitate the observance of trends in the data which signify deteriorating conditions, allowing remedy before actual failure occurs.
 2. Provide the capability of remotely changing preset alarm thresholds.
 3. Capable of managing multiple Battery monitoring systems and be able to auto poll each system on a programmed schedule from a modem connection, Ethernet collection or a combination thereof.
 4. Include real time monitoring mode to allow a graphic presentation of real time voltage, temperature and discharge data during a discharge test or live discharge.
 5. Automatically operate the functions of the Battery monitoring system. Monitor the Battery monitoring system for abnormal function.
 6. Provide a communication path to a host computer system. Messages sent from the Battery monitoring system controller shall inform the host of each Battery's status. These messages shall be directly interpreted as real time information about the system's ability to provide power.
 7. Include the following, manageable locally or remotely:
 - a. Setting of test intervals.

- b. Setting of alarm set points.
 - c. Configuration of Battery monitoring system.
- C. Provide common remote alarm contacts to annunciate Battery fault conditions and internal fault conditions.
- D. Provide event and test result-logging capabilities to facilitate trending of Battery performance. The log files shall be remotely accessible through the remote computer interface brought to the engineer's office.
- E. All access to internal data log files, alarm set points, etc., via the front panel and through the remote computer interface shall be password protected.

2.06 CONTROL PANEL

- A. Multiple module type enclosure.
- B. Cabinet: Welded, heavy gauge metal construction suitable for wall mounting, NEMA1.
- C. User Interface: The Battery monitoring system cabinet shall include a front panel display and user interface, which will allow the user to monitor the following parameters:
 - 1. On-line "normal" indicator.
 - 2. Alarm indicator (internal fault and each Battery).
 - 3. Measurements in progress.
 - 4. Measurement display.
 - 5. Alarm set points.
 - 6. Test interval.
- D. Internal Wiring: All internal wiring shall be UL listed. Wiring layout shall be installed to minimize the coupling of electrical noise between circuits.

2.07 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested, system controller before shipping.

2.08 ENVIRONMENTAL REQUIREMENTS

- A. Ambient Operating Conditions: Battery monitoring system shall operate continuously at temperatures from 0°C to 40°C, and relative humidity between 5% and 95%, non-condensing.

2.09 BATTERY SENSING HARNESS

- A. Custom fabricated by the manufacturer of the Battery monitoring system to connect the monitor to each Battery.
- B. All sensing harness wiring shall be UL listed. Install to minimize the coupling of electrical noise onto the wiring harness. Sensing harness leads shall be fused.
- C. Terminate with female disconnects terminating onto terminals affixed to the battery post.
- D. Stainless steel clamps may be used.
- E. Clearly label all harness leads.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and surfaces to receive motor-control centers for compliance with requirements, installation tolerances, and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 2. Meet with the manufacturer or an authorized manufacturer's representative at the site prior to ordering installation material. The site review must include the installer, the manufacturer, and the Battery plant owner to ensure proper coordination. Routing of sense lead lengths is to be determined at the initial site visit by agreement of the parties.

3.02 INSTALLATION

- A. Install Battery monitoring system per manufacturer's instructions.
- B. Connect the Battery monitoring system inputs to each cell of the Battery inverter system and connect the power system input to a provide source (provide fused switch or breaker in panelboard as required).
- C. Connect the Battery monitoring system remote alarm contacts to the systems remote alarm annunciator.
- D. Connect sensor harnesses per manufacturer's installation instructions.
- E. Connect the sensing leads as provided by the system manufacturer to each unit of the UPS battery. For multiple cell jars, connect at the jar level.
- F. The Impedance Load Harness to be protected and dressed in wire trays mounted on wall above the battery or within the battery rack as defined by the manufacturer's installation instructions.
- G. Conduit and wiring installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.
- H. Ground equipment according to Section 26 05 26 - Grounding and Bonding for Electrical Systems.

3.03 IDENTIFICATION

- A. Identify Battery monitoring system control, components and sensing harnesses according to Section 26 05 53 - Identification for Electrical Systems.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Board's maintenance personnel to adjust, operate, and maintain components of the Battery Monitoring System. Refer to Section 01 79 00 - Demonstration and Training.
- B. The following topics shall be included:
 - 1. Operation.
 - 2. Diagnosis.
 - 3. Trending.
 - 4. Alarm status.
 - 5. Data retrieval.
 - 6. Interpretation of Battery data.

7. Use of data and system to troubleshoot batteries.

3.05 CLEANING

- A. Remove paint splatters and other spots, dirt and debris. Touch up scratches and marks and finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

3.06 CONTRACTOR STARTUP AND REPORTING

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
 1. Inspect installation of harnesses, connections, and equipment installation and adjust controllers, components, and equipment.
 2. To assist in field testing of equipment including setting and adjusting of default limits.
 3. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 1. Perform each electrical test and visual and mechanical inspection. Certify compliance with test parameters.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION 26 09 11