

SECTION 33 72 33.43 – SUBSTATION BATTERY, BATTERY CHARGER, AND BATTERY RACK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.
- B. Section 13 34 23.23 - Fabricated Substation Control Enclosures
- C. Section 23 75 00 – Substation Enclosure HVAC Equipment
- D. Section 26 24 16 - Panelboards
- E. Section 26 51 23 - Substation Interior Lighting and Receptacles
- F. Section 26 36 00 – Power Switching and Control Devices
- G. Section 33 72 33 36 – Cable Tray and Wireway for Utility Substations
- H. Section 33 72 33 33 – Raceway and Boxes for Utility Substations
- I. Section 33 72 33.16 - Relay Switchboards
- J. Section 33 72 43 11 - Substation Wire, Cable and Accessories

1.02 SUMMARY:

- A. This Section includes the substation batteries, battery charger, battery rack, and accessories.

1.03 REFERENCE STANDARDS:

- A. Applicable Standards:
 - 1. Institute of Electrical and Electronics Engineers (IEEE):
 - a. 450 - Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications.
 - b. 484 - Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications.
 - c. 485 - Recommended Practice for Sizing Lead-Acid Batteries for Stationary Application.
 - d. 535 - Standard for Qualification of Class 1E Vented Lead Acid Storage Batteries for Nuclear Power Generating Stations.
 - e. 693 - Recommended Practice for Seismic Design of Substations.
 - f. 946 - Recommended Practice for the Design of DC Power Systems for Stationary Applications.
 - g. 1188 - Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications.
 - h. 1578 - Recommended Practice for Stationary Battery Electrolyte Spill Containment and Management.
 - i. 1818 - Guide for the Design of Low Voltage Auxiliary Systems for Electric Power Substations.
 - j. 2405 – IEEE Standard for the Design of Chargers Used in Stationary Battery Applications.
 - k. C37.90.1 - IEEE Standard for Relays, Relay Systems, and Control Devices used for Protection and Control of Electric Power Apparatus--Surge Withstand Capability (SWC) and Electrical Fast Transient (EFT) Requirements and Tests
 - 2. National Fire Protection Association (NFPA):
 - a. 70 - National Electrical Code.

1.04 COMPLIANCE SUBMITTALS:

- A. Include, but are not limited to, the following:

SECTION 33 72 33.43 – SUBSTATION BATTERY, BATTERY CHARGER, AND BATTERY RACK:
continued

1. Physical outline drawings.
2. Schematic diagrams.
3. Wiring diagrams.
4. Technical information such as overall dimensions, weight and ratings, etc.
5. Catalog Cut Sheets.
6. Nameplate and cover engravings.
7. Instruction books.
8. Seismic Qualification Report shall be included as required per IEEE 693.
9. The battery warranty period.
10. Recommended storage practices for each piece of equipment.

1.05 QUALITY ASSURANCE:

- A. Supplier shall have an ISO 9001, ISO 14001 and ISO 45001 certified Quality Assurance Program covering quality control and assurance measures. The ISO certified program shall be imposed by Supplier on the Work within the scope of these Specifications and upon sub-suppliers.
- B. The Supplier shall furnish equipment and materials meeting the specified ratings and performance at the altitude and ambient temperatures specified.
- C. Material requirements
 1. Any deviations require written approval from the Purchaser prior to starting fabrication.
 2. It is the responsibility of the Supplier to verify that all materials, components, and sub-components are in accordance with the requirements specified in this section and all other referenced technical sections.

PART 2 - PRODUCTS

2.01 SERVICE CONDITIONS:

- A. Equipment to be supplied under this specification will be installed inside enclosure and shall be suitable for satisfactory continuous operation under the following conditions.
 1. Maximum temperature (Degree F) 80
 2. Minimum Temperature (Degree F) 55
 3. Relative Humidity (percent) 10 to 95
 4. Maximum altitude above mean sea level (Meter) 1000.

2.02 SUBSTATION BATTERY:

- A. Ratings:
 1. Type: **VLA (Vented Lead Acid)**
 2. Nominal voltage (DC): **125 VDC**
 3. Voltage operating range: **105 to 139.5 VDC**
 4. Number of cells: **60 Cells**
 5. Load Profile Requirements:

Load (Amperes)	Duration (Minutes)
108.46	1
6.66	59
9.86	180
9.86	239
24.86	1

SECTION 33 72 33.43 – SUBSTATION BATTERY, BATTERY CHARGER, AND BATTERY RACK:
continued

6. Minimum Capacity: **200AH**
7. Nominal Specific Gravity: **VENDOR STANDARD** Kg/l at rated capacity.
8. Seismic Qualification: **IEEE 693 "Low"**
- B. Battery Construction:
 1. The Supplier shall provide the maximum short circuit current of each battery along with the safe duration in seconds which it can withstand.
 2. Negative plates shall be heavy duty, durable flat grid plate using lead alloy.
 3. The microporous separators shall be of synthetic material permitting free flow of electrolyte and not effected by the chemical reaction inside the cell. The internal resistance factor of the separators shall assure high discharge characteristics under all operating conditions. Housing and covers of heat-resistant, shock-absorbing self-extinguishing material (limited oxygen index of 28 or higher), non-absorbent and resistant to the acid with low water vapor permeability polycarbonate. They shall be sufficiently prudent against deformation under internal operating pressures and within the extreme temperature range.
 4. Cover and case O-rings of nitrile rubber with epoxy sealing shall be used for proper sealing of bushings for permanent leakproof bond.
 5. Terminal posts
 - a. Two terminal posts per cell with all necessary interunit and interstep connectors and lugs.
 - b. Terminal posts shall be suitably sealed leak-proof to prevent the escape of acid spray, using sealing compound or another suitable means.
 - c. Terminal posts of each cell shall be accessible for voltage and intercell connection readings.
 - d. The positive and negative terminals shall be clearly marked for easy identification.
 - e. All terminal posts shall have a plan area of at least one square inch.
 6. Connectors
 - a. Nickel plated solid copper intercell connectors shall be used for connecting adjacent cells and rows.
 - b. All interunit and interstep connectors shall be bolted type.
 - c. All connector bolts, nuts, etc., shall be made of stainless steel and of 5/16-inch minimum diameter. Stainless steel washers shall be provided for installation under each bolt head and/or nut.
 - d. All terminals and cell inter-connectors shall have insulation shrouds.
 - e. Inter-rack and inter-tier jumpers of cable shall be sufficient size to allow no more than a .075 volt drop while the battery is supplying its highest rated current.
 7. Vented Lead Acid (VLA) in addition to above requirements also:
 - a. The cells shall be flooded type containing sufficient reserve electrolyte.
 - b. Housing plastic jars shall be sealed, transparent with permanent, leak-proof vented covers are required to facilitate checking of electrolyte level. Once the battery is installed the electrolyte levels, all plate edges, sediment spaces of all cells shall be visible. In case of two step racks sediment spaces of the cells on the back step may be viewed using mirror from behind the rack.
 - c. Each Cell shall be fitted with one Acid Level-indicating float with High and Low electrolyte levels permanently marked on all sides.

SECTION 33 72 33.43 – SUBSTATION BATTERY, BATTERY CHARGER, AND BATTERY RACK:
continued

- d. The regulating valve type design shall be of self-resealing type.
 - C. Testing
 - 1. The Supplier shall perform capacity test by time adjusted method in accordance with IEEE 484 or IEEE 1188 accordingly to verify at least 90% of rated capacity.
- 2.03 SUBSTATION BATTERY ACCESSORIES:
- A. Battery Rack:
 - 1. Tier: **Two Tier**
 - 2. Step: **Two Step**
 - 3. Rack shall be constructed to house the batteries specified in Article 2.02 above.
 - 4. Constructed of acid-resistant powder coated steel and painted with two coats of acid-resistant gray paint.
 - 5. Seismic Qualification: **IEEE 693 "Low"**
 - B. Furnish one each of the following:
 - 1. Cell to Cell connectors (conductor or straps) with the following requirements:
 - a. Sized to carry full battery ampacity.
 - b. Appropriate quantity to facilitate all cell-to-cell connections.
 - c. Facilitates all cell-to-cell connections when batteries are set in selected battery rack.
 - 2. Cell lifter for cells more than 50 lbs.
 - 3. Anti-corrosion compound for battery connections.
 - 4. Portable hydrometer syringe.
 - 5. Vent plug hydrometer syringe.
 - 6. Vent hole thermometer.
 - 7. Set of connection bolt wrenches.
 - 8. Set of cell numbers.
 - 9. Funnel and Jug.
 - C. Spill Containment and Safety Equipment
 - 1. Spill containment appropriately sized to the battery rack.
 - 2. Neutralizing pillows
 - 3. Self-contained eye wash station.
 - 4. Safety goggles, apron, and gloves as manufactured by Norton Safety Products or approved equivalent.
- 2.04 SUBSTATION BATTERY CHARGER:
- A. Ratings:
 - 1. Input:
 - a. AC Voltage: **240 VAC**
 - b. Phase: **Single Phase**
 - c. Frequency of 60Hz
 - 2. Output:
 - a. Float Voltage: Adjustable from **120 to 143 VDC**.
 - b. Equalize Voltage: Adjustable from **133 to 145 VDC**.
 - c. Current: **25A**
 - 3. Seismic Qualification: **IEEE 693 "Low"**
 - B. Charger requirements

SECTION 33 72 33.43 – SUBSTATION BATTERY, BATTERY CHARGER, AND BATTERY RACK:
continued

1. The battery chargers shall be designed, manufactured, tested and supplied in accordance with the IEEE 2405 and IEEE C37.90.1 standards. The latest revisions of these reference standards shall be used.
2. Designed for continuous duty with natural convection cooling, the maximum temperature rise of any component shall be less than 55 °C. If fans are required, this shall be clearly stated with the submission.
- C. Charger Protection
 1. A DC adjustable current limit circuit factory set at 110% of the rated DC output current shall be provided, adjustable from 50% to 110%. The battery charger will automatically return to normal operation when the short is corrected.
 2. Provide properly sized two-pole disconnecting means of isolating the chargers from the load.
 3. During AC power failure or charger malfunction, design shall prevent battery from discharging back through the filter and rectifier.
 4. Failure of any component within the power supply will not result in the output of a higher than rated voltage or current.
- D. Charger enclosure
 1. Mounting: Wall Mounted
 2. Enclosure NEMA Rating: NEMA 3
 3. Enclosure shall be rigid, completely assembled, enclosed construction, made of steel and vermin proof.
 4. Provide at least two grounding connections on the enclosure.
 5. The panel shall have hinged doors with concealed type hinged locks and latches.
 6. All doors shall be gasketed with neoprene rubber.
 7. Louvers shall be provided with galvanized iron (G.I) wire screens and filters.
 8. Space heaters of adequate capacity shall be provided inside each cabinet to prevent moisture condensation.
 9. All equipment mounted inside the cabinet shall be labeled.
 10. Easy access to finger safe terminal blocks shall be provided such that they can be accessed without powering down the battery charger. Separating plate between terminals for different voltages or functions shall be provided.
 11. All instruments, status indicators, and controls shall be placed easily visible. All warning labels shall be clearly visible when any of the cabinet doors are open.
 12. All adjustments controls shall be behind the lockable cabinet doors.
- E. Include the following features and equipment:
 1. Output DC Voltmeter and Ammeter
 2. Input AC Failure Alarm Relay (PLR)
 3. Ground Detector Switch (GDS)
 4. Output DC Failure Alarm Relay (LVR)
 5. Output DC High-Voltage Relay (HVR)
 6. Current limiting protection to limit short circuit directly on charger output terminals.
 7. DC Output Filter, which complies to the limits specified in IEEE 2405
 8. Eliminator Filter
 9. Alarm board with two sets of form C contacts for each alarm. Alarms Fully Wired to Barrier Type Terminal Block.
 10. Certified Test Data
 11. Cabinet Heater
 12. Provision communications for the following:

SECTION 33 72 33.43 – SUBSTATION BATTERY, BATTERY CHARGER, AND BATTERY RACK:
continued

- a. Serial
- b. Ethernet

PART 3 - EXECUTION

3.01 EQUIPMENT STORAGE

- A. All equipment outlined in this spec shall be stored as recommended by equipment manufacturer.

END OF SECTION 33 72 33.43