PART 1 – GENERAL

1.01 SECTION INCLUDES

A. General
B. Batteries
C. Battery Chargers
D. DC/DC Converters
E. Battery racks and ventilation system
F. DC Distribution Panelboards
G. Molded Case Circuit Breakers
H. Finishes
I. Local and Remote Alarm Annunciation
J. Emergency Eyewash
K. Spill Containment System
L. Accessories
M. Factory Installation
N. Factory Acceptance
O. Wiring, Terminations and Conduit Work
P. Grounding
Q. Field Installation
R. Field Touch-Up
S. Installation Verification, Field Functional and System Integration Testing
T. Cleaning
U. Demonstration and Training
V. Closeout Procedures
1.02 RELATED SECTIONS

A. Refer to the following Sections for requirements:

1. Section 01 45 24 Testing Program Requirements
2. Section 01 33 00 Submittal Procedures
3. Section 01 33 23 Shop Drawings, Product Data, and Samples
4. Section 01 43 00 Quality Assurance
5. Section 01 45 00 Quality Control
6. Section 01 74 14 Cleaning
7. Section 01 77 00 Closeout Procedures
8. Section 01 78 23 Operation and Maintenance Data
9. Section 01 78 39 Project Record Documents
10. Section 01 78 44 Spare Parts and Maintenance Manuals
11. Section 01 79 00 Demonstration and Training
12. Section 20 50 13 Raceways for Facility Services
13. Section 26 05 24 Low Voltage Wires and Cables
14. Section 26 24 24 Circuit Breakers and Panel Boards
15. Section 34 21 01 General Requirements for the Traction Power System
16. Section 34 21 05 Prefabricated AC and DC Equipment Houses and Related Equipment
17. Section 34 21 07 Prefabricated Portable Substations
18. Section 34 21 50 Common Materials and Methods for Traction Power
19. Section 34 21 60 Grounding and Bonding for Traction Power
20. Section 34 21 70 Traction Power Facilities Installation Requirements
21. Section 34 21 75 Traction Power Facility System Factory Functional Testing
22. Section 34 21 80 Traction Power System Field Acceptance Testing
1.03 MEASUREMENT AND PAYMENT

A. Separate measurement and payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.04 REFERENCES

A. Activities shall be in accordance with the following codes, standards, and specifications except as provided otherwise herein. Where requirements conflict with requirements specified herein or elsewhere in the Contract the more restrictive requirements shall apply.

B. Institute of Electrical and Electronics Engineers (IEEE):

1. IEEE 450 IEEE Recommended Practice for Maintenance, Testing, and Replacement of Ventilated Lead-Acid Batteries for Stationary Applications

2. IEEE 484 IEEE Recommended practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications

3. IEEE 485 IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications

C. International Safety Equipment Association (ISEA):

1. ISEA/ANSI Z358.1 American National Standard for Emergency Eye Wash and Shower Equipment

D. National Electrical Manufacturers Association (NEMA):

1. NEMA AB1 Molded Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures

2. NEMA 250 Enclosure for Electrical Equipment (1,000 Volts Maximum)

3. NEMA PB 1 Panelboards

4. NEMA PE 5 Utility Type Battery Chargers

E. National Fire Protection Association (NFPA):

1. NFPA 70 National Electrical Code

F. Underwriters’ Laboratories, Inc (UL)

1. UL 67 Standard for Safety Panelboards
1.05 SUBMITTALS

A. Refer to the following Sections for additional requirements:

1. Section 01 33 00 Submittal Procedures
2. Section 01 33 23 Shop Drawings, Product Data, and Samples
3. Section 01 78 23 Operation and Maintenance Data
4. Section 01 79 00 Demonstration and Training
5. Section 34 21 01 General Requirements for the Traction Power System
6. Section 34 21 75 Traction Power Facility System Factory Functional Testing
7. Section 34 21 80 Traction Power System Field Acceptance Testing

B. Submit the following documents for equipment and materials specified herein and provided under the Contract for the DC control power system:

1. Shop Drawings, including but not limited to, the following:

   b. Physical arrangement drawings (including dimensions), and weight of equipment and major components.
   c. Complete unit wiring diagrams.
   d. Mounting locations and supports for equipment mounted in the cabinets and enclosures.
   e. Shop Drawings showing space available for conduit entrance, knockout locations, and for routing and training of cables. Available space shall take into consideration bending radius requirements of cables.
   f. Interconnection diagrams for circuits having externally located instruments, controls, alarms, and similar devices.

2. Product data: Submit product data for the battery, battery chargers, 125 V DC / 24 V DC converter, 125 V DC / 125 V DC converter, DC distribution panels, circuit breakers, battery rack, spill containment system, special installation tools, and accessories. Product data shall include product description, bill of materials, and detailed technical specifications.

3. Seismic calculations for the battery charger and battery rack assembly approved by California registered structural engineer.

4. Electrical design calculations for sizing the equipment based upon the electrical load at each traction power facility including:
a. Power consumption calculations: Estimated average power/current and peak power/current demand shall be provided for the 125 V DC and 24 V DC (if applicable) control power systems.

b. Battery, Battery Charger, and DC/DC Converter Sizing Calculations: Battery, converter and charger sizing shall be in accordance with the applicable IEEE Standards, and shall meet the requirements of this Section.

c. Number of battery cells, number of strings, nominal voltage, amp-hours of each cell, electrolyte information, battery unit short-circuit currents.

5. Certificates from manufacturers verifying that equipment conforms to specified requirements.


7. Factory acceptance test documentation (e.g. test plan and procedures, data sheets, reports) per Section 01 45 24, Testing Program Requirements.

8. Final accepted DC control power system field acceptance test records, used as baseline equipment verification of condition.

9. Installation Manual and Drawings

a. Installation manual shall include, but not limited to the following:

   1) A table of contents that shall identify pages of the manual by revision and date.

   2) The installation practices and procedures that the Contractor plans to use to accomplish the installation of the DC control power system and associated materials detailed in this Section. Documentation shall be kept current.

   3) A list of installation drawings by number, revision, title and approval status and a copy of each drawing reduced to B size (11 by 17 inches).

   4) Quality control procedures associated with the transportation and installation of the DC control power system and associated materials.

   5) Installation verification procedures and data sheets.

   6) Staging and implementation plans.

   7) Recommended maintenance equipment cycles and procedures.

10. Installation verification and field functional test documentation (e.g. procedures, data sheets, reports) per Section 34 21 80, Traction Power System Field Acceptance Testing.

11. System integration test documentation (e.g. procedures, data sheets, reports) per Section 34 21 80, Traction Power System Field Acceptance Testing.

12. Spare Parts List: Refer to Section 01 78 44, Spare Parts and Maintenance Materials for requirements.
13. O&M Manuals (Systems): Refer to Section 01 78 23, Operation and Maintenance Data for requirements.

14. Training Materials: Refer to Section 01 79 00, Demonstration and Training for requirements.

15. Warranty Certification.

1.06 QUALITY CONTROL, QUALITY ASSURANCE, AND SUPPLIER QUALIFICATIONS

A. Refer to Section 34 21 01, General Requirements for the Traction Power System; and Section 34 21 70, Traction Power Facilities Installation Requirements, for requirements.

B. The system and components shall conform to IEEE 485, NEMA 250, NEMA AB1, NEMA PB1 and UL 67.

1.07 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 34 21 70, Traction Power Facilities Installation Requirements, for requirements.

B. Refer to Section 34 21 07, Pre-Fabricated Portable Substations, for additional requirements for portable substations.

C. Equipment shall be handled and stored in conformance with manufacturer's instructions. One copy of these instructions shall be included with the equipment at time of shipment.

1.08 GENERAL REQUIREMENTS

A. Refer to Section 34 21 01, General Requirements for the Traction Power System, for requirements.

1.09 WARRANTY

A. Warranty for the batteries and battery chargers shall be provided and signed by the manufacturer and installer agreeing to correct system deficiencies and replace components that fail in materials or workmanship.

B. Batteries shall have a warranty of one year from the date the battery is placed into revenue service and an additional warranty of 19 years, pro rata, to deliver not less than 80 percent of its rated capacity. The battery chargers shall have a warranty of one year from the date the battery charger is placed in service.
PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. The DC Control power system shall be manufactured by any of the following:

1. Alpha Industry Power
2. C and D Technologies
3. EnerSys
4. Kawasaki
5. Or equal

2.02 GENERAL

A. DC control power system shall include primary input circuit breaker, DC circuit
breakers, isolation transformers, batteries, battery charger (AC-DC), voltage
converters (DC-DC), batteries, battery rack, molded case circuit breakers,
DC distribution panel, spill containment system, and related wiring and accessories
as specified herein and the Contract Drawings.

B. The input voltage to the DC control power system shall be as indicated, single
phase, 60 Hz. The output voltage shall be 125 V DC.

C. Ratings:

1. Ratings shall be determined by the Supplier.
2. The DC control power systems shall be designed for continuous operation at the
specified rating, for 24 hours a day, 365 days a year operation.
3. The DC control power systems shall be sized per IEEE 485.

D. Environmental Conditions: The batteries and battery chargers shall be suitable for
operation under the following ambient temperature ranges:

1. Operating Temperature Range: -7 degrees C to 40 degrees C
2. Maximum daily average temperature: 30 degrees C

E. DC control power systems shall be provided with neutralization consisting of a
liquid-light spill-control barrier of sufficient volume and absorbent neutralizing pads of
sufficient capacity to contain the electrolyte from the largest cell in the array and
raise its pH to the range of 7.0 to 9.0.

F. Ground enclosure door(s) to the enclosure by means of a visible, flexible copper
grounding strap.
G. Provide nameplates showing enclosure and component number.

H. Proper terminal identification shall be provided.

I. “Danger Electrical Hazard” warning signs shall be placed on access panels and doors.

J. Refer to the Contract Drawings, for additional identification requirements.

2.03 BATTERIES

A. The battery and its associated charger shall be connected in parallel. The charger, in addition to charging the battery, shall carry the continuous connected load. The battery shall supply the remainder of the heavy short-time current demands. When the AC supply to the charger is interrupted, the battery shall supply the required power for the specified load duty cycle.

B. The batteries shall be of heavy-duty, deep-cycle, maintenance free mono-block (multiple cells in a jar) design. The battery mono-blocks shall:

1. Be flooded lead-calcium with a minimum of 20 years design life under normal usage for the intended duty. Batteries shall be designed for float service.

2. Be valve-regulated lead acid type for portable substations, with a minimum of 20 years’ design life under normal usage for the intended duty. Batteries shall be designed for float service. Batteries shall not vent gas under normal operation.

C. Batteries shall consist of enough cells to provide specified output voltage. The battery shall accept a charging voltage as indicated with a tolerance of plus 12 percent (140 V DC) or minus 44 percent (70 V DC) as design operating range.

D. Batteries shall be able to support also one trip-close-trip cycle for 34.5 kV circuit breakers or vacuum fault interrupter, and 1200 V DC circuit breakers at any time during the 8-hour charger-down period, and provide acceptable operating voltage to 125-volt and 24-volt devices at the end of the period.

E. Batteries shall be rated to supply the high discharge rates necessary to close and trip electrically operated DC circuit breakers after the battery has supplied, without assistance from a charging source, the lower discharge rates required for the indicating lights, electronic relays and communication devices in the traction power facility, with the battery charger being out of service for eight hours.

F. Battery Capacity:

1. Determine the size of the batteries for each traction power facility in accordance with IEEE 485.

2. Batteries shall have ampere-hour capacity to provide rated power and acceptable voltage to connected equipment and devices for eight hours.
3. Battery capacities shall be adequate for the following load duty cycle over a period of eight hours from a fully charged state with the battery charger out of service:

   a. Normal continuous demand of traction power facility’s ancillary loads including relays, indicating lamps, control and annunciator panel, and supervisory control circuits.

   b. After eight hours, trip, close, and trip AC and all DC circuit breakers of the TPSS.

   c. Each positive and negative cell assembly shall be designed for the required battery duty and a long-life cycle. Cell elements shall be supported from projections in the bottom of the cell container or from the cover.

G. Cells shall have a specific gravity range as indicated in manufacturer’s recommendation plus or minus 0.02 at 77 degrees Fahrenheit, when fully charged.

H. Cells shall be provided with insulated intercell connectors. Batteries shall be provided with terminal plates and lugs as required. Connectors, plates, and lugs shall be lead-plated solid copper. Hardware shall be stainless steel hex nuts and washers. Provide non-conductive covers for battery terminals.

I. Cell Containers:

   1. The individual cell housing shall be molded, heat-resistant, flame-retardant, durable, impact resistant cases and shall not deteriorate or become cloudy upon exposure to the electrolyte.

   2. The cell covers shall be cemented in place to provide a permanent leak-proof seal.

   3. Polarity of cell terminal posts shall be clearly and permanently identified.

   4. Electrolyte level lines shall be marked on all four sides of the cell housing.

   5. Each cell shall be provided with a filler opening fitted with an explosion resistant vent.

   6. Each battery cell container shall be legibly and permanently marked with the following information:

      a. Manufacturer’s name.

      b. Battery type.

      c. Cell number and type.

      d. One-minute, one-hour, and eight-hour ampere ratings.

      e. Month and year of manufacture.

      f. Ampere-hour capacity.
J. Nameplates: Each battery shall be legibly and permanently marked with the following:

1. Manufacturer’s name.
2. Battery and cell type.
3. One-minute, one-hour, and eight-hour ampere ratings.
4. Month and year of manufacture.
5. Ampere-hour capacity for eight hours.

2.04 BATTERY CHARGERS

A. Battery chargers shall be completely automatic, silicon-controlled rectifier, convection cooled, and constant voltage, complying with NEMA PE 5.

B. Battery charger enclosure shall be NEMA 250, Type 1. Enclosure shall be provided with a hinged front panel complete with lockable handle and two-point latches, minimum.

C. The chargers, in addition to charging the battery, shall carry the continuous load and non-continuous current demands such that battery charger can operate as a DC power supply without batteries, and without affecting the normal operation of any of the equipment that is supplied by the DC battery system.

D. Battery chargers shall be rated as follows:

1. Capacity: In accordance with its associated battery size and continuous DC load.
2. Recharging: Shall be able to recharge the battery from 1.75 V per cell to 85 percent of the battery capacity in 8 hours, maximum.
3. Output Current: In accordance with its battery size and continuous DC load.
4. Regulation: Plus or minus 1 percent of output DC voltage over its complete load range with plus or minus 10 percent variation of input AC voltage.
5. Current Limiting: Adjustable from 90 to 115 percent; factory set at 110 percent of output nominal current rating.

E. Each battery charger shall be furnished with the following accessories:

1. One DC voltmeter, 0 to 200 V.
2. One DC ammeter, range as applicable.
3. One AC input pilot light marked AC POWER ON.

4. One selector switch two positions marked FLOAT and EQUALIZE.

5. Two ground detection alarm relays, positive and negative, for local and remote supervisory annunciation.

6. One AC input molded-case circuit breaker, NEMA AB 1.

7. One DC output molded-case circuit breaker, NEMA AB 1.

8. One equalizing time charger, 0 to 72 hours, to terminate a manually set adjustable equalizing charge of 2.33 V per cell.

9. One DC failure alarm relay for local and remote supervisory annunciation.

10. One AC failure alarm relay for local and remote supervisory annunciation.

11. DC over voltage alarm relay.

12. Temperature compensated charging based on monitoring of battery temperature.


15. Space heaters.

2.05 DC/DC CONVERTERS

A. General: Subject to the equipment vendor’s design, provide in each traction power facility a DC/DC converter with N+1 redundancy for reliability. DC/DC converters shall be of modular design with built-in automatic current sharing feature that provides the continued rated power output with failure of any one module. Converter design shall allow for “hot” replacement of modules. Key features of the DC/DC converter shall be as follows:

1. Input voltage: 125 V DC nominal. The converter’s acceptable input voltage range shall be coordinated with the 125 V DC control power system, so that the batteries float voltage and deep discharge levels are within the acceptable limits.

2. Output voltage: Output voltage shall be per the Contract Drawings with adjustment capability.

3. Power rating: To be determined by the Contractor, so that the DC/DC converter provides a minimum of 25 percent spare capacity when operating in N modules configuration.

4. Efficiency: Eighty percent at full load, or higher.

5. Output Ripple/Noise: Less than 1.5 percent of the output voltage, peak to peak.
6. Operating Temperature Range: Minus 10 degrees C to plus 55 degrees C.

7. Protection: Over-voltage, over temperature, reverse input voltage.

8. Indications and Controls: At a minimum, each DC/DC converter module shall have local LED indications for normal operations, local and remote trouble alarms, and a means to adjust the output voltage level. Converter module failure shall be indicated to the C02 panel. Refer to Contract Drawings for additional requirements.

9. Meters: Voltmeter and ammeter for measuring voltage and current on the output side shall be provided. The meters may be either separate for each module, or common for the entire converter.

10. As shown on the Contract Drawings, the input side of each DC/DC converter unit circuit in the N+1 configuration shall be connected to an independent circuit breaker in the main 125V panel and shall utilize separate cables for the entire run from the main panel to the converter unit. The output side of the side of each DC/DC converter unit circuit in the N+1 configuration shall likewise be connected to an independent circuit breaker through separate cables.

2.06 BATTERY RACKS AND VENTILATION SYSTEM

A. Batteries shall be provided with two-tier two-step structural steel support racks. Battery racks shall be provided with insulating plastic strips to cover supports, hold-downs, and restraining rails that are in contact with the battery cells. The exposed perimeter of the battery racks shall be covered with removable non-metallic acid-resistant barriers to preclude storage of foreign metallic objects.

B. Battery racks and associated anchorage shall be designed to meet the seismic requirements as specified in Section 34 21 01, General Requirements for the Traction Power.

C. A forced air ventilation system composed of fan, ducting and an exterior hood, shall be provided to remove all potentially explosive gases from the traction power facility batteries and vent it directly to the outside. Hood shall effectively prevent backflow of wind through the louver.

D. Provide an airflow switch in the ventilation duct to disable the battery bank upon loss of ventilation. The airflow switch shall be provided with two (2) Form C contacts for activating the battery bank circuit breaker and to provide remote annunciation via SCADA.

2.07 DC DISTRIBUTION PANELBOARDS

A. Refer to Section 26 24 24, Circuit Breakers and Panelboards, for additional requirements.
B. DC panelboards shall be suitable for 2-wire, 125 V DC and 24 V DC ungrounded power distribution service. Panelboard shall be equipped with main and branch circuit breaker type disconnects complying with NEMA PB1 certified to UL 67.

C. DC panelboard circuit breaker ratings shall be determined by the Supplier. Provide at least 20 percent spare of each branch circuit breaker rating and at least one of each size.

D. Panelboards shall be surface mounted, dead-front type, housed in a NEMA Type 12 steel enclosure with hinged front cover, lockable handle, and two-point latch, minimum.

E. A moisture resistant circuit identification typewritten chart with electrical loads, shall be provided and attached to the inside face of the cover.

F. Establish the required current rating of the control power distribution panelboards, including their supplied distribution loads for each DC control power system.

G. Each panelboard shall be provided with main incoming terminal lugs and main circuit breaker.

H. Panelboards shall be provided with the required number of branch circuit breakers, circuit breaker ratings and number of poles, based on the following control power distribution requirements:

1. 34.5 kV AC switchgear line-up or vacuum fault interrupter.
2. 1,200 V DC switchgear.
3. Rectifier-transformers and rectifiers.
4. Control and HMI panel.
5. Cabinets.
6. Miscellaneous low voltage electrical loads associated with the traction power facility and adjacent electrical loads. Refer to Contract Drawings for additional requirements.

2.08 MOLDED CASE CIRCUIT BREAKERS

A. Provide two (2) two-pole molded case circuit breakers, one (1) circuit breaker to be installed between the set of batteries and the line side of the DC panelboard main circuit breaker and one (1) circuit breaker to be installed between the battery charger DC output circuit breaker and the line side of the DC panelboard main circuit breaker as indicated. The circuit breakers shall provide overload and short circuit protection for the battery system and main cables to the DC distribution panelboard. The circuit breakers rating shall be coordinated with the DC output circuit breaker of the battery charger. The circuit breakers shall be mounted in a NEMA Type 12 enclosure.
B. Nameplates shall be mounted on the front of the enclosure and shall contain identification of circuit breaker type, style number, and short circuit ratings.

C. Accessories:

1. Lugs: Suitable for number, size, and conductor material.

2.09 FINISHES

A. Battery racks shall be treated with at least two coats of acid and alkaline resistant paint.

B. Equipment shall be cleaned, primed, and finish painted in accordance with the manufacturer’s standard specifications, suitable for indoor service.

2.10 LOCAL AND REMOTE ALARM ANNUNCIATION

A. Provide local fault indications for each battery system as applicable:

1. Loss of 125V DC control voltage, Device No. 27.

2. Loss of 24V DC control voltage, Device No. 27.

3. Battery system overvoltage, Device No. 59.

4. Battery charger overload, Device No. 51.


6. Loss of battery ventilation air flow, Device No. 63 AF.

7. DC/DC converter module failure, Device Nos. 26, 46 and 59.

8. Ground fault detected, Device 64G.

B. Refer to the Contract Drawings for remote fault indications for DC control systems.

2.11 EMERGENCY EYE WASH

A. Refer to Section 22 40 00, Plumbing Fixtures for requirements.

B. For portable substations, provide a portable eye-wash unit with twin spray heads 38 liter stainless steel tank automatic pressure control, push-to-operate valve and pressure gauge. Product shall be in conference with CAL/OSHA Industrial Safety orders and ANSI/ISEA Z358.1.

2.12 SPILL CONTAINMENT SYSTEM

A. Electrolyte resistant spill containment system shall be provided under each battery rack, extending not less than 12 inches outside the rack.
2.13 ACCESSORIES

A. One set of the following accessories shall be provided at each traction power facility:

1. Removable, transparent, non-conductive battery rack guards shielding top and all sides of battery rack.

2. Thermometer.

3. Hydrometer with holder.


5. Cell lifting sling, complete with strap and spreader.


7. Quart of terminal grease.

8. Set of special tools, if required.

9. Set of cell identification numbers.

2.14 FACTORY ASSEMBLY

A. Fabricate each DC control power system with equipment, devices, accessories, and appurtenances in place for a fully functioning and operable DC control power system.

B. Arrange the battery and rack assembly to provide easy access to each battery cell for maintenance and replacement. No equipment shall be installed above the battery rack and within 12 inches of battery rack horizontal footprint.

C. The minimum unobstructed horizontal clearance between the DC control power system enclosure and adjacent equipment and structures shall comply with the NEC.

D. Install the DC control power system secure, level with stainless steel shims (if required), plumb and in true alignment with related adjoining work. Secure the DC control power system to the floor / wall in accordance with equipment vendor’s recommendations and the approved seismic design.

E. Install supporting members, fastenings, framing, hangers, straps, bolts, and angles as required to set and rigidly connect the DC control power system.

F. Control erection tolerance requirements so as not to impair the strength, safety, serviceability, or appearance.

G. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not available, use those specified in UL 486 A&B.

2.15 FACTORY ACCEPTANCE TESTING
A. Refer to Section 34 21 80, Traction Power System Field Acceptance Testing, for additional requirements.

B. Prior to scheduling factory acceptance test to be witnessed by the Engineer, ensure:

1. Each DC control power system and enclosures are completely fabricated and assembled per the approved equipment vendor design.

2. Identifiers shall be installed.

3. DC control power systems shall be cleaned.

C. In addition to manufacturer’s standard tests, perform factory tests on equipment provided under this Section in accordance with ANSI, NEMA, and IEEE standards. Check control and power wiring, correct connections against the approved Shop Drawings, insulation resistance, and freedom from shorts and grounds.

D. Batteries: Required factory tests specified in IEEE 450 and including the following:

1. Temperature rise test.

2. Power loading at 100 percent capacity for 24 hours at 90 degrees F and 90 percent humidity.

E. Battery Charger:

1. Functional test and demonstration of functions, controls, indicators, sensors, and protective devices.

2. Dielectric test.

3. Circuit operation test.

4. No-load test.

5. Full-load test.


F. DC/DC Converter Test

1. Functional test and demonstration of functions, control, indicators, and protective devices.

2. Efficiency.

3. Input / output voltage levels.
2.16  WIRING, TERMINATIONS, AND CONDUIT WORK

A. Refer to the following Sections for requirements:

1. Section 20 50 13 Raceways for Facility Services.
2. Section 26 05 24 Low Voltage Wires and Cables.

2.17  GROUNDING

A. Refer to Section 34 21 60, Grounding and Bonding for Traction Power Facilities, for the grounding and bonding requirements.

PART 3 – EXECUTION

3.01  FIELD INSTALLATION

A. DC control power system, materials, and appurtenances shall be installed as recommended by the manufacturer.

B. Refer to the following Sections for additional requirements:


C. Provide anchor bolts and anchorage items as required, and field check to ensure proper alignment and location. Provide templates, layout drawings, and supervision at the jobsite to ensure correct placing of anchorage items in pre-engineered building or on concrete for equipment delivered loose. Check embedded items for correctness of location and detail before concrete is placed.

D. Confirm the DC control power system equipment and associated materials are in conformance with the approved Shop Drawings prior to placement.

E. Install the DC control power system secure, level with stainless steel shims (if required), plumb and in true alignment with related adjoining work. Secure the DC control power system to the floor / wall in accordance with equipment vendor’s recommendations and the approved seismic design.

F. Install supporting members, fastenings, framing, hangers, straps, bolts, and angles as required to set and rigidly connect the DC control power system.

G. Provide temporary bracing, guys, and other devices as required accomplishing erection and to provide safety and stability until work is in final position and approved.

H. Control erection tolerance requirements so as not to impair the strength, safety, serviceability, or appearance.
I. The DC control power system located in damp or wet locations, shall be placed and equipped so as to prevent moisture or water from penetrating and accumulating within the enclosure.

J. The minimum unobstructed horizontal clearance between the DC control power system enclosure and adjacent equipment and structures shall comply with the NEC and CEC.

K. Arrange the battery and rack assembly to provide easy access to each battery cell for maintenance and replacement. No equipment shall be installed above the battery rack and within 12 inches of battery rack horizontal footprint.

L. Verify the DC control power system and associated materials are correctly installed in accordance with the approved installation manual and drawings.

M. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not available, use those specified in UL 486 A&B.

N. Protect the DC control power system and associated materials during field installation and field testing activities. Repair or replace items damaged at no cost.

O. Complete the installation and cleaning of the DC control power system, associated materials and conduits before starting wire / cable installation.

P. Thoroughly clean the DC control power system per the manufacturer’s recommendations prior to installation verification and field testing.

Q. Interconnect indication functions specified in this Section to the C02 panel for local and remote operation / monitoring. Refer to the Contract Drawings and Section 34 21 33, Traction Power Control, Monitoring and Display Panel, for additional requirements.

R. Refer to Section 34 21 70, Traction Power Facilities Installation Requirements, for additional requirements.

3.02 FIELD TOUCH-UP

A. Remove paint splatters and other spots.

B. Clean and repaint damaged interior and exterior surface coatings of the DC control power system enclosures and racks with the same coating system used in the factory, using touch up paint provided by the manufacturers.

C. Painting shall follow closely the recommendations of the paint manufacturers. Provide the appearance of a new installation prior to Acceptance.

3.03 INSTALLATION VERIFICATION, FIELD FUNCTIONAL AND SYSTEM INTEGRATION TESTING.
A. Refer to Section 34 21 80, Traction Power System Field Acceptance Testing, for requirements.

3.04 CLEANING
A. Refer to Section 01 74 14, Cleaning, for additional requirements.

3.05 DEMONSTRATION AND TRAINING
A. Refer to Section 01 79 00, Demonstration and Training for additional requirements.
B. Supplier shall ensure that a factory-authorized service representative provides equipment demonstration and training for the District’s maintenance personnel to adjust, operate, and maintain the DC control power system and associated equipment.

3.06 CLOSEOUT PROCEDURES
A. Refer to Section 01 77 00, Closeout Procedures; and Section 01 78 39, Project Record Documents, for requirements.

END OF SECTION 34 21 40