SECTION 26 33 01

DC BATTERY SYSTEM

PART 1- GENERAL

1.01 SECTION INCLUDES:

A. Batteries.

B. Battery Rectifier/Chargers.

C. Fused disconnect switch and circuit breaker.

D. DC Distribution panel.

1.02 MEASUREMENT AND PAYMENT:

A. General: DC battery system, as specified herein, will not be measured separately for payment but will be paid for as part of the Contract lump-sum price for the related electrical or electronic systems work as indicated in the Bid Schedule of the Bid Form.

1.03 REFERENCES:

A. American National Standards Institute (ANSI)

1. Z358.1 Emergency Eye Wash and Shower equipment

B. American Society for Testing and Materials (ASTM)

1. ASTM B187 Standard Specifications for Copper stock

C. Institute of Electrical and Electronics Engineers (IEEE)

1. 450 IEEE Recommended Practice for Maintenance Testing, and Replacement of Ventilated Lead-Acid Batteries for Stationary Applications.
2. 484 IEEE Recommended Practice for Installation Design and Implementation of Vented Lead-Acid Batteries for Stationary Applications
3. 485 IEEE Recommended Practice for Sizing Lead Acid Batteries for Stationary applications.

D. National Electric Manufacturing Agency (NEMA)

1. 250 Enclosure for Electrical Equipment (600 Volts)
2. AB1 Molded Case Circuit Breakers
3. PB 1 Panel Boards
4. PB 1.1 Instructions for installations and Maintenance of Panel Boards

E. National Fire Protection Association (NFPA)

1. 70 National Electrical Code

F. Underwriters Laboratories (UL)

1. UL 67-88 Standards for safety Panelboards

1.04 SUBMITTALS:

Submit the followings:

A. Manufacturer's product description, catalog data and information.

B. Manufacturer's arrangement, wiring and detail drawing.

C. Power consumption calculations. Estimated average power and peak power demand shall be provided.

D. Battery and battery charger sizing calculations.

E. Product data and catalog cuts for battery, battery chargers and fused disconnect switches.

F. Certificates:

1. Factory trained manufacture's representative(s) shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacture's recommendations. The contractor shall provide three (3) copies of manufacture's representative's certification.

G. Supplier Qualifications:

1. The manufacture of the batteries and battery charger must have a minimum of 5 years of manufacturing experience.

2. Battery and battery chargers shall be proven standard products, or equivalent to the standard products of manufacture's engaged in the production of such equipment for at least the past five (5) years.

1.05 QUALITY ASSURANCE:

Battery and charger components, devices and accessories shall be listed and labeled as defined in NFPA 70. The system and component shall conform to IEEE 485, NEMA 250, AB1, PB1 and UL 67-88.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Batteries shall be delivered dry charged. Accessories including electrolyte, shall be packed in separate shipping cartons.

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

1.07 PROJECT / SITE CONDITIONS:

A. The batteries and battery charger shall be suitable for the operation under the following conditions

Ambient Temperature Ranges:

1.	Minimum temperature	-7ºC
2.	Maximum daily temperature	+40ºC
3.	Maximum daily average temperature	+30ºC

1.08 WARRANTY:

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

B. Batteries shall have warranty of one year from the date of the battery is placed in service and additional warranty of 9 years, pro rata, to deliver not less than 90% 0f its rated capacity.

C. The battery charger shall have a warranty of one year from the date of battery charger placed in service.

PART 2-PRODUCTS:

2.01 SYSTEM REQUIREMENTS:

A. General:

1. The battery systems shall include a primary input circuit breaker, isolation transformer, batteries, battery charger, dc filter, battery racks, fused disconnect switch, dc distribution panel, and related accessories as specified herein.

2. For UPS Battery System see section 26 34 37 for Battery Rectifier/Charger specifications.

3. Battery racks shall be designed for the seismic zone in accordance with applicable requirements of the California Building Code and the California Electrical Code.

4. Battery system shall be installed in a ventilated room. A forced air ventilation system composed of fan, ducting and a hood properly sized, shall be provided to remove all potentially hazardous gases from the battery racks and vent it directly to the outlet.

5. Provide the air flow sensors and associated electronics and monitoring circuits which will provide local alarming and remote alarming to Operation Control Center (OCC) via Supervisory Control And Data Acquisition (SCADA)

6. Battery system shall be sized to provide additional 20% capacity over the calculated equipment power.

7. The battery system shall be installed in sliding tray battery module cabinet to allow all maintenance to be performed quickly and easily from the front of the system. All interface cables and accessories for batteries and battery cabinets shall be provided for installation as a complete system. Each battery slide tray shall be automatically disabled from the system when slide tray is pulled for the service.

B. MANUFACTURERS:

All components of each system shall be supplied by one manufacturer. Battery component shall be manufactured by following:

1. C and D Power System
2. Yuasa-Excide Power Inc
3. Or Approved Equal

C. BATTERIES:

1. The batteries shall be of heavy-duty, sealed, and maintenance-free design with solid copper, lead-plated posts in individual cells. The batteries shall have the following:

    a. The battery cells shall be sealed valve regulated lead acid type with a minimum of 10 years of life under normal usage for intended duty.

    b. The battery consists of individual cells in molded, flame-retardant, durable and impact resistant cases.

    c. The battery cell posts shall be bolted with lead plated copper bars using stainless steel hex-head nuts.

    d. The battery cells warranted free from defects in materials and workmanship for five years.

    e. The batteries shall consist of sufficient number of cells to provide nominal floating voltage as specified in the Contract.

f. The battery capacity shall be sized in accordance with IEEE 485. Contractor shall establish the required capacity in rated ampere-hours (as specified for that location) discharge rate to 1.75 V per cell at 77ºF.

g. No venting of any gas under normal operation.

h. The battery cells shall be provided with sealed pressure relief and flame arrester.

i. As an alternative, maintenance free batteries shall be acceptable if it meet the technical requirements as specified in this specification.

D. RATINGS:

1. The battery voltage rating shall be as indicated with a tolerance of plus 16 percent or minus 12 percent. Battery shall have ampere-hour capacity to provide rated power to all connected equipment and devices for as specified hours.

2. The battery shall be able to retain full capacity during long term float service without maintenance.

3. The battery shall be sized to provide full operation as specified in the Contract at 50°C ambient without charger.

4. Complete battery system dimensions as specified in the Contract.

5. The battery shall be able to start up after AC supply failure. The line breaker must be closed before charger voltage is restored.

E. CELL CONTAINMENT:

1. The individual cell housing shall be heat-resistant and shall not deteriorate or become cloudy upon exposure to the electrolyte.

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

3. Cell terminal posts shall be clearly and permanently identified. Electrolyte level lines shall be marked on all four sides of the cell housing.

F. NAME PLATE:

1. Each battery shall be legibly and permanently marked with the following:

a. Manufacturer's name

b. Battery and cell type

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

d. Month and year of manufacture

e. Ampere-hour capacity for as specified hours

G. ACCESSORIES:

1. A set of accessories shall be provided for each set of batteries, which shall include the following:

   a. One cell-lifting sling, complete with strap and spreader

   b. One battery log-book

   c. One quart of terminal grease

   d. One set of special tools, if required

   e. Set of identification numbers

   f. One rack mounted thermometer for battery temperature

H. BATTERY RECTIFIER-CHARGER:

1. Battery rectifier/chargers shall be fully regulated, silicon-controlled rectifier, convection-cooled, constant-voltage type complying with NEMA PE 5. The charger shall be rated for operation in the voltage level and number of phases as indicated in the Contract Drawings.

2. 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.

3. The chargers shall be able to operate as a DC power supply without batteries.

4. Battery charger shall be rated as follows:

a.	Capacity	In accordance with its associated battery size and continuous DC load
b.	Recharging	Shall be able to recharge the fully discharge battery capacity in 6 hours
c.	Output current	In accordance with its battery size and continuous DC load.
d.	Regulation	± 1% of output DC voltage over its complete load range with ± 10% variation of input AC voltage.
e.	Current limiting	Adjustable from 90 to 115%, factory set at 110% of output normal current rating.

5. The charger, in addition to charging the battery, shall carry the continuous load, while the battery supplies all of the heavy, non-continuous current demands

6. The battery chargers shall be equipped with the following features

    a. One DC voltmeter (voltage as specified in the contract)

    b. One DC ammeter, range as applicable

    c. One AC input pilot light marked AC POWER ON.

    d. Float-equalize switch

    e. Float and equalizing voltage adjusting potentiometer

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

    g. AC input molded case circuit breaker, NEMA AB1

    h. DC output molded case circuit breaker, NEMA AB1

    i. Output DC failure alarm relay, for local and remote supervisory annunciation (SCADA)

    j. AC failure alarm relay, for local and remote supervisory annunciation

    k. Surge and transient protection

    l. DC high-low voltage alarm relay

    m. DC output thermal-magnetic circuit breaker

    n. Battery monitoring system shall provide early warning of battery failure and equalization of charge current to each battery cell

    o. Space heaters, as required

I. EMERGENCY EYE WASH:

1 Provide an eye wash unit with twin spray heads, automatic pressure control, push to operate valve, pressure gauge and drainage. Product shall be in conformance with CAL OSHA Industrial Safety Orders and ANSI Z358.1.

J. FUSED DISCONNECT SWITCH AND CIRCUIT BREAKER:

1. A two-pole hand-operated fused disconnect switch shall be provided between the battery and the battery charger

    a. The fuses shall comply with NEMA FU 1 and shall provide short circuit protection for the battery system and main cables to the DC distribution panel.

    b. The fuse rating and switch shall be coordinated with the dc output circuit breaker of battery charger.

    c. The fused disconnect switch and fuse shall be mounted in a surface mounted NEMA Type 12 enclosure.

    d. The fused disconnect switch shall be provided with two normally open (NO) and two normally closed (NC) contacts for monitoring and interlocks.

2. Circuit breakers shall be NEMA AB 1 molded case, quick-break, bolt on type, with thermal-magnetic type overload trip, suitable for AC/DC operations.

K. DC DISTRIBUTION PANELBOARDS:

1. General

    a. The DC distribution panel boards shall comply with the requirements of UL 67, NEMA 250, NEMA AB 1 and NEMA PB 1.

    b. Each distribution panel board shall contain a main power circuit breaker and branch circuit breaker with spacer blanks and bus provision for future branch circuit breaker installation, as shown on Contract drawing.

    c. The panel board shall be in NEMA Type 1 door-in-door enclosure made of galvanized steel, for surface mounting with multiple knockouts and wiring gutters.

    d. Each distribution panel board shall be provided with a swinging door with full length piano hinge and a flush spring latch.

    e. The open door shall expose the dead front circuit breaker handle and circuit breaker card directory.

    f. Interior component shall be mounted on back plate of reinforce steel for rigid support and accurate alignment.

    g. A moisture resistance circuit identification chart shall be furnished and attached to the inside face of the cover.

2. Electrical Requirements:

a. The panel boards shall be rated for short circuit of 10,000 amperes interrupting rating minimum and be equipped with two pole molded case circuit breakers and positive and negative bus bars.

b. Bus bars shall be ASTM B187, 98% conductive copper, with silver plated contact surface.

L. FINISHES:

1. The battery racks shall be treated with at least two coats of alkaline gray paint.

2. The distribution panel shall be cleaned, primed and finish painted in accordance with the manufacture's standard specifications, suitable for indoor service. The color of exterior finish paint shall be ANSI 61 gray polyester powder finish or equal unless otherwise directed by District.

M. SOURCE QUALITY CONTROL:

1. GENERAL

a. Notification of Test: The District shall be notified not less than 30 days in advance of dates schedule for test. Test procedure shall be approved by the District prior to the dates of schedule tests.

b. Test Program Plan**:** Submit a plan identifying the approach to be used for accomplishing the required shop tests. The projected schedule for the test and test execution, and submittal of the test results shall be included.

c. Test Procedures: The test procedures shall include as a minimum:

1). Objective and scope

2). Test set up

3). Test equipment to be used

4). Personnel required for the test

5). Estimated duration of the test

6). Pass/fail criteria

7). Samples of data sheets to be used.

8). Test procedures shall be submitted not less than 30 days prior to test.

2. Test Results: Test results will be reviewed and accepted by the District representative as submittal or additional tests are required. If additional tests are required because the test results submitted do not comply with the requirements

of the specifications, the retesting is to be documented and submitted to the District as a part of the work.

3. Test Reports: Test reports shall document the results obtained and be certified by manufacturer. Report shall include the following:

   a. Equipment tested including model and serial numbers

   b. Title of the test

   c. Objective of the test and pass/fail criteria

   d. Summary and conclusion

   e. Location and date of test

   f. Test methods and equipment used for the test

   g. Results including calculations and other supporting data

   h. Abbreviations and references

   i. Signature of the test supervisor and witnesses.

4. Test Witnessing**:** The District reserve the right to witness all tests including factory tests conducted elsewhere by Contactor, its suppliers, or by an independent agency. If District determines not to witness a test or tests, test report shall be submitted to District for review. Test reports shall be signed by all witnessing parties.

5. Test Equipment: Provide annually certified calibrated test equipment, instruments, tools and other required items necessary to perform the test indicated.

N. REPLACEMENT MATERIALS:

1. Replace or repair equipment, parts and materials that are rejected, damaged, lost, or consumed during performance of shop tests. Replacement materials shall be new and warranted.

O. FACTORY TESTS:

1. Factory test shall be including design and production tests performed by the Contractor, its supplier, or a testing agency prior to the shipment of the equipment. Unless otherwise indicated, the District may waive the requirements for design tests upon review of test procedures, test results and/or certified documentation of like equipment. Tests results on like equipment or materials shall be submitted for design tests which are to be waived.

P. Factory Test: Factory test shall be performed to include the following tests for the DC control power supply.

1. Temperature rise test

2. Power loading at 100% capacity for 24 hours at 32ºC and 90% humidity

PART 3-EXCUTION:

3.01 INSTALLERS:

The Contractor shall install the battery and battery charger including the associated devices in the train control battery rooms or other BART facilities with the manufacturer's recommendations and as shown the Contract Drawings

3.02 EXAMINATION:

The Contactor shall examine areas and conditions for compliance with requirement of DC Control Power system

3.03 INSTALLATION:

A. The installation of dc distribution panelboards shall comply with the requirements of NEMA PB 1.1

B. Battery and Battery Charger:

1. The battery shall be mounted on a two tier, two step racks.

2. The racks shall be bolted to the floor and wall, and shall satisfy the mounted requirements to satisfy the specified seismic zone.

3. The battery and rack assembly shall be arranged to provide easy access to each battery cell for maintenance and replacement.

4. The battery charger shall be installed as indicated on the Contract Drawings.

3.04 FIELD QUALITY CONTROL:

A. Power distribution test shall verify that the energy at all level is available and is properly distributed to the equipment requiring power in the train control rooms and other BART facilities. The test shall include verification:

1. No grounds, short circuits, open circuits, or misplaced wiring exists in the power distribution system.

2. Standby, reserve and battery power circuitry are complete and operate properly.

3. Output AC power supplies, provide the correct voltage levels and phasing where required, record voltages

4. Output DC power supplies, provide the correct voltage levels and correct polarity, record voltage and loads.

5. Adjustable transformer or voltage regulators are adjusted correctly.

6. Ground fault detectors are operating correctly.

3.05 CLEANING:

On completion of installation, the Contractor shall inspect the battery and battery charger and ancillary equipment. The contractor shall remove paint splitters and other spots. The Contractor shall remove excess materials, vacuum dirt and debris. The Contractor shall repair exposed surfaces to match original finish.

3.06 DEMONSTRATION:

A factory authorized service representative shall demonstrate operation of equipment for the District's maintenance personnel to adjust, operate and maintain DC power system controls, protective devices, instrumentation and accessories.

END OF SECTION 26 33 01