PART 1 – GENERAL

1.01 SECTION INCLUDES

A. General Requirements
B. Enclosure
C. Buses and Bus Connections
D. Fittings
E. AC Busway Rating
F. AC Busway Structural Supports

1.02 RELATED SECTIONS

A. Refer to the following Sections for requirements:

1. Section 01 33 00 Submittal Procedures
2. Section 01 33 23 Shop Drawings, Product Data, and Samples
3. Section 01 74 14 Cleaning
4. Section 01 77 00 Closeout Procedures
5. Section 01 78 23 Operation and Maintenance Data
6. Section 01 78 39 Project Record Documents
7. Section 01 79 00 Demonstration and Training
8. Section 05 12 00 Structural Steel Framing
9. Section 34 21 60 Grounding and Bonding for Traction Power
10. Section 34 21 01 General Requirements for the Traction Power System
11. Section 34 21 05 Prefabricated AC and DC Equipment Houses
12. Section 34 21 21 Transformer-Rectifier Units
13. Section 34 21 50 Common Materials and Methods for Traction Power
14. Section 34 21 70 Traction Power Facilities Installation Requirements
1.03 MEASUREMENT AND PAYMENT

A. Separate measurement and payment will not be made for work required under this Contract Specifications 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 herein. Where requirements conflict with requirements specified herein or elsewhere in the Contract the more restrictive requirements shall apply.

B. American National Standards Institute (ANSI):
   1. IEEE C37.23 Standard for Metal-Enclosed Bus

C. National Electrical Manufacturers Association (NEMA):
   1. NEMA BU1 Busways

D. Underwriters Laboratories (UL):
   1. UL 857 Standard for Safety Busways

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 45 24 Testing Program Requirements
   4. Section 01 78 23 Operation and Maintenance Data
   5. Section 01 79 00 Demonstration and Training
   6. Section 34 21 01 General Requirements for the Traction Power System

B. Submit the following documents for equipment and materials specified herein and provided under the Contract for the AC busways:
   1. Refer to Section 34 21 01, General Requirements for the Traction Power System, Article 1.17C and Article 1.17D for traction power general and vendor deliverable requirements.
2. Product data and shop drawings for the AC busways and associated structural supports.

3. Electrical calculations approved by California-registered professional electrical engineer.

4. Seismic calculations for the structural supports approved by California-registered structural engineer.

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


7. Painting process details.

8. Factory acceptance test documentation (e.g. test plan and procedures, data sheets, reports).


   a. Installation manual shall include:

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

      2) Installation practices and procedures that the Contractor plans to use to accomplish the installation of the AC busways and associated structural supports and shall be kept current at all times.

      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 AC busways and associated structural supports.

      5) Installation verification procedures and data sheets.

      6) Staging and implementation plans.

10. Certification that exterior powder coating system for the AC busways is a two-step process that provides 5 mils minimum thick weather-resistant finish.

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

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

13. Spare Parts List.

1.06 QUALITY CONTROL, QUALITY ASSURANCE AND SUPPLIER QUALIFICATIONS

A. Refer to Section 34 21 01, General Requirements for the Traction Power System, Article 1.07, and Section 34 21 70, Traction Power Facilities Installation Requirements, Article 1.06 for requirements.

1.07 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 34 21 70, Traction Power Facilities Installation Requirements, Article 1.07 for requirements.

B. Equipment shall be weatherproofed for shipment. Connection openings shall be closed to prevent entrance of foreign material during shipment and storage.

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 FOR THE TRACTION POWER SYSTEM

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

PART 2 – PRODUCTS

2.01 GENERAL

A. Aerial AC busways shall connect the outdoor rectifier transformers to the traction rectifiers installed inside the DC switchgear house, for operation as an integral unit.

B. AC busways and associated accessories shall be of the non-segregated type.

C. Each AC busway shall include an assembly of rigid copper conductors with associated connections, joints, insulators, bracing, and supports within a metal enclosure.

2.02 ENCLOSURE

A. AC busways shall be housed in enclosure with bolted flange connection for assembly at the rectifier transformer and traction rectifier throat. The busway enclosure shall be a rigid structure, fabricated from formed steel sheets of No. 11 gauge minimum thickness.

B. The outdoor portion of the AC busway enclosure shall be weatherproof.
C. The AC busway enclosure shall be provided with:

1. Removable gasketed covers for access to bolted bus connections and insulators, and access at the transformer connection for ease of maintenance and testing. Covers shall be secured with rust-resistant bolts to the frame of the AC busway.

2. Space heaters as specified in Article 2.20A of Section 34 21 50, Common Materials and Methods for Traction Power, and provisions for draining condensation.

3. Insulating joints at the interface with the traction rectifier, for electrical isolation from the high-resistance grounding system of the rectifier frame and structure.

4. Noncombustible, weatherproof seals at each location where the busway penetrates an outside wall. The seals shall be on both sides of the wall and shall accommodate 1/2 inch differential settlement between the foundations.

5. Removable covers for ease of installation and maintenance.

D. Finish

1. Enclosure finish shall be treated with a galvannealed coating and finish with a powder coat.

2. The galvannealing coating process shall be a two-step coating process with the following characteristics:
   a. Lower coating shall be 10 percent iron-zinc alloy deposited by the hot-dip process.
   b. Lower coating weight: 60 g/m2, minimum.
   c. Lower coating shall be 80 percent iron-zinc alloy electroplated deposited by the hot-dip process.
   d. Upper coating weight: 3 g/m2, minimum.
   e. Corrosion resistant capabilities: Maximum 1/8 inch creep corrosion when vertically scribed and exposed to five percent salt fog per ASTM B117 for 1500 hours.

3. The powder coating process shall be a two-step process with the following characteristics:
   a. Thickness: 5 mils, minimum.
   b. Color: Medium beige to match the color of the traction power substation houses provided.
   c. Weather, graffiti, and ultra-violet (UV) resistant.
d. Following busway assembly, areas exposed to the outside atmosphere that have been affected by cutting or welding shall be spot galvanized with a primer that forms a dry film no less than 90 percent pure zinc. Touch-up paint shall be applied to match the powder coat finish.

e. Following house assembly areas exposed to the outside atmosphere that have been affected by cutting or welding, shall be spot galvanized with a primer that forms a dry film no less than 90 percent pure zinc. Touch-up paint shall be applied to match the powder coat finish.

2.03 BUSES AND BUS CONNECTIONS

A. Buses and bus connections shall be as specified in Article 2.01 of Section 34 21 50, Common Materials and Methods for Traction Power.

B. The length of each bus conductor including fittings shall be insulated individually within each busway. Insulation and insulators shall be NEMA Class B and nonhygroscopic.

C. Provide visible grounding provisions for connection to main substation grounding system.

2.04 FITTINGS

A. AC busway assemblies shall be complete with connection flanges, seals, taps, elbows, insulated housing sections, offsets, splicing plates, terminal connectors, and associated accessories.

B. Expansion joints shall be provided where required for normal operation of the equipment.

C. AC busways shall be designed to minimize induced magnetic heating and induced circulating currents in the metallic enclosure of the busway, adjacent enclosures, and supporting structures.

D. Each AC busway shall be provided with support fittings for trapeze hangers.

2.05 AC BUSWAY RATING

A. AC busways shall be rated for 1,200 V AC nominal, with a continuous current rating not less than 160 percent of the continuous full-load current rating of the associated transformer-rectifier unit.

B. The AC busway shall be capable of withstanding stresses due to a phase bolted short-circuit at the rectifier terminals, with a fault level of 1,000 MVA symmetrical on the 34.5 kV side of the rectifier transformer.
2.06 AC BUSWAY STRUCTURAL SUPPORTS

A. AC busway enclosures shall be supported by the transformer throat connection, the trapeze hangers inside the DC switchgear house and intermediate supports as required. If made of ferrous metal, busway enclosure components and supports shall be hot-dip galvanized. Nuts, bolts, and washers shall be cadmium plated.

B. The structural supports shall include ungalvanized grounding lug plates welded to the tubular steel members to permit connection of bonding jumpers and/or ground connections. Lug plate design shall include holes to permit attachment of 2 hole compression lugs (associated with 250 kcmil bare copper ground pigtail).

C. Refer to Section 05 12 00, Structural Steel Framing, for additional requirements.

2.07 FACTORY INSTALLATION

A. Fabricate AC busways with equipment, devices, accessories, and appurtenances in place for a fully functioning and operable AC busway.

2.08 FACTORY ACCEPTANCE TESTING

A. Refer to Section 01 45 24, Testing Program Requirements, for additional requirements.

B. Prior to scheduling factory acceptance test to be witnessed by the Engineer, ensure AC busways are fabricated and assembled per the approved equipment vendor design.

C. Design tests shall be performed in accordance with IEEE C37.23 and UL 857 on one unit for the metal-enclosed bus, including the following:

1. Dielectric tests:
   a. Power frequency withstand voltage.
   b. Impulse withstand voltage.

2. Temperature rise test.


4. A test to verify that the busway enclosure is watertight.

D. Power frequency voltage withstand tests shall be performed on AC busways in accordance with the production tests specified in UL 857 for metal-enclosed bus.
PART 3 – EXECUTION

3.01 FOUNDATION COORDINATION

A. Examine foundations, anchor bolts, and exposed grounding embed conditions for compliance with the approved construction design and vendor’s requirements prior to placement of the AC busway structural steel supports.

B. Note items may infringe on the necessary clearances and other non-compliances. Promptly bring noted issues to the attention of the Engineer for direction and approval before proceeding.

C. Provide corrective actions, as required, at no additional cost to the District.

3.02 FIELD INSTALLATION

A. Reference Section 34 21 21, Transformer-Rectifier Units, for requirements relating to the installation of the transformer rectifier units.

B. Where the AC busway structural support is located within the containment area (of the rectifier transformer) the following requirements apply:
   1. The design of the containment area shall include a concrete plinth upon which the supporting structure shall be installed.
   2. No part of the AC busway supporting structure shall be below the highest point in the containment area.

C. Install the AC busway supports on the foundation secure, level (with stainless steel shims if required), plumb, and in true alignment with related adjoining work. Secure the AC busway structural supports to the foundations in accordance with equipment vendor’s recommendations and the approved seismic design.

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

E. The portion of the AC busway enclosure between the insulating joint at the rectifier interface and the rectifier transformer shall be connected to the underground ground grid. Install grounding connections to the underground ground grid system and bonding conductors between AC busway components and structural steel supports per the approved construction and equipment vendor designs, and Section 34 21 60, Grounding and Bonding for Traction Power.

F. Apply waterproof, non-hardening sealing compound/grout between the foundation and the base perimeter of the AC busway structural supports.

G. The physical arrangement shall permit installation and removal of throat or bus connections without moving the rectifier or rectifier transformer.
H. Unless otherwise approved by the District, the AC busway’s vibration bellows and stiffener collars shall be installed adjacent to the rectifier transformer end.

I. The bottom or underside surface of the AC busways shall be installed not lower than 84 inches above finished floor.

J. Provide visible bus duct ground connection direct to primary substation ground.

K. The minimum unobstructed horizontal clearance between AC busway structural supports and adjacent equipment and structures shall be 36 inches.

L. Protect the AC busways and associated structural supports during field installation and field testing activities.

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

3.03 FIELD TOUCH-UP

A. Remove paint splatters and other spots.

B. Clean and repaint damaged interior and exterior surface coatings of the AC busways and associated structural supports 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.

3.04 INSTALLATION VERIFICATION, FIELD FUNCTIONAL AND SYSTEM INTEGRATION TESTING

A. Refer to Section 34 21 80, Traction Power System Field Acceptance Testing, for requirements.

END OF SECTION 34 21 20