PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Separable insulated connector assembly.
B. 35 kV elbow termination enclosures.
C. Existing switchgear cable termination and bus modifications.

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 43 00 Quality Assurance
   4. Section 01 45 00 Quality Control
   5. Section 01 45 24 Testing Program Requirements
   6. Section 01 74 14 Cleaning
   7. Section 01 78 23 Operation and Maintenance Data
   8. Section 01 77 00 Closeout Procedures
   9. Section 01 78 39 Project Record Documents
  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 70 Traction Power Facilities Installation Requirements
  13. Section 34 21 80 Traction Power System Field Acceptance Testing
  14. Section 34 22 23 Traction Power Cables
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 REFERENCE STANDARDS

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. Association of Edison Illuminating Companies (AEIC):

1. AEIC CS8 Specifications for Extruded Dielectric, Shielded Power Cables Rated 5 through 46 kV

C. Insulated Cable Engineers Association (ICEA):

1. ICEA S-94-649 Concentric Neutral Cables Rated 5 through 46 kV

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

1. IEEE 386 Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV
2. IEEE 404 Extruded and Laminated Dielectric Shielded Cable Joints Rated 2.5 kV to 500 kV

E. National Electrical Manufacturers Association (NEMA):

1. NEMA C119.4 Electrical Connectors – Connectors for Use between Aluminum to Aluminum and Aluminum to Copper Conductors Designed for Normal Operation at or Below 93°C and Copper to Copper Conductors Designed for Normal Operation at or Below 100°C

F. Underwriters Laboratories Inc. (UL):

1. UL 486 A & B Standard for Safety Wire Connectors

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 34 21 01 General Requirements for the Traction Power System
5. Section 34 21 80 Traction Power System Field Acceptance Testing

B. Shop Drawings: Submit the following Shop Drawings:

1. Separable insulated connector section details for materials and assembly construction.

2. Connector and cable terminations showing cross sections, dimensions, and installation details.

3. Installation details for the 35 kV elbow termination enclosures showing overall dimensions and clearances, U-Channel support details, mounting details, cable routing and outline dimensions and tolerances, installation details, and grounding installation details.

C. Product Data: Submit data for 35 kV elbow termination enclosures, separable insulated connector assembly and associated materials including junction bars, connectors, insulated bushing with standard brackets, protective caps with drain wires, special installation tools, and accessories. Product data shall include product description, bill of materials, and detailed technical specifications.

D. Samples

1. Provide one (1) sample of each type of separable insulated connector assembly that includes the connector (plug), junction bar with the parking stand, grounding components, and insulated protective covers.

2. Samples shall be labeled with the following data: name of the manufacturer, type, model, size, voltage rating, insulation, application, and use.

3. Before submitting the sample, ensure that the product will be available in the quantities required for the Contract. No change or substitution will be permitted after submittal of the samples.

4. Product incorporated in the work shall match the approved samples.

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

F. Material safety data sheets.

G. Factory acceptance test documentation (e.g. test plan and procedures, data sheets, reports) per Section 01 45 24, Testing Program Requirements. Manufacturer shall certify factory design and production test reports indicating compliance of connector assemblies and enclosures with referenced Standards and these specifications.
H. Assembly, Installation, Termination and Connection, and Testing Manuals:

1. Provide a detailed written narrative describing the installation, termination and connection methods, manufacturer recommended field testing procedures and maintenance instructions for the separable insulated connector assembly to be furnished. Drawings, sketches, part numbers, sources of special tools, gauges, handling equipment required, and other pertinent information shall be included in the manual. Manual format and contents shall conform to the requirements for operation and maintenance manuals as defined in Section 01 78 23, Operation and Maintenance Data.

2. Draft versions of the manuals for the separable insulated connector assembly shall be submitted for approval. Final versions of manuals shall be submitted 30 Days after receipt of District’s comments and not less than 60 Days prior to connector installation in the field.

3. The manual shall include at a minimum the following:
   a. Site storage instruction including handling and storage requirements for short and long term.
   b. Installation equipment checklist, equipment set-up with diagram, illustrations, and sketches.
   c. Connector terminations and connections to 35 kV EPR cables.
   d. Instrumentation and procedures for field testing after connection to cables and termination to the junction bars.

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

J. Spare Parts List. One (1) separable connector with test point, plug, insulated cover, grounding elbow, adjustable bracket with three insulated parking bushing for every three 200A elbow connectors and every three 600A elbow connectors.

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.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 34 21 70, Traction Power Facilities Installation Requirements, for requirements.
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 MANUFACTURERS
A. The separable insulated connectors shall be manufactured by any of the following:
   1. Eaton Power Systems
   2. Thomas & Betts
   3. Elastimold
   4. The Durham Company
   5. Or equal.

2.02 SEPARABLE INSULATED CONNECTOR ASSEMBLY
A. General: Separable insulated connector assembly shall be provided for 35.4kV power circuits. The connector assembly shall be factory mounted and housed in an enclosure. Provide suitable connector assembly enclosures as needed. Enclosure type shall either be suitable for aerial installation or shall be free standing type for at grade installation. The elbow termination box or enclosure is specified herein Article 2.02C.

B. Separable Insulated Connector Assembly
   1. Separable insulated connector system shall consist of in-line and Y-splice junction bars, bushing wells, bushing inserts, elbow and straight connectors (Plugs), grounding elbows, parking stands, mounting brackets, and accessories.
   2. The connector system shall be submersible, made of vacuum cast resin, and shall meet all the requirements of IEEE 386.
   3. Elbow connector assembly shall be 35 kV, 200A loadbreak type and provided with test point and operating eye, (used for TPSS connection to elbow box or IDS). Straight connector assembly shall be 600A deadbreak type (used for TPSS IDS to TPSS IDS connections).
   4. Elbow and straight connector assemblies shall be sized as indicated EPR shielded cable.
5. The 200A loadbreak elbow connector assembly shall be rated for 150 kV BIL, 50 kV AC one minute withstand, 103 kV DC 15 minute withstand, 26 kV Corona Extinction, 10 kA rms symmetrical for 0.17 second and 3.5 kA rms symmetrical for 3 seconds.

6. The 600A deadbreak straight connector assembly shall be rated 600A rms continuous, 1 kA rms for 24 hour overload, 25 kA rms symmetrical for 0.17 second and 10 kA rms symmetrical for 3 seconds.

7. The connector assembly shall have an electrically conductive shield and shall have provision for connecting an external ground to the shield.

8. The junctions shall provide for fully rated, insulated, watertight conductor connections between terminals and shall be complete with grounding lugs, manufacturer’s standard accessories such as protective caps, stainless steel mounting brackets, and attaching hardware.

9. Junction bars shall be provided with one elbow interface and one parking stand per circuit conductor as indicated.

10. Elbow connector assembly shall be operable by means of a suitable shotgun type live-line hotstick tool that clamps the elbow so that operation is along the probe axis. One hotstick shall be provided for each traction power facility.

C. 35 kV Elbow Termination Enclosure for At-Grade Mounting Installation

1. Provide free standing 35 kV elbow termination enclosures sized as indicated. Each 35 kV elbow termination enclosure shall have factory installed connector assemblies as indicated.

2. The 35 kV elbow termination enclosures shall be of preformed galvanized steel channels, angles, and side sheets braced and welded together to form an outdoor, free standing NEMA 3R metal enclosure, with ventilated front double hinged doors, base, and roof sections. Access doors shall be flanged and shall close against rubber or similar gasketing material. Ventilated openings shall be provided with filtered covers and screened vents for protection against the weather and insects. Doors shall be equipped with latch, stops, and door-locking mechanism and with padlock provisions. The roof section shall be unit construction with openings for 6 inch conduit hubs and connected 6 inch expansion and deflection flex conduits for top cable entry. The enclosure shall form a rigid structure free of mechanical vibration and shall have steel channels or unistruts to mount the connector assembly junction bars and associated components. The base frame shall be provided with mounting holes to allow anchorage to concrete. The enclosure shall be provided with grounding studs for equipment grounding purposes. The interior and exterior surfaces of the enclosure shall be primed and finish painted.

3. 35 kV elbow termination enclosures and associated anchorage shall be designed to meet the seismic requirements as specified in Section 34 21 01, General Requirements for the Traction Power System.
4. The 35 kV elbow termination enclosure shall be prepared, primed, and painted with epoxy paint, color to match the AC equipment house. Refer to Section 34 21 05, Prefabricated AC and DC Equipment Houses and Related Equipment, for additional requirements.

5. The finished elbow termination enclosure shall meet the specification seismic requirements. Requirements shall be confirmed through testing or calculation.

6. The enclosure shall be provided with grounding bus bar installed as indicated.

7. Provide adjustable cable supports as indicated.

8. A nameplate shall be provided in the front of each enclosure. Show from and to for the connected circuit.

9. “Danger High Voltage” warning signs shall be placed on panels and doors.

10. Refer to the Contract Drawings and Section 34 21 70 for additional identification requirements.

D. Grounding:

1. Provide copper ground bus and lugs within T-tap and elbow termination enclosures and ground each cable concentric neutral. Provide separate NEMA two hole ground lugs for 250 kcmil ground wires and connect to existing facility ground grid. Provide two ground connections between enclosure ground bus and facility ground grid for each enclosure.

E. Accessories:

1. One set of three 200A grounding elbow assemblies for each traction power facility site using separable insulated connector assembly enclosures.

2. One set of three 600A grounding elbow assembly for each traction power facility site using separable insulated connector assembly enclosures.

3. For each elbow assembly enclosure provide one set of manufacturer’s standard accessories including three 200A and three 600A protective caps, stainless steel mounting brackets, and attaching hardware.

2.03 FACTORY ACCEPTANCE TESTING:

A. Factory Testing:

1. Separable Insulated Connector Systems:

   a. The following production tests shall be performed in accordance with IEEE 386 by the manufacturer on connector components, except ground bushings and grounding elbows:

      1) Partial discharge test.
2) AC withstand or full-wave impulse withstand voltage.
3) Test point voltage test.

b. The design tests listed in Table 8 of IEEE 386 shall be performed by the manufacturer to demonstrate compliance of the design with the standard. In lieu of performing the actual tests, certified test results of previous design tests of identical connector components are acceptable.

PART 3 – EXECUTION

3.01 GENERAL

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

3.02 WIRING WORK

A. Refer to Section 34 22 23, Traction Power Cables, for requirements.

3.03 FOUNDATION COORDINATION

A. Examine foundations, anchor bolts, levelling channel, and exposed grounding embed conditions for compliance with the approved Shop Drawings and vendor’s requirements prior to placement of the 35 kV elbow termination enclosures.

B. Note items that 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, shall be undertaken by the Contractor at no cost to the District.

3.04 35 KV ELBOW TERMINATION ENCLOSURE

A. 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 concrete. Check embedded items for correctness of location and detail before concrete is placed.

B. Minimum working platform in front of the enclosure shall be 6 feet wide.

C. Confirm 35 kV elbow termination enclosures and associated materials are in conformance with the approved Shop Drawings prior to placement.

D. Install the 35 kV elbow termination enclosures on the foundation secure, level with stainless steel shims (if required), plumb and in true alignment with related adjoining work. Secure the 35 kV elbow termination enclosures to the foundations in accordance with equipment vendor’s recommendations and the approved seismic design.
E. Install supporting members, fastenings, framing, hangers, brackets, straps, bolts, and angles as required to set and rigidly connect the 35 kV elbow termination enclosures.

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

G. Avoid overloading any part of the structure. Repair or replace any item damaged due to overloading.

H. 35 kV elbow termination enclosures located in damp or wet locations, shall be placed and equipped as to prevent moisture or water from penetrating and accumulating within the enclosure. Minimum foundation pad height from the surrounding ground surface elevation shall be four inches.

I. Ensure pad mounted 35 kV elbow termination enclosure or stand is not in direct contact with the concrete foundation.

J. Apply waterproof, non-hardening sealing compound or grout between the foundation and the base perimeter of the 35 kV elbow termination enclosures enclosure (for the pad mounted option).

K. The minimum unobstructed horizontal clearance between 35 kV elbow termination enclosures enclosure (for the pad mounted option) and adjacent equipment and structures shall be 8 feet.

L. Verify the 35 kV elbow termination enclosures and associated materials are correctly installed in accordance with the approved installation manual and drawings. No cable bends allowed within 12 inches of connector assembly. Minimum 18 inches vertical distance between bottom of enclosure and ground.

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 35 kV elbow termination enclosures and associated materials during field installation and field testing activities. Repair or replace items damaged.

O. Complete the installation and cleaning of 35 kV elbow termination enclosures, associated materials and conduits before starting wire or cable installation.

P. Route new 35 kV cables and conduits to the 35 kV elbow termination enclosure as indicated.

Q. Connect grounding cables from enclosure, elbow assembly, and cables to common grounding bar in the 35 kV elbow termination enclosure.

R. Clean 35 kV elbow termination enclosures per the manufacturer’s recommendations prior to installation verification and field testing.
3.05 FIELD TOUCH-UP

A. Remove paint splatters and other spots.

B. Clean and repaint damaged interior and exterior surface coatings of the 35 kV elbow termination enclosures with the same coating system using touch up paint provided by the manufacturers.

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

3.06 INSTALLATION VERIFICATION, FIELD FUNCTIONAL AND SYSTEM INTEGRATION TESTING

A. Refer to following Sections for requirements:

1. Section 34 21 80 Traction Power System Field Acceptance Testing
2. Section 34 22 23 Traction Power Cables

3.07 CLEANING

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

3.08 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 19