SECTION 34 21 27
LIQUID IMMERSED TYPE AUXILIARY POWER TRANSFORMERS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Self-cooled, three-phase, two-winding liquid immersed medium voltage auxiliary power transformers (34.5 kV - 480/277 V), associated devices and appurtenances.

1.02 RELATED SECTIONS

A. Refer to the following Sections for requirements:

1. Section 01 20 00  Price and Payment Procedures
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 45 24  Testing Program Requirements
7. Section 01 74 14  Cleaning
8. Section 01 77 00  Closeout Procedures
9. Section 01 78 23  Operation and Maintenance Data
10. Section 01 78 39  Contract Record Documents
11. Section 01 78 44  Spare Parts and Maintenance Materials
12. Section 01 79 00  Demonstration and Training
13. Section 20 50 13  Raceway for Facility Services
14. Section 20 50 16  Underground Ductworks and Structures for Facility Services
15. Section 26 05 24  Low Voltage Wires and Cables
16. Section 26 05 29  Hangers, Supports, Seismic Protection and Sealants
17. Section 26 05 53  Identification Requirements
18. Section 34 21 01  General Requirements for the Traction Power Systems
19. Section 34 21 02 Design and Product Deliverable Requirements for the Traction Power System
20. Section 34 21 19 Separable Insulated Connector
21. Section 34 21 33 Traction Power Control, Monitoring and Display Panel
22. Section 34 21 50 Common Materials and Methods for Traction Power System
23. Section 34 21 60 Grounding and Bonding for Traction Power Facilities
24. Section 34 21 70 Traction Power Facilities Installation Requirements
25. Section 34 21 80 Traction Power System Field Acceptance Testing
26. Section 34 22 23 Traction Power Cables

1.03 MEASUREMENT AND PAYMENT

A. Liquid immersed type auxiliary power transformers will be measured for payment by the individual unit (each) for the locations indicated in the Bid Schedule of the Bid Form, installed in place, including associated devices and appurtenances.

B. Liquid immersed type auxiliary power transformer will be paid for at the indicated Contract unit price per each for the computed quantities as determined by the measurement method specified in Article 1.03A, herein.

1.04 REFERENCES

A. Activities shall be in accordance with 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. ANSI B.1.1 Unified Inch Screw Threads
   3. ANSI/NEMA C29.1 Test Methods for Electrical Power Insulators
   4. ANSI/NEMA C39.1 Requirements for Electrical Analog Indicating Instruments
   5. ANSI C57.12.70 Terminal Markings and Connections for Distribution and Power Transformers
   6. ANSI Z 55.1 Gray Finishes for Industrial Apparatus of Equipment
C. American Society for Testing and Materials (ASTM):
   1. ASTM D6871 Standard Specification for Natural (Vegetable Oil) Ester Fluids used in Electrical Apparatus

D. International Electrochemical Commission (IEC):
   1. IEC 1203 Synthetic Organic Esters for Electrical Purposes - Guide for Maintenance of Transformer Esters in Equipment

E. California Electric Code (CEC)

F. Institute of Electrical and Electronics Engineers (IEEE):
   1. IEEE 48 Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV Through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV
   2. IEEE C37.2 Standard Electrical Power System Device Function Numbers, Acronyms, and Contact Designations
   3. IEEE C37.90 Standards for Relays and Relay Systems Associated with Electric Power Apparatus
   4. IEEE C57.12.00 Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
   5. IEEE C57.12.34 Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformer, 10 MVA and Smaller; High-Voltage, 34.5 kV Nominal System Voltage and Below; Low-Voltage, 15 kV Nominal System Voltage and Below
   8. IEEE C57.91 Guide for Loading Mineral-Oil-Immersed Transformers and Step-Voltage Regulators
   10. IEEE 386 Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV
   11. IEEE 519 IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power System
   12. IEEE 693 Recommended Practices for Seismic Design of Substations
G. National Electrical Manufacturers Association (NEMA):
   1. NEMA BU 1 Busways
   2. NEMA ICS 4 Application Guideline for Terminal Blocks
   3. NEMA ICS 6 Industrial Control and Systems: Enclosures
   4. NEMA TR1 Transformers, Regulators and Reactors
   5. NEMA WC 70/ICEA S-95-658 Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

H. National Fire Protection Association (NFPA):
   1. NFPA 70 National Electrical Code (NEC)
   2. NFPA 130 Standard for Fixed Guideway Transit and Passenger Rail Systems

I. Underwriters Laboratories (UL):
   1. UL 486 A and B 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 01 79 00 Demonstration and Training
   5. Section 34 21 01 General Requirements for the Traction Power System
   6. Section 34 21 02 Design and Product Deliverable Requirements for the Traction Power System
   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 auxiliary power transformers:

1. Product Data: Submit product data for the liquid immersed medium voltage auxiliary power transformers, enclosure, connectors, materials, special installation tools, and accessories. Product data shall include product description, bill of materials, and detailed technical specifications.

2. Shop Drawings to include but not limited to the following:
   a. Single line diagrams.
   b. Physical arrangement drawings and weights of equipment.
   c. Transformer bushing drawing.
   d. Unit wiring diagrams.
   e. Drawings showing space available for conduit entrance and for routing and training of cables. Available space shall take into consideration bending radius requirements of cables.
   f. Schematic diagrams.
   g. Setting diagrams and templates for anchoring in concrete.
   h. Interconnection diagrams for circuits having externally located instruments, controls, alarms or similar devices.
   i. Nameplate schedule.
   j. Component list.
   k. Ratings:
      1) KVA.
      2) Voltage.
      3) Continuous current.
      4) Basic insulation level.
      5) Resistance and impedance.
      6) Transformer efficiency at 100 percent, 75 percent, 50 percent, and 25 percent of the full load rating.
      7) Cable terminal sizes.

3. Seismic calculations to show compliance with the requirements of the Contract. Submittals shall be signed and sealed by a registered professional structural engineer licensed in the State of California.

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

5. Material safety data sheets.
6. Factory acceptance test documentation (e.g. procedures, data sheets, reports) per Section 34 21 80, Traction Power System Field Acceptance Testing.

7. 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) Installation practices and procedures that the Contractor plans to use to accomplish the installation of the liquid immersed medium voltage auxiliary power transformers 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 liquid immersed auxiliary power transformers.
      5) Installation verification procedures and data sheets.
      6) Staging and implementation plans.

8. Certification that exterior powder coating system is a two-step process that provides 5 mils minimum thick weather-resistant finish.

9. Certification from a CA factory-trained manufacturer’s representative(s) that certifies the equipment has been installed, adjusted, and tested in accordance with the manufacturer’s recommendations.

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 (System): 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, Article 1.06 for the requirements.

1.07 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 34 21 70, Traction Power Facilities Installation Requirements, Article 1.06 for the 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 the requirements.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. The liquid immersed medium voltage auxiliary power transformers shall be manufactured by any of the following:

1. Square D Company

2. Eaton/Cutler Hammer

3. ABB

4. Cooper Power Systems

5. Or equal

2.02 GENERAL

A. One outdoor, three-phase, pad mounted compartmental type liquid immersed medium voltage auxiliary power transformer shall be provided at each traction power facility location as indicated on the Contract Drawings.
B. Liquid immersed medium voltage auxiliary power transformers shall be completely metal enclosed with voltage, primary and secondary winding connections and ratings as specified in Article 2.03 herein.

C. The liquid immersed medium voltage auxiliary power transformers shall be designed for continuous operation at the specified rating, for 24 hours a day, 365 days a year operation.

D. The liquid immersed medium voltage auxiliary power transformers shall be sized for the connected electrical loads plus the spare capacity as specified in the Contract Specifications.

E. Liquid immersed medium voltage auxiliary power transformers 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.

2.03 RATINGS

A. The liquid immersed medium voltage auxiliary power transformers ratings shall be in accordance with ANSI, NEMA and other applicable standards and shall be as follows:

1. kVA Rating: As indicated on the Contract Drawings.

2. Liquid immersed medium voltage auxiliary power transformers shall have continuous self-cooled kVA ratings, as indicated, based upon average winding temperature rise (by resistance) not exceeding 65 degrees Celsius, and 80 degrees Celsius winding hottest spot temperature over a maximum ambient temperature of 40 degrees Celsius.

3. Primary windings shall be delta-connected with voltage rating 34,500 V. Insulation class (BIL) shall be not less than 150 kV.

4. Impedance: Liquid immersed medium voltage auxiliary power transformers shall be rated as indicated herein and have an impedance of less than or equal to 5.75 percent. Verify adequacy after short circuit and voltage drop calculations.

5. Primary windings shall be provided with six standard, equally-spaced, full capacity taps, three 2-1/2 percent above and three 2-1/2 percent below the nominal rated line to line nominal voltage.

6. Secondary windings shall be wye-connected, 4-wire, rated 480/277 V, 30 kV BIL. Winding neutral shall be solidly grounded and shall have a minimum insulation level of 10 kV.

7. Angular displacement between primary and secondary winding phase voltages shall be standard.
8. Sound level shall not exceed the maximum permissible values for applicable ratings under standard conditions of measurement. Refer to Section 34 21 01, General Requirements for the Traction Power Systems, for additional requirements.

2.04 ENCLOSURE

A. General

1. The pad-mounted compartmental type liquid immersed medium voltage auxiliary power transformer shall consist of a tank with high-voltage and low-voltage cable terminating compartments separated by a barrier of metal or other rigid material. The high-voltage and low-voltage compartment shall be partitioned such that high and low voltage sides are isolated from each other. When viewed from the front, the low-voltage compartment shall be on the right.

2. Each compartment shall have a door that is constructed so as to provide access to the high-voltage compartment only after the door to the low-voltage compartment has been opened. Where the low-voltage compartment door is of a flat panel design, the compartment door shall have three-point latching with a handle provided for a locking device. Hinge pins and associated barrels shall be constructed of corrosion-resistant material, passivated AISI Type 304.

3. The liquid immersed medium voltage auxiliary power transformer tank and compartments shall be so constructed as to limit disassembly, breakage, and prying open of any doors, panels and sills with the door in the closed and locked position. The bottom edges of the compartment shall be so constructed as to provide for the use of hold-down devices that are accessible only from the inside of the compartments. Construction of the unit shall be such that it can be lifted, skidded, slid, or any combination of these, into place on the mounting surface without disturbing the high-voltage or low-voltage cables.

4. Jacking facilities shall be provided on the tank. The vertical clearance for a jack shall be 1.5 inches minimum and 6.5 inches maximum. The transformer shall be provided with lifting provisions that are permanently attached and arranged on the tank in such a manner as to provide a distributed balanced lift in a vertical direction for the completely assembled transformer. The liquid immersed medium voltage auxiliary power transformer shall be designed to provide a safety factor of 5 in accordance with the requirements of IEEE C57.12.26.

5. Ground enclosure door(s) to the enclosure by means of a visible, flexible copper grounding strap.

6. Terminal identification shall be provided.

7. “Danger High Voltage” warning signs shall be placed on high voltage access panels and doors.

8. Diagram instruction plate shall be placed on each door and removable panel.
9. Refer to the Contract Drawings and Section 26 05 53, Identification Requirements, for additional identification requirements.

B. Core

1. Core shall be constructed of non-aging, cold rolled, high permeability silicon strip, firmly clamped by fiberglass bands and structural steel members and insulated bolts.

2. Core design shall minimize and isolate sound transmission caused by excitation currents.

3. Core and coil assembly shall be rigidly braced to withstand, without degradation, the mechanical forces under short-circuit conditions and resist normal vibration and shock forces during shipment and installation.

4. Core clamps and structural steel members shall be grounded to the enclosure frame by a bolted copper strap.

C. High and Low Voltage Terminals

1. The design, electrical characteristic, clearances location and arrangement of the completely assembled high and low-voltage terminals shall conform to IEEE C57.12.26.

D. Nameplate

Identical nameplate shall be located in two places: On the door and within the low-voltage compartment. The nameplate information shall conform to IEEE C57.12.00. The high-voltage BIL shall be included on the nameplate.

E. Tank

1. The liquid immersed medium voltage auxiliary power transformer tank shall be of sufficient strength to withstand an internal static pressure of 7 psig without permanent distortion and 15 psig without rupturing or displacing components of the auxiliary power transformer or affecting cabinet security. The manufacturer shall certify that design tests have been made on representative samples and submit documentation thereof. A one inch upper plug or cap for filling and pressure testing shall be provided. A one inch NPT drain valve with built-in sampling device shall be provided. Both the filling plug or cap and the drain valve shall be located within the low-voltage termination compartment.

2. Gasketed joints shall have machined surfaces on both sides, and shall be provided with gasket retainers and metal-to-metal stops; this assures even and effective pressure, and avoids over-stressing the gasket. Gaskets shall maintain oil-tight joints under normal service conditions.

3. The tank ground provision shall consist of two stainless steel pads, each with a 1/2-13 UNC tapped hole, 7/16 inch deep. These ground pads shall be welded on or near the transformer base: one in the high-voltage compartment and one in the low-voltage compartment.
4. Liquid immersed medium voltage auxiliary power transformer tanks shall be of sealed-tank construction. The transformer shall remain effectively sealed for a top oil temperature range of minus 5 degrees Celsius to plus 105 degrees Celsius continuous and under operating conditions described in IEEE C57.12.90 and IEEE C57.12.92.

5. The liquid immersed medium voltage auxiliary power transformer shall be provided with dial type, winding hot-spot temperature indicator. Setting shall be recommended by the liquid immersed medium voltage auxiliary power transformer manufacturer. The liquid immersed medium voltage auxiliary power transformers shall also be provided with pressure relief valve and oil level gauge as required.

F. Auxiliary Power Transformer Oil

1. The liquid immersed medium voltage auxiliary power transformer shall be filled with natural ester-based insulating fluids (such as Envirotemp FR3 fluid) which are classified as less-flammable transformer fluids, defined by NEC, as well as non-toxic and biodegradable.

2.05 TERMINATIONS

A. Power and control cables shall enter and leave the liquid immersed medium voltage auxiliary power transformers at the bottom. Provisions shall be made to accommodate the cables.

B. Medium voltage AC power cable terminations shall be deadfront (elbow) connectors that satisfy the requirements of IEEE 386, Section 34 21 19, Separable Insulated Connector, and Section 34 22 23, Traction Power Cables.

C. Low voltage terminations shall be as specified in the Section 26 05 24, Low Voltage Wires and Cables.

2.06 EQUIPMENT PROTECTION AND CONTROL DEVICES

A. Winding temperature, Device No. 26 shall be provided and mounted for viewing from outside of the liquid immersed medium voltage auxiliary power transformer enclosure through a viewing window. The temperature gauge shall be provided with two stage contacts. First stage contact shall be for local and remote annunciations and second stage contact for tripping the associated circuit breaker as indicated on the Contract Drawings.

1. The pick-up point of the first stage shall be adjustable and factory set so that upon a designated temperature increase the device initiates an alarm.

2. Further temperature increase, the device shall initiate the tripping of the associated circuit breaker.
2.07 APPURTENANCES AND AUXILIARY DEVICES

A. Liquid immersed medium voltage auxiliary power transformer appurtenances and auxiliary devices, such as wiring devices, low voltage wires and cables shall be as specified in Section 34 21 50, Common Materials and Methods for Traction Power System.

2.08 MAINTENANCE ACCESSORIES

A. Provide at least the following accessories for each liquid immersed medium voltage auxiliary power transformer:

1. Equipment needed for the normal operation and preventive maintenance of the liquid immersed medium voltage auxiliary power transformers.

2. Special tools required for obtaining access to and replacement of equipment or device in the liquid immersed medium voltage auxiliary power transformers. Tools for tap changer and fuse removal (if applicable) shall be provided.

3. Provide a ground set. Each ground set shall have label identifying the traction power facility and liquid immersed medium voltage auxiliary power transformer designations as indicated on the Contract Drawings. Ground set labels shall be a round disc 2 inches to 3 inches in diameter affixed to the ground cable with non-conductive straps. Ground set cable size shall be at least # 250 kcmil copper.

2.09 FACTORY INSTALLATION

A. Fabricate each liquid immersed medium voltage auxiliary power transformer with all equipment, devices, accessories and appurtenances in place for fully functioning and operable liquid immersed medium voltage auxiliary power transformer.

2.10 FACTORY ACCEPTANCE TESTING

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

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

1. Liquid immersed medium voltage auxiliary power transformers and associated equipment, cabling, and appurtenances shall be completely installed per the approved equipment vendor design.

2. All identifiers shall be installed.

3. Liquid immersed medium voltage auxiliary power transformers and associated equipment shall be cleaned.
C. Perform the following standard factory tests on all equipment provided under the Contract. All tests shall be in accordance with IEEE C57.12.00, C57.12.90 and C57.12.98:

1. Resistance measurements of all windings on the rated voltage connection of each unit and at the tap extremes of one unit only of a given rating.

2. Ratio tests on the rated voltage connection and on all tap connections.

3. Polarity and phase-relation tests on the rated voltage connections.

4. No-load loss at rated voltage on the rated voltage connection.

5. Exciting current at rated voltage on the rated voltage connection.

6. Impedance and load loss at rated current on the rated voltage connection of each unit and on the tap extremes of one unit only of a given rating.


8. Induced potential tests.

D. Perform the following special factory tests on the equipment provided under the Contract. All tests shall be in accordance with IEEE C57.12.00, C57.12.90 and C57.12.98.

1. Temperature test shall be made for each kVA rating specified. Where more than one unit of a given kVA rating applies, only one unit needs to be tested. Tests shall not be required when there is a certified record of a temperature test available on a duplicate unit.

2. BIL impulse test on all windings.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for the liquid immersed medium voltage auxiliary power transformers.

B. Note items that may infringe on the necessary clearances for the equipment and other non-compliances. Promptly bring noted issues to the attention of the Engineer correct deficiencies prior to proceeding.

3.02 FOUNDATION COORDINATION

A. Examine foundations, anchor bolts and levelling channel, and exposed grounding embed conditions for compliance with the approved construction design and vendor’s requirements prior to placement of the liquid immersed medium voltage auxiliary power transformers.
B. Note items that may infringe on the necessary clearances and other non-compliances. Promptly bring noted issues to the attention of the Engineer and correct deficiencies prior to proceeding.

3.03 WIRING, TERMINATIONS AND CONDUIT WORK

A. Refer to the following Sections for requirements:

1. Section 20 50 13 Raceways for Facility Services
2. Section 20 50 16 Underground Ductworks and Structures for Facility Services
3. Section 26 05 24 Low Voltage Wires and Cable
4. Section 34 21 19 Separable Insulated Connectors
5. Section 34 21 50 Common Materials and Methods for Traction Power
6. Section 34 22 23 Traction Power Cables

3.04 GROUNDING

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

3.05 INSTALLATION

A. All liquid immersed medium voltage auxiliary power transformers, materials, and appurtenances shall be installed in accordance with NECA 410, and as recommended by the manufacturer.

B. Provide leveling channels and anchorage items as required, and field check to ensure proper alignment and location. Provide templates and layout drawings to ensure correct placing of anchorage items. Check embedded items for correctness of location and detail before concrete is placed.

C. Confirm liquid immersed medium voltage auxiliary power transformers and associated materials are in conformance with the approved Shop Drawings prior to placement.

D. Install each transformer on the foundation secure, level with stainless steel shims, plumb and in true alignment with related adjoining work. Secure the transformers 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 auxiliary power transformers, and to meet approved seismic design.
F. Provide temporary bracing, guys, or other devices as required to accomplish erection and to providing safety and stability until work is in final position and approved.

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

H. Exercise care during installation to avoid overloading any part of the structure. Repair or replace any item damaged due to overloading, at no cost to the District.

I. Transformers located in damp or wet locations, shall be placed and equipped to prevent moisture or water from penetrating and accumulating within the enclosure.

J. Ensure the transformers are not in direct contact with the concrete foundation.

K. Apply waterproof, non-hardening sealing compound or grout between the foundation and the base perimeter of the transformer enclosures.

L. Verify transformers 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 and B.

N. Protect transformers and associated materials during field installation and field testing activities. Repair or replace items damaged at no cost to the District.

O. Complete the installation and cleaning of transformers, associated materials, and conduits before starting wire and cable installation.

P. Thoroughly clean transformers in accordance with the manufacturer’s recommendations prior to installation verification and field testing.

Q. Leave the transformer lifting lugs, complete with boxed hardware, in the DC equipment house for future use by the District. Clearly label lugs and hardware.

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

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

3.06 FIELD TOUCH UP

A. Remove paint splatters and other spots.

B. Clean and repaint damaged interior and exterior surface coatings of transformers using touch up paint provided by the transformer manufacturers.
C. Painting shall follow the recommendations of the transformers paint manufacturers.

D. Protect the appearance of a new installation prior to final acceptance.

3.07 INSTALLATION VERIFICATION, FIELD FUNCTIONAL AND SYSTEM INTEGRATION TESTING

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

3.08 CLEANING

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

B. On completion of installation, the Contractor shall inspect the transformers. The Contractor shall remove paint splatters and other spots. The Contractor shall vacuum dirt and debris. Compressed air to assist in cleaning shall not be used. The Contractor shall repair exposed surfaces to match original finish.

3.09 DEMONSTRATION AND TRAINING

A. Refer to Section 01 79 00, Demonstration and Training, for requirements.

B. Contractor shall provide equipment demonstration and training for the District’s maintenance personnel to adjust, operate, and maintain the transformers and accessories.

3.10 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 27