SECTION 26 22 13 – LOW-VOLTAGE DISTRIBUTION TRANSFORMER

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes distribution, dry-type transformers with nominal primary and secondary rating of 600V and less, with capacities up to 1500 kVA.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
3. Include diagrams for power wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Source quality-control reports.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: On receipt, inspect for and note shipping damage to packaging and transformer.

1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.

B. Storage: Store in warm, dry, and temperature-stable location in original shipping packaging.

C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in space that is continuously under normal control of temperature and humidity.

D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each transformer type from single source from single manufacturer.

B. Low-voltage distribution transformers shall be manufactured by ABB, Eaton, Schneider Electric, or Siemens.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-hertz service.

B. Comply with NFPA 70.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by qualified testing agency, and marked for intended location and use.

C. Transformers Rated 15 kVA and Larger:

1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.

2. Marked as compliant with DOE 2016 efficiency levels by NRTL.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70, and list and label as complying with UL 1561.

B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

1. One leg per phase.
2. Grounded to enclosure.

C. Coils: Continuous windings without splices except for taps.

1. Coil Material: Aluminum.
2. Internal Coil Connections: Brazed or pressure type.
3. Terminal Connections: Welded .

D. Enclosure (Interior): Ventilated.

1. NEMA 250, Type 2: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.
4. Finish: Comply with NEMA 250.
    a. Finish Color: **Gray** weather-resistant enamel.

E. Enclosure (Exterior): Ventilated.

1. NEMA 250, Type 4X, Stainless Steel: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.

F. Enclosure (Exterior): Ventilated.

1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
2. Wiring Compartment: Sized for conduit entry and wiring installation.
3. Finish: Comply with NEMA 250.
    a. Finish Color: **Gray** weather-resistant enamel.

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

H. Insulation Class, 30 kVA and Larger: 220 degrees C, UL-component-recognized insulation system with maximum of 115 degrees C rise above 40 degrees C ambient temperature.

I. Grounding: Provide ground-bar kit or ground bar installed on inside of transformer enclosure.

J. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for non-sinusoidal load current-handling capability to degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor, without exceeding indicated insulation class in 40 degrees C maximum ambient and 24-hour average ambient of 30 degrees C.

2. Indicate value of K-factor on transformer nameplate.

3. Unit shall comply with requirements of DOE 2016 efficiency levels when tested according to NEMA TP 2 with K-factor equal to one.

K. Neutral: Rated 200 percent of full load current for K-factor-rated transformers.

L. Low-Sound-Level Requirements: Maximum sound levels when factory tested according to IEEE C57.12.91, as follows:

1. 9.01 to 30.00 kVA: 45 dBA.

2. 30.01 to 50.00 kVA: 45 dBA for K-factors of 1, 4, and 9 and 48 dBA for K-factors of 13 and 20.

3. 50.01 to 150.00 kVA: 50 dBA for K-factors of 1, 4, and 9 and 53 dBA for K-factors of 13 and 20.

2.4 IDENTIFICATION

A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification."

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.

1. Resistance measurements of windings at rated voltage connections and at tap connections.

2. Ratio tests at rated voltage connections and at tap connections.

3. Phase relation and polarity tests at rated voltage connections.

4. No load losses, and excitation current and rated voltage at rated voltage connections.

5. Impedance and load losses at rated current and rated frequency at rated voltage connections.

6. Applied and induced tensile tests.

7. Regulation and efficiency at rated load and voltage.

8. Insulation-Resistance Tests:

a. High-voltage to ground.

b. Low-voltage to ground.

c. High-voltage to low-voltage.

9. Temperature tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for environment in which they are located.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Construct concrete bases according to Section 033000 "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions and requirements in Section 260529 "Hangers and Supports."

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

B. Secure transformer to concrete base according to manufacturer's written instructions.

C. Secure covers to enclosure and tighten bolts to manufacturer-recommended torques to reduce noise generation.

D. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding."

B. Connect wiring according to Section 260519 "Low-Voltage Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at conduit and conductor terminations and supports to eliminate sound and vibration transmission to building structure.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Small (Up to 167-kVA Single-Phase or 500-kVA 3-Phase) Dry-Type Transformer Field Tests:

1. Visual and Mechanical Inspection.
    a. Inspect physical and mechanical condition.
    b. Inspect anchorage, alignment, and grounding.
    c. Verify that resilient mounts are free and that any shipping brackets have been removed.
    d. Verify unit is clean.
    e. Perform specific inspections and mechanical tests recommended by manufacturer.
    f. Verify that as-left tap connections are as specified.
    g. Verify presence of surge arresters and that their ratings are as specified.
2. Electrical Tests:
    a. Measure resistance at each winding, tap, and bolted connection.
    b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: value of index shall not be less than 1.0.
    c. Perform turns-ratio tests at tap positions. Test results shall not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.
    d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and before loading.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. Infrared Scanning: Two months after Substantial Completion, perform infrared scan of transformer connections.

1. Use infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Perform 2 follow-up infrared scans of transformers, one at 4 months and other at 11 months after Substantial Completion.
3. Prepare certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

E. Test Labeling: On completion of satisfactory testing of each unit, attach dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION