**SECTION 26 12 16**

**MEDIUM-VOLTAGE TRANSFORMERS, DRY TYPE (INDOOR)**

**BASED ON DFD MASTER ELECTRICAL SPEC DATED 03/01/23**

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

**PART 1 - GENERAL**

**SCOPE**

The work under this section includes indoor, dry type, medium voltage distribution transformers. Included are the following topics:

PART 1 - GENERAL

Scope

Related Work

Reference Standards

Submittals

Operation and Maintenance Data

Quality Assurance

Delivery, Storage, and Handling

PART 2 - PRODUCTS

Transformers

PART 3 - EXECUTION

Examination

Installation

Field Quality Control

Adjusting

Construction Verification Items

Agency Training

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Section 26 08 00 - Commissioning of Electrical

Section 01 91 01 or 01 91 02 – Commissioning Process

**REFERENCE STANDARDS**

U.S. Department of Energy (DOE) CFR Title 10, Chapter II, Subchapter D, Part 431, Subpart K - Distribution Transformers.

**SUBMITTALS**

Shop Drawings

Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, loss data, efficiency at 25, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, and rated temperature rise.

Include detailed drawings of any changes to existing installations to suit proposed equipment to be furnished.

Include manufacturer's installation instructions.

Factory Certified Tests

Factory certified tests shall be performed on the transformer being supplied and the results presented to the A/E for approval prior to shipment. The following factory certified tests shall be performed:

1. A turns ratio test shall be performed between windings at all service tap settings.
2. Over potential test shall be made on all high and low voltage windings to ground.
3. Winding resistance tests shall be made for each winding at the rated voltage tap.

# OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS and specification Section 01 91 01 or 01 91 02.

**QUALITY ASSURANCE**

Manufacturer: Company specializing in distribution transformers with ten years experience.

**DELIVERY, STORAGE, AND HANDLING**

Store and protect equipment in a warm, dry location with uniform temperature. Cover ventilating openings to keep out dust.

Protect dry type transformers from moisture by using appropriate heaters as instructed by the manufacturer. Provide a heat source (example, two incandescent lamps) to keep transformer windings dry prior to energizing.

Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet, or snow if handled in inclement weather.

**PART 2 - PRODUCTS**

**TRANSFORMERS**

Description: Three phase ventilated dry type distribution transformer.

All transformers 2500 kVA and below shall meet the U.S. Department of Energy (DOE) minimum efficiency levels for distribution transformers as mandated in CFR Title 10, Chapter II, Subchapter D, Part 431, Subpart K - Distribution Transformers.

Capacity: [\_\_\_\_\_] kVA, self-cooled (AA rating) [;] [.] [ [\_\_\_\_\_] kVA, forced air cooled (FA rating)] [size as shown on drawings].

Voltage: [\_\_\_\_\_] kV primary; [\_\_\_/\_\_] volts secondary.

Connections: Delta primary – Grounded Wye secondary.

Primary winding taps: Two 2-1/2% above and two 2-1/2% below rated voltage (split taps).

***Use 60 kV BIL for 5 kV class transformers and 95 kV for 15 kV class transformers. Coordinate with manufacturer and DFDM reviewer if these values cannot be met.***

Basic Impulse Level: [ ] [60] [95] kV.

Impedance

Transformers rated 750 kVA and above: 5.3% to 6.2% (5.75% nominal)

Transformers rated 300 kVA to 500 kVA: 3.1% to 6.2%

Transformers rated below 300 kVA: 2.7% to 5.75%

Insulation system shall be a Class 220 insulation system rated at 220 degrees C.

Average winding temperature rise rating shall be 115 degrees C at full load, above a 40 degrees C ambient.

Provide factory installed fan cooling on transformers rated 500 kVA and above.

The consultant shall coordinate sound attenuation with Architect to ensure sound level is acceptable to agency program requirements. Sound attenuating materials may need to be provided in the electrical room to reduce the transformer sound levels in adjacent occupied rooms.

Sound Levels

Isolate core and coil from enclosure using vibration absorbing mounts designed specifically to reduce 120 HZ and multiple harmonic sound. Provide maximum sound levels as follows:

KVA Sound

Rating Level

150 55 dB

300 58 dB

500 60 dB

750 64 dB

1000 64 dB

1500 65 dB

2000 66 dB

2500 68 dB

3000 68 dB

3750 70 dB

Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

Core Steel

Manufacture core from a high-grade, non-aging silicon steel with high magnetic permeability, low hysteresis and eddy current losses. Keep magnetic flux densities well below saturation to allow for a minimum of 10 percent over-voltage excitation.

Cut laminations with the direction of the grain and free from burrs. All laminations must be core plated or annealed and firmly butted. The core laminations shall be clamped tightly and compressed to provide quiet operation and to prevent damage during shipment or rough handling.

Enclosure

NEMA Type 1, indoor type, suitable for floor mounting.

Front and back panels shall be easily removable for access to taps and maintenance.

Ventilated openings shall be baffled or screened to prevent entrance of extraneous material.

Degrease, clean, phosphatize and paint the entire enclosure with one (1) coat of zinc chromate primer and two (2) coats of gray enamel.

Provide lifting eyes or brackets.

Nameplate: Include transformer connection data, ratings, and capacity based on rated allowable temperature rise. Provide nameplate indicating minimum ventilation clearance per NEC Article 450-9.

***The consultant shall ensure electrical room and equipment layout allows for minimum clearances.***

Primary Terminations: Porcelain insulator with two bolt pad type connector.

Secondary Terminations: Multi-hole NEMA spade type connector.

[Surge Arresters: Distribution class, one for each phase, mounted on primary side of transformer. Surge arresters shall meet the requirements of Section 26 18 23.]

**PART 3 - EXECUTION**

**EXAMINATION**

Verify field measurements are as shown on Drawings.

Beginning of installation means installer accepts conditions.

**INSTALLATION**

Install in accordance with manufacturer's instructions.

Install to meet nameplate clearances.

Set transformer plumb and level on a 3-1/2” high (minimum) concrete pad.

Connect transformer to adjacent equipment using new cables on the primary side and flexible copper braid on the secondary side.

[Mount primary surge arresters inside of transformers. See Section 26 18 23 for specifications on surge arresters.]

The contractor shall provide filter media on all ventilated openings during the construction stage. The contractor shall remove the filter media and thoroughly clean and vacuum the transformer upon completion of the project.

Install safety labels to NEMA 260.

**FIELD QUALITY CONTROL**

Prior to energizing the transformer, field testing will be performed by independent testing consultant furnished by the DFD. The contractor shall coordinate the scheduling of the testing consultant with DFD.

Check for damage and torque connections to manufacturer recommendations prior to energizing transformer.

Verify and/or connect transformer "XO" to ground, load side of "WYE" systems.

**ADJUSTING**

Measure secondary voltage phase-to-phase and phase-to-ground after final energization and prior to loading.

Adjust primary taps so that secondary voltage is within 2 percent of rated voltage.

**CONSTRUCTION VERIFICATION**

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

**AGENCY TRAINING**

All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

END OF SECTION