

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. This section includes dry type transformers rated 600 volts and below.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 REFERENCES

Transformers shall be manufactured, tested and installed in accordance with the latest revision of the following Standards and Publications.

- A. American National Standards Institute (ANSI)
  - 1. ANSI C57.12.91 IEEE Standard Test Code for Dry Type Distribution and Power Transformers.
- B. National Electrical Manufacturer's Association (NEMA)
  - 1. NEMA ST-20 Dry-Type Transformers for General Applications
  - 2. NEMA TP-1 Guide for Determining Energy Efficiency for Distribution Transformers
  - 3. NEMA TR-1 Transformers, Regulators and Reactors R2000.
  - 4. NEMA TP-3 Standard for the Labeling of Distribution Transformer Efficiency.
  - 5. NEMA 250 Enclosures for Electrical Equipment 1,000 volts maximum.
- C. Underwriters Laboratories, Inc. (UL)
  - 1. UL 506 Standard for Specialty Transformers (for transformers rated 10 kVA and below)
  - 2. UL 1561 Standard for Dry Type General Purpose and Power Transformers (for transformers rated 10 to 1500 kVA)
- D. American Association of State Highway and Transportation Officials (AASHTO)

### 1.3 SUBMITTALS

- A. General: Conform to the contract document submittal requirements according to Section 260500 - Common Work Results For Electrical, and additional requirements described in this specification section..
- B. Demonstrate conformance with specification requirements. Provide typical load losses for each transformer size at 50%, 75% and 100% of full load rating.
- C. Include dimensioned front plan and section views, wiring and connection diagrams and bolting template. Submit information indicating minimum clearance requirements around transformer, and anchor bolt patterns. Indicate mounting methods and demonstrate loading compatibility with mounting surface.
- D. Submit lug schedule showing proposed lugs for each transformer.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

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

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURER

- A. Subject to compliance with requirements, provide products by one of the following: Acme, Cutler Hammer, Federal Pacific, General Electric, Hammond, MagneTek, Siemens, Sola/Hevi-Duty Electric, Square D, or Tierney.

#### 2.2 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20 and list and label as complying with UL 1561.
- B. Provide transformers that are internally braced to withstand seismic forces specified in Section 260529 - Hangers And Supports For Electrical Systems.

#### 2.3 ENCLOSURE

- A. Steel panel enclosure over core, coil and terminal chamber with louvered openings for convection cooling. Cooling and terminal access shall be possible with both sides and rear of enclosure obstructed. Minimum 14 gage steel with appropriate reinforcement and lifting lugs
- B. Indoor: Ventilated, NEMA 250, Type 2.
- C. Finish: Comply with NEMA 250 for "Indoor Corrosion Protection" Manufacturer's standard gray finish.

#### 2.4 WINDINGS

- A. Separate primary and secondary. Windings shall have Class H insulation and shall be rated for continuous operation at rated kVA with temperature rise of not over 150 degrees C above a 40 degree C ambient, with a maximum hot spot temperature of 220 degrees C.
- B. Core and coil mounted on rubber isolation mounting pads. Windings and core and coil assembly shall be treated and built to resist the effects of dirt and moisture.
- C. Unless noted otherwise three phase transformers shall have a 480 volt delta connected primary and 208Y/120 volt, three phase, four wire secondary. Single phase transformers shall be 480 volt, single phase, primary, 120/240 volt, single phase, three wire secondary.
- D. Windings shall be copper or aluminum.

## 2.5 PRIMARY TAPS

- A. Transformers rated 15 KVA and larger shall have full capacity taps, minimum of two 2-1/2 percent above and four 2-1/2 percent below normal (rated) primary voltage.
- B. Transformers rated less than 3 kVA: One 5 percent tap above normal full capacity
- C. Transformers rated 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity]

## 2.6 RATINGS

- A. Continuous capacity rating not less than size noted.
- B. K Factor Ratings

Provide transformers rated for harmonic loads characterized by the K-Factor indicated on the drawings, when loaded at full nameplate rating.]

### K Factor Ratings

- 1. Transformers with 120 volt or 208 volt secondary voltages shall be rated at the size noted for a harmonic load characterized and, unless noted otherwise on the drawings, with a K-factor of K-13 and shall be U.L. listed and labeled for harmonic current loads.
- C. Efficiency
  - 1. Transformers (except K rated, quiet type and ultra quiet type) shall comply with Class 1 efficiencies as set forth in NEMA TP-1, when tested in accordance with NEMA TP-2. Provide Energy Star label in accordance with NEMA TP-3.
  - 2. Transformers up to and including 2500kVA shall meet the US Department of Energy efficiency standards that are scheduled to be mandatory on all such transformers shipped on or after January 1, 2010.

## 2.7 CONNECTIONS

- A. Provisions for external connections shall be made by means of a terminal board employing lugs conforming to Section 260519 - Conductors and Cables which are compatible with the external conductors installed. All connections shall be accessible from front of cabinet.

## 2.8 NOISE LEVEL

- A. Manufacturer shall test for noise level compliance in accordance with ANSI C57.12.91, IEEE Standard Test Code for Dry Type Distribution and Power Transformers.
- B. Noise level shall not exceed 45 db for sizes less than 51 kVA, 50 db for 51-150 kVA, 55 db for 151-300 kVA and 60 db for sizes greater than 300 kVA.
- C. Quiet type reduced noise level transformers shall have noise levels not exceeding 42db for sizes less than 51 kVA, 47 db for 51-150 kVA and 52 db for 151 to 300 kVA and 57db for greater than 300 kVA.

## 2.9 BUCK-BOOST TRANSFORMERS

- A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.
- B. Enclosure: Ventilated, NEMA 250, Type 2.

## 2.10 CONTROL AND SIGNAL TRANSFORMERS

- A. Description: Self-cooled, two-winding dry type, rated for continuous duty, complying with NEMA ST 1, and listed and labeled as complying with UL 506.
- B. Ratings: Continuous duty. If rating is not indicated, provide at least 50 percent spare capacity above connected peak load.

## 2.11 VIBRATION ISOLATORS

- A. Approved Manufacturers: Mason Industries, Inc., Cal-Dyn, or Korfund. Mason Industries design series numbers used as references.
- B. Isolators shall be sized to safely accommodate weight of transformer.
- C. Pads
  1. Vibration isolation shall exceed 95%.
  2. Pads shall be constructed of Bridge Bearing neoprene rubber as defined by AASHTO.
  3. When mounted on concrete, type SW pad, with standard dimensions used to match or exceed the footprint of the transformer base rail. Alternatively, and for other non-suspended applications, provide type SWM pad with steel plate to disperse weight and rubber grommet to isolate plate from mounting bolt.
- D. Combination Isolators
  1. Combination construction of rubber and spring. Vibration isolation shall exceed 98%. Furnish vibration isolation calculations with submittal.
  2. Bridge Bearing neoprene rubber as defined by AASHTO.
  3. Ceiling suspension: Type DNHS spring and double deflection neoprene hangers. Cable for sway bracing shall be stainless steel with tensile strength exceeding transformer weight by 1000%.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Comply with manufacturer's requirements for storage, handling, and installation. Include copy of manufacturer's recommendation in Operations and Maintenance manual.
- B. Remove all shipping blocks prior to installation.

### 3.2 MOUNTING

#### A. General

1. Attach to the building structure to prevent overturning in the event of Seismic category D, group IV earthquake. All attachment nuts to have split and flat washer.
2. Mount on floor, as indicated or as needed to coordinate with adjacent equipment. Set transformers level and plumb within 1/2 degree.
3. Combination isolators to optimize vibration isolation at 60 Hz.

#### B. Floor mounting

1. Refer to Section 260500 - Common Work Results For Electrical for housekeeping pad requirements.
2. Mount transformer on combination isolator.

### 3.3 CONNECTIONS

- A. Provide raceway rough-in to allow for cable pulling and minimum cable bending requirements.
- B. 208/120 volt three phase and 120/240 volt single phase secondary transformers shall be considered "grounded neutral separately derived systems" and neutral shall be grounded per code.
- C. Transformer raceway connections shall be flexible metal conduit as specified in Section 260533 - Raceways and Boxes For Electrical Systems.
- D. Voltage Tap Connections: Connect all transformers at "normal" tap. After facility is completely energized, measure secondary voltages and phase current at all transformers and service switchboard. Forward a list to Engineer and Architect for evaluation. Include copy in O&M Manual. Reconnect taps as subsequently directed. All costs associated with this work to be included in base bid.

### 3.4 IDENTIFICATION

- A. Provide permanently attached engraved nameplates per Section 260553 - Identification For Electrical Systems for each transformer.

**END OF SECTION**