

## SECTION 16460 - TRANSFORMERS

## PART 1 - GENERAL

## 1.1 SUMMARY:

- A. This section includes general purpose and specialty dry type transformers and voltage regulators with windings rated 600 V or less.

## 1.2 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data including rated kVA, frequency, primary and secondary voltages, percent taps, polarity, impedance and certification of transformer performance efficiency at indicated loads, percentage regulation at 100% and 80% power factor, no-load and full-load losses in watts, % impedance at 75 deg. C, hot-spot and average temperature rise above 40 deg. C ambient temperature, sound level in decibels, and standard published data.
- B. Wiring diagrams from manufacturer differentiating between manufacturer-installed and field-installed wiring.
- C. Product certificates, signed by manufacturer of transformers certifying that their products comply with the specified requirements.

## 1.3 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of transformers of types and ratings required for this project, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 5 years of successful installation experience on projects utilizing electrical power and distribution transformers similar to those required for this project.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Square D Co.
  - 2. General Electric Co.
  - 3. Hevi-Duty Electric.
  - 4. ITE Siemens Energy & Automation, Inc.

## 2.2 TRANSFORMERS, GENERAL:

- A. Transformers: Factory assembled and tested, air cooled units of types specified, having characteristics and ratings as indicated. Units shall be designed for 60-Hz service.
- B. Cores: Grain oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
- D. Internal Coil Connections: Brazed or pressure type.

2.3 GENERAL PURPOSE, DRY-TYPE TRANSFORMERS:

- A. Comply with NEMA Standard ST 20 "Dry-Type Transformers for General Applications."
- B. Transformers shall have the following features and ratings:
  - 1. Enclosure: Indoor, ventilated.  
Enclosure: Indoor, ventilated, drip proof.  
Enclosure: Outdoor, ventilated, raintight NEMA 3R.  
Enclosure: Totally enclosed, nonventilated.  
Enclosure: Totally enclosed, nonventilated, suitable for outdoor use.
  - 2. Insulation Class: 185 deg C or 220 deg C class for transformers 15 kVA or smaller; 220 deg C class for transformers larger than 15 kVA.
  - 3. Insulation Temperature Rise: 115 deg C maximum rise above 40 deg C.
  - 4. Windings:
    - a. 2-winding type, three phase transformers shall use one coil per phase in primary and secondary. Conductors shall be individually insulated, as small in size as possible, and transposed when necessary to minimize eddy current losses. The primary winding shall be of sufficient size to limit temperature rise to its rated value even with circulating 3rd harmonic current.
    - b. Provide aluminum windings.
    - c. Windings shall be delta-wye with 30° lagging phase shift to match ANSI standard, unless noted otherwise.
  - 5. Sound Level: Minimum of 3 dB less than NEMA ST 20 standard sound levels for transformer type and size indicated when factory tested in accordance with that standard.
  - 6. Taps: For transformers 3 kVA and larger, full capacity taps in high-voltage winding as follows:
    - a. 3 kVA through and including 15 kVA: Two 5 percent taps below rated high voltage.
    - b. Greater than 15 kVA through and including 500 kVA: Six 2-1/2 percent taps, 2 above and 4 below rated high-voltage.
    - c. 750-1000 kVA: Four 2-1/2 percent taps, 2 above and 2 below rated high-voltage.
  - 7. BIL: 10kV for all windings.
  - 8. Secondary Neutral: Twice the ampacity of the secondary phase conductors.
  - 9. Core Flux Density: Maintained below saturation point to prevent core saturation caused by harmonics even with a 10% primary over-voltage.
- C. Accessories: The following accessory items are required where indicated:

1. Surge Arresters: Low voltage type, factory-installed and connected to high-voltage terminal; complying with NEMA Standard LA 1.
2. Surge Arresters: Low-voltage type, factory-installed and connected to low-voltage terminals; complying with NEMA Standard LA 1.
3. Electrostatic shielding (where indicated): Insulated metallic shield between primary and secondary windings. Connect to terminal marked "shield" for grounding connection.
4. Wall mounting brackets: Manufacturers standard brackets for transformers sized up to 75 kVA where wall mounting is indicated.
5. Fungus Proofing: Permanent fungicidal treatment for coil core.

#### 2.4 BUCK-BOOST TRANSFORMERS:

- A. Comply with NEMA Standard ST 1 "Specialty Transformers", and UL Standard 506, "Specialty Transformers."
- B. Ratings: As indicated, and for continuous duty.
- C. Type: Self-cooled, dry type, connected as autotransformers to provide the percentage of buck or boost indicated.
- D. Enclosure: Suitable for the location indicated.
- E. Sound Level: Minimum of 3 dB less than NEMA St 1 standard for transformer of type and size indicated when factory tested in accordance with that standard.

#### 2.5 CONTROL AND SIGNAL TRANSFORMERS:

- A. Comply with NEMA Standard ST 1 "Specialty Transformers", and UL Standard 506, "Specialty Transformers."
- B. Ratings: As indicated and for continuous duty. Where rating is not indicated, provide capacity in excess of load.
- C. Type: Self-cooled, two-winding dry type.
- D. Enclosure: Indoor, except as indicated.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION:

- A. Arrange equipment to provide adequate spacing for cooling air circulation.
- B. Identify transformers in accordance with Division 16 Section on Electrical Identification.
- C. Tighten electrical connectors and terminals in accordance with manufacturer's published torque values. Where manufacturer's torque values are not indicated, use those specified in UL 486A for copper and UL 486B for aluminum.

- D. Install transformers as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NESC, NEMA, ANSI and IEEE standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.
  - E. Install units on vibration mounts; comply with manufacturer's indicated installation method, if any. Vibration mounts shall be Neoprene seismic isolator series RSM as manufactured by Vibration Mountings and Controls/Aeroflex.
  - F. Where indicated, suspend transformer from structure using transformer mounting detail as shown on the drawings.
  - G. Only totally enclosed non-ventilated transformers are allowed to be installed in ceiling air plenum spaces.
- 3.2 GROUNDING:
- A. Ground transformers and tighten connections to comply with torque values specified in UL Standard 486A.
- 3.3 FIELD QUALITY CONTROL:
- A. Tests shall conform to National Electrical Testing Association (NETA) Standard ATS, "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems," and the following:
    - 1. Test Objectives: To assure transformer installation is operational within industry and manufacturer's tolerances, is installed in accordance with Contract Documents, and is suitable for energizing.
    - 2. Procedures: Upon satisfactory completion of tests, attach a label to tested components.
    - 3. Schedule tests and notify Engineer/Architect at least one week in advance of schedule and of test commencement.
    - 4. Reports: Provide a written report of observations and tests. Report defective materials and workmanship and retest corrected defective items.
    - 5. Submit written test reports to the Engineer/Architect.
    - 6. Testing for transformers shall include verification of manual and/or automatic switching, protection, or control devices, insulation resistance test, taps verification, excitation test, and audible sound level tests.
    - 7. Provide tap voltage readings and adjust tap connections for appropriate secondary voltage. Include tap settings and voltage readings in test report.
- 3.4 ADJUSTING AND CLEANING:
- A. Upon completion of installation, inspect interiors and exteriors of accessible components. Remove paint splatters and other spots, dirt, and construction debris. Touch up scratches and mars of finish to match original finish.
  - B. Adjust transformer taps to provide optimum voltage conditions at utilization equipment.

3.5 PROTECTION:

- A. Temporary Heating: Apply temporary heat in accordance with manufacturer's recommendations within enclosure of each transformer throughout periods during which equipment is not in a space that is continuously under normal control of temperature and humidity.

END OF SECTION 16460