SECTION 26 22 00

LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General purpose transformers.

B. K-factor transformers rated for nonlinear loads.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 05 34 - Conduit: Flexible conduit connections.

E. Section 26 24 16 - Panelboards.

1.03 REFERENCE STANDARDS

A. IEEE C57.94 - Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type General Purpose Distribution and Power Transformers.

B. IEEE C57.96 - Guide for Loading Dry-Type Distribution and Power Transformers.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction.

D. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers.

E. NEMA ST 1 - Specialty Transformers (Except General Purpose Type); National Electrical Manufacturers Association.

F. NEMA ST 20 - Dry-Type Transformers for General Applications; National Electrical Manufacturers Association.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)

H. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association.

I. NFPA 70 - National Electrical Code; National Fire Protection Association.

J. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors required for mounting of transformers.

B. NEMA TR-1/ANSI 57.12.51 and 57.12.50

C. Federal Register - US department of Energy, Office of Energy Efficiency and Renewable Energy, 10 CFR Part 30, July 29, 2004. Energy Conservation Program for Commercial and Industrial Equipment, Energy Conservaiton Standards for Distribution Transformers, Proposed Rule.

D. ANSI/ASHRAE/IESNA 90.1 - Energy Efficient Design on New Buildings Except Low- Rise Residential Buildings.
   1. Transformer selection based on optimizing the combination of no-load, part-load, and full-load losses without compromising operational and reliability requirements for the building.

E. ANSI/NEMA TP-1 - Guide for Determining Energy Efficiency for Distribution Transformers.
   1. For Reference only. US DOE deos not consider NEMA TP-1 efficiency levels to reflect low life cycle cost.

F. ANSI/NEMA TP-2 - Standard Test Method for Measuring Energy Consumption of Distribution Transformers.

G. IEEE C57.110-1998 - IEEE Recommended Practice for establishing transformer capability when feeding nonsinusoidal load currents.
   1. Transformers losses increase in proportion to the mix of electronic equipment in the overall load fed from transformer.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.

C. Provide linear load efficiency data at 25 %, 35%, 50 %, 75 % , and 100 % full load.
   1. Vibration Isolators: Include attachment method and rated load and deflection.
   2. K-factor Rated Transformers: Include K-factor ratings.
   3. Shielded Transformers: Include shielding method and noise attenuation performance.

D. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA ST 20 as design and routine tests.

F. Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, core and coil material and rated temperature rise.

G. Test Reports: Indicate loss data, efficiency at 0, 25, 50, 75 and 100 percent rated load, and sound level.

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Project Record Documents: Record actual locations of transformers.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed 86 degrees F average or 104 degrees F maximum measured during any 24 hour period during and after installation of transformers.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Schneider Electric; Square D Products; Premium 30 energy efficient: www.schneider-electric.us.

B. Eaton Electrical/Cutler-Hammer: www.eatonelectrical.com.

C. Powersmiths International Corp.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ALL TRANSFORMERS

A. Description: High performance,energy efficient, copper wound transformer with 30 % less loses than NEMA TP_1 , K-13 rated. Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
   1. Altitude: Less than 3,300 feet.
   2. Ambient Temperature: Not exceeding 86 degrees F average or 104 degrees F maximum measured during any 24 hour period.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with epoxy coploymer build 72 Mils@3.2 kv/mil(dielectric) to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

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

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 K-FACTOR TRANSFORMERS RATED FOR NONLINEAR LOADS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 1561, and designed to supply nonlinear loads to the degree designated by the UL defined K-factor; ratings as indicated on the drawings.

B. Primary Voltage: 480 volts delta, 3 phase.

C. Secondary Voltage: 208Y/120 volts, 3 phase.

D. Impedance: 5 % max

E. Minimum efficiency: 99.04 % at 35 % loading of nameplate with linear /resistive laod.

F. Temp Rise: 115 deg cent. (full linear load)

G. Impregnation:Epoxy copolymer build 72 mils@ 3.2kv/mil (dielectric)

H. K-factor Rating: K-13, or higher.

I. Insulation System and Allowable Average Winding Temperature Rise: Class 220 degrees C insulation system with 115 degrees C average winding temperature rise.

J. Coil Conductors: Continuous copper windings with terminations brazed internal connections. Individually insulate secondary conductors and arrange to minimize hysteresis and eddy current losses at harmonic frequencies. Size secondary neutral conductor at twice the secondary phase conductor ampacity.

K. Winding Taps: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.

L. Neutral Bus: Sized to accommodate twice the rated secondary current.

M. Energy Efficiency: Premium efficiency complying with CSL-3 efficiency requirements of DOE 10 CFR Part 431.

N. Sound Levels: Standard sound levels complying with NEMA ST 20.
   1. 151-300 kVA: 55 dB.

O. Mounting Provisions:
   1. Up to 75 kVA: Suitable for wall, floor, or trapeze mounting.
   2. Larger than 75 kVA: Suitable for floor mounting.

P. Electrostatic Shield: Provide grounded copper electrostatic shield between primary and secondary windings to attenuate electrical noise.

Q. Transformer Enclosure: Comply with NEMA ST 20.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor clean, dry locations: Type 2.
   2. Construction: Heavy gage steel, ventilated.
   3. Finish: Manufacturer's standard grey, suitable for outdoor installations.

4. Provide lifting eyes or brackets.

R. Accessories:
1. Mounting Brackets: Provide manufacturer's standard brackets.
2. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

2.04 SOURCE QUALITY CONTROL

A. Factory test transformers according to NEMA ST 20.

B. Production test each unit according to NEMA ST 20.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1.

B. Install transformers in accordance with manufacturer's instructions.

C. Install transformers in accordance with NECA 409 and IEEE C57.94.

D. Use flexible conduit, under the provisions of Section 26 05 34, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

F. Set transformers plumb and level.

G. Mount floor-mounted transformers on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.

H. Mount floor-mounted transformers using vibration isolators suitable for isolating the transformer noise from the building structure.

I. Mount floor-mounted transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.

J. Mount trapeze-mounted transformers as indicated.

K. Provide seismic restraints.

L. Provide grounding and bonding in accordance with Section 26 05 26.

M. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

N. Where not factory-installed, install lugs sized as required for termination of conductors as

shown on the drawings.

O. Identify transformers in accordance with Section 26 05 53.

P. Install transformer identification nameplate in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

3.04 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from transformer components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION