SECTION 16460
TRANSFORMERS (600V & LESS)

1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General purpose, dry-type distribution transformers (less than 1000 kVA); complete, ready for operation, including all necessary parts, accessories, connections, tests and equipment.

B. Related Sections:
   1. Section 16050 - Basic Electrical Materials and Methods

1.2 QUALITY ASSURANCE

A. The transformer(s) and all components shall be designed, manufactured, installed and tested in accordance with the latest editions of the following codes and standards:
   1. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
   2. National Electrical Manufacturers Association (NEMA)
   3. Institute of Electrical and Electronics Engineers (IEEE)
   4. Underwriters Laboratory (UL) listed and labeled.
   5. American National Standards Institute (ANSI)
   6. Transformers losses shall conform to NEMA TP1 requirements
   7. Transformers losses shall be tested in accordance with NEMA TP2 procedures
   8. Transformers shall be labeled in accordance with NEMA TP3 procedures

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.3 SUBMITTALS

A. Submit to Engineer the following information in accordance with the requirements of section 16050 and General Conditions of Contract:
   1. Dimension drawing and weight
   2. Technical certification sheet
   3. Conduit entry/exit locations
   4. Transformer ratings including:
      a) kVA
      b) Primary and secondary Voltage
c) Taps

d) Primary and secondary continuous current

e) Impedance

f) Insulation class and temperature rise

g) Sound level

B. When requested by the Engineer the following product information shall be submitted:

1. Descriptive bulletins
2. Product sheets

1.4 OPERATION AND MAINTENANCE DATA

A. Submit to Engineer the following operation and maintenance information in accordance with the requirements of section 16050 and General Conditions of Contract:

1. Recommended renewal parts list
2. Final as-built drawings
3. Operation and Maintenance Manuals

2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Cutler-Hammer
2. Square D
3. Siemens
4. General Electric

2.2 RATINGS

A. All insulating materials are to exceed NEMA ST20 standards and be rated for 220°C UL component recognized insulation system.

B. Transformers 15kVA and larger shall be 150°C temperature rise above 40°C ambient. Transformers 25kVA and larger shall have a minimum of 4 - 2.5% full capacity primary taps. Exact voltages and taps to be as designated on the plans or the transformer schedule.

C. The maximum temperature of the top of the enclosure shall not exceed 50°C rise above a 40°C ambient.

D. Transformers shall be low loss type with minimum efficiencies per NEMA TP1 when operated at 35% of full load capacity. Efficiency shall be tested in accord with NEMA TP2.

<table>
<thead>
<tr>
<th>Single Phase</th>
<th>Three Phase</th>
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<tbody>
<tr>
<td>kVA</td>
<td>Efficiency</td>
</tr>
<tr>
<td>15</td>
<td>97.7%</td>
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<tr>
<td>25</td>
<td>98.0%</td>
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<tr>
<td>37.5</td>
<td>98.2%</td>
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2.3 CONSTRUCTION

A. Windings shall be wound of high quality copper.

B. Transformer coils shall be of the continuous wound construction and shall be impregnated with non-hygroscopic, thermosetting varnish.

C. All cores to be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating. Cores for transformers greater than 500kVA shall be clamped utilizing insulated bolts through the core laminations to ensure proper pressure throughout the length of the core. The completed core and coil shall be bolted to the base of the enclosure but isolated by means of rubber vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure except for a flexible safety ground strap. Sound isolation systems requiring the complete removal of all fastening devices will not be acceptable.

D. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.

E. The transformer enclosures shall be ventilated and be fabricated of heavy gauge, sheet steel construction. The entire enclosure shall be finished utilizing a continuous process consisting of degreasing, cleaning and phosphatizing, followed by electrostatic deposition of polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces. The coating shall be UL recognized for outdoor use. The coating color shall be ANSI 49.

2.4 SOUND LEVELS

A. Sound levels shall be warranted by the manufacturer not to exceed the following: 15 to 50KVA - 45dB; 51 to 150kVA - 50dB

2.5 WIRING/TERMINATIONS

A. External cable shall be rated 90 degrees C (sized at 75 degrees C ampacity) for encapsulated and 75 degrees C for ventilated designs. Connectors shall be selected based on the type and cable size used to wire the specific transformer.

B. All connections to transformers on both primary and secondary sides shall be made using short sections of flexible conduit to eliminate noise transmission.

C. All floor mounted transformers shall be mounted on resilient neoprene pads. Basis of design shall be 1/4" thick Korpad, as manufactured by Korfund Dynamics Corporation.
2.6 ENCLOSURE
   A. The enclosure shall be made of heavy-gauge steel. All transformers shall be equipped with a
      wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The
      maximum temperature of the enclosure shall not exceed 90 degrees C. The core of the transformer
      shall be grounded to the enclosure.
   B. On units rated 15 kVA and above the enclosure construction shall be ventilated, NEMA 2, drip-
      proof, with lifting holes. All ventilation openings shall be protected against falling dirt.

2.7 FINISH
   A. Enclosures shall be finished with weather-resistant enamel.

2.8 ACCESSORIES
   A. On outdoor units rated 15 kVA or above, provide suitable weathershields over ventilation
      openings.

3 EXECUTION
3.1 INSTALLATION
   A. Install in accordance with Section 16050 and per manufacturer’s recommendations.

3.2 TESTS
   A. The following standard factory tests shall be performed on the equipment provided under this
      section. All tests shall be in accordance with the latest applicable ANSI and NEMA standards:
      1. Ratio tests on the rated voltage connection and on all tap connections.
      2. Polarity and phase-relation tests on the rated voltage connections.
      3. No-load loss at rated voltage on the rated voltage connection.
      4. Exciting current at rated voltage on the rated voltage connection.
      5. Applied potential test
      6. Induced potential test
   B. The following field tests shall be performed on the equipment provided under this section. All
      tests shall be in accordance with the latest applicable ANSI and NEMA standards:
      1. Measure primary and secondary voltages for proper tap settings.

3.3 FIELD ADJUSTMENTS
   A. Perform field adjustments of the taps to deliver appropriate secondary voltage as required to place
      the equipment in final operating condition in accordance with the contract documents.
   B. Necessary field adjustments and minor modifications to equipment shall be carried out by the
      Contractor at no additional cost to the owner.