PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general conditions, Division 26, and Basic Electrical Materials and Methods (Section 260500) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.

B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 SUMMARY

A. Section Includes: Distribution, dry-type transformers rated 600 V and less, with capacities up to 1500 kVA.

1.3 QUALITY ASSURANCE AND STANDARDS

A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.

B. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.

C. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

D. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.4 SUBMITTALS

A. Submit shop drawings per Section 260500 for review.

B. Action Submittals
   1. Product Data: For each type of product.
      a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
      b. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

2. Shop Drawings:
   a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   b. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
   c. Include diagrams for power, signal, and control wiring.

C. Informational Submittals
1. Seismic Qualification Certificates: For transformers, accessories, and components, from manufacturer.
   a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
2. Qualification Data: For testing agency.
3. Source quality-control reports.
4. Field quality-control reports.

D. Closeout Submittals
1. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Acceptable manufacturers shall be Siemens, Eaton, or Square D.

B. Transformers shall be general purpose, energy efficient, ventilated dry-type, factory assembled, dead-front, metal enclosed, self-supporting floor standing as noted in the construction documents.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

D. Provide transformers that are constructed to withstand seismic forces specified in Section 260548.16 "Seismic Controls for Electrical Systems."

E. Transformers shall be 480V-208Y/120V 3PH 4W (primary-secondary) voltage rated, unless noted otherwise.

F. Transformers shall be rated for 115 degrees C rise above an ambient temperature of 40 degrees C.

G. Transformers shall have Class 220 coil insulation minimum.

H. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
   1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
   2. Indicate value of K-factor on transformer nameplate.
   3. Unit shall meet requirements of NEMA TP 1 when tested according to NEMA TP 2 with a K-factor equal to one.

I. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses. One leg per phase.

J. Coils shall be continuously wound non-hygroscopic type with thermosetting varnish. Windings shall be copper.

K. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.

L. Taps shall be provided at primary windings with (6) 2 1/2% taps, two above and four below rated voltage.

M. Grounding shall be provided by means of a flexible grounding strap.

N. Transformers shall be suitable for the environment in which they are located and shall be NEMA 1, indoor, unless noted otherwise on the construction documents.

O. Transformers shall have lifting lugs and be enclosed in a heavy gauge, sheet steel housing with baked enamel finish. The enclosure shall be ventilated.

P. Transformers located in exterior areas shall be NEMA 3R, with drip shield and corrosion resistant finish.

Q. Transformers shall comply with the latest ANSI and NEMA ST-20 sound performance requirements and as a minimum exceed the requirements by 3 dB.

R. Transformers 15kVA and larger shall comply with the latest NEMA TP-1 energy efficiency requirements as mandated by California Administrative Code Title 20 and 24.

S. Transformers shall have impedances greater than or equal to the following minimum values:

30kVA:	2.7%
45kVA:	1.8%
75kVA:	2.5%
112.5kVA:	2.2%
150kVA:	2.3%
225kVA:	3.6%
300kVA:	4.3%

T. Neutral: Rated 200 percent of full load current for K-factor rated transformers.

U. Wall Brackets: Manufacturer's standard brackets.

V. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

2.2 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.3 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.
1. Resistance measurements of all windings at the rated voltage connections and at all tap connections.
2. Ratio tests at the rated voltage connections and at all tap connections.
3. Phase relation and polarity tests at the rated voltage connections.
4. No load losses, and excitation current and rated voltage at the rated voltage connections.
5. Impedance and load losses at rated current and rated frequency at the rated voltage connections.
6. Applied and induced tensile tests.
7. Regulation and efficiency at rated load and voltage.
8. Insulation Resistance Tests:
a. High-voltage to ground.
b. Low-voltage to ground.
c. High-voltage to low-voltage.
9. Temperature tests.

B. Factory Sound-Level Tests: Conduct prototype sound-level tests on production-line products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by CEC and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Installation method of transformers shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.

B. Install all transformers in accordance with the manufacturer's recommendations and requirements.

C. Coordinate transformer location and size with architectural and interior drawings. Coordinate with other trades to identify conflicts with transformer locations and notify the Engineer of any conflicts.

D. Locate transformers away from corners and not parallel to adjacent wall surface.

E. Coordinate transformer size with concrete housekeeping pads, structural frames, and mounting hardware.

F. Construct concrete bases according to Section 033000 "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 260529 "Hangers and Supports for Electrical Systems."
   1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

G. Brace transformers per California Code of Regulations, Title 24, Seismic Design Category D requirements.

H. Provide rubber vibration isolation between transformer and floor, structure, or any fixed surface (including wireways).

I. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

J. Remove shipping bolts, blocking, and wedges.

K. Test all transformers for voltage level at primary and secondary windings.

L. Install all transformers plumb and square to structure and adjacent surfaces.

M. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

N. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

O. Install all conduit connections to transformer with flexible conduit.

P. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.
   1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.

2. Brace wall-mounted transformers as specified in Section 260548.16 "Seismic Controls for Electrical Systems."

Q. Clean all transformer interiors and exteriors prior to handing over to Owner. Touch up scratched paint and finishes as necessary.

R. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Tests and Inspections:
1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS for dry-type, air-cooled, low-voltage transformers. Certify compliance with test parameters.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

END OF SECTION