

CITY OF AUSTIN - AUSTIN ENERGY

PURCHASE SPECIFICATION

FOR

TRANSFORMER, NTKW, 3PH, 5,000 KVA, 34.5KV-12.47KV

DATE	PREPARED BY	ISSUANCE/REVISION	APPROVAL PROCESS SUPV. / MATERIALS SUPV.
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<i>REASON FOR REVISION</i>	<i>AFFECTED PARAGRAPHS</i>

This specification, until rescinded, shall apply to each future purchase and contract for the commodity described herein.
Retain for future reference.

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FOR
TRANSFORMER, NTWK, 3PH, 5,000 KVA, 34.5KV/12.47KV

1.0 SCOPE AND CLASSIFICATION

1.1 Scope

1.1.1 This specification covers three-phase mineral oil filled network type transformers. AE Item # 24263.

1.1.2 No deviations from this specification will be permitted.

1.2 Classification

1.2.1 Voltage shall be 34,500 Volts delta, 12470Y/7200 Volts.

1.2.2 Transformer rating shall be 5 MVA.

1.2.3 No-load high voltage taps shall be two 2-1/2% (5% total) below rated voltage and two 2-1/2% (5% total) above rated voltage.

1.2.4 Basic Insulation Level (BIL) shall be 200 kV for windings, 150 kV for bushings.

2.0 APPLICABLE STANDARDS

Network transformers furnished under these specifications shall meet all applicable, ASTM, EEI-NEMA, ANSI, AND IEEE Standards, latest revision.

2.1 ANSI C57.12.40 - Subway and Vault Types (Liquid Immersed) Requirements.

2.2 ANSI/ASTM D3487 - Mineral Insulating Oil Used in Electrical Apparatus.

2.3. ASTM D2300 - Standard Test Method for Gassing of Insulating Oils Under Electrical Stress and Ionizing. Modified Pirelli Method R (1991)

2.4 ASTM D1816 - Standard Test Method for Dielectric Breakdown Voltage of Insulating Oils of Petroleum Origin Using VED Electrodes.

2.5 ASTM D877 - Standard Practices for Sampling Water-Formed Deposits. R (1994)

2.6 ASTM D971 - Standard Test Method for Interfacial Tension of Oil Against Water by the Ring Method.

2.7 ASTM/D1500 - Standard Test Method for ASTM Color of Petroleum Products. (ASTM Color Scale) (IP Designation: 196/91)

2.8 ASTM D1524 - Standard Test Method for Visual Examination of Used Electrical Insulating Oils of Petroleum Origin in the field.

2.9 ASTM D1533 - Standard Test Method for Water in Insulating Liquids. (Karl Fisher Method)

2.10 ASTM D924 - Standard Test Method for Dissipation Factor and Relative Permittivity of Electric Insulating

Liquids.

3.0 FUNCTIONAL REQUIREMENTS

- 3.1 Transformers shall be self-cooled, 65 degrees (°) Centigrade (C) temperature rise above ambient, vault type construction, suitable for occasional submerged operation.
- 3.2 Marking of terminals, winding connections, and vector relationships of windings shall be as shown on the attached drawing (Attachment I). On the faceplate of the transformer the phase configuration shall be denoted such that the phase corresponding to H1 shall be denoted as C-phase, H2 shall be denoted as A-phase, and H3 shall be denoted as B-phase.
- 3.3 The transformer shall be equipped with a glass or magnetic type liquid level indicator on all oil filled compartments. The liquid level shall have a dark dial face with light markings and a light indicating hand. The dial markings shall show the 25 degrees (°) centigrade (C) level and the minimum and maximum levels. The words "Liquid Level" shall be on the dial or on a suitable nameplate mounted adjacent to the indicator.
- 3.4 The transformer shall be equipped with a dial type thermometer on the main tank for indicating liquid temperature. The thermometer shall have a black indicating hand and a red maximum indicating hand. The main tank thermometer shall be provided with electric alarm contacts.
- 3.5 A primary disconnect and grounding switch shall be provided on the transformer. This primary disconnect and grounding switch shall conform to the requirements identified in IEEE standard C57.12.40-2011.

When the transformer is viewed from the side of the primary switch, with the switch handle on the right hand side of the chamber, C-phase (H1) shall be closest to the handle, B-phase (H3) furthest from the handle, and A-phase (H2) between Phase B (H3) and C-phase (H1).

Sequential grounding sequence of operation shall be C-phase, then Phases C and A, and then Phases C, A, and B. This sequence of operation shall be identified on the switch index plate and also by stainless steel tags on the switch chamber. Those tags shall identify which phases are grounded and coordinate to the switch operation such that the operator can clearly determine which phases are grounded.

- 3.6 Transformers shall utilize a primary dead break switch with sequential grounding.
- 3.7 Transformers shall use a primary dead break switch with sequential grounding, which requires de-energized operation only w/special Austin Energy sequential grounding & phase notation (C, CA, CAB). The primary dead break switch with sequential grounding shall be a Quality Switch Type or buyer approved equal.
- 3.8 Alarm contacts shall be suitable for interrupting:
 - A. 0.02 ampere direct-current inductive load
 - B. 0.02 ampere direct-current non-inductive load
 - C. 2.5 ampere alternating-current non-inductive or inductive load
 - d. 250 volts maximum in all cases
- 3.9 A sudden pressure relay shall be mounted on the main tank to respond to sudden increases in internal gas pressure. A seal-in relay with contacts for alarm and tripping and a reset switch shall be externally mounted. Normal operating voltage of the seal-in relay shall be 125VAC. Shall have adequate surge suppression to prevent false operations due to transient voltages on control leads shall be provided. The sudden pressure relay shall be designed such that external vibration or mechanical shocks shall not cause false operations. All mechanical provisions and equipment for testing shall be provided. In addition, the seal –in relay and wiring shall be rated for in-circuit testing with remote lockout relay.
- 3.10 A DGA (Dissolve Gas Analysis) gauge shall be mounted on the main tank.

3.11 All transformers supplied to AE shall meet or exceed the efficiency values in accordance with the latest revision of Department of Energy CFR Title 10, Volume 3, Chapter II, Subchapter D, Part 431, Subpart K – “Energy Efficiency Program for Certain Commercial and Industrial Equipment” as applicable. Certified test data by serial number shall be provided with each transformer.

4.0 PHYSICAL REQUIREMENTS

- 4.1 The transformer high and low side shall have 600 ampere minimum side-mounted apparatus bushings. The bushings shall be bolted to the tank for ease in replacement. Welded bushings are not acceptable. Bushings provided shall be a 35 kV high side, 15kv low side, and 600 A short shank bushing without stud and be equipped with a standard copper conductor rod.
- 4.2 No internal CT’s. Austin Energy will order the CT’s separately.
- 4.3 The neutral bushing shall be insulated from the transformer tank. The ground to tank shall be made by a flexible copper braid bolted between the transformer tank and the neutral bushing of the transformer. Copper braid size shall be equal to 500 MCM bare copper. The neutral bushing shall have a six hole NEMA pad.
- 4.4 The high voltage compartment shall be completely sealed and filled with insulating oil prior to shipping.
- 4.5 The tap changer shall be designed for de-energized operation. An indicator shall clearly show the position of the tap changer.
- 4.6 The transformer tank shall be of a sealed construction, consisting of a welded main cover equipped with lifting lugs and gasketed hand-hole cover(s).
- 4.7 Jack pads or bars shall be provided so that there is three inches (3”) of clearance up from the bottom of the transformer for lifting jacks.
- 4.8 Transformer sizes listed below ~~are~~ is maximum and shall not be exceeded.

<u>KVA</u>	<u>HEIGHT</u>	<u>LENGTH</u>	<u>DEPTH</u>
5MVA	9’	11’	7’

4.10 All high & low voltage windings shall be made of copper.

5.0 INSULATING OIL REQUIREMENTS

- 5.1 The insulating oil shall be non-PCB (polychlorinated biphenyl), defined as containing less than one part per million (ppm) PCB. Certification of the non-PCB oil shall be furnished and shall include the method of testing used.
- 5.2 The transformer nameplate shall be marked “non-PCB”. In addition, a blue “non-PCB” label of a minimum 1”X 2” size shall be installed directly below the nameplate.
- 5.3 The oil shall conform to the latest revision of ANSI/ASTM D3487, Type II. The gassing coefficient shall be negative when tested in accordance with ASTM D2300, Section 2.0.
- 5.4 The Contractor shall supply test reports, which verify compliance with the oil performance requirements given below:

Test and Method

Dielectric Strength, ASTM D-1816, kV Minimum,	
0.04 inch gap:	20 kV
0.08 inch gap:	40 kV
Dielectric Strength,	30 kV

ASTM D-877, kV Minimum	
Power Factor, ASTM D-924, % maximum; 25° C	0.15
% maximum; 100 ° C	1.50
Interfacial Tension, ASTM D-971, mN/m Minimum:	35
Color, ASTM D-1500, ASTM Units:	1.0
Visual Examination, ASTM D-1524	Bright and Clear
Water Content, ATSM D-1533, ppm, maximum:	25

- 5.5 The Contractor shall be subject upon request, to furnish laboratory test data for the insulating oil. Oil furnished under these specifications shall be subject to tests and any insulating oil failing these tests will be returned to the Contractor at the Contractor's expense.

6.0 COST EVALUATION

- 6.1 All network transformer bids will be evaluated based on purchase price, guaranteed no load losses, and guaranteed winding losses. The formula and cost of losses are as follows:

Total Evaluated Bid (owning cost) = Bid Price + (cost of no load losses) x (quoted guaranteed no load losses) + (Cost of winding losses) x (quoted guaranteed winding losses)

Cost of no load losses = \$5,239.00/kW
Cost of winding losses = \$3.123.00/kW

- 6.2 Each Bidder shall quote the guaranteed no load losses and guaranteed winding losses at the time of bid opening.
- 6.3 Before or upon delivery, Contractor's certified factory test reports shall be provided to AE for final review.
- 6.4 Losses shall be the actual tested losses corrected to 20°C no load and 85°C for load, reported by serial number and City of Austin purchase order number for each transformer delivered (see section 6.2).
- 6.5 The actual losses of any one transformer on an order shall not exceed the quoted guaranteed losses by more than the following percentages:

	<u>No load losses</u>	<u>Total losses</u>
Network Transformer	10%	6%

- 6.6 Penalty

For each transformer where the actual losses exceed the quoted guaranteed losses, a penalty will be assessed through a price reduction for each transformer.

$$\text{Penalty} = 2[(\$5,239.00/\text{kW}) (\text{actual no load losses} - \text{quoted guaranteed no load losses}) + (\$3.123.00/\text{kW}) (\text{actual winding losses} - \text{quoted guaranteed winding losses})]$$

7.0 SIGNAGE

7.1 TYPICAL EXTERNAL SIGNAGE MATERIAL REQUIREMENTS OF 3-PHASE PAD-MOUNTED TRANSFORMERS

“NO PCBS” decal: 6 inch X 6 inch, blue. Base Film: 0.0035-inch cast polyvinyl chloride, with UV inhibitors as per MIL-M-22106A. Cyasorb UV-9 light absorber C14H1203, Gloss 80 UL 94 rated. Over lamination: 002PVF (polyvinylflouride) Tedlar UV screening film from E.I. DuPont. Cold-seal bonded. Adhesive: 0.002-inch permanent acrylic hi-tack, with high-temperature-resistant Elasticisors for adhesion at 40 deg. F. PSTC test method: #1 modified for a 15 minute dwell time, with 2 mils of adhesive, 56 oz/inch width rating. Ink: Silkscreen type 4, with automotive grade pigments and binders, 0.0004-inch thick + 0.0001, inch high pigment volume concentration total PVC 40-50 (copper phthalocyanines). Liner: 0.0007-inch + 0.001-inch Kraft coated one side chemical resistant. Salt spray: 240 hours 5%, at 100 degrees, with no blistering, color change, or other material degradation. No effect when immersed in diesel fuel, motor oil, anti-freeze, detergent 2 %, ammonium hydroxide (12% and 39%), kerosene, acetic acid, acetone and water. Service temperature range: -40 to +170 deg. F. Decal shall last a minimum lifetime exterior durability of 15 years from installation date with proper surface preparation.

“SIZE KVA” decal: width as required, 2 7/8 inches tall, Engineer Grade, adhesive reflective vinyl, with yellow numbers, black background.

“SIZE SECONDARY” decal: width as required, 2-7/8 inches tall, Engineer Grade, adhesive reflective vinyl, with yellow numbers on Black Background. Sticker shall read “L-L Voltage Y / L-G Voltage”.

7.2 NAMEPLATE

As described in IEEE C57.12.00, the contractor shall affix a durable metal nameplate to each transformer. The nameplate shall be located in the low-voltage compartment and shall be readable with the cables in place.

The nameplate shall be made from anodized aluminum or non-rust stainless steel. The information contained on the nameplates shall be inscribed and painted black.

The nameplate shall conform to IEEE C57.12.00: Nameplate B for 500 kVA and below and Nameplate C for 750 kVA and above. All information shall be in English and ft-pound-seconds (fps) non-metric units of measure.

The nameplate shall indicate the current-limiting fuse on a circuit diagram.

The nameplate shall contain a permanent bar code that meets the following requirements:

Information: The bar code shall display the Manufacturer Identification Code (see Attachment I) and manufacturer’s serial number.

Durability: The bar code shall last the lifetime of the transformer, as specified by IEEE C57.12.00, regarding the nameplate. The bar code shall be constructed such that, when

using a contact-type bar code reader, the bar code shall be capable of a minimum of thirty successful scans.

Dimensions: The height of the bar code shall be either 0.24 inches or 15% of the bar-code length (L); whichever is greater (see Attachment II).

Character Size: The bar code print quality shall be in accordance with ANSI X3.182. The permanent bar code shall be of medium density, ranging from 4 to 6.9 characters per inch.

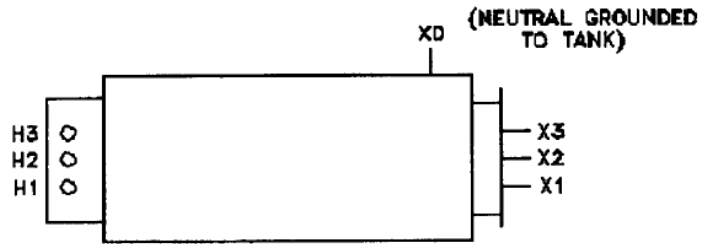
Bar Code Symbology: The bar code symbology shall be Code 39, also referred to as 3-of-9 bar code, using the 43-character ASCII set, in accordance with ANSI X3.4.

Orientation of the Bar Code Characters: The bar code characters shall be arranged in one line. A start character shall precede the manufacturer's code and a stop character shall follow the transformer serial number (see Attachment II).

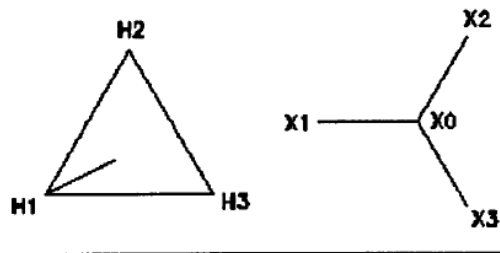
Quiet Zones: A minimum quiet zone of 0.25" shall immediately precede and follow the bar codes.

Human-Readable Interpretation: A human-readable interpretation line shall be provided directly beneath the bar code, in accordance with ANSI MH10.8M. The interpretation of the 3-of-9 bar code shall be clearly identifiable with the bar-code symbol above. The preferred shapes of the human-readable interpretation shall conform to either ANSI X3.17 or ANSI X3.49. As an alternative, any human-readable font with characters no less than 3/32" in height is acceptable.

ATTACHMENT I



TERMINAL DESIGNATIONS

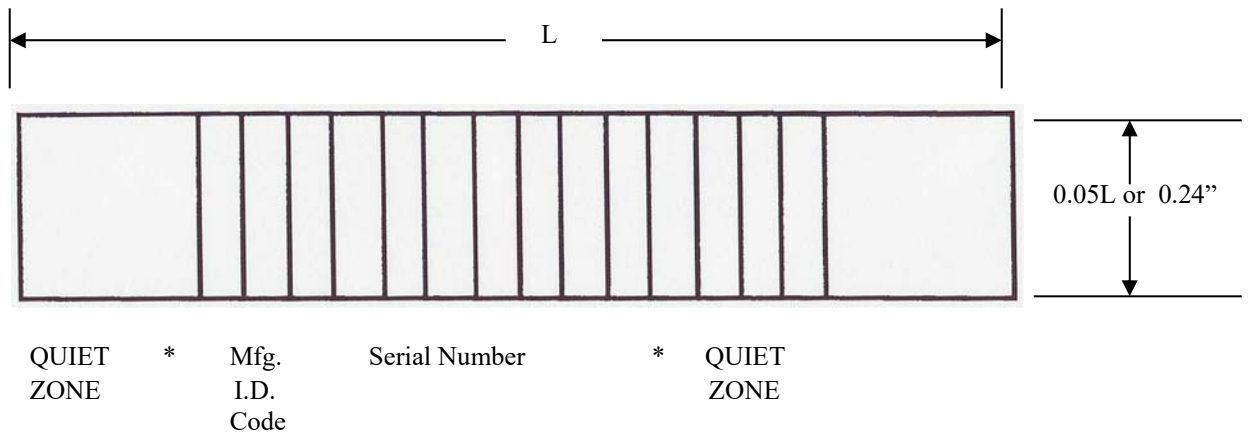


**DELTA - WYE
VECTOR RELATIONSHIPS**

TERMINAL DESIGNATIONS AND VECTOR RELATIONSHIPS FOR NETWORK TRANSFORMERS

ATTACHMENT II

ORIENTATION OF BAR CODE CHARACTERS



* Start/Stop Character