

**UTILITIES COMMISSION NEW SMYRNA BEACH
TECHNICAL SPECIFICATION FOR**

**SINGLE PHASE – OVERHEAD DISTRIBUTION TRANSFORMERS
STAINLESS STEEL - DUAL VOLTAGE**

1.0 SCOPE

- 1.1 This specification covers the general requirements for all single phase **10 to 75kVA**, 60 Hertz, mineral-oil filled, two high-voltage cover mounted bushings, overhead type distribution transformers, high voltage 7620/13200Y X 13200/22860Y low voltages 120/240.
- 1.2 **Unless otherwise specified herein, all transformers shall be in accordance with the latest revision of ANSI Standard C57.12.20.**
- 1.3 No amorphous core transformers will be accepted.

2.0 BASIC IMPULSE INSULATION LEVELS shall be in accordance with the following:

Primary:

Transformer High Voltage (kV)	7620/13200Y X 13200/22860Y
Insulation Class (kV)	18 kV
Insulation BIL (kV)	125 kV minimum

Secondary:

Rated Low Voltage (Volts)	120/240
Insulation Class (kV)	1.2
Insulation BIL (kV)	30

3.0 INTERLACED LV WINDINGS

- 3.1 **Secondary windings 10 through 75 kVA must be furnished with interlaced secondary windings.** Specific exceptions to interlaced windings must be noted on bid.
- 3.2 Internal secondary leads shall be identified with appropriate markings permanently embossed in the lead that correspond with lead markings on the nameplate.

4.0 INSTRUCTION NAMEPLATE AND MARKINGS:

- 4.1 The nameplate shall be mounted on a bracket in such a manner that there are no sharp edges exposed.

- 4.2 The winding conductor (aluminum or copper) used in each winding shall be shown on the nameplate.
- 4.3 The nameplate shall include the true date of manufacture; Month and year. Example: 0103 or 01/03. No codes will be acceptable.
- 4.4 The approximate total weight (mass) in pounds and the volume of oil (in gallons) shall be shown on the nameplate.
- 4.5 The kVA rating in Arabic numerals shall be on the tank, within nine (9) inches of the tank bottom, centered below the low voltage bushings. These numerals and letters shall be black, and shall be 2-1/2 inches high. These markings may be applied by stenciling or by any other permanent method.
- 4.6 No markings, signs or decals are to be placed on the outside of these transformers unless required by this specification.

There is to be no decal, label or sign on the transformer marked with information regarding the PCB level in the dielectric fluid. This requirement includes the transformer nameplate. Preferred wording for the nameplate is "MINERAL OIL FILLED".

5.0 CONSTRUCTION

5.1 Bushings and Terminals:

- (a) Primary bushings for severe corrosion shall have transformer bushings with a minimum creepage distance of thirty (30) inches.

5.2 Maximum Transformer Dimensions and Weights:

- (a) Transformers supplied under this specification shall conform to the following maximum weights, tank heights, and tank diameters:

Transformer Size (kVA)	Maximum Weight (LBS)	Maximum Tank Height	Maximum Tank Diameter
15	375	32.0"	16.0"
25	490	32.0"	18.5"
50	750	34.5"	23.0"
75	1,010	36.5"	25.5"

5.3 Accessory Equipment:

- 5.3.1 **Dual voltage transformers shall have an externally operated dual voltage switch set at factory on the lower of the two tap positions.** The voltage settings shall be legibly and permanently marked. Decals or markings painted on the tank are not acceptable. The transformer nameplate shall also indicate the dual voltage connection. The switch handle shall be non-corrosive with a fastening device to prevent inadvertent operation. The switch must be arranged so as not to interfere with field replacement of aerial bushings with potheads. **Switches that must not be operated while energized shall have a warning sign to this effect near the switch.**
 - 5.3.2 Transformer tanks shall be equipped with one of the following pressure relief valves. BETA Valve 1712K-3, Qualitrol 201-6, 202-030-01, or 202-037-01. The body of the valve shall be brass, bronze, or stainless steel. Approval of other valves is specifically required by the Utilities Commission.
 - 5.3.3 Two ground pads for tank grounding and low voltage grounding provisions, each consisting of 1/2 inch -13 threaded boss, 7/16 inch deep, shall be provided. Each pad shall contain #8 solid - 2 stranded copper conductor.
- 5.4 Tank Construction:
- 5.4.1 **Transformer tank design and pressure withstand requirements shall be tested in compliance with ANSI/IEEE C57.12.20.**
 - 5.4.2 Transformer cover shall be coated with insulating material capable of withstanding operating voltage to ground for five seconds.
 - 5.4.3 **The transformer tank, cover, clamping ring, hangers, and all related hard-ware will be constructed of 304L stainless steel.** If used, clamping ring bolts will be silicon-bronze to prevent galling. Weep holes must be provided in clamping rings to allow for drainage.
 - 5.4.4 The tank, cover and all bushings shall be No. 70 Light Gray in accordance with ANSI Specification Z55.1
 - 5.4.5 All external fittings shall be of corrosion resistant material.
 - 5.4.6 All welds on the exterior of the tank are to be full welds. Spot, tack, or skip welds are not acceptable for attaching brackets, grounding bosses, etc. Tank designs which minimize pockets and crevices where corrosion may occur are preferred.
 - 5.4.7 No manufacturer's installation instructions are to be packaged or shipped with the transformers. Copies of installation instructions may be delivered to the Director of Electric Operations, Utilities Commission, City of New Smyrna Beach, Florida.
 - 5.4.8 Each transformer shall be banded to a two-way entry, disposable pallet of the

manufacturer's own design. This pallet must be of such dimension as to provide two inch clearance of the transformer at its widest outside measurements, including switch handles, pressure relief valves, lifting hooks, hanger brackets, etc., on all four sides.

- 5.4.9 This pallet must provide a minimum of 2-1/2 inches of fork under-clearance. The transformer shall be banded to the pallet in such a way as to prevent shifting of the unit on the pallet surface during transit, while allowing the unit to be handled by sling or by fork truck without removing the banding.

6.0 MANUFACTURER'S PROPOSAL

6.1 The following items shall be included in the Inquiry-Reply to the Utilities Commission:

- (a) The guaranteed values of no load and load (winding) losses. No load losses shall be quoted at 20 degrees centigrade temperature. The value for load losses shall be corrected to 85 degrees centigrade temperature.

The losses for each primary voltage connection shall be supplied for all transformers with dual primary voltage ratings. (Guaranteed average losses are defined as: The average of the losses of all of the transformers in a shipment.)

The losses of an individual unit in the shipment shall not exceed the tolerances specified in Table 13, ANSI Standard C57.12.00 - 10% no load, 6% total.

Units exceeding these limits shall not be shipped to the Utilities Commission. If any such unit is found to have been shipped, the Utilities Commission will request full credit, based upon the purchase price of the unit. The unit will be returned if it can be found, if not, the full credit is still required.

- (b) An excel spreadsheet listing of the following data should be provided for each proposed unit at the time of quotation:

- Manufacturer
- Transformer ID
- kVA Rating
- Delivered Price in dollars
- Delivery (weeks)

- No Load watts @ 20 °C
- Load Loss watts @ 85 °C
- % Exciting Current
- % Impedance

- Total Transformer Weight – lbs
- Oil Volume – gallons

- Oil type (Mineral Oil or FR3)
- Maximum Total Height – inches
- Maximum Tank width - inches
- Tank Diameter – inches
- Tank Height – inches
- Tank Air Space above oil – inches

7.0 Outline Drawings

Outline Drawings and nameplate details will be provided in pdf format for each unit quoted.

8.0 TRANSFORMER EVALUATION AND LOSS PENALTY

8.1 Methodology:

The total cost of a transformer (T.C.) being evaluated will be based on the purchase price plus the present value of expected future cost due to core (no load) and winding (loaded) losses. The unit with the lowest total cost is the most economical unit purchase.

$$TC = PP + CW \times BCL + WW \times BWL$$

where:

PP = Purchase Price
 CW = Dollar per watt of core loss
 BCL = Bid Core Loss
 WW = Dollar per watt of winding loss
 BWL = Bid Winding Loss
 P = Penalty
 ACL = Actual Core Loss
 AWL = Actual Winding Loss

i = 4%
 n = 20 years
 E = .06009 \$ per KWH
 L = 60%

8.2 Calculation of Total Cost:

To calculate total cost, the present worth factor must first be found:

$$PW = \frac{(1+i)^n - 1}{i (1+i)^n} \quad \text{where } i = \text{interest rate} \\ \text{and } n = \text{transformer life in years}$$

then:

$CW = (PV)(E)(8.760)$ where E = Energy cost in \$ per KWh.

Then:

$WW = (PV)(E)(8.760)(L^2)$ where L = Percent of transformer load.

Lastly:

With PV, CW, WW calculated and PP, BCL, and BWL supplied by the vendor.

$TC = PP + CW \times BCL + WW \times BWL$

8.3 Calculation of Loss Penalty:

$P = (ACL - BCL) CW + (AWL - BWL) WW$

9.0 AUDITS - PENALTIES

9.1 The Utilities Commission may conduct random audits of transformer losses. These audits consist of actual loss measurements, which are compared to the vendor's guaranteed losses.

9.2 When the Actual Total Losses received exceed the Quoted Total Losses **and the Utilities Commission agrees to accept the unit**, the adjusted total cost of a transformer (T.C.) may be used to calculate the Price adjustment (in Dollars).

This is to be done when the actual losses exceed the quoted losses and will result in a price reduction for each unit where the losses penalty applies.

10.0 INVOICE AND LOSS DATA

10.1 The format of actual loss data is to be transmitted with each invoice. **INVOICES SHALL BE HELD UNTIL ACTUAL LOSSES ARE RECEIVED.**