

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

**THREE PHASE - LOOP FEED - DEAD FRONT PAD MOUNTED TRANSFORMER
13200GRDY/7620 X 22860GRDY/13200 - 480Y/277**

1.0 SCOPE

1.1 These specifications cover the electrical characteristics and mechanical features of dead front, loop feed, three-phase, 60Hz, mineral-oil immersed, self-cooled, pad mounted, compartmental-type distribution transformers rated 750 kVA and smaller, high voltage **13200GRDY/7620 X 22860GRDY/13200** connected with low voltages of **480Y/277**. Unless otherwise specified herein, all transformers shall be in accordance with the latest revision of ANSI Standard **C57.12.34-2009**.

1.2 No amorphous core transformers will be accepted.

2.0 RATINGS

2.1 Transformer connected Wye-Wye and all three phase units must have a five legged core, or must be of triplex design (3 single phase units in one tank).

2.2 Case temperature rise over ambient shall not exceed 45 degrees Centigrade.

No individual unit shall exceed the noise level for that size unit listed in Column A below.

The average sound level shall not exceed that shown in Column B.

	A	B
	MAXIMUM LEVEL INDIVIDUAL UNITS	AVERAGE LEVEL
<u>kVA</u>	<u>(dBA)</u>	<u>(dBA)</u>
100 and below	51	48
101 through 300	55	52
500	56	52
750	58	54

All units of each design of each size shall be tested for audible sound level. The test shall be conducted in accordance with **ANSI/IEEE C57.12.90**.

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

Primary:

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

Secondary:

Rated Low Voltage (volts)	480Y/277
Insulation Class (kV)	1.2 kV
Insulation BIL (kV)	30 kV

3.0 INTERNAL LEAD

3.1 Internal secondary leads shall be identified with appropriate markings permanently embossed in the lead that corresponds with lead markings on the nameplate.

4.0 INSTRUCTION AND NAMEPLATE 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 metal (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: 01 03 or 01/03. No codes will be acceptable.

4.4 No markings, signs, or decals are to be placed on these transformers unless required by this specification.

4.5 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 Bushing and Terminals:

(a) The transformer shall be furnished with removable stud bushing wells, Central Moloney #3-7019-1192 or approved equal, for use with replaceable load break type bushing inserts. Bail tabs are required on the bushing well clamp.

Specific written approval is required for use of wells other than the one specified. (Bushing inserts and elbows will be furnished by the Utilities Commission).

- (b) The bushing wells shall be oriented so that the elbows can be operated with a hot stick.
- (c) Primary bushing wells shall have a dust cover in place for shipment, and shall be elevated 12-1/2 degrees from the horizontal.
- (d) The internal risers to externally clamped bushing wells shall allow replacement of the bushing wells from the exterior of the tank.
- (e) Four copper one inch (min. or larger if required) threaded secondary terminals with spades (6 holes min. or larger if required) shall be located on the side wall of the transformer in the low voltage section. **Additional support for spades will be required for transformers larger than 150 KVA.** The center line of the secondary bushing shall be thirty inches above the base.

5.2 Maximum transformer weights

- (a) Transformers supplied under this specification shall conform to the following maximum weights.

TRANSFORMER SIZE (KVA)	MAXIMUM WEIGHT (LBS)
75	2400
112	2800
150	3300
225	4000
300	4400
500	5200
750	7400

5.3 Accessory Equipment

- (a) Dual voltage transformers shall have an externally operated dual voltage switch set at factory on the higher primary voltage tap position. The voltage setting 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. Switches that must not be operated while energized shall have a warning sign to this effect near the switch.
- (b) The transformer shall be equipped with a pressure relief valve with characteristics listed below:
 - 1) The body of the valve shall be brass, bronze, or stainless steel.
 - 2) Venting on rising pressure shall occur between 8 and 12 psi.

- 3) Resealing on falling pressure shall occur between 5 and 8 psi.
 - 4) The valve shall have provisions for manual venting with the use of a live line hook stick.
 - 5) The valve shall be threaded into a metal boss welded to the tank above the 140 degree top oil level.
- (c) Provide a protective bay-o-net oil immersed fuse link externally replaceable with a hot stick without opening the transformer that isolates the transformer from the system in case of an internal fault. Transformer shall be fused for higher primary voltage with lower primary voltage fuses provided with each unit.
- (d) Two 304L stainless steel hold down cleats, slotted for 1/2 inch bolts, shall be provided for the front sill.

5.4 Tank and compartment.

- (a) The transformer tank, clearances and bushing arrangements must be tamper-resistant. There shall be no exposed screws, bolts or other fastening devices which are externally removable. There shall be no openings through which foreign objects such as sticks, rods or wires might be inserted to contact live parts. If a handhole is used, a false cover shall be provided.
- (b) All welds on the exterior of the tank are to be full welds. Spot, tack or skip welds are not acceptable for attaching hinges, brackets, grounding bosses, etc. Tank designs which minimize pockets and crevices where corrosion may occur are preferred.
- (c) Two ground pads, each consisting of 1/2 in. - 13 threaded boss, 7/16 in. deep, shall be provided. The pads shall be plugged before the transformer is painted.
- (d) A compartment shall be affixed to one side of the transformer, with primary bushings on the left side of the compartment and secondary bushings on the right. Barriers fixed between primary and secondary sections and on the right side of the compartment are to be fifteen in. and sixteen in. minimum. They are to be mounted with the top of the barrier six in. above the centerline of the secondary bushings. The minimum depth between the transformer tank and the compartment door shall be eighteen in.
- (e) Doors and top-hinged lids shall be designed to prevent inadvertent dislodgement from the hinge. Preference will be given to transformer designs with compartment access that is initiated by first opening a hinged-top lid, and where such action would then permit the release of other captive front doors. The top lid shall be operable by one person, and shall be suitably supported by locking braces in the open position. The lid and doors must be designed so as not to interfere with replacement of the bay-o-net fuse being provided.
- (f) Construction of the unit shall be such that it can be lifted, skidded or slid into place on the mounting pad without disturbing the entrance cables. A removable sill is required.

- (g) The entire unit shall be primed and painted in such a way as to prevent corrosion of the interior or exterior of the unit even under coastal atmospheric conditions. The color shall be Munsell 7GY 3.29/1.5.
- (h) Suitable means for padlocking the compartment door shall be provided. Aluminum handles and latches are not acceptable. A 1/2 inch hex captive bolt with NC Class 2 threads separate from the locking device may also be provided. The bolt shall be threaded into a blind hole.
- (i) An oil drain plug shall be provided near the center of the tank. This plug should be located in an area clear of grounding pads, bushings, etc., to allow clear access for removal.
- (j) A one-half in. oil sight gauge, Tedco No. M36E or approved equivalent, shall be provided in sectionalizing type three phase units. It shall be located one-half in. to one in. below the surface of the 25 degree Centigrade oil level. Units not requiring the oil level indicator shall have an oil level plug.
- (k) Tanks without cooling fins are preferred. If required, cooling fins shall be designed so that no sharp points or edges exist on any part of the fins or where they attach to the tank. External edges shall be rounded and smoothed. Cooling fins shall be arranged to minimize their protrusion from the tank.
- (l) **Transformer tank will be constructed of 304L stainless steel, including doors, hinges, sill and other related hardware.**
- (m) All transformers rated 500 kVA or below shall have a bolted cover to allow for inspection and maintenance. Above 500 kVA shall have a welded cover and handhole to allow for maintenance.
- (n) **Transformers larger than 150KVA shall have provisions to provide support for the Low Voltage terminals. This method shall be reviewed and approved by representatives from UCNSB prior to shipment.**

5.5 **Bayonet Fusing.** Provide a protective bay-o-net oil immersed fuse link externally replaceable with a hot stick without opening the transformer that isolates the transformer from the system in case of an internal fault. The fuse size shall be stenciled on the front plate underneath the bayonet for the voltage(s).

6.0 PACKAGING AND SHIPPING

6.1 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 of the Utilities Commission.**

- 6.2 Each transformer shall be banded or cleated to a two-way entry, disposable pallet of the manufacturer's own design. This pallet must be of such dimensions as to provide 2 inch clearance of the transformer at its widest outside measurements on all four sides. This pallet must provide a minimum of 3-1/2 inches of fork under clearance. The transformer shall be attached 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 cleating.

7.0 MANUFACTURER'S PROPOSAL

- 7.1 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 several 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 must be provided for each proposed unit at the time of quotation: **The following data should be provided for each unit submitted for consideration at the time of quotation.**

- Manufacturer
- Transformer ID
- kVA Rating
- Delivered Price
- Delivery (weeks)
- No Load watts @ 20° C
- Load Loss watts @ 85° C

- 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

7.2 Outline Drawings

Outline Drawings and nameplate details will be provided in pdf format for each unit quoted at the time of quotation.

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:

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

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.**