UTILITIES COMMISSION NEW SMYRNA BEACH
TECHNICAL SPECIFICATION FOR

SINGLE PHASE – 23 KV VOLTAGE LOOP FEED - DEAD FRONT SWITCHINGPAD MOUNTED TRANSFORMER - STAINLESS STEEL

1.0 SCOPE

1.1 This specification covers ANSI Type 1, pad mounted, single phase, 60 Hertz, mineral oil filled, self cooled distribution transformers, 250 kVA and smaller, primary voltage **22860GRDY/13200**. Unless otherwise specified herein, all transformers shall be in accordance with the latest revision of ANSI/IEEE Standard **C57.12.38-2009**.

1.2 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)	**22860GRDY/13200**
Insulation Class (kV)	18 kV
Insulation BIL (kV)	125 kV minimum

Secondary:

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

3.0 INTERNAL LEAD

3.1 Transformers below 100kVA must be furnished with interlaced secondary windings. Specific exception must be noted on bid if units do not have interlaced winding.

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 two (2) 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. A bracket for ground or test bushing shall be located between primary bushings.

(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) High voltage wells for dead front application shall be externally clamped and conform to C57.12.38-2009 Type-1 Arrangement.

(e) The internal riser to externally clamped bushings shall allow replacement of the secondary bushings (50 kVA and smaller) or bushing wells (all sizes), from the exterior of the tank.

(f) Secondary bushings/spades shall have adequate strength to support the cables and prevent oil leaks. Transformers larger than 150KVA will require additional support for spades. The neutral bushing shall be insulated from the tank and provided with a detachable ground strap adequate to conduct maximum available fault current.

(g) The low voltage line and neutral terminals for 167 kVA and smaller transformers shall be a one inch threaded copper stud. The neutral stud shall be furnished with one jam nut suitable for retaining the ground strap between the nut and a secondary connector. The secondary connectors will be furnished and installed by the Utilities Commission.

5.2 Accessory Equipment

(a) **PRESSURE RELIEF DEVICE -** 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.

(b) Two 304L stainless steel hold down cleats, slotted for 1/2 inch bolts, shall be provided for the front sill.

(c) **High Voltage Switching:** Transformers will be a "switching" type transformer, used in the midpoint of the underground primary loop. Transformers shall be provided with high voltage oil immersed load break switch(es) to isolate H1A and H1B. These switch(es) will be utilized by the operator to quickly isolate/switch a line fault in an underground primary loop feed system. Please provide copy of nameplate schematic showing diagram of high voltage switch and transformer.

5.3 TANK CONSTRUCTION

(a) The tank and compartment construction shall be in accordance with ANSI C57.12.28 (latest revision) for Pad Mounted Equipment Enclosure Security.

(b) The transformer height shall be approximately **35 inches**. Tamper-resistant construction must be used throughout. 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.

(c) 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.

(d) Lifting provisions shall be threaded stainless steel .625-11 Tap X 1 inch thread inserts. The inserts shall be placed for balanced lifting, using one sling attached at two points on the transformer. Suitable blanking plugs for the lifting wells shall be provided.

(e) Two ground pads, each consisting of .500-13 Tap X .625 Deep Ground Pads. Each pad shall contain a bronze transformer tank ground connector suitable for #8 solid - 2 stranded copper conductor, Penn Union HGSE-C-1-SBH, Anderson GTCL-23A or approved equal.

(f) If a removable lid is furnished, it must be detachable only in the fully open position to prevent accidental dislodgement from the hinge. The lid shall be hinged at the top. The retainers used to prevent accidental removal of the lid from its hinges should not protrude above the hinges or have exposed sharp edges. The retainers shall be stainless steel.

(g The t**ransformer tank will be constructed of 304L stainless steel, including doors**, **hinges, sill and other related hardware**. Hinge pins shall be a minimum of .340 inches in diameter and 3 inches in length. The hinges shall be continuously welded to the tank and lid. The gauge of the hinges is to be the same or greater than the gauge of the tank.

(h) 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. The compartment sill shall be attached to the tank with 3/8 inch bolts on each side of the sill. The minimum depth between the transformer tank and the sill shall be 15 inches.

(i) 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.

(j) Suitable means for padlocking the compartment door shall be provided by a recessed latch. The latch shall be designed so as not to interfere with the operation of the primary elbow connectors and primary cable. A 1/2 inch hex head captive bolt with NC Class 2 threads separate from the locking device shall also be provided. The bolts shall be threaded into a blind hole.

(k) A 1/2 inch 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.

(l) 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. Studs, nuts, washers, and clamps on the faceplate of the tank shall be made of non-corrosive metal.

5.4 **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). Fuses shall be provided for both voltages.

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 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 2 and 2-1/2 inches of 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.

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 <u>will be provided</u> in pdf format for each unit quoted.

8.0 TRANSFORMER EVALUATION AND LOSS PENALTY

8.1 <u>Methodology:</u>

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:

$$PW = \frac{(1+i)^n - 1}{i(1+i)^n}$$

where i = interest rate
n = 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 x BCL + WW x 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.

mr 2/2012