

**SPECIFICATION NUMBER ENG97-03**

**SPECIFICATION**

**FOR**

**SINGLE-PHASE OVERHEAD**

**TYPE DISTRIBUTION TRANSFORMERS**

**500 KVA AND SMALLER**

**REVISED September 21, 2000**

**LAKELAND ELECTRIC**

**ELECTRIC SYSTEM ENGINEERING**

**LAKELAND, FLORIDA**

**INFORMATION FOR PURCHASING:**

THIS SHEET NOT TO BE INCLUDED IN THE REQUEST FOR QUOTATION.

- 1.0 Items which must be stated in the Request for Quotation
  - 1.1 Size of transformer(s) in KVA. (Section 1.1)
  - 1.2 Rating (Section 2.1 and 2.3)  
High Voltage and Low Voltage
  - 1.3 Tap Changer - if required other than required by Section 2.2

## SPECIFICATIONS

### 1.0 SCOPE

- 1.1 This specification provides for furnishing single-phase, overhead type, 60 hertz, mineral oil immersed distribution transformers, 500 KVA and smaller. SIZE SHALL BE SPECIFIED IN THE REQUEST FOR QUOTATION.
- 1.2 All characteristics, definitions and terminology except as specifically covered in this specification, shall be in accordance with American National Standards Institute (ANSI) C57.12.20, latest revision, and all specifications referenced therein.

### 2.0 RATINGS

- 2.1 The high voltage, AS SPECIFIED IN THE REQUEST FOR QUOTATION, shall be:
- a) 7200/12470 Y volts (2 high voltage cover bushings)
  - b) 12470 GRD Y/7200 volts (1 high voltage cover bushing)
  - c) Dual rated, 2400/4160 Y X 7200/12470 Y volts, (2 high voltage cover bushings) with dual voltage switch. Dual rated units shall be shipped with the switch in the higher position.
- 2.2 A primary voltage tap changer with external operator shall be installed in all transformers 167 KVA and above. If a tap changer is required for any other transformer, it will be specified in the request for quotation. The tap changer shall have two (2) 2 1/2% taps above and two (2) 2 1/2% taps below stated primary voltage. All taps shall be rated for full transformer KVA and shall be set on stated primary voltage when shipped.
- 2.3 The low voltage, AS SPECIFIED IN THE REQUEST FOR QUOTATION, shall be:
- a) 120/240 volts or
  - b) 277 volts

### 3.0 IMPEDANCE VOLTAGE

- 4.1 The percent Impedance Voltage, as measured on the rated voltage connection, shall be as follows:

<u>KVA RATING</u>	<u>IMPEDANCE RANGE</u>	
	<u>MINIMUM</u>	<u>MAXIMUM</u>
5-75	1.50%	3.00%
100-167	1.60%	3.00%
250-333	2.20%	4.00%
500	4.50%	5.50%

### 5.0 TESTING

- 5.1 Routine tests on all transformers shall be made as specified in ANSI Standard C57.12.00 latest revision. ANSI Standard Test Code C57.12.90 shall be followed for all testing procedures.
- 5.2 A certified test report (1) shall be provided to the T&D Engineering Supervisor, Electric System Engineering of Lakeland Electric at 501 E. Lemon St. Lakeland, FL 33801, on each unit prior to payment to vendor. This report shall include the following test data:
  - a) Percent impedance @ 85 degrees C
  - b) Percent excitation current
  - c) Excitation loss @ 85 degree C and 100% rated voltage expressed in watts
  - d) Load loss @ 85 degrees C and rated load expressed in watts.
- 5.3 Prior to the manufacture of transformers, manufacturer shall submit certified test results that the transformer design to be manufactured for Lakeland Electric has passed the required ANSI short circuit testing requirements. The results shall be submitted to the T&D Engineering Supervisor at Lakeland Electric for approval.

6.0 **CONSTRUCTION**

- 6.1 The construction of the tank shall conform to ANSI Standard C57.12.20, latest revision.
- 6.2 All external hardware (bolts, washers, bolt spacers, etc.) shall be made of corrosion resistant type 300 series grade stainless steel. The external hardware shall be of sufficient quality to insure ample uniform mechanical strengths and properties to perform its intended function.
- 6.3 Units shall be filled with the proper quantity of new or highly refined, non-detectable PCB insulating oil as per latest EPA, definition, containing a minimum of 0.1% inhibitor. At the time of installation, the oil shall have a minimum dielectric strength of 26,000 volts. Insulating oil tests shall conform to ANSI Standards C57.106, latest revision. Material Safety Data Sheets (MSDS) shall be provided to the City of Lakeland, Electrical Apparatus Shop at 1140 E. Parker Street, Lakeland, Florida 33801.
- 6.4 All 120/240 volt transformers 50 KVA and smaller shall have interlaced secondary design.
- 6.5 All transformers shall be provided with one of the following pressure relief devices:
 

<u>Manufacturer</u>	<u>Catalog Number</u>
Beta	1712K-3 or 1750K-3
Qualitrol	202-037-01 or 202-030-01

which shall be located according to ANSI Standard C57.12.20 latest revision.
- 6.6 Transformers 100 KVa and smaller shall be designed for single-position pole mounting. Transformers 167 KVA and above shall be designed for pad or platform mounting.
- 6.7 All transformers shall be provided with arrester mounting pads.
- 6.8 Amorphous Core Transformers are not acceptable.

7.0 **ACCESSORY EQUIPMENT**

- 7.1 On 500 KVA units, a one inch drain valve with built in oil sampling unit shall be provided.
- 7.2 On 500 KVA units, a liquid level gauge shall be mounted on the transformer according to ANSI Standard C57.12.20, latest revision.
- 7.3 On 500 KVA units, a dial-type thermometer direct stem mounted in a closed well shall be provided to indicate top liquid temperature. The thermometer shall be removable without breaking the tank seal and shall have a resettable drag hand to indicate maximum temperature. It shall be located according to ANSI Standard C57.12.20, latest revision.
- 7.4 All dual voltage switches shall have the following features:
  - a) Shall have a permanent and clearly marked voltage position indicator plate. Stenciling is not acceptable.
  - b) Shall be a positive locking device.
  - c) All external parts shall be noncorrosive.
- 7.5 All transformers shall be provided with a properly sized copper ground strap from the appropriate secondary neutral bushing to a tank ground located directly below. One additional tank ground shall be located near the bottom and back of the tank. All unused tank grounds and arrester pads are to be plugged or capped.
- 7.6 All transformers shall be equipped with a two pole, 480v high energy, MOV, secondary lightning arrester which meets ANSI Standard C62.11 latest revision for Light Duty, Distribution Class Arresters. The arrester is to be externally mounted on the tank ground just below the secondary neutral bushing (X2). Acceptable arrester would be the Cooper Power Systems model Stormtrapper H.E., Catalog #ASZH480C201, Joslyn #Z2-480-4C or equivalent to be approved by the T&D Engineering Supervisor of Lakeland Electric.

## 8.0 **BUSHINGS AND TERMINALS**

- 8.1 The number, location and arrangement of bushings shall be in accordance with ANSI C57.12.20, latest revision.
- 8.2 The high voltage terminal(s) shall be tinplated, nonferrous material size to accept #8-#2 stranded copper wire.
- 8.3 The high voltage bushings shall be in accordance with ANSI C57.12.20 latest revision and shall have a minimum height of 6 inches from the tank top to the uppermost part of the insulator, excluding the terminal. Both high voltage and low voltage bushings shall be colored Munsell gray 5BG7.0/0.4.
- 8.4 The low voltage terminals shall be tinplated and sized in accordance with ANSI C57.12.20, latest revision, and shall be designed to allow maximum clearance between live parts in the working area.
- 8.5 The low voltage terminals shall be compatible with the continuous rating of the transformer at maximum KVA and suitable for operation with overload capabilities per ANSI C57.92, latest revision.

9.0 **LABELS AND MARKINGS**

- 9.1 The size KVA of the transformer shall be indicated with 3" high numbers and letters. The lettering to be reflective yellow with a black background and located midway between the X2 terminal and the bottom of the tank.
- 9.2 All tap changers shall be labeled with a "De-energize Before Operating" label.
- 9.3 All dual voltage switches are to be appropriately marked "7.2KV" and "2.4KV".

10.0 **TANK**

10.1 All transformers shall be provided with a removable grounded transformer tank cover. Tank covers shall have a slope for moisture run off and 100 KVA and below shall have an insulated coating on the cover capable of withstanding 10kV at a 2000 volt/sec rate of rise. The cover shall be grounded with a suitable ground strap. The tank and cover shall be zinc phosphatized or shot blasted to remove oil and dirt, resist rust and improve the paint to metal bond. The primer shall be a rust resistant coating with 1 mil minimum thickness and shall be a color other than the finish coat. The finish coat shall be a minimum of 2 mils thickness and shall provide a tough non chalking weather resistant finish. The color shall be light gray No. 70 Munsell Notation 5BG7.0/0.4, as specified in ANSI Z55.1 latest revision. The quality of the paint finish shall meet the following American Society for Testing and Materials (ASTM) environmental and physical tests:

- a) Salt fog cabinet test (ASTM B-117, latest revision)
- b) Accelerated weathering test (ASTM G-53/D-523, latest revision)
- c) Mandrel flexibility test (ASTM D-2794, latest revision)

10.2 The inside of the tank shall be painted a light gray color (ANSI 70) as per section 10.1.

11.0 **INSTRUCTION NAMEPLATE**

11.1 The instruction nameplate and information thereon shall meet all the requirements as specified in ANSI C57.12.00, latest revision. The month and year of the manufacture date shall be uncoded and stamped on the nameplate.

12.0 **EVALUATION**

12.1 The economic evaluation will be based on the following evaluation factors for losses:

- a) \$  2.61  /watt for excitation loss @100% rated voltage and 85 degree C.
- b) \$  0.60  /watt for load loss @ 85 degree C and rated load.

13.0 **EXCEPTIONS TO THESE SPECIFICATIONS**

- 13.1 Should the manufacturer wish to make exceptions to these specifications, he shall provide complete written specifications and any supporting drawings on the equipment he is submitting the proposal on. Written approval on any exceptions must be obtained from the T&D Engineering Division of Lakeland Electric.
- 13.2 After initial approval of a specific design, any design changes shall be approved by the T&D Engineering Division of Lakeland Electric, prior to manufacture.

14.0 **LOSS ADJUSTMENT PROCEDURES**

- 14.1 Each manufacturer is expected to supply distribution transformers which do not exceed the quoted values for excitation loss or load loss as described in paragraph 16.6 and as submitted in the bid proposal. Any unit(s) delivered by a manufacturer to Lakeland Electric that possess any parameter outside the quoted values as specified shall, at the option of Lakeland Electric:
  - a) Be returned to the manufacturer, freight collect, for replacement with units meeting quoted values.
  - b) Be retained by Lakeland Electric subject to a loss adjustment charged to the manufacturer. The adjustment shall be equal to the levelized present value of the difference in loss costs (using actual parameter versus quoted parameter) evaluated at the present cost of money for Lakeland Electric over a 20 year period but not to exceed the current price of the unit(s). The adjustment will be based only on losses over the quoted values. Credit will not be given for losses under quoted values. The loss adjustment amount will be deducted from the total invoice and payment made on the balance.
- 14.2 Any manufacturer who delivers distribution transformers which fail to meet the manufacturer's quoted losses may be suspended from bidding on the next fiscal year's requirements for which quotes are requested. Any manufacturer who continually or willingly delivers distribution transformer shipments to Lakeland Electric which fail to meet the manufacturer's quoted losses, will be deleted as an approved supplier of distribution transformers.

15.0 **SHIPPING AND ACCEPTANCE**

- 15.1 All units shall be single stacked and shipped in such a manner that no chafing or shifting is allowed. Each unit shall be securely attached to a single weather resistant pallet by metal bands or bolts.
- 15.2 Receipt of the order by the Purchasing Department, City of Lakeland, is not acceptance. Acceptance will be at the option of the T&D Engineering Division of Lakeland Electric.

16.0 **INFORMATION REQUIRED WITH PROPOSAL**

- 16.1 Unit price FOB Lakeland for each size unit.

- 16.2 Delivery Schedule.
- 16.3 Dimensional data on each size unit.
- 16.4 Weight of each size unit.
- 16.5 Guaranteed losses as specified in a and b below at 85 degrees C. The average of the losses of the total transformers for each KVA design shall not exceed the quoted values for excitation loss or load loss. The losses of an individual unit in the shipment may not exceed the tolerances specified in ANSI Standard C57.12.00, latest revision.
  - a) Excitation loss: The no load power loss of the transformer at 100% rated voltage, expressed in watts at 85 degrees C.
  - b) Load loss: The  $I^2R$  winding loss of the transformer at rated load, expressed in watts at 85 degrees C.
- 16.6 Percent impedance at 85 degrees C.