



ENERGY DELIVERY ENGINEERING

SPECIFICATION

EDEN-201

SPECIFICATION

FOR

SINGLE-PHASE OVERHEAD

TYPE DISTRIBUTION TRANSFORMERS

833 KVA AND SMALLER

LAKELAND ELECTRIC
ENERGY DELIVERY ENGINEERING
LAKELAND, FL

REVISED: 12/14/2012

TABLE OF CONTENTS

GENERAL REQUIREMENTS

1.	SCOPE.....	1
2.	RATINGS.....	1
3.	IMPEDANCE VOLTAGE.....	1
4.	TESTING.....	1
5.	CONSTRUCTION.....	2
6.	ACCESSORY EQUIPMENT.....	2
7.	BUSHINGS AND TERMINALS.....	3
8.	LABELS AND MARKINGS.....	3
9.	TANK.....	3
10.	NAMEPLATE.....	3
11.	EVALUATION.....	4
12.	EXCEPTIONS TO THESE SPECIFICATIONS.....	4
13.	LOSS ADJUSTMENT PROCEDURES.....	4
14.	SHIPPING AND ACCEPTANCE.....	4
15.	INFORMATION REQUIRED WITH PROPOSAL.....	5

GENERAL REQUIREMENTS

1. SCOPE

- 1.1. This specification provides for the furnishing of single-phase, overhead type, 60 hertz, mineral oil immersed distribution transformers, 833 KVA and smaller. KVA SIZE'S 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 ANSI/IEEE C57.12.20, latest revision, and all specifications referenced therein.

2. RATINGS

- 2.1. The high voltage shall be 7200 / 12470 Y (2 high voltage cover bushings)
- 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 shall be 120/240 volts unless otherwise specified.

3. IMPEDANCE VOLTAGE

- 3.1. 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%

4. TESTING

- 4.1. Routine tests on all transformers shall be made as specified in ANSI/IEEE Standard C57.12.00 latest revision. ANSI/IEEE Standard Test Code C57.12.90 shall be followed for all testing procedures.
- 4.2. A certified test report (1) shall be provided via Email or mail, to the T&D Engineering Supervisor of Energy Delivery Engineering (EDEN) 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. CONSTRUCTION

- 5.1. The construction of the tank shall conform to ANSI/IEEE Standard C57.12.20, latest revision.
- 5.2. All external hardware (bolts, washers, bolt spacers, etc.) shall be made of corrosion resistant type 300 series stainless steel. The external hardware shall be of sufficient quality to insure ample uniform mechanical strengths and properties to perform its intended function.
- 5.3. Units shall be filled with the proper quantity of new, 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/IEEE Standards C57.106, latest revision.
- 5.4. Material Safety Data Sheets (MSDS) shall be provided to the City of Lakeland, Electrical Apparatus Shop at 1140 E. Parker Street, Lakeland, Florida 33801 on all oil contained in transformers. A single MSDS will suffice for each award provided no changes are made to the oil referenced on the MSDS.
- 5.5. All 120/240 volt transformers 50 KVA and smaller shall have interlaced secondary design.
- 5.6. All transformers shall be provided with an approved pressure relief device, (35 SCFM @ 15 PSIG Min.), which shall be located according to ANSI/IEEE Standard C57.12.20 latest revision
- 5.7. 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.
- 5.8. All transformers shall be provided with arrester mounting pads.
- 5.9. Amorphous Core Transformers may be accepted as an alternative to silicon steel transformers.

6. ACCESSORY EQUIPMENT

- 6.1. On 500 KVA units, a one inch drain valve with built in oil sampling unit shall be provided.
- 6.2. On 500 KVA units, a liquid level gauge shall be mounted on the transformer according to ANSI/IEEE Standard C57.12.20, latest revision.
- 6.3. 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/IEEE Standard C57.12.20, latest revision.
- 6.4. 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.
- 6.5. All transformers shall be equipped with a two pole, 480 volt high energy, MOV, secondary lightning arrester which meets ANSI/IEEE 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 arresters would be the Cooper Power Systems model Storm trapper H.E., Catalog #ASZH480C201, Joslyn #Z2-480-0M or approved equivalent.

7. BUSHINGS AND TERMINALS

- 7.1. The number, location and arrangement of bushings shall be in accordance with ANSI/IEEE C57.12.20, latest revision.
- 7.2. The high voltage terminal(s) shall be tinned, nonferrous material size to accept #8-#2 stranded copper wire.
- 7.3. The high voltage bushings shall be in accordance with ANSI/IEEE 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.
- 7.4. The low voltage terminals shall be tinned and sized in accordance with ANSI/IEEE C57.12.20, latest revision, and shall be designed to allow maximum clearance between live parts in the working area.
- 7.5. 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/IEEE C57.92, latest revision.

8. LABELS AND MARKINGS

- 8.1. The KVA size of the transformer shall be indicated with 3" high numbers and letters. The lettering is to be a reflective yellow with a black background and located midway between the X2 terminal and the bottom of the tank.
- 8.2. All tap changers shall be labeled with a "De-energize before Operating" label.

9. TANK

- 9.1. 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/IEEE 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)
- 9.2. The inside of the tank shall be painted a light gray color (ANSI 70) as per section 9.1 from 2" below the oil fill line to the top.

10. NAMEPLATE

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

11. EVALUATION

- 11.1 The annual cost evaluation will be based on the formula $A + B + C = \text{Total ownership costs (TOC)}$, where $\text{TOC} = [A \times (\text{Core Loss})] + [B \times (\text{Winding Loss})] + \text{Initial Cost}$.
- 11.2. The economic evaluation will be based on the following evaluation factors for losses:
- \$ 3.07 /watt for excitation core loss @100% rated voltage and 85 degree
 - \$ 0.98 /watt for load winding loss @ 85 degrees C and rated load.

12. EXCEPTIONS TO THESE SPECIFICATIONS

- 12.1. Should the manufacturer wish to make exceptions to these specifications, they shall provide complete written specifications and any supporting drawings on the equipment they are submitting the proposal on. Written approval on any exceptions must be obtained from the T&D Engineering supervisor of Energy Delivery Engineering (EDEN) of Lakeland Electric, at 501 E. Lemon Street, Lakeland, Florida 33801.
- 12.2. After initial approval of a specific design, any design changes shall be approved by the T&D Engineering supervisor of Energy Delivery Engineering (EDEN) of Lakeland Electric, at 501 E. Lemon Street, Lakeland, Florida 33801 prior to manufacture.

13. LOSS ADJUSTMENT PROCEDURES

- 13.1. 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 15.5 and as submitted in the bid proposal. Any unit(s) delivered by a manufacturer to Lakeland Electric that possesses any parameter outside the quoted values as specified shall, at the option of Lakeland Electric:
- Be returned to the manufacturer, freight collect, for replacement with units meeting quoted values.
 - 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. For annual/multi-year awards, the loss adjustment amount will be calculated quarterly based on the average of all certified losses provided by the manufacturer for that quarter and will be deducted from the next processed total invoice with payment made on the balance.
- 13.2. Any manufacturer who delivers distribution transformers which fail to meet the manufacturer's quoted losses may be suspended from bidding on the next quotation. Any manufacturer, who continually or willingly delivers distribution transformer shipments to Lakeland Electric which fails to meet the manufacturer's quoted losses, will be deleted as an approved supplier of distribution transformers.

14. SHIPPING AND ACCEPTANCE

- a) All units shall be 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 bands or bolts.
- b) Receipt of the order by the Purchasing Department, City of Lakeland, is not acceptance. Acceptance is contingent upon satisfactory inspection of the units and review of test reports by Lakeland Electric, T&D Engineering (EDEN) and will be at their option.

15. INFORMATION REQUIRED WITH PROPOSAL

- 15.1. Unit price FOB Lakeland for each size unit.
- 15.2. Delivery Schedule.
- 15.3. Dimensional data on each size unit.
- 15.4. Weight of each size unit.
- 15.5. 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.
- 15.6. Percent impedance at 85 degrees.