ENERGY DELIVERY ENGINEERING

SPECIFICATION

EDEN-211

SPECIFICATION
FOR
SINGLE-PHASE PAD-MOUNT
DISTRIBUTION TRANSFORMERS
167 KVA AND SMALLER

LAKELAND ELECTRIC
ENERGY DELIVERY ENGINEERING
LAKELAND, FL

REVISED: 12/14/2012

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GENERAL REQUIREMENTS

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1. SCOPE

1.1 This specification provides for the furnishing of single-phase, 60 hertz, dead-front, pad-mount (loop-feed), compartmental type, self cooled, mineral oil immersed transformers, 167 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 Standard C57.12.38 latest revision, and all specifications referenced therein.

2. RATINGS

2.1 The high voltage shall be 7200 / 12470 Y volts.

2.2 No tap changer shall be provided unless otherwise specified.

2.3 The low voltage shall be 120/240 volts.

3. INSULATION LEVEL

3.1 The high voltage insulation shall be 15kV class and shall have a minimum Basic Impulse Level (BIL) of 95kV.

3.2 The low voltage insulation shall be 1.2kV class and have a minimum BIL of 30kV.

4. IMPEDANCE VOLTAGE

4.1 The percent impedance voltage, as measured on the rated voltage connection, shall be as follows:

KVA RATING	IMPEDANCE RANGE	
	MINIMUM	MAXIMUM
25-75	1.50%	3.00%
100-167	1.60%	3.00%

5. TESTING

5.1 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.

5.2 A certified test report 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 Street, Lakeland, Florida 33801, on each unit prior to payment to vendor. This report shall include the following test data:

a. Percent impedance at 85 degrees C.

b. Percent excitation current.

c. Excitation loss at 85 degrees C and 100% rated voltage expressed in watts.

d. Load loss at 85 degrees C and rated load expressed in watts.

6. CONSTRUCTION

6.1 The pad-mounted transformers shall meet the requirements for tamper resistance as set forth in ANSI/IEEE Standard C57.12.28, latest revision.

6.2 The construction of the tank shall conform to ANSI/IEEE Standard C57.12.25, latest revision, with the following exceptions:

a. A one half inch (1/2") captive, spring loaded, penta head bolt of silicon bronze material with NC class 2 threads, shall be installed on the door handle. The nut shall be made captive in a metal cup that is permanently attached. A minimum size hole of one half inch (1/2") shall be provided in the cup for a padlock. The bolt shall be installed such that it is accessible only after the lock is removed and it must be tightened before the lock can be installed. The nut shall be made of stainless steel with NC class 2 threads and shall be installed in a manner that will allow it to be replaced. The method of containing the nut must be designed so that it shall not be possible to insert a wire through or around the nut into the cable compartment when the bolt is not in place. This locking device shall be suitable for locking with a Sterling junior rotary ring lock with ¼" shank.

b. The front compartment shall be easily removable and shall have a safety device to prevent the door from being accidentally removed from its hinges. Each hinge shall be made of 300 series stainless steel welded or bolted on and have a 300 series grade stainless steel hinge pin. The gauge of the hinges shall be the same or greater than the gauge of the tank. If the hinges are bolted on, the bolts shall not be exposed or accessible with the door(s) closed.

c. The faceplate of the transformer tank shall have no opening greater than ¼" from the bottom of the oil compartment to the base of the transformer.

d. All external and internal hardware (i.e. clamps, bolts, nuts, bails, etc.) shall be made of corrosion resistant 300 series stainless steel. The sill shall be a removable design constructed of 300 series stainless steel. Silicon bronze nuts and bolts are also acceptable.

6.3 Lifting provisions on all units shall be 5/8" - 11 threaded flush mounted inserts of corrosion resistant material and so arranged to provide suitable balanced lift for the completely assembled unit.

6.4 All transformers shall be provided with an approved pressure relief device, (35 SCFM @ 15 PSIG Min.). This device shall be located in the upper right hand corner of the secondary voltage compartment.

6.5 Units shall be filled with the proper quantity of new, non-detectable PCB insulating oil as per latest EPA definition, containing a minimum of 0.2% 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.

6.6 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.

6.7 The high voltage compartment shall have one RTE Flapper Bay-O-Net (or approved equivalent) fuse assembly equipped with the appropriate externally removable oil fuse shown in the Fusing Schedule (Section 17).

6.8. Inside each unit, RTE ELSP, Hi-Tech, or approved equivalent oil submersible back-up current limiting fuses shall be installed as shown on the Fusing Schedule (Section 17). They shall be connected before and in series with the Bay-O-Net fuses.

6.9 An oil drip shield or cup shall be provided beneath the Bay-O-Net fuse(s) to prevent oil from dripping on primary bushings or terminators and shall be located such that they do not interfere with the switching operations of the unit.

a. Oil drip shields shall be at least 4 inches wide along its complete length and shall be slightly angled down to the left and designed to drain away any transformer oil that may drip from the Bay-O-Net Fuses.

b. Oil drip cups shall be constructed such that they are easily positioned and fastened to the exposed end of the Bay-O-Net holder without removal of the fuse holder.

6.10 All 120/240 volt transformers 50 KVA and smaller shall have interlaced secondary design.

6.11 Amorphous Core Transformers may be accepted as an alternative to silicon steel transformers.

7. AUDIBLE SOUND LEVELS

7.1 Transformers shall be so designed that the average sound level will not exceed the values specified by the National Electrical Manufacturers Association (NEMA) Standard TR1 latest revision, when measured at factory in accordance with conditions outlined in NEMA Standard TR1 latest revision.

8. BUSHINGS AND TERMINALS

8.1 The high voltage bushings, terminals and parking stands shall be arranged according to ANSI Standard C57.12.38, latest revision.

8.2 The high voltage terminations shall be 8.3/14.4kV - 125kV BIL dead front, externally clamped, universal type Central Maloney, Cooper Power Systems, or approved equivalent, bushing wells with removable copper stud. The minimum current carrying capabilities of components for the looped primary cable system shall be 200 amps (continuous) and 10,000 amps symmetrical (momentary).

8.3 The high voltage bushing wells shall be externally replaceable.

8.4 The high voltage bushings shall have an external clamp with 3 or 4 protruding tabs (one on each corner) that are sufficient in length and hole size to tie down a super close feed through insert or an approved alternative.

8.5 The low voltage line and neutral terminals shall have a 5/8" - 11 copper stud with jam nut for 75 KVA and smaller and a 1" - 14 copper stud with jam nut for 100 and 167 KVA. On 75 KVA and smaller, the stud shall protrude at least 1 1/4 inches beyond the end of the bushing. On 100 and 167 KVA units, the stud shall protrude at least 1 3/4 inches beyond the end of the bushing. The bushings shall be (1) externally replaceable approved non-porcelain bushings, (2) externally replaceable porcelain bushings, or (3) on those units designed with bolted covers providing access to the internal clamps and connections, internally clamped bushings may be provided.

8.6 The low voltage neutral bushing shall be fully insulated with a removable copper ground strap or cable connected between the neutral bushing and a ground pad on the outer surface of the tank. This strap shall be sized for the rating of the transformer.

9. LABELS AND MARKINGS

9.1 The high voltage bushings and low voltage terminals shall be labeled with the appropriate letters and numbers as indicated in ANSI/IEEE Standard C57.12.38 and C57.12.28, latest revision. These labels shall be clearly shown adjacent to each bushing in positions which will be visible with cables installed and door open.

9.2 All tap changers shall be permanently labeled with a "De-Energize before Operating" label.

9.3 The transformers shall be provided with the National Electrical Manufacturers Association (NEMA) transformer markings. A "Warning" label shall be installed on the outside of the transformer near the door handle and a "Danger" label shall be installed inside the transformer to be visible when facing into the transformer.

The labels shall be made of a tamper resistant, durable, highly reflective UV resistant film.

9.4 No recommended fuse size or schedules shall be stenciled, stamped or otherwise marked on or attached to the units, except current limiting fusing as described in this specification.

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 date of manufacture shall be stamped on the nameplate uncoded.

10.2 When used current limiting fuse type and rating information shall be shown on the nameplate.

11. TANK

11.1 The coating system shall meet ANSI/IEEE Standard C57.12.28, latest revision.

11.2 The top coat shall be olive green Munsell 7GY3.29/1.5 in color. The paint finish shall be smooth, even, and free of any grainy appearance or paint runs. 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 -2794, latest revision)

11.3 A tar base pitch, zinc rich (85% minimum) or approved epoxy coating, 1.5 mil minimum thickness, shall be applied to the tank bottom and all surfaces that are in contact with the mounting pad for a minimum height of TWO (2) inches. A stainless steel bottom may be accepted as an alternative to coating.

12. SHIPPING AND ACCEPTANCE

12.1 All units shall be shipped in such a manner so as to prevent chafing or shifting. Each unit shall be securely attached to a single weather resistant pallet by bands or bolts.

12.2 Receipt of the order by the City of Lakeland Purchasing Department shall not constitute acceptance. Acceptance is contingent upon satisfactory inspection of the units and

reviews of test reports by Lakeland Electric, T&D Engineering (EDEN) and will be at their option.

13. EVALUATION

13.1 The annual cost evaluation will be based on the formula A + B + C = Total ownership costs (TOC), where TOC = [A x (Core Loss)] + [B x (Winding Loss)] + Initial Cost.

13.2 The economic evaluation will be based on the following evaluation factors for losses.

a. $ 3.07 /watt for excitation (core) loss at 100% rated voltage and 85 degree C.

b. $ 0.98 /watt for load (winding) loss at 85 degrees C and rated load.

14. EXCEPTIONS TO THESE SPECIFICATIONS

14.1 Should the manufacturer wish to make exceptions to these specifications, they shall provide complete written specifications and any supporting drawings. Written approval on any exceptions must be obtained from Lakeland Electric T&D Engineering (EDEN).

14.2 After initial approval of a specific design, any design changes shall be approved by Lakeland Electric T&D Engineering (EDEN), prior to manufacture.

15. LOSS ADJUSTMENT PROCEDURES

15.1 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 16.5 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:

a. Be returned to the manufacturer, freight collect, for replacement with unit(s) meeting quoted values.

b. Be retained by Lakeland Electric subject to a loss adjustment charged to the manufacturer on an invoice basis. 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.

15.2 Any manufacturer, who continually or willingly delivers distribution transformer shipments to Lakeland Electric which fails to meet manufacturer's quoted losses, will be deleted as an approved supplier of distribution transformers.

16. 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 all the transformers of each KVA design shall not exceed the quoted values for excitation or load loss. The tested loss valves 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^2 R winding loss of the transformer at rated load, expressed in watts at 85 degrees C.

16.6 Percent impedance at 85 degrees C.

17. FUSING SCHEDULE SINGLE PHASE PAD-MOUNT DISTRIBUTION TRANSFORMERS

1 PHASE KVA	BAY-O-NET[1]	ELSP	Hi-Tech
5	C03	3543030M61M	HTSS232040
10	C03	3543030M61M	HTSS232040
15	C03	3543030M61M	HTSS232040
25	C05	3543030M61M	HTSS232040
37.5	C08	3543065M61M	HTSS232050
50	C08	3543065M61M	HTSS232065
75	C10	3543125M71M	HTSS232100
100	C10	3543125M71M	HTSS232125
167	C12[2]	3543150M71M	HTSS232150

1. 125A High Ampere Overload Bay-O-Net Fuse Link, Cooper Power Systems: 4038361C05CB
2. Bay-O-Net Fuse is Current (fault) Sensing RTE 4000353C ___