S. C. Electric Cooperative's
Specification for a Three-Phase, Padmounted URD Transformer
(Revised 12/2014)

1.0 GENERAL

1.1 This specification covers the electrical and mechanical characteristics of Three-Phase, Oil-Filled (certified non-PCB), Pad-Mounted URD Transformers.

1.2 All characteristics, definitions, and terminology, except as specifically covered in this specification shall be in accordance with the latest revision of the following ANSI and NEMA standards.

C57.12.00 - IEEE Standard General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers.

C57.12.26 - Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers With Separable Insulated High-Voltage Connectors; High Voltage, 34500GRDY/19920 Volts and Below; 2500 kVA and Smaller.

C57.12.28 - Pad-Mounted Equipment - Enclosure Integrity.

C57.12.90 - IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and IEEE Guide for Short-Circuit Testing of Distribution and Power Transformers.

1.3 In addition to the above requirements, the transformers shall also meet the requirements of the Rural Utility Service (RUS-formerly REA) Specification U-5and Department of Energy (DOE) 10 CFR Part 431 Efficiency Compliance.

2.0 RATINGS

2.1 The transformer shall be designed in accordance with this specification and shall have one of the following kVA ratings:

45, 75, 112.5, 150, 225, 300, 500, 750, 1000, 1500, 2000, 2500

<The applicable kVA rating(s) shall be specified on Attachment A.>

2.2 The primary voltage and the basic insulation level (BIL) shall be 95 kV for 12,470 Grd. Y/7200 volts,125 kV for 24,940 Grd.Y/14,400 volts and 95 X125 kV for 12,470 Grd. Y/7200 X 24,940 Grd. Y/14,400 volts (dual voltage primary).

2.2.1 Dual voltage transformers shall have dual voltage primary windings connected to an externally operable, dual voltage selector switch for de-energized operation only. Two operations (minimum) shall be required to change switch position. Unit to be shipped with voltage selector switch in highest voltage position.

<The primary voltage shall be specified on Attachment A.>

2.3 The secondary voltage shall be 208Y/120 or 480Y/277 volts. The basic insulation level (BIL) of the secondary shall be 30 kV.

<The secondary voltage shall be specified on Attachment A>

2.4 ***If specified on Attachment A***, the transformer shall be furnished with full capacity high-voltage taps. The tap changer shall be clearly labeled to reflect that the transformer must be de-energized before operating the tap changer. If taps are required on dual voltage units, the taps shall be on the higher voltage (series) position only. The unit shall have one of the following tap configurations:

Two - 2½% taps above and below rated voltage
Four - 2½% taps below rated voltage

2.5 **Percent Voltage Impedance** of units shall be as specified in table below with a tolerance of +/- 7.5%.

500 KVA and smaller	>1.8% to < 4.0%
750 KVA and larger	5.75%

3.0 HIGH VOLTAGE BUSHINGS

3.1 There shall be six (6) high voltage bushings wells for dead front, loop feed operation rated for three-phase duty. These wells shall be externally clamped and removable to allow for field replacement of the bushings without opening the tank. The bushing well studs shall be removable without removing the bushing wells.

3.2 The bushing configuration shall be per ANSI Figure 6A for loop feed configuration.

3.3 Cable accessory parking stands shall be provided and shall be located such that the separable insulated connectors designed for operation after the transformer is in place can be operated with hot-line tools.

3.4 ***If specified on Attachment A***, bushing well inserts of the specified voltage shall be installed in the transformer. These inserts shall have an all copper current carrying path.

4.0 LOW VOLTAGE BUSHINGS AND TERMINALS

4.1 The configuration of the secondary bushings shall be per ANSI C57.12.26-*staggered (Figure 8A - default configuration)* or *in-line (Figure 8B).*

<The applicable low voltage bushing configuration shall be specified on Attachment A.>

4.2 These bushings shall be externally clamped and shall be removable to allow for field replacement without opening the tank if possible. The transformer shall have threaded, stud-type line and neutral bushings with jam nuts as per ANSI C57.12.26 Figure 9(d) with blade type spade terminals.

Transformers larger than sizes listed in Figure 9(d) can have solid one-piece bushings with non-removable spades if threaded type bushings are not available in ampere range required. The number of holes in the spade terminals shall be as follows:

Size	Number of holes
225 kvA and smaller	4
300 kvA	6
500 kvA	8
750 kvA	10
1000 kvA	12
1500 & 2000 kvA	14
2500 kvA	16

Spade terminals with ten (10) or more holes shall be equipped with an insulated, disconnectable support that prevents upward or downward movement of the terminal.

4.3 The low voltage neutral shall be a fully insulated bushing with a removable ground strap.

5.0 PROTECTION

5.1 The transformer primary shall include loadbreak, hook stick operable bayonet dual element fuse assemblies (RTE type 108 or equal) with oil valves to minimize oil spillage. The bayonet assembly shall be used in series with an internally mounted isolation link. Maximum interrupting rating in RMS amperes shall be 3500 for 8.3 kV class and 2500 for 15.5 kV class. If bayonet fuse cannot be used on larger transformer sizes, please note alternate on quotation. A decal or stencil shall be placed in the primary compartment with

fuse size installed at factory. **The fuse installed on dual voltage transformers will be the higher voltage current rating unless specified differently on Attachment A.**

5.2 Bayonet assembly is to have drip shield to prevent oil from dripping on cable components.

6.0 TANK AND TERMINAL COMPARTMENT

6.1 The high-voltage and the low-voltage compartments shall be compartmentalized by a suitable barrier. Unlocking the padlock shall permit access to the low-voltage compartment. The high-voltage compartment door shall have a fastening device which is accessible only through the low-voltage compartment. Both high and low-voltage compartment doors must be easily removable and must be equipped for latching in the full open position. In addition to the regular pad-locking provision, all access doors shall be secured by a recessed, captive, pentahead bolt that meets the dimensions set forth in REA Drawing A3759.

6.2 The transformer shall be of sealed tank construction of sufficient strength to withstand a pressure of 7 psig without permanent distortion, and 15 psig without rupturing or affecting cabinet security.

6.3 The tank shall include a pressure relief device, located on the tank above the 140° C top-oil level, as a means to relieve pressure in excess of pressure resulting from normal operation. The venting and sealing characteristics shall be as follows:

1. Cracking Pressure - 10 psig ± 2 psig
2. Resealing Pressure - 6 psig minimum
3. Zero leakage from re-seal pressure to -8 psig
4. Flow at 15 psig - 35 SCFM minimum

The pressure relief device shall have a pull ring for manually reducing pressure to atmospheric level using a standard hook-stick and shall be capable of withstanding a static pull force of 25 pounds for one minute without permanent deformation.

6.4 The tank coating shall meet all requirements in ANSI C57.12.28 (Munsel green).

6.5 The pad-mounted equipment shall meet the requirements for tamper resistance set forth in ANSI C57.12.28 including but not limited to the pry test, pull test, and wire probe test.

6.6 An anodized aluminum or stainless steel laser engraved nameplate shall be installed in the secondary compartment and *if specified, on the outside of the secondary compartment*. This nameplate(s) shall meet ANSI Standard C57.12.00 for Nameplate B.

<The outside nameplate, if required, shall be specified on Attachment A.>

6.7 The pentahead bolts and associated threaded receptacles, hinges and hinge pins shall be AISI type 304 stainless steel or silicon bronze.

6.8 Minimum depth of primary and secondary compartments shall be 24 inches or as specified on Attachment A.

<Minimum depth of greater than 24 inches, if required, shall be specified on Attachment A.>

6.9 Lifting lugs shall be permanently attached and arranged on the tank to provide a distributed balanced lift for a completely assembled transformer.

6.10 Danger decals (5" X 7" minimum) shall be provided inside the compartments. This decal shall be the latest ANSI Z-535 specification using the "hand pictorial."

6.11 The size kVA rating of the transformer, the primary voltage rating ("7.2 kV", "14.4 kV" or "7.2X14.4 kV") and the secondary voltage rating (“208Y/120” or “480Y/277”) shall be legibly and durably labeled on the front of the secondary cabinet in a contrasting color of characters 2 inches high.

6.12 *If specified,* the transformer shall be a "hybrid" tank design of mild steel and 400 or 304 series stainless steel. This "hybrid' design shall have a stainless steel sill, a stainless steel tank base, and a two (2) inch stainless steel strip on each side of the cabinet. *If specified for severe corrosive environments,* the entire tank and the entire compartment shall be AISI type 304 stainless steel.

<The special type tank design, if required, shall be specified on Attachment A.>

6.13 *If specified,* the transformer shall be equipped with two (2), three phase – two position “on-off” internal oil-immersed switches for the purpose of loop switching. These switches shall be rated 200 amperes (minimum) continuous and have a have a momentary and fault close rating of 10,000 amperes symmetrical.

6.14 *If specified,* the transformer shall be equipped with one (1), three phase – two position “on-off” internal oil-immersed switch for the purpose of de-energizing the windings of the transformer. This switch shall be on the source-side of the bayonet fuses and shall be rated 200 amperes (minimum) continuous and have a have a momentary and fault close rating of 10,000 amperes symmetrical.

<The oil switches, if required, shall be specified on Attachment A.>

6.15 Transformers shall be equipped with a one-inch (NPT) standard drain valve with a one-half inch (NPT) sampling device.

7.0 SHIPPING

7.1 The unit shall be banded, blocked, or bolted to a suitable wood pallet or skid with 2½ inch minimum clearance for shipment on a flatbed trailer. All transformers less than 4000 pounds shall be side-loaded so they can be unloaded with forklift. Any transformer more than 4000 pounds must be unloaded with a crane.

7.2 A temporary bar code label shall be attached to the exterior of the transformer in accordance with ANSI C57.12.35.

7.3 The customer shall be notified at least 24 hours in advance of shipment ***as specified on Attachment A.*** Shipper shall give total number of units to be shipped and the weight of the heaviest unit(s).

8.0 TESTING

8.1 All units shall be tested for no-load (20°C) losses, load (85°C) losses, percent impedance (85°C), and excitation current (100% voltage). Each unit shall be subjected to a full wave voltage impulse and leak test. The manufacturer shall provide certification upon request for all design and other tests listed in Table 17 of ANSI C57.12.00 including verification that the design has passed Short Circuit Criteria per ANSI C57.12.00 and ANSI C57.12.90.

8.2 The manufacturer shall provide and send electronically and by mail (if requested by Purchaser on Attachment A) Certified Test Reports (CTR) in IEEE 1388 format. The CTR shall guarantee the average no-load and load losses. **No individual unit shall be shipped that exceeds guaranteed losses by more than 10% no load and/or 6% total loss. If actual average losses exceed the guaranteed value, the penalty will be as specified on Attachment A.**

8.3 The CTR shall also report the following DOE efficiency values:

1. Standard Efficiency Level as specified in DOE Chart, Table I.1
2. Absolute Minimum Efficiency for any one unit calculated using DOE formula n=1.
3. Minimum Average Efficiency for number of units in the basic model as calculated using DOE's formula.
4. Number of units (n) in the basic model
5. Tested or calculated DOE Efficiency for each unit
6. Average of the Tested DOE Efficiency for number of units in the basic model.
7.

RCD 4/29/02 (Original)

Attachment "A"
Three Phase Padmount URD Transformer

_____Electric Cooperative Dated _____

I. Rating (kVA) and secondary voltage[Quantity]:

208Y/120 volt units:
_____45 _____75 _____112.5 _____150 _____225 _____300 _____500
_____750 _____1000 _____1500 _____2000 _____2500

480Y/277 volt units:
_____45 _____75 _____112.5 _____150 _____225 _____300 _____500
_____750 _____1000 _____1500 _____2000 _____2500

II. Primary Voltage (volts):

___ 12,470 Grd Y/ 7200 ___ 24,940 Grd Y/14,400
___ 12,470 Grd Y/7200 X 24,940 Grd Y/14,400

III. Primary taps: ___ None ___ Two-2 1/2% above and below ___ Four below

IV. Primary Bushing Well Inserts: ___ No ___ Yes (if yes, ___ 15 kV class or ___ 25 kv class)

V. Secondary Bushing Configuration: ___ Staggered (Figure 8A) ___ In-line (Figure 8B)

VI. Extra Nameplate on Front of Secondary Cabinet: ____ Yes ____ No

VII. Minimum Depth of Compartments (if more than 24"):

___ Inches Minimum Depth for units larger than _____ kVA

VIII. Alternate Current Rating of Bayonet Fuse to be Installed on Dual Voltage Units:

____ 15 kV Operation _____ User Specified Catalog #

IX. Tank and Cabinet: ____ Mild Steel _____ "Hybrid" Design _____ All Type 304 Stainless

X. A. Two 200A primary "on-off" Oil Switches: ____ Yes ____ No

B. One 200A primary "on-off" Oil Winding Switch: _____Yes _____No

XI. Loss Formula (Based on Present Worth):

Total Owning Cost (TOC) = (1.5 X initial unit cost) + ($8.00 X NL losses) + ($2.00 X Load losses).
Units within a +3% window of lowest TOC will be considered equal.

XII. Penalty for Exceeding Guaranteed Losses:

Total Penalty = [$ _____ X (Average NL losses furnished - NL losses guaranteed) + $ _____ X (Load losses furnished – Load losses guaranteed)] X Total number of Units. This will apply to the average for all units in each line item of the purchase order with no credits back to manufacturer.

VIII. The Certified Test Reports (CTR) shall be sent:

_____ At time of shipment ____ monthly _____ quarterly _____ other _____
_____ By mail to _____

XIII. Shipping:

Notify _____ at phone # _____ at least 24 hours before shipment. Receiving hours are _____ Monday through Friday. Ship to _____ office in _____ , SC.

XIV. Other Special requirements:_____