

S. C. Electric Cooperative's
Specification for a Single-Phase, Padmounted URD Transformer
(Revised 10/13)

1.0 GENERAL

- 1.1** This specification covers the electrical and mechanical characteristics of Single-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.

C57.12.25 - Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers With Separable Insulated High-Voltage Connectors; High Voltage, 34500GRDY/19920 Volts and Below; Low Voltage, 240/120 Volts; 167 kVA and Smaller-Requirements.

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.

C57.12.91 - Guide for Loading Mineral-Oil-Immersed Overhead and Pad-Mounted Transformers Rated 500 kVA and Less with 65°C or 55°C Average Winding Rise.

- 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-5 and 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:
15, 25, 37.5, 50, 75, 100, 167

<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 240/120 volts or as specified on Attachment A1. The basic insulation level (BIL) of the secondary shall be 30 kV. All secondary windings for 15 & 25 kVA ratings shall be interlaced.

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

3.0 HIGH VOLTAGE BUSHINGS

3.1 There shall be two (2) high voltage bushings wells for dead front, loop feed operation. 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 2(a) (diagonal) or, *if specified on Attachment A*, Figure 1(a) (horizontal).

3.3 Cable accessory parking stand 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 shall be per ANSI C57.12.25 Figure 2(a) (diagonal) or, *if specified on Attachment A*, Figure 1(a) (triangular). These bushings shall be externally clamped and shall be removable to allow for field replacement without opening the tank.

4.2 The transformer shall have threaded stud-type line and neutral terminals with jam nuts per ANSI C57.12.25 or, *if specified on Attachment A*, the transformer shall have 4-hole H-spade line and neutral terminals

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 a load-break, hook stick operable bayonet dual element fuse assembly (RTE type 108 or equal) with an oil valve 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. 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.
- 5.3 *If specified on Attachment A*, the transformer shall be equipped with an under oil surge arrester (10 kV class for 95 kV BIL and 18 kV class for 125 kV BIL), This arrester shall be installed between the bayonet fuse and the primary winding with a switch to isolate the ground lead. Transformers with under oil arresters shall be labeled "UOA" on the front of the cabinet.

6.0 TANK AND TERMINAL COMPARTMENT

- 6.1 In addition to the regular pad-locking provision, all access doors or hood 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 \pm 2 psig
 2. Resealing Pressure - 6 psig minimum
 3. Zero leakage from reseal 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 compartment. This nameplate shall meet ANSI Standard C57.12.00 for Nameplate B.

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 Maximum size of cabinet shall be as follows:

<u>Rating</u>	<u>Height</u>	<u>Width</u>
15-75 kVA	≤ 26.0 inches	≤ 36.0 inches
100-167 kVA	≤ 32.0 inches	≤ 38.0 inches

6.9 Threaded receptacles for 5/8 inch diameter bolts shall be provided on each side of the tank to provide a method to lift a completely assembled transformer.

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

6.11 The size kVA rating of the transformer shall be legibly and durably labeled on the front of the cabinet in a contrasting color in characters not less than 1 1/2 inches high. ***If specified on Attachment A***, the primary voltage rating ("7.2 kV", "14.4 kV" or "7.2X14.4 kV") shall be labeled on the front of the cabinet.

6.12 ***If specified on Attachment A***, the transformer shall be a "hybrid" tank design of mild steel and 400 or 304 series stainless steel. This "hybrid" design shall have a 1.5 inch (minimum) strip butt-welded to bottom of the tank wall and a 400 series or 304 series stainless steel sill in the compartment.

6.13 ***If specified on Attachment A for severe corrosive environments***, the entire tank and the entire compartment shall be AISI type 304 stainless steel.

7.0 SHIPPING

7.1 The unit shall be banded, blocked, or bolted to a suitable wood pallet with 2½ inch clearance for shipment.

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.

8.4 The radio influence voltage shall not exceed 100 micro-volts at 1000 kHz when measured at 110% of rated voltage.

Any exceptions to these specifications must be stated by the manufacturer when submitting the proposal.

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Attachment "A"
Single Phase Padmount URD Transformer

_____ Dated _____

I. Rating (kVA) [Quantity]:

___ 15 ___ 25 ___ 37.5 ___ 50 ___ 75 ___ 100 ___ 167

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

Secondary Voltage (volts):

___ 120/240 ___ 240/480

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

IV. Primary Bushing Configuration: ___ Diagonal (Standard-Figure 2a) ___ Horizontal (Figure 1a)

V. Primary Bushing Well Inserts: ___ No ___ Yes (if yes, ___15 kV class or ___ 25 kV class)

VI. Secondary Bushing Configuration: ___ Diagonal (Standard-Figure 2a) ___ Triangular (Figure 1a)

VII. Secondary Bushing Terminals: ___ Studs (Standard) ___ Four hole H-spades

VIII. Alternate Current Rating of bayonet fuse to be installed on dual voltage units:

___ 15 kV Operation _____ User specified Catalog #

IX. Under Oil Primary Arrester: ___ No ___ Yes

X. Primary Voltage Rating on Front of Cabinet: ___ Yes ___ No

XI. Tank and Cabinet: ___ Carbon Steel ___ "Hybrid" Design ___ All Type 304 Stainless

XII. 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.

XIII. 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.

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

_____ At time of shipment ___ monthly _____ quarterly ___ other _____

_____ By mail to _____:

XV. Shipping:

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

XVI. Other Special requirements: _____

Attachment "A1"
Single Phase Padmount URD Transformer

Mid-Carolina Electric Cooperative Dated _____

I. Rating (kVA) [Quantity]:

___ 15 ___ 25 ___ 37.5 ___ 50 ___ 75 ___ 100 ___ 167

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

Secondary Voltage (volts):

___ 120/240 ___ 240/480

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

IV. Primary Bushing Configuration: ___ X ___ Diagonal (Standard-Figure 2a) ___ Horizontal (Figure 1a)

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

VII. Secondary Bushing Configuration: ___ X ___ Diagonal (Standard-Figure 2a) ___ Triangular (Figure 1a)

VII. Secondary Bushing Terminals: ___ X ___ Studs (Standard) ___ Four hole H-spades

IX. Alternate Current Rating of bayonet fuse to be installed on dual voltage units:

___ 15 kV Operation _____ User specified Catalog #

IX. Under Oil Primary Arrester: ___ X ___ No ___ Yes

X. Primary Voltage Rating on Front of Cabinet: ___ X ___ Yes ___ No

XI. Tank and Cabinet: ___ X ___ Carbon Steel ___ "Hybrid" Design ___ All Type 304 Stainless

XIII. 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.

XIII. 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.

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

_____ At time of shipment ___ monthly _____ quarterly _____ other _____
_____ By mail to Brian Sandifer P.O. Box 669 Lexington, SC 29071

XV. Shipping:

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

XVI. Other Special requirements: _____
