

**SINGLE-PHASE
PAD MOUNT
TRANSFORMER SPECIFICATION**





TABLE OF CONTENTS

<u>Section</u>	<u>Description</u>	<u>Page</u>
1.0	General	1
2.0	Ratings	2
3.0	High Voltage Bushings and Terminals	3
4.0	Low Voltage Bushings and Terminals	3
5.0	Protection	4
6.0	Tank and Terminal Compartment	4
7.0	Accessories	6
8.0	Shipping	6
9.0	Testing	6
10.0	Bar Coding	7



1.0 GENERAL

- 1.1 This specification covers the electrical and mechanical characteristics of single-phase pad-mounted distribution transformers. All single-phase pad-mounted distribution transformers covered by this specification shall be the shrubline type. No other style of pad mount transformer is acceptable.
- 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 and shall comply with the latest requirements of the Rural Utility Service (RUS) specifications associated with pad mount transformers.
 - 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.
 - C57.12.35 - Bar Coding for Distribution Transformers
 - 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 Manufacturers shall include both actual and evaluated prices on all bids. Prices quoted shall include all options and accessories covered in this specification, shipping and handling charges, Washington sales tax, and losses in accordance with Section 9.3.
- 1.4 Pend Oreille Public Utility District #1 reserves the right to reject any bids that do not comply with the provisions of this specification.

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 ratings shall be specified on the inquiry.

**Table 1
Transformer and Connector High-voltage Ratings and Electrical Characteristics**

Transformer		Electrical Characteristics of the Completely Assembled High-voltage Connectors ¹			
		High-voltage Rating ²		BIL (kV)	60-Hz dry one minute withstand (kV)
High-voltage Ratings (V)	Minimum BIL ³ (kV)	Phase-to-Ground (kV)	Phase-to-Ground /Phase-to-Phase (kV)		
Single High-Voltage 12470GrdY/7200 24940GrdY/14400	95	8.3	8.3/14.4	95	34
	125	15.2	15.2/26.3	125	40
Series - Multiple High-Voltage 12470GrdY/7200 x 24940GrdY/14400	95 x 125	15.2	15.2/26.3	125	40

- 1) For complete connector rating, see ANSI/IEEE 386.
- 2) Transformers are suitable for connectors with phase-to-ground or phase-to-ground/phase-to-phase high-voltage ratings as listed.
- 3) Arrester coordination may require higher BIL on multiple connections than indicated to achieve a minimum protection level of 20%.
- 4) The required connector rating is to be specified.

2.2 The applicable voltage rating and BIL shall be specified on the inquiry. Dual voltage primaries shall utilize an externally operable switch. Unit must be de-energized prior to changing voltages. The BIL level for dual voltage units will correspond to each connection.

The applicable multiple voltage rating shall be specified on the inquiry.

2.3 The secondary voltage shall be 240/120 Volts (3 bushings). The basic insulation level (BIL) of the secondary voltage shall be 30 kV.

- 2.4 The transformer shall be furnished with full capacity high-voltage taps. The taps shall be +/- (2) 2¹/₂% above and below nominal voltage. The tap changer shall be clearly labeled to reflect that the transformer must be de-energized before operating the tap changer as required in Section 3.2.1 of ANSI C57.12.25.

Transformer Impedances shall be between 1.7 and 2.6 percent with tolerances per ANSI and IEEE standards.

3.0 HIGH VOLTAGE BUSHINGS AND TERMINALS

- 3.1 Transformers shall be dead front.
- 3.2 Transformers shall be loop feed with two high side voltage bushings and come with bushing well inserts installed.
- 3.3 The high voltage bushings provided shall be externally clamped Zytel® HTN bushing wells. These wells shall be removable to allow for field replacement of the bushings without opening the tank and shall be rated for 200 Amp operation.
- 3.4 The bushing configuration shall be per Figure 2A (15 & 25 kV Class) for ANSI Type II units.
- 3.5 A cable accessory parking stand shall be provided and shall be located such that the separable insulated connectors that are designed for operation after the transformer is in place can be operated with hot-line tools.

4.0 LOW VOLTAGE BUSHINGS AND TERMINALS

- 4.1 The configuration of the secondary shall be per ANSI C57.12.25 Figure 2A (This specifies an angled bushing pattern or ANSI Type II unit). These bushings 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 per Table 2.

**Table 2
Stud-type line and neutral terminals**

kVA Rating	Thread Size	Minimum Length	
		in	mm
25-75	0.625-11 UNC-2A	1.25	31.9
100-167	1.000-14 UNC 2S	1.75	44.5

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

5.0 PROTECTION

5.1 The protection scheme provided with the transformer shall consist of the following attributes. If for any reason a special protection scheme is required it shall be clearly stated on the inquiry.

- a. The transformer primary shall include a loadbreak Bay-O-Net assembly with a flapper valve to minimize oil spillage. The Bay-O-Net assembly shall be used in series with an internally mounted isolation link.

6.0 TANK AND TERMINAL COMPARTMENT

6.1 The core and coil shall be vacuum processed to ensure maximum penetration of insulating fluid into the coil insulation system. While under vacuum, the windings will be energized to heat the coils and drive out moisture, and the transformer will be filled with preheated filtered degassed insulating fluid. The core shall be manufactured from burr-free, grain-oriented silicon steel and shall be precisely stacked to eliminate gaps in the corner joints. The coil shall be insulated with B-stage, epoxy coated, diamond pattern, insulating paper, which shall be thermally cured under pressure to ensure proper bonding of conductor and paper.

6.2 The dielectric coolant in the transformer must be highly refined inhibited new mineral oil and meet the minimum requirements as specified in Table 1, "Functional Property Requirements," of ASTM D3487 and ANSI C57.106. Insulating oil shall be certified PCB free.

6.3 In addition to the regular locking provision, all access doors or hood shall be secured by a recessed, captive, pentahead bolt that meets the dimensions set forth in RUS Drawing A3759.

6.4 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.

- 6.5 The tank shall include a pressure relief device as a means to relieve pressure in excess of pressure resulting from normal operation. The venting and sealing characteristics shall be as follows:

Cracking Pressure: 10 psig \pm 2 psig
Resealing Pressure: 6 psig minimum
Zero leakage from reseal pressure to -8 psig
Flow at 15 psig: 35 SCFM minimum

- 6.6 The tank coating shall meet all requirements in ANSI C57.12.28 including:

Salt spray
Crosshatch adhesion
Humidity
Impact
Oil resistance
Ultraviolet accelerated weathering
Abrasion resistance - taber abraser

The entire unit shall be primed and painted green. The color shall be Munsell 7GY 3.29/1.5 or equivalent.

- 6.7 The pad-mounted equipment shall meet the requirements for tamper resistance set forth in ANSI C57.12.28 including the pry test, pull test, and wire probe test.
- 6.8 The tank shall be complete with an anodized aluminum laser engraved nameplate. Nameplate shall conform to ANSI C57.12.00, nameplate A.

7.0 ACCESSORIES

- 7.1 The following accessories shall be provided:

- a. Stainless steel hardware
- b. steel tank, sill, door
- c. steel pedestal (bottom 1.5" of tank), sill, door
- d. Top hinged door.
- e. Mounting cleats
- f. Lifting bolts
- g. Tank ground connectors
- h. Bushing wells with removable studs
- i. Load break bushing inserts
- j. Bay-O-Net drip shield
- k. Pressure relief valve.

Any additional accessories will be specified on the inquiry.

8.0 SHIPPING

- 8.1 The unit shall be banded, blocked, or bolted to a suitable wood pallet or poly-pad.
- 8.2 Units shall be shipped FOB "Free on Board" Destination to Pend Oreille Public Utility District's warehouse at 112 S Union Ave, Newport, WA 99156
- 8.3 Delivery will be "Flatbed Side-load only".

9.0 TESTING

- 9.1 All units shall be tested for no-load (85°C) losses, total (85°C) losses, percent impedance (85°C), 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 19 of ANSI C57.12.00 including verification that the design has passed short circuit criteria per ANSI C57.12.00 and C57.12.90.
- 9.2 The manufacturer shall provide the guaranteed average no-load and load losses for the unit at 85°C. These losses will be subject to the tolerance specified in Table 3.

**Table 3
Tolerances for Transformer Losses**

Number of Units on One Order	Basis of Determination	No-Load Losses (%)	Total Losses (%)
1	1 unit	10	6
2 or more	Each Unit	10	6
2 or more	Average of all units	0	0

9.3 Loss Formula and Evaluated Purchase Price

Transformer prices will be evaluated on the following formula:

$$\text{Evaluated Price} = (3.5 \times \text{NLL}) + (1.25 \times \text{FLL}) + \text{Delivered Price}$$

Where:

NLL is the no-load loss in watts.

FLL is the load loss in watts at the transformer's rated load.

Delivered Price is the per unit price for the transformer including the cost of the transformer, shipping and handling charges, and all applicable taxes.

Manufacturers shall provide both actual and evaluated prices on all bids along with NLL and FLL values for each transformer quoted.

10.0 BAR CODING

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