

DISTRIBUTION TRANSFORMERS

SPECIFICATION #1212.02



12.47kV Delta -Delta

3 Phase Padmount

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1 SCOPE

This specification is to cover minimum requirements for a Three Phase Delta – Delta Padmount type, outdoor, oil-immersed distribution transformers suitable for operation on the District's 12470GrdY/7200 Volt Distribution System.

2 STANDARDS

All material and equipment furnished under these specifications shall conform to the latest applicable approved standards of IEEE, ANSI, and NEMA, except as otherwise specified herein

- 2.1 ANSI C37.47 Specifications For Distribution Fuse Disconnecting Switches, Fuse Supports, And Current Limiting Fuses.
- 2.2 ANSI/IEEE C57.12.00 General Requirements for Liquid Immersed Distribution, Power and Regulatory Transformers.
- 2.3 ANSI/IEEE C57.12.01 General Requirements for Dry Type Distribution and Power Transformers.
- 2.4 ANSI C57.12.22 Requirements for Pad Mounted, Compartmental Type, Self Cooled, Three Phase Distribution Transformers with High Voltage Bushings: High Voltage, 34,500 Grdy/19,900 Volts and Below, 2500kva and Smaller.
- 2.5 ANSI C57.12.26 Requirement for Pad Mounted, Compartmental Type, Self Cooled, Three Phase Distribution Transformers with High Voltage Bushings: High Voltage 24,940 Grdy/14,400 Volts and Below, 2500kva and Smaller.
- 2.6 ANSI C57.12.28 - Switchgear and Transformers - Pad-Mounted Equipment - Enclosure Integrity.
- 2.7 ANSI C57.12.70 Terminal Markings and Connections for Distribution and Power Transformers.
- 2.8 ANSI/IEEE C57.12.80 Terminology for Power and Distribution Transformers.
- 2.9 ANSI/IEEE C57.12.90 Test Code for Liquid Immersed Distribution Power, And Regulating Transformers.
- 2.10 ANSI/IEEE C57.12.91 Test Code for Dry Type Distribution and Power Transformers.
- 2.11 ANSI/IEEE 386 Separable Insulated Connector Systems for Power Distribution Systems Above 600v.
- 2.12 ASTM D877 Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.
- 2.13 ANSI Z535.

3 EVALUATION AND AWARD

For the purpose of evaluating bids in addition to the evaluation criteria set forth in Section B, Evaluation of Bids, consideration will be given to the following three items.

- Product Quality
- Loss Evaluation
- Adherence to Specifications.

3.1 Product Quality

Product quality will be determined by the placement of the manufacturer in the most recent Washington PUD Design Committee (WAPUD) transformer teardown. Current approved manufactures are listed below.

- Three Phase Padmount Transformers: CG, COOPER, ABB, Ermco

3.2 Loss Evaluation

3.2.1 Losses furnished for evaluation shall be guaranteed maximum losses for each transformer bid.

3.2.2 No load losses (NLL) shall be in watts, at 20^oC in accordance with ANSI C57.12.00 and shall be evaluated at \$4.07 per watt.

3.2.3 Full-load losses (FLL) shall be in watts, measured at rated nameplate load at 85^oC in accordance with ANSI C57.12.00 and shall be evaluated at \$1.79 per watt

3.2.4 Evaluated Price Formula = [\$4.07 x NLL] + [\$1.79 x FLL] + Unit Price

3.2.5 The manufacturer shall furnish with each transformer a certified test report of the no-load and full-load losses. The test report shall be submitted with the Contractor's invoice.

3.3 Adherence To Specifications.

The District expects all bids to conform to these Specifications. Any exception is cause for rejection.

4 INFORMATION TO BE FURNISHED WITH BID OR QUOTE

Technical information shall be provided by Bidder with their Bid in a Microsoft Excel Spreadsheet on CD for all bid items. An electronic copy of the form is available on CD; a sample form is shown below.

Technical Information Sample Form

Technical Information – The following data must be provided for each Bid Item in the following format in hard copy and electronically in an Excel spreadsheet. Only one spread sheet shall be submitted per contractor. Add columns as needed.

BID ITEM:	1	2	3	4
Manufacturer				
Contract Number:				
Vendor				
KVA Size:				
High Voltage (ANSI Designation) (kV)				
Low Voltage (ANSI Designation) (volts)				
Impedance Voltage: (%)				
Maximum L.V. Short Circuit Current (kA)				
Maximum L.V. Short Circuit Current is at: L-L or L-N				
L.V. Windings (Interlaced or Non-interlaced):				
Short Circuit Impedance: (%)				
Total Weight: (lbs)				
Oil: (Gallons)				
H.V. Winding Metal:				
L.V. Winding Metal:				
Core Metal, Type: (Grain Oriented, Amorphous)				
Minimum Primer Thickness: (Mils)				
Minimum Paint Thickness: (Mils)				
Base Dimensions:				
Overall Width: (Inches)				
Overall Depth: (Inches)				
Overall Height: (Inches)				
Access Hole Width: (Inches)				
Access Hole Depth: (Inches)				
Core Loss: (Watts)				
Copper (Winding) Loss: (Watts)				
Describe the coating system on separate sheets. Include the corrosion resistant material used on the bottom and lowest 2" of the sides.				

5 PAD-MOUNTED TRANSFORMERS – THREE PHASE DELTA - DELTA

5.1 Ratings

- 5.1.1 All ratings shall be for 60 Hertz alternating current, oil immersed, self-cooled transformers capable of continuous operation at rated KVA without exceeding either a 65^oC average temperature rise or an 80^oC hot spot temperature rise.
- 5.1.2 The electrical characteristics of the completely assembled high and low voltage terminals shall be in accordance with IEEE C57.12.26, Table 3 and Table 4.
- 5.1.3 The basic impulse level (BIL) shall be 95 kV.

5.2 Transformer Type

- 5.2.1 Transformers shall be loop feed construction, in accordance with Figure 2 of IEEE C57.12.26.

5.3 Core Construction

- 5.3.1 The core shall be either triplex or five-legged construction.

5.4 Pressure Relief Device

- 5.4.1 All transformers shall be designed such that all excessive pressure build-ups are released without damage to the tank in accordance with IEEE C57.12.26.
- 5.4.2 All transformers shall be equipped with a pressure relief device (either Tomco Series 1776K or Qualitrol Model 202-032-1).

5.5 Transformer Taps

- 5.5.1 No transformer taps are required.

5.6 High Voltage Bushings

- 5.6.1 Transformers shall come equipped with high voltage bushing wells and corresponding load break inserts for dead front application. The bushing wells shall be externally clamped, 200-amp rated, separable, and rated for primary switching per IEEE 386.
- 5.6.2 The load-break bushing inserts shall be Cooper Power Systems (Catalog No. LBI 215 or Elastimold (Catalog No. 1601A4).
- 5.6.3 The primary neutral shall be insulated and no H₀ bushing provided on Y-Δ transformers.
- 5.6.4 Inserts shall be shipped with physically wired down & secured duct caps, or have a pressure relief hole to prevent “popping” off.

5.7 Low Voltage Bushings

- 5.7.1 Transformers shall be equipped with fully insulated, low voltage bushings, in accordance with Fig. 8(a) of IEEE C57.12.26.
- 5.7.2 Transformers shall be furnished with the following NEMA standard stud or spade terminals as per IEEE C57.12.26 Fig. 9.

Three Phase Padmount Transformers – Terminal Sizes		
KVA	Secondary Voltage	Terminal Size
1000 - 1500 Delta	480 Delta	Spade, 10 hole - (Fig. 9c)

5.7.3 Ten-hole pads shall be furnished with additional support, as designed by the manufacturer. The supports shall be attached to the pads at the farthest point from the tank wall and attached in a manner so as to not interfere with the use of any of the pad’s holes.

5.8 Grounding Lugs

5.8.1 Transformers shall be furnished with one ground lug installed in the transformer low-voltage ground provision and two ground lugs installed in the transformer high-voltage ground provision.

5.8.2 The ground lugs shall be Fargo (Catalog No. GC-207).

5.9 Compartmental Locking

5.9.1 All hinged or removable cabinet access lids or doors shall have a three point latch and be provided with a 9/16” stainless steel or silicon bronze Pentahead captive bolt locking device and provisions for padlocking. The Pentahead bolt shall be coordinated so that it must be engaged before a padlock can be inserted into or removed from the hasp. All transformers shall meet the requirements for tamper-resistance of NEMA TR-1 and Western Underground Guide No. 2.13.

5.10 Hand Holes

5.10.1 A bolted on tank hand hole shall be secured against tampering by some means accessible only from the inside of the compartment.

5.11 Fusing

5.11.1 Transformers shall be provided with Cooper Power Systems Bay-O-Net fuse holders. They shall be of the sidewall mount type with flapper, Cat. No. 40003616C99FV.

5.11.2 Transformers shall be provided with Cooper Power Systems Bay-O-Net, dual sensing, load break, externally removable fuses. They shall also be provided with internally mounted partial range current limiting fuses (CLF) manufactured by Cooper Power Systems.

5.11.3 The partial range current limiting fuses (type ELSP) shall be placed in series with the Bay-O-Net fuse holder and be mounted internally under oil. Partial range current limiting fuses shall have a nominal voltage rating of 8.3kV.

5.11.4 Oil drip shields shall be provided with the Bay-O-Net fuse holder and be designed to catch and hold oil. Oil drip shields that redirect oil rather than catch and hold it will not be allowed.

5.11.5 The Bay-O-Net Fuse size and type shall be painted on the inside of the primary side cabinet door utilizing yellow characters one (1) inch high. In addition, the bayonet and current limiting fuse part numbers will be displayed on the nameplate. Fuses shall meet the District’s current fusing specifications which are shown in the table below.

Three Phase Transformers - Fusing				
Stock #	Three Phase KVA	Dual Sensing Bay-O-Net Fuse Cooper Power Systems	Fuse Ampere Rating	Current Limiting - ELSP Cooper Power Systems

Material Specification 1212.02 Distribution Transformers – Delta/Delta 3 Phase Padmount

	1000 Δ - Δ	4000358C16	100	CBUC15125C100*
	1500 Δ - Δ	4000358C17	140	CBUC15125C100*

* Two fuses in parallel

5.12 Transformer Tanks

5.12.1 Transformer tanks shall be constructed in accordance with IEEE C57.12.26.

5.13 Oil Drain Valve

5.13.1 Transformers shall come equipped with an oil drain valve installed at the bottom edge in the transformer secondary compartment, ¾” minimum diameter, gate or ball activated.

5.14 Labeling

5.14.1 A danger label, complying with ANSI Z535, shall be located on the inside of the transformer and readily visible whenever the first equipment door is open.

5.15 Accessories

5.15.1 In addition to standard accessories, each transformer 1500 KVA and larger shall be properly equipped with the following gauges mounted in the low voltage compartment.

5.15.1.1 Oil Level Gauge.

5.15.1.2 Dial thermometer with maximum top oil temperature indicator and magnetic reset.

5.15.1.3 Tank Pressure Vacuum Gauge.

5.16 Tank Dimensions

5.16.1 The maximum dimensions of the 3 phase Padmount transformers shall be as shown below. These dimensions do not include cooling fins.

Three Phase Transformers – Maximum Dimensions			
	75 KVA Mini-Pad	150 to 500 KVA	750 to 2500 KVA
Height	42” max	70” max	89” max
Width	44.5” max	72” max	88” max
Depth	42” max	62” max	66” max

5.16.2 Depth of Apparatus Compartment - The minimum depth of the apparatus compartment (except 75KVA mini-pad) shall be 24 inches, as shown in Dimension F of Figure 7 of IEEE Standard C57.12.26 - 1992.

5.16.3 Cooling Fins - Cooling fins shall not extend further than 12 inches beyond the dimensions shown above.

6 TRANSFORMER OIL

- 6.1 Transformers shall be insulated with new (unused) mineral oil. The oil shall meet the requirements of ANSI C57.12.00, Article 6.6.1 (1), ANSI C57.106 and ASTM 3487 Type II. The transformer nameplate shall indicate that the PCB content of said transformer is less than 1 PPM or at time of manufacture gas chromatographic analysis certified non-detectable PCB. The oil shall be inhibited mineral oil containing 0.2 % by weight DBPC. The nameplate shall show the gallons of oil.

7 NOISE

- 7.1 Transformer sound levels shall not exceed the values specified in the latest revision of NEMA Publication TR 1-0.11.

8 PAINT FINISH

- 8.1 The transformer shall have a corrosion resistant finish that shall be capable of meeting the functional specifications or exceed paint requirements of ANSI C57.12.28, latest revision. The outside shall be properly prepared, primed and painted with highly weather resistant paint. All transformers shall have the manufacturer's premium paint system.
- 8.2 Transformers shall be given a phosphatizing bath, or sand blasted, grit blasted or shot blasted, then primed with epoxy or vinyl primer. Transformers shall have a corrosion resistant finish that shall be capable of meeting the functional specifications or exceed ANSI c57.12.28. The exterior finish coat shall be semi-gloss polymer, free of runs and sags, primed with a primer, no less than 2.0 mils dry thickness and a coat of semi-gloss polymer type enamel paint no less than one (1) mil dry thickness (total measured thickness 3 mils).
- 8.3 Pole Mounted Transformers – the finish coat shall be semi-gloss sky gray similar in color to ANSI Standard no. 70. The transformer top shall have at least 10 mils of paint. The transformer sides and bottom shall have at least 3 mils of paint. The inside of the transformer shall have at least 3 mils of paint from a point 2 inches below the oil level up to and including the top. Complete painting of the inside is acceptable.
- 8.4 Pad Mounted Transformers - the finish coat shall be semi-gloss olive-green gray similar to Munsel no. 7GY3.29/1.5. The interior cabinet surfaces shall be primed and finished, with no less than 2.0 mils dry thickness

8.5 NAMEPLATES

- 8.5.1 Nameplates shall be made of stainless steel or anodized aluminum and permanently marked with essential operating data meeting ANSI standard c57.12.00 for nameplate b.
- 8.5.2 The transformer nameplate shall specifically state that the transformer is **mineral oil filled** and the number of gallons of oil it contains.
- 8.5.3 The nameplate shall indicate that the PCB content of said transformer is less than 1 ppm or that at the time of manufacture gas chromatographic analysis certified non-detectable PCB.
- 8.5.4 Each nameplate shall contain a transformer bar code. The bar code label shall meet all requirements of IEEE standard c57.12.35 – 1996.
- 8.5.5 The bayonet and current limiting fuse part numbers will be displayed on the nameplate for all Padmount units
- 8.5.6 Each nameplate shall be physically attached with bolts or rivets. Glue or double sided tape are not acceptable.

9 INSPECTION

- 9.1 The purchaser shall at any reasonable time be permitted to have a representative visit the Contractor's factory for the purpose of witnessing manufacture of the transformers to ascertain if the material and process used in the manufacturing conform to the Specifications.

10 TESTS

- 10.1 Each transformer shall receive complete tests at the factory in accordance with latest ANSI standards. At the option of the district, transformers may be tested for acceptance upon receipt.
- 10.2 All transformers manufactured under this specification shall be tested for core (85°C) and winding (copper) (85°C) losses, percent impedance (85°C), and exciting current (100% voltage and subjected to a full wave voltage impulse. Actual loss data shall be prepared in accordance with the bid form.
- 10.3 Vendor shall supply verification that the design has passed short circuit criteria per ANSI C57.12.00 and c57.12.90 latest revision.
- 10.4 Guaranteed losses: the losses submitted by the bidder for bid evaluation shall be considered as guaranteed losses by the district.
- 10.5 Certified test reports shall be furnished to the district at time of delivery or invoicing of transformers. Invoices must reference serial number of transformer, bid item and quoted losses. No payment will become due until proper serial numbers and the corresponding certified test reports are received by the district.

11 WORKMANSHIP, MATERIAL, AND FINISH

- 11.1 All workmanship and material used on the equipment shall be first class, the best of their respective kinds and shall be in full accordance with the most modern manufacturing practices for distribution transformers.

12 DELIVERY METHODS

12.1 Destination

- 12.1.1 The transformers shall be shipped f.o.b. destination to 1150 Hawley Street, Wenatchee, WA. 98801. The delivery will be accepted Monday through Friday between the hours of 9:00 am and 2:00 pm. No delivery of transformers will be accepted on holidays. Please call the Hawley Street Warehouse Forman at (509) 663-8121, ext. 4730, 24 hours prior to delivery. No transformers will be received on national holidays.

12.2 Methods

- 12.2.1 Polemount transformers shall be filled with the proper amount of transformer oil and shipped, completely assembled, in an enclosed van or curtain side trailer.
- 12.2.2 Padmount transformers rated up to 300 KVA shall be shipped on individual pallets made with “4 by 4 lumber” minimum (one transformer per pallet) and securely attached to the pallets to facilitate handling with forklift and shipped, completely assembled, in an enclosed van or curtain side trailer.
- 12.2.3 Padmount transformer rated 500-2500 KVA shall be capable of being unloaded with an overhead crane (skids are not required on these sizes) and must be shipped on a flatbed trailer, curtain side trailers or otherwise protected from the elements during shipping.

12.3 Rejection Of Shipment

- 12.3.1 Transformers exhibiting damaged parts, broken securing devices, or are dirty from lack of proper shipping, shall be cause for rejection of shipment.

13 SPECIFICATIONS REVISIONS LOG

#	Date	Description	Author
1	9/26/05	New Standard	DLS
2	10/05/05	Changed Spec Number from 2200.0100 to 2212.0200	DLS
3	3/29/07	Reduce size of transformers than can be delivered in an enclosed van.	DLS
4	12/2/11	Corrected fuse sizes and delivery method to curtain side trailer.	JCN