

# DISTRIBUTION TRANSFORMERS

## SPECIFICATION #1212.01



## 12.47kV Grd Wye Padmount & Polemount

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## 1 SCOPE

This specification is to cover minimum requirements for Polemount & Padmount type, outdoor, oil-immersed distribution transformers suitable for operation on the District's 60 hz 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, NEMA and DOE except as otherwise specified herein. All distribution transformer shall be manufactured in the United States of America.

- 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**.
- 2.14 **DOE 2016** Medium Voltage Transformer Efficiencies.
- 2.15 **ANSI C57.12.20** Overhead Type Distribution Transformers 500 kva and Smaller.

## 3 EVALUATION AND AWARD

See ITB-8, Evaluation of Bids. For the purpose of evaluating 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. Quality will be ranked by the manufacturer placement on the teardown.

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### **3.2 Loss Evaluation**

**3.2.1** Losses furnished for evaluation shall be guaranteed maximum losses for each transformer bid. No delivered unit shall exceed the guaranteed maximum losses. Guaranteed maximum losses shall comply with DOE 2010 requirements for a single unit. (no averaging).

**3.2.2** No load losses (NLL) shall be in watts, at 20<sup>o</sup>C 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<sup>o</sup>C 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 – evaluation credit

**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, at the District's discretion.

### **3.4 Evaluation Credit**

- 3% for being 50-100lbs under the maximum specified weight
- 5% for being 150lbs or more under the maximum specified weight
- No credit given between 101-149 lbs under the maximum specified weight

## **4 INFORMATION TO BE FURNISHED WITH BID OR QUOTE**

See ITB-9, Bidder's Data, for required information. Technical information shall be provided by Bidder with their Bid in a Microsoft Excel Spreadsheet on CD or USB thumb drive, and a paper copy of the same for all bid items. Outline and nameplate drawings shall be submitted with bid package. An electronic copy of the form is available; a sample form is shown below.

**Table 1 : Technical Information Sample Form**

EXHIBIT H TECHNICAL INFORMATION – This form must accompany your proposal in hard copy and electronically on a compact disc.

Technical information – The following data must be provided for each Bid Item in the following Excel format: it must be submitted in hard copy and electronically on a compact disc or thumb drive. Only one spreadsheet shall be submitted per bid.

Describe the coating system on separate sheets. Include the corrosion resistant material used on the bottom and lowest 2" of the sides.

BID ITEM - Line #	Manufacturer	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)
A-1											
A-2											
A-3											
A-4											
A-5											
A-6											
A-7											
A-8											
A-9											
A-10											
A-11											
A-12											
A-13											
A-14											
A-15											
A-16											
A-17											
A-18											
A-19											
B-1											
B-2											
B-3											
B-4											
B-5											
B-6											
B-7											
B-8											
B-9											
B-10											
B-11											
B-12											
B-13											
B-14											

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BID ITEM - Line #	Oil: (Gallons)	H.V. Winding Metal:	L.V. Winding Metal:	Core Metal Type: (Grain Oriented, Amorphous)	Minimum Insulation Thickness (Mils)	Minimum Paint Thickness (Mils)	Base Dimensions:					Core Loss: (Watts)	Copper (Winding) Loss: (Watts)
							Overall Width: (Inches)	Overall Depth: (Inches)	Overall Height: (Inches)	Access Hole Width: (Inches)	Access Hole Depth: (Inches)		
A-1													
A-2													
A-3													
A-4													
A-5													
A-6													
A-7													
A-8													
A-9													
A-10													
A-11													
A-12													
A-13													
A-14													
A-15													
A-16													
A-17													
A-18													
A-19													
B-1													
B-2													
B-3													
B-4													
B-5													
B-6													
B-7													
B-8													
B-9													
B-10													
B-11													
B-12													
B-13													
B-14													



## **5 POLEMOUNT TRANSFORMERS**

### **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°C average temperature rise or an 80°C hot spot temperature rise.

**5.1.2** The basic impulse level (BIL) shall be 95 kV.

**5.1.3** Overhead transformers shall have an impedance of 2.0%, ± 10%

### **5.2 Pressure Relief Device**

**5.2.1** All transformers shall be designed such that all excessive pressure build-ups are released without damage to the tank in accordance with ANSI C57.12.25.

**5.2.2** All transformers shall be equipped with a pressure relief device (either Tomco Series 1776K or Qualitrol Model 202-032-1). The threads shall be sealed with pipe dope.

### **5.3 Transformer Taps**

**5.3.1** No transformer taps are required.

### **5.4 Transformer Oil**

**5.4.1** 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 and state the oil type as “Mineral Oil”.

### **5.5 High Voltage Bushings and Terminals**

**5.5.1** Transformers shall be equipped with cover-mounted, wet process porcelain high voltage bushings (two bushings) with clamp style terminals in accordance with ANSI C57.12.20, Table 7. The bushings shall be light gray in color. The clamp type terminal shall be capable of being tightened with a Fargo wrench (Fargo Manufacturing, Catalog No. GP-203).

**5.5.2** High voltage bushings shall be equipped with Reliaguard Handwheel Type Wildlife Guards which are a hinged wildlife guard for use with handwheel tightened bushing terminals.

### **5.6 Low Voltage Bushings and Terminals**

**5.6.1** Transformers shall be equipped with side wall-mounted, low voltage bushings. Units 100 KVA and smaller shall have clamp type terminals in accordance with ANSI C57.12.20, Figure 4a. Units 167 KVA and larger shall have 4-hole square spade type terminals in accordance with ANSI C57.12.20, Figure 4b, Spade H.

**5.6.2** Transformers of 100kVA and larger shall have a bracket centered below the secondary bushings for mounting cable supports for the secondary voltage wires.

**5.6.3** Number and arrangement of low-voltage terminals shall be in accordance with ANSI C57.12.20, Table 9.

**5.6.4** Polymer secondary bushings shall be used for transformers.

**5.7 Transformer Tanks**

**5.7.1** Transformer tanks shall be of welded steel construction. The tank shall be a conventional, oil-filled, pole-type with only one pole-mounting position.

**5.7.2** The tank covers shall have a slope of 10-15 percent for moisture run-off and shall have an insulated coating on the cover capable of withstanding a minimum of 10kV at a 2000 volt/second rate of rise, tested per ASTM D149 using ¼” diameter electrodes.

**5.7.3** The overall size of the transformer and the weight of the transformers, once filled with oil, shall not exceed the following:

<b>Table 2: Single Phase Pole Mount Transformers – Max Dimensions</b>				
<b>Size (KVA)</b>	<b>Weight (lbs.)</b>	<b>Height (in.)*</b>	<b>Width (in.)**</b>	<b>Depth (in.)***</b>
10	200	40	22	24
25	375	41	23	25
37.5	480	42	24	26
50	600	45	25	27
75	875	51	25	27
100	1000	50	32	30
167	1600	54	38	38

\* Height shall be measured from bottom of tank to top of primary terminal at top of primary bushing.

\*\* Width shall be measured from lifting hook to lifting hook.

\*\*\* Depth shall be measured from mounting bracket to outside of secondary terminal.

**5.7.4** Tanks shall have tank ground provisions and support lugs in accordance with ANSI Standard C57.12.20.

**5.8 Grounding Lugs**

**5.8.1** Transformers shall be furnished with a minimum of 2 ground lugs. One installed in the transformer low-voltage ground provision, and a second on the opposite side of the tank. The ground lugs shall be a Fargo (Catalog No. BVC-207-FT with slim brass jam nut). Installed vertically on pole mount transformers.





**5.9 TIF and RIV Requirement**

**5.9.1** TIF - Transformers shall be designed to meet REA Telephone Influence Factor (TIF) requirements, as detailed in REA Specifications D-10. Transformer I-T tests shall be made in accordance with the method described in IEEE Standard No. 469-1977, except as noted in REA Specifications D-10. REA Specification D-10 requires that the average overall I-T of the secondary windings per transformer nameplate KVA shall not exceed the following limits:

<b>I-T per KVA</b>	
120 Volts	132 Volts
22	66

**5.9.2** RIV - The Radio Influence Voltage (RIV) shall not (per REA Specification D-10) exceed 100  $\mu$ V (average measurement) at 1 MHz measured at 110% of rated voltage in accordance with the methods outlined in ASA Publication C63.2, 1950, Appendix A, Figure 5. Dual voltage transformers shall be tested on the highest connection.

**6 PAD MOUNT TRANSFORMER – SINGLE PHASE**

**6.1 Ratings**

- 6.1.1** 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<sup>o</sup>C average temperature rise or an 80<sup>o</sup>C hot spot temperature rise.
- 6.1.2** The electrical characteristics of the completely assembled high and low voltage terminals shall be in accordance with ANSI C57.12.25, Table 1 and Section 6.2.1.
- 6.1.3** The basic impulse level (BIL) shall be 95 kV.

**6.2 Loop Feed**

- 6.2.1** Transformers will be suitable for loop feed.
- 6.2.2** The minimum current-carrying capabilities of components for looped primary cable systems shall be 200 Amps (continuous) and 10,000 Amps rms symmetrical for 0.17 sec. (short-time current rating) for transformers with or without high-voltage switching.

**6.3 Transformer Type**

- 6.3.1** Transformers shall be Type 2 in accordance with Figure 2a of ANSI C57.12.25

**6.4 Pressure Relief Device**

- 6.4.1** All transformers shall be designed such that all excessive pressure build-ups are released without damage to the tank in accordance with ANSI C57.12.25.
- 6.4.2** All transformers shall be equipped with a pressure relief device (either Tomco Series 1776K or Qualitrol Model 202-032-1). The threads shall be sealed with pipe dope.

**6.5 Transformer Taps**

- 6.5.1** No transformer taps are required.



**6.6 High Voltage Bushings**

- 6.6.1 Transformers shall come equipped with two 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.
- 6.6.2 The bushings shall conform to ANSI C57.12.25, Type 2 arrangement.
- 6.6.3 The load-break bushing inserts shall be Cooper Power Systems LBI 215 or Elastimold (Catalog No. 1601A4).
- 6.6.4 Inserts shall be shipped with physically wired down & secured dust caps or use a dust cap equipped with a pressure relief hole to prevent pressure build up in the dust cap that would cause loss of the dust cap.

**6.7 Low Voltage Bushings**

- 6.7.1 Transformers shall be equipped with fully insulated, low voltage bushings with in-line NEMA standard stud terminals in accordance with Figure 4C of ANSI C57.12.25.
- 6.7.2 Transformers shall be furnished with the following terminals:

Table 3: Single Phase Padmount – Terminal Size		
KVA	Secondary Voltage	Terminal Size
25-75	240/120	Stud, 5/8” – 11 UNC-2A
100 – 167	240/120	Stud, 1” – 14 UNC-2A

**6.8 Grounding Lugs**

- 6.8.1 Transformers shall be furnished with a total of 2 grounding lugs installed in the transformer high-voltage ground provision, centered near the bottom of the HV compartment and spaced horizontally 8 inches or more apart.
- 6.8.2 The ground lugs shall be Fargo (Catalog No. BVC-207-FT) with thin brass jam nut, installed in horizontal position on pad mount transformers.

**6.9 Compartmental Locking**

- 6.9.1 The terminal compartment covers shall be secured with a captive nut and a captive recessed 9/16” stainless steel or silicon bronze Pentahead bolt, 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.

**6.10 Fusing**

- 6.10.1 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.
- 6.10.2 Transformers shall be provided with Cooper Power Systems Bay-O-Net, dual sensing, load break, externally removable fuses, in series with under oil, internally mounted 8.3 kV partial range current limiting fuses (CLF). The partial range fuse shall be manufactured by Cooper Power Systems (Type ELSP).

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- 6.10.3** The partial range current limiting fuses 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.
- 6.10.4** Oil drip shields shall be provided designed to catch and hold oil. Oil drip shields that redirect oil rather than catch and hold it will not be allowed.
- 6.10.5** The Bay-O-Net Fuse size and type for each voltage 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.
- 6.10.6** Dual Voltage Units shall be delivered with fusing according to the lower voltage and include Bay-O-Net fuses for the higher voltage.

**Table 4: 7.2 kV Single Phase Transformer Fusing**

Stock #	KVA	Bay-O-Net Fuse (Dual Sensing)	Continuous Rating (A)	Current Limiting (ELSP Backup)	ELSP Rating (A)
88888	15	4000358C03M	3	3001861A01M (Isolation Link only)	na
88801	25	4000358C05M	8	CBUC08040C100	40
88802	50	4000358C08M	15	CBUC08080C100	80
88803	75	4000358C10M	25	CBUC08125C100	125
88804	100	4000358C10M	25	CBUC08125C100	125
88805	167	4000358C12M	50	CBUC08165D100	165

### 6.11 Transformer Tanks

- 6.11.1** Transformer tanks shall be constructed in accordance with ANSI C57.12.25. The primary and secondary bushing compartment shall have a hinged, vertical-swing cover. Both the cover and the tank shall be domed or sloped to prevent moisture collection.
- 6.11.2** The cover hinge pins and the threaded lifting inserts shall be stainless steel.
- 6.11.3** Grounding provisions shall consist of two grounding lugs, centered near the bottom of the HV compartment of the transformer and spaced horizontally 8 inches or more apart. The tapped holes shall be plugged during painting to prevent coating of the threads.
- 6.11.4** Drain and fill plugs shall be bronze, cadmium, or stainless steel. No galvanized hardware will be acceptable. Drain and fill plugs will be sealed with pipe dope.
- 6.11.5** Drain and fill plugs shall be a threaded plug, not a cap, to minimize interference with anything inside the HV or LV compartments.
- 6.11.6** The overall maximum transformer size shall be within the following dimensional ranges:

<b>Table 5: Single Phase Transformers - Tank Sizes</b>				
<b>Size (KVA)</b>	<b>Height (in.)*</b>	<b>Width (in.)**</b>	<b>Depth (in.)***</b>	<b>Minimum Terminal Compartment Depth (in.)****</b>
25 – 167	36” max.	31” min. 36” max.	40” max	15”
< 25	27” max	26” max	29” max	15”

\* Height shall be measured from top of highest point to bottom of unit.

\*\* Width shall be measured from left to right, when facing the lid, across widest part of unit.

\*\*\* Depth shall be measured from lid to rear, across deepest part of unit.

\*\*\*\* Depth shall be measured from lid to front of bushing well wall.

**7 PAD-MOUNTED TRANSFORMERS – THREE PHASE**

**7.1 Ratings**

7.1.1 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°C average temperature rise or an 80°C hot spot temperature rise.

7.1.2 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.

7.1.3 The basic impulse level (BIL) shall be 95 kV.

**7.2 Transformer Type**

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

**7.3 Core Construction**

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

**7.4 Pressure Relief Device**

7.4.1 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.

7.4.2 All transformers shall be equipped with a pressure relief device (either Tomco Series 1776K or Qualitrol Model 202-032-1). The threads shall be sealed with pipe dope.

**7.5 Transformer Taps**

7.5.1 No transformer taps are required.

**7.6 High Voltage Bushings**

7.6.1 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.



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**7.6.2** The load-break bushing inserts shall be Cooper Power Systems (Catalog No. LBI 215 or Elastimold (Catalog No. 1601A4).

**7.6.3** The primary neutral shall be insulated and no H<sub>0</sub> bushing provided on Y-Δ transformers.

**7.6.4** Inserts shall be shipped with physically wired down & secured dust caps or use a dust cap equipped with a pressure relief hole to prevent pressure build up in the dust cap that would cause loss of the dust cap.

**7.7 Low Voltage Bushings**

**7.7.1** Transformers shall be equipped with fully insulated, low voltage bushings, in accordance with Fig. 8(a) of IEEE C57.12.26.

**7.7.2** Transformers shall be furnished with the following NEMA standard stud or spade terminals as per IEEE C57.12.26 Fig. 9.

<b>Table 6: Three Phase Padmount Transformers – Terminal Sizes</b>		
KVA	Secondary Voltage	Terminal Size
75-300	480Y/277	Stud, 5/8” – 11 UNC – 2A (Fig. 9d)
75-150	240, 208Y/120	
225-300	240, 208Y/120	Stud, 1” – 14 UNC – 2A With 6 hole Spade
500	480Y/277	
500	240	Spade, 6 hole - (Fig. 9b)
500	208Y/120	
750	240	
750-1500	480Y/277	Spade, 10 hole - (Fig. 9c)
750-1500	208Y/120	
1000	240	
2000-2500	480Y/277	

**7.7.3** Ten-hole spade 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.

**7.7.4** On 300 kVA and larger, a galvanized shackle shall be installed beneath each bushing for the purpose of hanging a cable grip support. Transformers rated 300 kva and larger shall have supports on the bushings for strength to support secondary conductors.

**7.8 Grounding Lugs**

**7.8.1** Transformers shall be furnished with a total of 4 ground lugs: two ground lug installed in the transformer low-voltage ground provision and two ground lugs installed in the transformer high-voltage ground provision.

**7.8.2** The ground lugs shall be Fargo (Catalog No. BVC-207-FT) with thin bronze jam nut.

**7.8.3** Each compartment’s ground lugs shall be installed three inches from the compartment wall, one on each side of the compartment.



**7.9 Compartmental Locking**

**7.9.1** 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.

**7.10 Hand Holes**

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

**7.11 Fusing**

**7.11.1** 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.

**7.11.2** 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.

**7.11.3** 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.

**7.11.4** 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.

**7.11.5** The Bay-O-Net Fuse size and type for each voltage 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.

<b>Table 7: 12.47 kV Three Phase Transformer Fusing</b>					
<b>Stock #</b>	<b>Three Phase KVA</b>	<b>Bay-O-Net Fuse (Dual Sensing)</b>	<b>Continuous Ampere Rating</b>	<b>Current Limiting (ELSP Backup)</b>	<b>ELSP Ampere Rating</b>
88843 88845	75	4000358C05M	8	CBUC15030C100	30
88848 88849	150	4000358C08M	15	CBUC15080C100	80
88853 88854	300	4000358C10M	25	CBUC15100C100	100
88857	500	4000358C12M	50	CBUC15150D100	150
88858 88859	750	4000358C14M	65	CBUC15125C100*	250
88861	1000	4000358C14M	65	CBUC15125C100*	250
88862	1500	4038361C04CB	100	CBUC15125C100*	250
88863	2000	4038361C05CB	125	CBUC15125C100*	250
89007	2500	4038361C05CB	125	CBUC15125C100*	250

**7.12 Transformer Tanks**

- 7.12.1 Transformer tanks shall be constructed in accordance with IEEE C57.12.26.
- 7.12.2 Grounding provisions shall consist of 4 grounding pads, two on the HV compartment and two on the LV compartment side of the transformer. The tapped holes shall be plugged during painting to prevent coating of the threads.
- 7.12.3 Drain and fill plugs shall be bronze, cadmium, or stainless steel. No galvanized hardware will be acceptable. Drain and fill plugs will be sealed with pipe dope.
- 7.12.4 Drain and fill plugs shall be a threaded plug, not a cap, to minimize interference with anything inside the HV or LV compartments.
- 7.12.5 For all three phase transformers (except 75kVA mini pads), the front cabinet apparatus compartment shall have side panels that open, extend, and lock allowing side entry to termination compartments and less restricted space.
- 7.12.6 For transformers 300 kVA and larger, Roof sections shall be able to be raised to allow vertical cable pulling / support.

**7.13 Oil Drain Valve**

- 7.13.1 Transformers shall come equipped with an oil drain valve installed at the bottom edge in the transformer secondary compartment, 3/4" minimum diameter, gate or ball activated.
- 7.13.2 The threads shall be sealed with pipe dope.

**7.14 Labeling**

- 7.14.1 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.

**7.15 Accessories**

**7.15.1** 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.

**7.15.1.1** Oil Level Gauge.

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

**7.15.1.3** Tank Pressure Vacuum Gauge.

**7.16 Tank Dimensions**

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

<b>Table 8: Three Phase Transformers – Maximum Dimensions</b>			
	<b>75 KVA Mini-Pad</b>	<b>150 to 500 KVA</b>	<b>750 to 2500 KVA</b>
<b>Height</b>	45” max, 40” min	70” max	89” max
<b>Width</b>	45” max, 40” min	72” max, 50” min	88” max
<b>Depth</b>	42” max, 35” min	62” max, 35” min	66” max

**7.16.2** 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.

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

**7.16.4** Transformers must fit on vaults and lids specified in Chelan County PUD Material Catalog 1313.

**8 TRANSFORMER OIL**

**8.1** 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.

**9 NOISE**

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

**10 PAINT FINISH**

**10.1** 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 finish coat. All transformers shall have the manufacturer’s premium paint system.





## Material Specification 1212.01 Distribution Transformers – Padmount & Polemount

- 10.2** 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 meet or exceed the following: 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).
- 10.3** Pole Mounted Transformers – the finish coat shall be semi-gloss sky gray similar in color to ANSI Standard no. 70. The transformer top shall meet or exceed the following: 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.
- 10.4** 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

### **11 NAMEPLATES**

- 11.1** Nameplates shall be made of stainless steel or anodized aluminum and permanently marked with essential operating data meeting ANSI standard c57.12.00 for nameplates.
- 11.2** The transformer nameplate shall specifically state that the transformer is filled with “Mineral Oil” and the number of gallons of oil it contains.
- 11.3** Nameplate impedance must be the actual tested impedance on all units.
- 11.4** 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.
- 11.5** Each nameplate shall contain a transformer bar code. The bar code label shall meet all requirements of IEEE standard c57.12.35 – 1996.
- 11.6** The bayonet and current limiting fuse part numbers will be displayed on the nameplate for all Padmount units
- 11.7** Nameplates shall be mechanically fastened with rivets, bolts, or screws. Glue, adhesives, or double sided tape are not acceptable.

### **12 INSPECTION**

- 12.1** 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.

### **13 TESTS**

- 13.1** 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.
- 13.2** All transformers manufactured under this specification shall be tested for core and winding (copper) losses at 85°C, percent impedance at 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.
- 13.3** Vendor shall supply verification that the design has passed short circuit criteria per ANSI C57.12.00 and c57.12.90 latest revision.

- 13.4 Guaranteed losses: the losses submitted by the bidder for bid evaluation shall be considered as guaranteed losses by the district. DOE efficiencies will be calculated off of these quoted losses.
- 13.5 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.

#### **14 WORKMANSHIP, MATERIAL, AND FINISH**

- 14.1 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.

#### **15 DELIVERY METHODS**

##### **15.1 Destination**

- 15.1.1 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.

##### **15.2 Methods**

- 15.2.1 Polemount transformers shall be filled with the proper amount of transformer oil and shipped, completely assembled, in an enclosed van.
- 15.2.2 Padmount transformers rated up to 300 KVA shall be shipped on individual pallets made with 4" x 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.
- 15.2.3 Padmount transformer rated 500-2500 KVA shall be capable of being unloaded with an overhead crane and must be shipped on flatbed trailers and tarped or otherwise protected from the elements during shipping. Shall be shipped on individual pallets made with 6" x 6" lumber.
- 15.2.4 Transformers must be oriented on the truck with the heavy side of the transformer facing the direction that will be picked up by offloading forklift.
- 15.2.5 All pallets or mounting timbers the transformers are shipped on must be high quality and long lasting. Overhead transformers shall be strapped to the pallet. Broken pallets are unacceptable.

##### **15.3 Rejection of Shipment**

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