Revision 19
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1. Scope

This specification covers the requirements for furnishing and delivering single phase, 60-Hz, mineral-oil-immersed, self-cooled, overhead-type distribution transformer(s) rated 500 kVA or smaller, suitable for use on a 12.47 Grounded. Y/7.2kV electrical distribution system.

2. Reference Standards

All characteristics, definitions, terminology, voltage designations and tests, except as otherwise specified herein, shall be in accordance with the following industry standards for distribution, power and regulating transformers. When the following standards are superseded by an approved revision, the revision shall apply.

Industry Standards

ANSI/AIM BC2-1995 Uniform Symbology Specification - Code 39
ANSI C57.12.00-2010IEEE Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
ANSI C57.12.20-2011IEEE Standard for Overhead-Type Distribution Transformers, 500 kVA and Smaller: High Voltage, 34 500 V and Below; Low voltage 7970/13800Y V and Below
ANSI C57.12.31-2010IEEE Standard for Pole Mounted Equipment — Enclosure Integrity
ANSI C57.12.35-2013IEEE Standard for Bar Coding for Distribution Transformers
ANSI C57.12.37-2006IEEE Standard for the Electronic Reporting of Distribution Transformer Test Data
ANSI C57.12.70-2011IEEE Standard Terminal Markings and Connections for Distribution and Power Transformers
ANSI C57.12.80-2010IEEE Standard Terminology for Power and Distribution Transformers
ANSI C57.12.90-2010IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and IEEE Guide for Short Circuit Testing of Distribution and Power Transformers
DOE Title 10 Part 431.191 Distribution Transformers — Energy Conservation Standards and Their Effective Dates
NEMA TR 1 (R2000) Transformers, Regulators & Reactors

District Standards

Material Standard 387151.1 3-1/2" Labels for Marking District Owned Equipment
Material Standard 1000212.1 Non-PCB Label

3. Losses and Efficiency

3.1 No-Load Losses

No-load losses (core losses) shall be quoted in watts, referenced at 20°C in accordance with ANSI C57.12.00-2006.

3.2 Load Losses

Load losses (winding losses) shall be quoted in watts, referenced at 85°C in accordance with ANSI C57.12.00-2006.

3.3 Efficiency

Transformers shall meet the efficiency requirements of the U.S. Department of Energy as stated in DOE 10 CFR Part 431, Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule, as applicable.

4. Electrical Ratings, Material ID Numbers & DOE Minimum Efficiencies

kVA Size	High Voltage	Low Voltage	Material ID	DOE Min. Efficiency
1.5	7.2/12.47Y	120/240	630253	N/A
10	7.2/12.47Y	120/240	---	98.70%
10	7.2/12.47Y	240/480	---	
10	7.2/12.47Y	120	---	
15	7.2/12.47Y	120/240	630427	98.82%
15	7.2/12.47Y	240/480	630419	
15	7.2/12.47Y	120	630394	
25	7.2/12.47Y	120/240	630534	98.95%
25	7.2/12.47Y	240/480	630518	
25	7.2/12.47Y	120	630493	
25	7.2/12.47Y	277	630526	
37.5	7.2/12.47Y	120/240	630617	99.05%
37.5	7.2/12.47Y	240/480	630625	
37.5	7.2/12.47Y	120	630592	
37.5	7.2/12.47Y	277	630633	
50	7.2/12.47Y	120/240	630708	99.11%
50	7.2/12.47Y	240/480	630716	
50	7.2/12.47Y	120	630691	
50	7.2/12.47Y	277	630724	
75	7.2/12.47Y	120/240	630807	99.19%
75	7.2/12.47Y	240/480	630815	
75	7.2/12.47Y	120	630790	
75	7.2/12.47Y	277	630823	
100	7.2/12.47Y	120/240	630906	99.25%
100	7.2/12.47Y	240/480	630914	
100	7.2/12.47Y	120	630899	
100	7.2/12.47Y	277	630922	

kVA Size	High Voltage	Low Voltage	Material ID	DOE Min. Efficiency
167	7.2/12.47Y	120/240	631201	99.33%
167	7.2/12.47Y	240/480	631219	
167	7.2/12.47Y	277	631227	
250	7.2/12.47Y	120/240	631508	99.39%
250	7.2/12.47Y	240/480	631516	
250	7.2/12.47Y	277	631524	
333	7.2/12.47Y	120/240	631706	99.43%
333	7.2/12.47Y	240/480	631714	
333	7.2/12.47Y	277	631722	
500	7.2/12.47Y	120/240	632001	99.49%
500	7.2/12.47Y	240/480	632019	
500	7.2/12.47Y	277	632027	

5. Construction

5.1 Transformer Tank

The tank(s) shall be of welded steel construction free from leaks and seepage. The surface shall be properly cleaned and painted for protection against severe atmospheric conditions, oxygen, acid salts and alkalis.
All external fittings, cover bolts and clamping devices shall be of corrosion-resistant material.
When a handhole is provided, it shall be fitted with a moisture-resistant gasket and closing device.
A solderless connector which will accommodate AWG copper conductor size No. 8 solid to No. 2 stranded shall be located on the tank as indicated in ANSI C57.12.20-2011, Figure 11.

5.2 Finish

The transformer shall have a corrosion resistant finish that meets or exceeds the coating system requirements of ANSI C57.12.31-2010. The topcoat color of paint shall be semi-gloss ANSI Light Gray No. 70, Munsell Notation 5BG 7.0/0.4. Combined primer and topcoat thickness shall be no less than 3.0 mils. All finish components shall be lead free.

5.3 Transformer Size & Weight

Transformer dimensions and weights shall not exceed the values listed below:

Size (kVA)	Height (in)	Width (in)	Depth (in)	Weight with Oil (lb)
1.5	32	19	22	150
10	34	20	24	375
15	35	21	24	450
25	37	22	25	575
37.5	39	25	28	775
50	40	26	28	900
75	48	36	36	1,225
100	51	36	36	1,425
167	54	39	38	2,300

6. Components

6.1 High-Voltage Bushings

Transformers shall be equipped with two cover mounted high-voltage bushings positioned as indicated in ANSI C57.12.20-2011, Figure 11. Both primary bushings shall come equipped with moulded wildlife protectors with integral insulated hand-wheels for securing the primary and ground leads to the bushing terminals. The protectors shall be constructed from shatter, track, corrosion and UV resistant material with a high dielectric strength.

6.2 Low-Voltage Bushings

Low-voltage bushings on units 100 kVA and smaller shall be equipped with tank mounted, clamp type terminals. 120V and 277V units shall have two (2) low voltage bushings while 120/240V and 240/480V units shall have three (3) low voltage bushings per Table 7 of ANSI C57 12.20-2011. Units 167 kVA and larger shall have four (4) hole spades with NEMA hole spacing and be capable of accepting either copper or aluminum terminal lugs. Low voltage bushing insulation shall be manufactured from polymeric materials. Ceramic low voltage bushings are not acceptable.
A neutral grounding strap shall not be provided.

6.3 Primary Taps

Transformer(s) with 120/240 or 120 volt low-voltage ratings shall not have taps unless specified on the Special Provision Sheet.
Transformer(s) with 240/480 or 277 volt low-voltage ratings shall have two (2) 2.5% taps above and below rated voltage unless otherwise specified on the Special Provision Sheet. Tap changers when furnished shall be externally operable.

6.4 Transformer Oil

The transformer shall be shipped with the proper quantity of mineral insulating oil. Oil shall meet the requirements of ASTM D 3487 for Type II (inhibited) oil. At the time the oil is put into the tank it shall contain less than (1) ppm PCB certifiable by a

laboratory test approved by the United States Environmental Protection Agency. The insulating oil, or any of its components, shall not be listed by IARC, NTP, OSHA or ACGIH as carcinogens. The successful bidder shall supply an MSDS sheet for each distinct formulation of insulating oil supplied to the District.
Alternative insulating fluids, including ester-based and silicone-based oils may be supplied with prior District review and approval.

6.5 Relief of Excessive Pressure

The transformer shall be equipped with a replaceable pressure relief valve as specified in Section 7.2.5.1 of ANSI C57 12.20-2011. A pressure relief cover assembly as the sole means of pressure relief is not acceptable.

7. Noise

Transformer sound levels shall not exceed the values listed below when measured in accordance with ANSI C57.12.90-2010:

Equivalent Two-Winding kVA	Average Sound Level (Decibels)
0-50	48
51-100	51
101-300	55
301-500	56

8. Identification

8.1 Nameplate

A corrosion-resistant nameplate shall be provided which conforms with Section 5.12 of ANSI C57.12.00-2010. Additionally, the nameplate shall show gallons of oil and total transformer weight with oil.
The following statement shall appear on the nameplate: “Contains less than 1 ppm PCB at the time of manufacture”.
Nameplates shall be bar coded in accordance with ANSI C57.12.35-2013.

8.2 kVA Decals

kVA decals, if specified in the Special Provisions Sheet, shall meet the following requirements.
The kVA size of the transformer shall be marked with 3” white reflective decals located immediately below the secondary bushings on the front surface. Marking decals shall conform to the latest revision of District Material Standard 387151.1.
A 10” high x 14” wide area centered on the bottom front of the transformer shall be left bare of any stenciling and/or decals.

8.3 Non- PCB Decal

A "NON-PCB" decal, if specified in the Special Provisions Sheet, shall meet the following requirements.
One “NON-PCB” decal shall be attached to each transformer. “NON-PCB” decals shall conform to the latest revision of District Material Standard 1000212.1 (see Figure 1).
The decals shall be positioned on the bottom half of the transformer tank, aligned with the center line of either the 2nd or 4th quadrants.

8.4 Labeling

Each transformer shall be labelled with the following information:

Line	Data	Length	Example
1	District's Material Number*	11	"00006303130" *The number 0 must prefix the catalog number to fill 11 characters
2	District's Material Description	<= 50	"Transformer, Underground 15 kVA Pad-mount (L) 240/120"
3	Date	8	"05/22/03"
4	"PO/REL" *space* PO Number (8 Characters) *space* Release Number (5 Characters)	12	"PO/REL 00001111 00001"
5	Transformer Serial Number	12	"000125875632"

The decal shall be durable and weather resistant. The decal shall be placed on the transformer tank cover.

9. Test Reports

The bidder shall furnish certified copies of the short-circuit tests they have performed on each transformer design. Short-circuit tests shall be in accordance with ANSI/IEEE C57.12.00-2010 and C57.12.90-2010.
The District may reject any bid, when in its judgment, the bidder has not taken sufficient steps to meet the mechanical short-circuit requirements as detailed in the ANSI/IEEE standards.

10. Guarantee

The failure of any transformer due to defective design, material and/or workmanship within twelve months after being energized or eighteen months after delivery, whichever comes first, shall be repaired or replaced without cost to the District. Any defect in design, material and/or construction discovered within this period shall be corrected on all transformers furnished on this order at the manufacturer’s expense, either by repair or by replacement.

11. Inspection and Testing

After delivery, all of the delivered lot will be inspected for defects and conformance to this Specification and tested for proper internal connections. The manufacturer (or his representative) will be notified of all defects and mutual arrangements shall be made for correcting the defects at no expense to the District. All subsequent testing required due to the defects will be at the manufacturer’s expense.

12. Packaging

Transformers shall be shipped secured to individual nonreturnable wooden pallets suitable for handling with a forklift. Transformers shall be shipped in an enclosed van. Transformers shipped on flatbed trucks, even if tarped or otherwise protected shall be refused and returned to vendor.

13. Bidder's Data

For each transformer line item, all bidders shall supply:

- One certified copy of all design tests as called for in ANSI C57.12.00-2010, Table 18.
- All data and information as requested on the attached bidder's data file.

A description of any proposed changes, additions or exceptions to the Specification shall be submitted along with reasons for the departure.

14. Data to be Furnished by the Successful Bidder

14.1 CAD Drawings

A CAD drawing outline dimensions of each transformer line item with accessories. Acceptable formats include Microstation, AutoCad or DXF.

14.2 Certified Transformer Test Data

Certified data for each transformer shall be submitted for each transformer at the time of shipment or other mutually agreed upon interval. Test data shall reported in electronic form, supplied as an ASCII file with variable length records, comma delimited. Fields shall be stripped of leading and trailing blanks. The data set shall include the standard and extended data sets per ANSI C57.12.37-2006 modified as given:

Field	Field Name	Data Type	Sample Data	Valid Values
1	User Name	Char(20)	SNOHOMISH COUNTY PUD	SNOHOMISH COUNTY PUD
2	User Purchase Order Number	Char(8)	00026350	PO number including leading zeros.
3	User Stock Number	Char(10)	0000630592	Mat. ID number including leading zeros.
4	Producer Identification	Char(2)	HI	See ANSI C57.12.35-2007.
5	Producer Order Number	Char(14)	4337	
6	Producer Catalog Number	Char(15)	1037-418997-000	
7	Producer Serial Number	Char(13)	1765201303	
8	Product Type	Char(2)	PM	See ANSI C57.12.37-2006, 4.2.8.
9	Number of Phases	Int(1)	1	1,2 or 3
10	kVA Rating	Numeric(7,1)	37.5	Nominal ONAN kVA to 1 decimal point.
11	Primary Voltage	Char(47)	12 470GrdY/7200	See ANSI C57.12.00-2006.
12	Secondary Voltage	Char(28)	240/120	See ANSI C57.12.00-2006.
13	Polarity	Char(1)	S	A (Additive), S (Subtractive), Null (3Ø).
14	Quoted No-Load Loss	Int(5)	45	Quoted no-load losses in watts at nominal kVA, Pri. voltage & 20°C.
15	Quoted Load Loss	Int(6)	201	Quoted load losses in watts at nominal kVA, Pri. voltage & 85°C.
16	Quoted Impedance Voltage (IZ)	Numeric(4,2)	2.57	Quoted IZ in percent at nominal kVA, Pri. voltage & 85°C.

Field	Field Name	Data Type	Sample Data	Valid Values
17	Quoted Excited Current (IEX)	Numeric(4,2)	0.27	Quoted IEX in percent at nominal kVA, Pri. voltage & 85°C.
18	Tested No-Load Loss	Int(5)	44	Tested no-load losses in watts at nominal kVA, Pri. voltage & 20°C.
19	Tested Load Loss	Int(6)	189	Tested load losses in watts at nominal kVA, Pri. voltage & 85°C.
20	Tested Impedance Voltage (IZ)	Numeric(4,2)	2.6	Tested IZ in percent at nominal kVA, Pri. voltage & 85°C.
21	Tested Resistance Voltage (IR)	Numeric(4,2)	1.66	Tested IR in percent at nominal kVA, Pri. voltage & 85°C.
22	Tested Exciting Current (IEX)	Numeric(4,2)	0.30	Tested IEX in percent at nominal kVA, Pri. voltage & 85°C.
23	Total Mass	Int(5)	892	Total mass, including accessories & oil.
24	Mass Unit of Measure	Char(2)	lb	lb (pounds), kg (kilograms).
25	Date of Manufacture	Char(7)	2005/05	Alphanumeric in yyyy/mm format.
26	Test Data Reporting Lot	Char(7)	2005/05	yyyy/mm or yyyy/qx where qx is Q1, Q2, Q3 or Q4.
27	User Release Number	Char(5)	00107	Release number including leading zeros.
28	Producer Plant Location	Char(10)	MSLAUREL	See ANSI C57.12.00-2006, 4.3.2.
29	Quoted Loss Guarantee Type	Char(2)	GA	See ANSI C57.12.00-2006, 4.3.3.
30	No-Load Loss Evaluation Factor	Numeric(5,2)	5.2	00.00 to 99.99
31	Load Loss Evaluation Factor	Numeric(5,2)	1.23	00.00 to 99.99
32	Frequency	Int(2)	60	Nominal operating frequency in hertz, 0 to 99.
33	Cooling Class	Char(9)	ONAN	ONAN, ONAN/ONAF, KNAN/KNAF or LNAN/LNAF.
34	Average Winding Temperature Rise	Char(5)	65	55, 55/65, 65 or other as specified.
35	Type of Insulating Fluid	Char(8)	MIN_OIL	MIN_OIL, FR3, EnviroTemp, R TEMP or as specified.
36	No-Load Loss Reference Temperature	Int(2)	20	0 to 99.
37	Load Loss Reference Temperature	Int(2)	85	0 to 99.
38	Total Volume of Oil	Int(4)	47	0 to 9999.
39	Volume Unit of Measure	Char(2)	GL	GL (gallons) or LT (liters).

14.3 Equipment Data Sheet

Each shipment of transformers shall include a digital spreadsheet including all transformers in the shipment and their nameplate data. The spreadsheet shall be formatted to the District's requirements and shall be emailed to the District's Standards Department prior to delivery of each transformer shipment. The District will provide the required spreadsheet template to the manufacturer.