

DISTRIBUTION TRANSFORMER

SPECIFICATION #1212.03



**15kV Single Phase Submersible Transformer
Stainless Steel**

1. SCOPE

This specification covers single-phase submersible transformers for use on the District's 12470 GrdY/7200 Volt 60 Hertz, underground distribution system and appropriate for 3 ϕ banking. The transformers are intended for installation below ground in vaults. The transformers shall be suitable for continuous submersion. The primary winding of the transformers will be connected Y-D or Y-Y when used in a three-phase application. The primary bushings shall be configured in an H1/H2 configuration. The low voltage windings will normally be connected closed delta or closed Y.

2. STANDARDS

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

3. RATINGS

3.1. 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 55°C average temperature rise or a 70°C hot spot temperature rise.

3.2. The electrical characteristics of the completely assembled high and low voltage terminals shall be 7200/12470Y, and 120/240 (4 low-voltage bushings).

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

4. RADIAL FEED

Transformers shall be two high voltage bushings, H1 and H2. Looping shall be done externally by Chelan PUD by utilizing a feedthrough bushing in the bushing well or vault mounted feed throughs.

5. CONSTRUCTION

5.1. Construction of the units shall be such that they can be lifted and lowered into place in a suitably designed and constructed enclosure having a minimum diameter of 36 inches. To allow for cabling space and proper airflow for cooling, the transformers covered by this standard shall not have overall diameters in excess of 30 inches for sizes 100 kVA and smaller, in excess of 33 inches for 167 kVA or 38 inches for 250 kVA and larger.

5.2. The transformer tank, cover, and all external appurtenances shall be of corrosion-resistant 304L stainless steel. This includes welds, plugs (may be brass), nameplates, etc.

5.3. A protective (paint) coating of semi-gloss sky gray similar in color to ANSI Standard no. 70 shall be applied that is at least 3 mils thick.

5.4. Welds shall be smooth and shall not cut workers hand or gloves. The tank and cover shall be capable of withstanding a full vacuum.

5.5. Tank Cover

5.5.1. The tank cover shall be welded to the tank. No handhole shall be installed in the cover.

5.5.2. The threads between the oil fill plug and the boss on the tank shall be sealed with a liquid pipe thread compound. Teflon tape is undesirable as it leaves

shreds floating in the oil.

- 5.5.3. If a fill plug is not provided, a 1/4-inch NPT boss with a brass plug shall be provided for the purpose of pressure testing.

5.6. Tank Ground

The tank grounding connection shall be per ANSI C57.12.20, Section 6.5.4 except:

- 5.6.1. The connection shall consist of a stainless-steel boss or pad and shall be equipped with a solder less tinned copper-alloy connector that will accommodate #8 solid through #2 AWG stranded copper wire. The clamping eye bolt threads shall be 3/8-16NC.
 - 5.6.2. The tapped hole in the boss or pad and the stud of the connector shall be 1/2-inch-13NC, Class 2 fit. The tapped hole shall be coated with an oxide-inhibiting compound before installation of the connector.
 - 5.6.3. This connection shall be plainly labeled "G". The ground connectors shall be Fargo BVC-207 FT with slim jam nut.
 - 5.6.4. Extra tank ground bosses shall be protected with oxide-inhibiting compound and a plastic flanged cup pressed into the threads (aluminum cups are not acceptable).
- 5.7. Base bars of 401 Stainless Steel shall be provided on the transformer tank to protect the bottom of the tank while in transit and when installed in the underground enclosure. Minimum bar height is 1.00 inch.
 - 5.8. The lifting provisions shall be permanently attached and arranged on the tank to provide a distributive balanced lift in a vertical direction for the completely assembled transformer. They shall be designed to provide a safety factor of 5.

6. TRANSFORMER TAPS

No transformer taps are required.

7. CONNECTORS AND TERMINALS

7.1. Primary Bushing

- 7.1.1. Transformers shall come equipped with two high voltage bushing wells (H1 and H2), and corresponding load break inserts for dead front application. The bushing wells shall be welded to the transformer cover, 200-amp rated, separable, and rated for primary switching per IEEE 386. Gasketed bushing wells are not acceptable. The bushing well shall have a cover or cap to prevent the entrance of moisture or dirt during shipping or storage. The cap shall be secured in a manner that prevents its loss during shipment or temporary storage. Bushings shall be able to screw out from the well in order for Chelan PUD to install feedthrough if needed (Cooper LFI215 or Elastimold 1602A3R or similar).
- 7.1.2. The bushings shall conform to IEEE C57.12.23.
- 7.1.3. The load-break bushing inserts shall be Cooper Power Systems (Catalog No. 2604797B01M) or Elastimold (Catalog No. 1601A4).
- 7.1.4. One parking stand shall be welded in Segment 3 as shown in the latest IEEE

C57.12.23.

7.2. Secondary Terminals or Leads

7.2.1. Four low-voltage cable leads (eight for 167 kVA, 250 kVA, and 333 kVA) extending 36 inches above the top of the cover shall be provided and arranged for vertical takeoff. The secondary neutral shall be floating and extended for external grounding. Leads shall be 500 kcmil copper.

7.2.2. The cable insulation shall be in accordance with IEEE C57.12.23. The leads shall be 500 kcmil Copper. The ends of the cable leads shall be water sealed. The secondary bushing shall be plainly labeled X1, X3, X2, or X4, appropriately.

7.2.3. The cable ends shall be sealed with a heat or cold shrink cap and cannot be removed without cutting the cap.

7.3. Ground connections shall be suitably sized for the short-circuit rating of the transformer as defined in the latest IEEE C57.12.00

8. FUSING

8.1. Transformer H1 bushing leads shall be provided with Eaton-Cooper Power Systems Bay-O-Net, dual sensing, load break, cover-mounted, externally removable links in series with under-oil, internally mounted 15 kV partial range current limiting fuses (CLF). The partial range fuse shall be manufactured by Eaton-Cooper Power Systems (Type Multi-Coil ELSP).

8.2. 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 15 kV.

8.3. Fuses shall meet the Districts current fusing specifications which are shown below:

Single Phase KVA	Bay-O-Net Fuse (Dual Sensing)	Continuous Ampere Rating	ELSP Rating (A)	Current Limiting (ELSP Backup)
25	4000358C05	15	CBUC15030C100	30
37.5	4000358C08	15	CBUC15050C100	50
50	4000358C08	15	CBUC15065C100	65
75	4000358C10	25	CBUC15100C100	100
100	4000358C10	25	CBUC15100C100	100
167	4000358C12	65	CBUC15165D100	165
250	4000358C14	65	CBUC15165D100*	330
333	4000358C14	65	CBUC15165D100*	330
				*indicates parallel fusing

9. TRANSFORMER OIL

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”.

10. NOISE

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

11. PAINT FINISH – NONE REQUIRED

12. NAMEPLATES

12.1. A stainless steel diagrammatic nameplate shall be affixed to the tank cover (or any nameplate extension bracket) using stainless steel fasteners. The nameplate shall state all information per ANSI C57.12.00, nameplate A, except the nameplate shall include the following:

12.1.1. A manufacturer’s serial number barcode shall be etched into the nameplate using a character size of 128A. The barcode shall be a maximum ½” high and 2½” wide. The manufacturer’s identification characters shall not be included in the barcode.

12.1.2. The date (month/year) of manufacture. Serial numbers that include a date code will not suffice.

12.1.3. The statement “Contains less than one ppm PCB at time of manufacture.” Separate “NON PCB” stickers, labels, or extra nameplates will not suffice.

12.1.4. The gallons of oil.

12.1.5. The weight of each main component of the transformer including core & coil, tank & fittings, weight of oil, and total weight (in pounds).

12.1.6. The manufacturer and catalog number for the primary fuses and fuse holder.

13. INSPECTION

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 and/or witness testing, at no additional cost.

14. TESTS

14.1. 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. Certified test reports shall be sent to the District engineer 24 hours before shipment of the transformer.

14.2. Test Tags. Each transformer shall have a durable, weatherproof tag firmly attached, reading:

“This transformer has been tested at rated line voltage and has successfully passed all applicable tests specified by ANSI and NEMA.” The tag shall show the transformer serial number, the date, and name of the person who performed the test. (State of Washington, Safety Statutes, Section 19.29.010, Rule 5). NOTE: Slight variations in wording will be acceptable with prior approval.

15. EVALUATION AND AWARD

- 15.1. Each individual transformer must meet DOE loss requirements, averaging not allowed.
- 15.2. Delivery date. Bids must meet or exceed the requested delivery date in the bid. All deliveries over the life of the contract must meet the quoted lead time in the bid.
- 15.3. 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.

- 15.4. Transformers will be evaluated on losses using the following criteria.
 - 15.4.1. Losses furnished for evaluation shall be guaranteed maximum losses for each transformer bid.
 - 15.4.2. No load losses (NLL) shall be in watts, at 20°C in accordance with ANSI C57.12.00.
 - 15.4.3. Full-load losses (FLL) shall be in watts, measured at rated nameplate load at 85°C in accordance with ANSI C57.12.00.
 - 15.4.4. Losses will be evaluated at the following values:
 - 15.4.5. \$4.07 per watt for no-load losses
 - 15.4.6. \$1.79 per watt for full-load losses
 - 15.4.7. 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.
- 15.5. Transformer evaluated prices will be determined as follows:

$$\text{Evaluated \$} = \{\$4.07 \times \text{NLL}\} + \{\$1.79 \times \text{FLL}\} + \{\text{Base Price} \times (\text{Transformer Evaluation Factor})\}$$

16. DATA TO BE SUBMITTED WITH BID

Each bidder shall submit with his proposal the data listed below. Bidder shall submit a description of any changes, additions or exceptions to the specification he proposes, together with reasons for the departure. Product evaluation and conformance to specification will be determined on the basis of information submitted. The drawings and data furnished must be in sufficient detail and clarity to enable making a complete and positive check with the technical provisions of the specification.

- 16.1. Outline drawings with overall dimensions.
- 16.2. Details of the primary and secondary bushings. Manufacturers' name and catalog numbers will suffice for primary bushings if no exceptions are requested. Secondary bushing details shall include (1) materials (cable or spade), (2) finish, such as plating, (3) dimensions (cable size + length or spade size and thickness).
- 16.3. Maximum core losses (no load) at 20° C and load losses (windings) at full load at 85° C. If other temperatures are used, provide an explanation and correction factor.
- 16.4. That the transformer is a 55/65° C rise design.
- 16.5. Impedance of windings at rated load expressed in percent of rated voltage.
- 16.6. Information concerning details of construction, tank materials and tank finish. State grade of stainless steel and total thickness of paint.
- 16.7. Make and specification of oil. Inhibited oil is required.
- 16.8. Complete primary fuse data including fuses specified for each size of transformer. Include manufacturer and catalog number of fuse and holder.
- 16.9. State all electrical tests given transformers at the factory and whether these tests apply to all units or only sample units.
- 16.10. Total weight of completely assembled transformer, including oil.
- 16.11. A drawing of the transformer nameplate and outline drawing. Complete fuse data shall be shown on the nameplate: type, size, catalog number and manufacturer.

17. WORKSMANSHIP, MATERIAL, AND FINISH

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.

18. PAYMENT

The contractor's invoice must include an itemized list of size (kVA) voltage and serial numbers of units sent, along with certified test reports before the invoice will be paid. An order is not complete until certified test reports on each transformer shipped is in the District's possession.

19. DATA TO BE FURNISHED BY THE SUCCESSFUL BIDDER

The successful bidder shall supply:

- 19.1. Outline drawing with dimensions of the transformer with accessories.
- 19.2. Transformer nameplate drawing.
- 19.3. Electronic copy of an instruction book covering installation, operation, and maintenance of the equipment furnished.
- 19.4. One copy of certified test data for each transformer supplied. The test data shall contain the minimum following information:
 - (1) core loss,
 - (2) load loss,
 - (3) exciting current at rated voltage,
 - (4) insulation tests.

20. DELIVERY

- 20.1. The transformers shall be shipped F.O.B. destination to 203 Olds Station Road, 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 Warehouse Foreman at (509) 661-4893 for (509) 661-4287, 24 hours prior to delivery. No deliveries will be received on national holidays.
- 20.2. Transformers shall be shipped completely assembled in an enclosed van or curtain trailer and filled with the proper amount of transformer oil.
- 20.3. Transformers shall be shipped on individual pallets (one transformer per pallet). Transformers shall be securely attached to the pallets to allow for forklift handling.
- 20.4. Rejection Of Shipment
 - 20.4.1. Transformers exhibiting damaged parts, broken securing devices, or are dirty from lack of proper shipping, shall be cause for rejection of shipment.

21. SPECIFICATIONS REVISIONS LOG

#	Date	Description
1	9/18/07	Added Specifications Revision Log
2	9/18/07	Added requirement for heat or cold shrink secondary leads caps
3	9/18/07	Added requirement that all welds, plugs, nameplates shall be 401 SS or brass.
4	9/18/07	Added requirement that unit be painted ANSI 70 Sky Gray.
5	12/2/11	Updated fuse part numbers and corrected formatting to match other specs
6	12/12/23	Changed HV to H1/H2 rather than feed through.