WESTERN UNDERGROUND COMMITTEE
GUIDE 2.6 (2.6/00/0868)

THREE-PHASE SUBSURFACE UNDERGROUND COMMERCIAL DISTRIBUTION (UCD) TRANSFORMER

NOTE: This "Guide" summarizes the opinions, recommendations, and practices of the Western Underground Committee members and is issued only to assist these members in preparing their own specifications, or in making recommendations to specification agencies. Thus, this "Guide" may not reflect the complete requirements of each individual utility and is not binding upon them.

1.0 SCOPE

These specifications cover three phase, 60 cycle, oil-filled, self-cooled subsurface UCD (Underground Commercial Distribution) transformers for installation in below ground enclosures, which will be subject to flooding.

2.0 GENERAL

2.1 All characteristics and definitions except as specifically covered herein shall be in accordance with applicable parts of the current USASI Standards C57.12.00, C57.12.10, C57.12.20, C57.12.80 and C57.12.90.

2.2 The complete transformer including secondary and primary bushings (when covered with dead end receptacle or cable termination) and all other trough-tank fittings shall be suitable for both continuous and part time submersion.

2.3 Transformers supplied under this Specification are intended to be placed in a minimum sized underground concrete enclosure, which will have removable cover sections. The sides and ends of the transformer will be close to the enclosure wall and not accessible. All transformer parts, which require maintenance, and all operating accessories, must be located on or within approximately six inches from the top of the transformer.

3.0 ORDERING INFORMATION

3.1 The following shall be specified on all orders:

3.1.1 kVA rating, three phase.

3.1.2 High and low voltage rating (see Section 4.0).

3.1.3 State style required (see Section 14.0).

4.0 TRANSFORMER RATINGS

4.1 High Voltage Rating - Volts**

25,000 grounded wye and below

15,000 delta and below

(Purchaser to specify voltage)

** Dual voltage rated transformers may be specified.

4.2 Low Voltage Rating - Volts*

480Y/277
480 delta

208Y/120
240 delta

(Purchaser to specify voltage)

* 120/240 four-wire delta may be specified.

4.3 kVA Ratings: 150, 225, 300, 750, and 1,000.

4.4 Basic Impulse Insulation Levels: Basic impulse insulation levels shall be in accordance with Section 12.02 of USASI Standard C57.12.00 or as agreed to by Purchaser and manufacturer.

4.5 Temperature Rise: At rated voltage and kVA, the temperature rise of the windings shall not exceed 55°C when tested in accordance with the current USASI Standard Test Code USASI C57.12.90. The transformer shall have a 65°C temperature rise insulation system approved by Purchaser, to provide rated capacity under ambient temperature 10°C higher than standard. An additional kVA rating of 65°C rise shall be assigned by the manufacturer and shown on the nameplate. Performance characteristics shall be based on 55°C rise rating. (USA C57.12.00a - 1966 supplement to C57.12.00-1965, Table 8 Note b.)

4.6 When permitted by the Purchaser, the manufacturer may furnish a "T-T" connected transformer in place of a conventional delta-wye connection, provided that the "T-T" connection is arranged to simulate a delta-wye connection.

4.7 Transformers may have an impedance lower than USAIA Standard unless otherwise specified by Purchaser. When lower impedance designs are used, the transformers shall withstand mechanical forces generated by full secondary short circuit current.

5.0 HIGH VOLTAGE TAPS

When high voltage taps are specified, they shall be suitable for de-energized operation only. The tap changer switch shall be gang operated and the control shall be located under a corrosion resistant pip plug located on the top surface of the transformer.

6.0 HIGH VOLTAGE TERMINALS

6.1 The transformers shall be designed for operation in arrangements shown in Figure 1, page 9.

6.2 Transformers shall be supplied with high voltage apparatus bushings as specified by Purchaser.

6.2.1 Transformer bushings shall have a voltage and BIL rating equal to or greater than the transformer rating. The minimum corona level rating of the bushings shall be equal to or greater than 150% of the transformer phase to ground rating. The bushings shall be rated 200 amps at rated voltage.

6.3 The cable terminations will be furnished by Purchaser unless specified otherwise.

6.4 The transformer bushings shall be suitably covered during shipment to prevent contamination of the bushings or transformer.

6.5 Means shall be provided for securely holding the cable terminations to the bushings.

6.6 The preferred design of the high voltage bushings shall be such that they may be mounted on the transformer so as to allow the operator to stand at the side of the enclosure, i.e., does not require operator to be directly over the bushing while installing or removing the

cable termination. (Note: Cable terminations will be installed and removed by one man using a standard hot stick.)

7.0 LOW VOLTAGE TERMINATIONS

As specified by Purchaser, low voltage terminations shall be either (1) Tinned copper spades with standard EEI-NEMA dimensions or (2) 1-1/2-12 plated copper studs, 2½ inches long.

8.0 PROTECTION

8.1 When specified on the order, the transformer shall contain approved externally replaceable internal fuses (see Figure 1). These fuses must be hot stick replaceable from above the transformer with the feed through circuit energized. The rating of the fuse shall be 10,000 amperes RMS symmetrical minimum interrupting capacity. The fuse assembly must incorporate a safety device, which will not allow the fuse to be directly inserted into the faulted transformer or secondary. The minimum melting current shall be approximately 400 percent of the rated load current of the transformer.

8.2 On kVA sizes and secondary voltage ratings applicable, and when specified by Purchaser, and Internal high voltage fuse-coordinated with a thermal over current type circuit breaker(s) may be provided in place of the protection method described in Section 8.1.

9.0 HIGH VOLTAGE LOAD BREAK SWITCHES

9.1 When specified in the order, the transformer shall contain an oil immersed, high voltage, load break sectionalizing switch (see Figure 1, page 9).

9.2 A two-position ("ON-OFF") three-phase switch for each high voltage line is required. The switch position (open-close, etc.) shall be distinctly observable by position of handle at a distance of three feet above the transformer. The switch position identification shall be permanent.

9.3 The switch handle shall be mounted on or near the cover of the transformer and shall be operable from above using a standard hot stick (see Figure 2, page 10).

9.4 Switch Ratings:

9.4.1 Load Break Capability: 200amperes at rated voltage and 0.6 power factor.

9.4.2 Momentary Current Rating: 12,000 amperes asymmetrical.

9.4.3 Close and Hold Rating: 12,000 amperes asymmetrical.

9.4.4 Voltage Rating: Not less than transformer rating.

9.5 On Transformers that contain oil-immersed switches, visible means shall be provided to assure oil level is above the switch contacts. The oil level indication shall be visible from above. It shall not be a dipstick or other device that would require exposing the interiors of the tank.

10.0 TRANSFORMER TANK

10.1 The transformer tank including radiators shall be steel and shall be a minimum thickness of 3/16 inch.

10.2 All exterior surfaces shall be coated using a system of coordinated and thoroughly tested materials and application techniques that will assure long life under submersed conditions. Special attention shall be given to welds, seams, edges, and rough spots.

10.2.1 Acceptance Requirements: The transformer supplier shall submit information describing transformer coating and shall also submit tests performed to assure that the coating will provide long transformer life under total or intermittent submersed conditions.

10.3 No portion of the tank or protruding appurtenances shall trap and hold water.

10.4 The cover shall be welded and shall be fitted with brackets that will accept accessories that are used in conjunction with high voltage cable terminations referred to in Section 6.0.

10.5 An instruction nameplate of stainless steel or other approved corrosion resistant material shall be provided. This nameplate shall be securely attached to the top of the transformer by means of stainless steel screws, rivets or other approved fasteners. The letters and numbers shall be stamped on the nameplate. The instruction nameplate shall contain the

information specified in Section 9.3.5.1 of USA Standard C57.I2.00. Unless otherwise specified by Purchaser, this nameplate shall contain switch-rating information (when switches are furnished) unless this information appears on separate switch nameplates.

10.6 One tinned copper alloy-grounding lug (or approved equivalent) shall be provided on the top of the transformer adjacent to each high voltage bushing.

10.7 The grounding lugs described in Section 10.6 shall accommodate No. 4 through 1/0 AWG stranded copper wire.

10.8 Space shall be provided adjacent to each switch handle for attachment of the user's switch identification plate.

10.9 Transformer terminal identification (markings) shall be permanent and clearly marked.

10.10 At option of Purchaser, the transformer shall contain a gasketed handhole with a minimum dimension of 8 inches. It shall contain a lip (or other means) on the transformer surface to minimize contaminants from falling into the hole when the cover is removed.

10.11 Lifting lugs shall be designed and located on the tank to avoid interference between lifting slings and any attachments (bushings, switch handles, etc.) on the transformer and to avoid scratching or marring the transformer coating. Transformers shall contain suitable jacking and rolling facilities.

10.12 Tanks shall be tested at a pressure equal to or greater than the maximum operating pressure and for a sufficient period of time to insure that all welds are free from leaks.

10.13 Dimensions: The maximum over-all dimensions shall be as shown below:

KVA (Three Phase)	Width (In.)	Length (In.)	Height (In.)
150	36	70	70
225	36	70	70
300	36	85	70
500	36	85	75
750	48	95	80

1,000	48	95	80

10.14 High voltage and low voltage bushings shall be located on the top of the transformer as shown in Figure 2. Other surface mounted devices shall be so arranged to provide adequate space for safe operation of all such devices.

10.15 A positive liquid level device shall be provided. (The device required in Section 9.5 may satisfy this requirement.) A hole, which will safely allow a sampling pipe to be run through this opening to the bottom of the tank, shall be provided on the top of the tank. A drain plug shall be provided at the base of the transformer.

11.0 TESTING AND INSPECTION

11.1 Each transformer shall successfully pass the following routine tests in accordance with USASI standards after final assembly:

11.1.1 Applied potential

11.1.2 Induced potential

11.1.3 Losses at no load

11.1.4 Ratio

11.1.5 Polarity

11.1.6 Exciting current

11.1.7 Tank pressure

11.1.8 Impulse (production type)

11.1.9 Radio interference voltage (50 microvolts maximum at 115% of rated voltage)

12.0 APPROVAL

12.1 Manufacturers shall submit proposed transformer design details to Purchaser for approval.

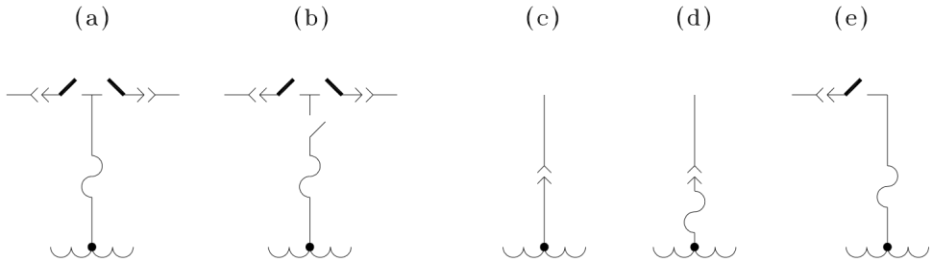
12.2 Approved suppliers shall notify Purchaser whenever a significant change in material or design is to be made.

13.0 DATA TO BE SUBMITTED WITH PROPOSAL WHEN REQUESTED

When requested, descriptive information shall be furnished together with performance data on each rating of transformer with the bid proposal. This data shall include rating, actual test voltages applied to both windings on all dielectric tests, average copper, hottest spot, and top oil temperature rise at rated load, no load and total load losses, RIV level at 115% of rated voltage, percent regulation at rated load 100 percent P.F. and at rated load 80 percent P.F., percent impedance, thermal time constant, exciting current at 100% and 100% of rated volts, type of insulation and conductor used, fault current allowable without damage to the transformer, outline dimension, and net weights. It shall be expressly understood that these performance specifications as furnished by the successful bidder shall constitute guarantees with variance permitted therefore only insofar as allowable by applicable NEMA and USASI standard tolerances and not expressly prohibited by these specifications.

14.0 ARRANGEMENTS

Various arrangements of fusing and switching are shown in Figure 1, page 9.



LOOP FEED

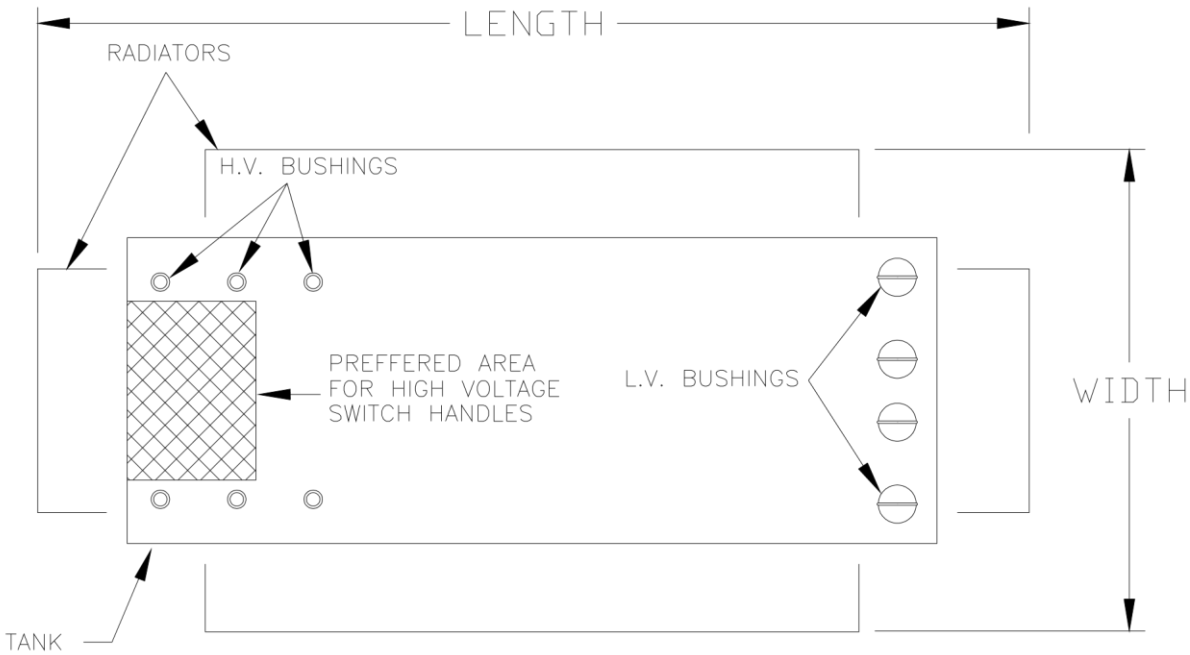
RADIAL FEED

SYMBOLS:

- 3-HIGH INTERRUPTING CURRENT FUSES
- THREE-PHASE TWO POSITION LOAD BREAK SWITCH
- 3 SINGLE-PHASE TWO POSITION LOAD BREAK SWITCH
- 3-PRIMARY SEPARABLE CONNECTORS
- TRANSFORMER PRIMARY COILS

NOTE
OTHER ARRANGEMENTS MAY BE MADE AS AGREED TO BY PURCHASER AND MANUFACTURER.

FIGURE 1
HIGH VOLTAGE SCHEMATIC
ONE-LINE DIAGRAM



NOTE
FOR MAXIMUM OVERALL DIMENSIONS, SEE PARAGRAPH 10.13.

FIGURE 2

PREFERRED LOCATION OF
HIGH VOLTAGE AND LOW VOLTAGE BUSHINGS
AND HIGH VOLTAGE SWITCH HANDLES