

## 1.0 **SCOPE**

This specification covers single-phase-phase, 60 Hz., dead-front, oil immersed, self-cooled, 65° C rise, pad-subway type, loop-feed distribution transformers for manhole or vault installation, with primary voltages of 14,400/24,940 V and below, and secondary voltages of 480Y/277 V and below.

## 2.0 **APPLICABLE PUBLICATIONS AND STANDARDS**

All items characteristic, definitions and terminology, except as specifically covered in this specification, shall be in accordance with the latest revisions of ANSI/IEEE Standard C57.12.23, Department of Energy and NEMA standards, including US Department of Energy National Efficiency Standard 78 FR 2335.

## 3.0 **PRODUCT REQUIREMENTS**

### 3.1. **General**

- 3.1.1. All insulating components, oil, paper and wire enamel, shall be made of thermally upgraded materials, which are all compatible at today's industry standard 65 degrees Celsius temperature rise.
- 3.1.2. Transformers shall conform to latest issue of ANSI/IEEE Standard C57.12.23 except as specified herein.

### 3.2. **Nameplate**

- 3.2.1. In addition to the information specified in ANSI/IEEE C57.12.00 (Nameplate A), latest edition, the nameplate shall contain a PCB statement, the total volume of oil in gallons, and the DIV ID #.
- 3.2.2. Nameplate shall be 300-series stainless steel and affixed to the transformer with 300-series stainless steel or silicon bronze fasteners and readable with cables in place.
- 3.2.3. Lettering to be etched or engraved.

### 3.3. **kVA Ratings**

Standard kVA ratings are 25, 50, 75, 100, 167, and 333.

### 3.4. **Primary Voltage Ratings and Basic Impulse Levels**

- 3.4.1. The primary voltage ratings and BIL are shown in Table 1. Transformers shall all be of a loop feed design.

**Table 1: Standard Single-Phase Subway Transformer Voltages**

Voltage Configuration	Voltage (V)	BIL (kV)	Number of Primary Bushings
E / E1 Y	14400/24940Y	125	4
E / E1 Y x E / E1 Y	7200/12470Y x 14400/24940Y	125	4
E1 Grd Y / E	14400 Grd Y/8320	95	2

3.4.2. The transformers shall be equipped with no-load adjustable primary taps for de-energized operation. Taps shall be 2-2½% above and 2-2½% below rated voltage.

3.5. **Secondary Voltage**

The secondary voltage ratings shall be 120/240, 208Y/120, 240/480, and 480Y/277.

3.6. **Primary Voltage Terminals**

3.6.1. Transformers shall be provided with two (E1 Grd Y / E) or four (E /E1 Y and E / E1 Y x E / E1 Y) loop-feed bushing wells, with molded shield and externally removable stud. Bushing wells are to have provisions for bailing assemblies. Bushing well plugs shall be provided and installed, Elastimold 276BWP or approved equal. Elastimold 15/25 kV dead end caps shall be installed by the manufacturer. Bushing wells shall be permanently marked for identification, such as welded, engraved or stamped.

3.6.2. A parking stand shall be mounted equally spaced between the bushing wells to accommodate a primary loadbreak feed-thru and grounding accessory. The parking stand shall have its opening facing the center of the transformer.

3.6.3. Bushing wells shall conform to ANSI/IEEE 386.

3.7. **Secondary Voltage Terminals**

3.7.1. Secondary terminals shall be three (3) foot cable leads in accordance with IEEE C57.12.23 standard and listed in Table 5. Two (2) of the secondary connections shall be internally connected for three phase banking of transformers. Secondary leads shall be permanently marked for identification, such as welded, engraved or stamped.

**Table 2: Secondary Terminal Lead Sizes**

kVA Rating	Copper Cable Size
25	2/0 AWG
50	4/0 AWG
75	500 MCM
100	500 MCM
167	500 MCM (2 per terminal)
333	Spade terminal

**3.8. Neutral and Tank Grounding**

- 3.8.1. Single-phase subway transformers rated at 167 kVA or less must be capable of passing through a 33-inch diameter manhole opening.
- 3.8.2. The transformer tank, cover and all external appurtenances shall be the subway type, constructed with stainless steel of minimum grade 304L per ASTM A240 standard and type shall be labeled on nameplate. The cover shall be bolted to the tank and shall be sealed with a nitrite gasket or the tank shall be completely welded. The tank surface shall be prepared and finished with a dark coating system. This coating shall be adhesive and corrosive resistant required for submersible transformers in vault installations.
- 3.8.3. Tank shall meet all the integrity requirements of IEEE C57.12.23, Section 7.5.
- 3.8.4. Enclosure design and coating system shall meet all requirements of IEEE C57.12.32 Section 4.
- 3.8.5. The transformer shall be equipped with mounting pads and lifting lugs.

**3.9. High Voltage Fuses**

- 3.9.1. Transformers shall be equipped with a Cooper Bay-O-Net current sensing fuse in series with a partial range current limiting fuse under oil. The current limiting fuse shall be inaccessible and electrically located on the source side of the Bay-O-Net fuse. The Bay-O-Net assembly shall be equipped with a flapper valve and drip cup to minimize oil spillage.
- 3.9.2. Dual ratio transformers shall be supplied with Cooper Bay-O-Net fuses sized for the lower voltage rating.
- 3.9.3. Fuse link, fuse cartridge and end plug are to be placed in a plastic bag and attached to the fuse handle.
- 3.9.4. The transformer manufacturer shall size the partial range current limiting fuse to coordinate with the listed Cooper current sensing Bay-O-Net fuse.

3.10. **Automatic Pressure Relief Valve**

- 3.10.1. An automatic pressure relief valve shall be provided per ANSI/IEEE C57.12.20, Section 7.2.5.1 with the following clarifications:
- 3.10.2. Indicator shall include an orange or red indicator that becomes visible only after the valve has vented.
- 3.10.3. Cap and pull ring shall cover the valve that separates from the assembly during venting, revealing the orange or red indicator and hanging down from the valve via a chain or strap.
- 3.10.4. Valve threads shall be sealed with a liquid pipe thread compound such as Rectorseal, liquid Teflon, or similar, not Teflon tape.

3.11. **Efficiency**

Transformers manufactured under this specification shall meet both of the following (where applicable):

- 3.11.1. The efficiency requirements as directed by the Department of Energy (DOE) per its Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards, Final Rule – 72 Fed. Reg. 58,191 (2007).
- 3.11.2. The minimum efficiency levels contained in tables 4-1 and 4-2 of National Electrical Manufacturers Association (NEMA) standard TP-1-1996.

3.12. **Required Tests**

Each transformer shall receive all standard routine tests required by ANSI/IEEE C57.12.00 and performed as specified by ANSI/IEEE C57.12.90. As a minimum, the following tests shall be performed. Test results will be provided to DOP upon request.

- a) Insulation resistance test on both primary and secondary windings.
- b) Turns ratio tests on each tap.
- c) Losses: load (corrected to 85° C) and no load (at rated voltage and corrected to 20° C).

3.13. **Approval Drawings and Documentation**

- 3.13.1. The awarded supplier will be required to submit preliminary drawings in one Adobe Acrobat PDF file for approval prior to the manufacturer of the transformers. The drawings will promptly be reviewed by the city and returned approved or with corrections as required.
- 3.13.2. All documentation shall be in English and use customary inch-pound units. The successful bidder shall submit in a single Adobe Acrobat PDF file the following:

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- a) An outline drawing showing the principle view and dimensions and including a descriptive table of the accessories
- b) A nameplate drawing including wiring diagram
- c) No-load (core) losses, load (winding) losses at rated current
- d) Information on compliance with IEEE corrosion resistance standards
- e) Instructional materials demonstrating the proper installation, operation, and maintenance of the equipment
- f) Certified test data for each transformer type bid and for every category listed in ANSI/IEEE C57.12.00 Section 8.7. Format test data using numbering system shown in ANSI/IEEE C57.12.00 Section 8.7.
- g) Estimated delivery days after order

3.13.3. Final drawings, operating manuals, maintenance manuals, and certified test results shall be provided at time of delivery.

3.14. **Standard Transformers**

<b>Division ID</b>	<b>Primary Voltage Configuration</b>	<b>Primary Voltage (V)</b>	<b>Secondary Voltage (V)</b>	<b>Size (kVA)</b>
77468	E1 Grd Y / E	14400 Grd Y/8320	120/240	50
77469	E1 Grd Y / E	14400 Grd Y/8320	120/240	100
77470	E1 Grd Y / E	14400 Grd Y/8320	120/240	167
77471	E1 Grd Y / E	14400 Grd Y/8320	120/240	333
20734	E / E1 Y	14400/24940Y	120/240	50
20737	E / E1 Y	14400/24940Y	120/240	75
20740	E / E1 Y	14400/24940Y	120/240	100
20745	E / E1 Y	14400/24940Y	120/240	167
20728	E / E1 Y	14400/24940Y	240/480	25
20735	E / E1 Y	14400/24940Y	240/480	50
20738	E / E1 Y	14400/24940Y	240/480	75
20741	E / E1 Y	14400/24940Y	240/480	100