

**Pad-Mounted, Single-Phase, Natural Ester Fluid  
 Distribution Transformers**

**Not for new construction. For maintenance of existing facilities only.**



**1. Scope**

This standard details the manufacturer requirements for single-phase, pad mounted transformers from 25 kVA to 167 kVA and as listed in Table 1.

**Table 1, 25 564GrdY/14 760 – 240/120, Single-Phase, Pad Mounted (PM)-Transformers by Stock Number:**

kVA	Stock No.
25	373122
50	373132
75	373134
100	373136
167	373142

**2. Application**

This class of transformers is installed on concrete pads and is used to serve homes and small businesses in the rare cases that overhead or submersible transformers are unworkable. As of this publication, these units make up less than one percent of the transformers installed annually in the Seattle City Light distribution system.

These transformers are only for replacing units that have failed in service. They are not for new construction. Consider installing a submersible-type unit instead. See SCL 4320.00.

**3. Industry Standards**

Transformers shall meet the applicable requirements of the following industry standards:

**ANSI C57.12.25-1990;** “American National Standard for Transformers-Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers with Separable Insulated High-Voltage Connectors; High Voltage, 34 500 GrdY/ 19 920 Volts and Below; Low Voltage, 240/120 Volts; 167 kVA and Smaller -Requirements”

**DOE 10 CFR Part 431;** “Energy Efficiency Program for Certain Commercial and Industrial Equipment”; Department of Energy

**IEEE 386-2006;** “IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600 V”

**IEEE C57.12.00-2010;** “Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers”

**IEEE C57.12.28-2005;** IEEE Standard for Pad-Mounted Equipment – Enclosure Integrity

**IEEE C57.12.70-2000;** “IEEE Standard Terminal Markings and Connections for Distribution and Power Transformers”

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**3. Industry Standards, continued**

**IEEE C57.12.90-2010**; "Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers"

**IEEE C57.147-2008**; "Guide for Acceptance and Maintenance of Natural Ester Fluids in Transformers"

**NEMA TR 1-1993 (R2000)**; "Transformers, Regulators, and Reactors"

**RCW 19.29.010, Rule 5 -2011**; *Revised Code of Washington*, Rules for Test Tag

**4. Conflict**

Where conflict exists, the following order of precedence shall apply:

1. Seattle City Light Purchase Order (PO)
2. City of Seattle General Terms and Conditions
3. This material standard
4. Other industry standards

**5. Ratings**

**5.1 Kilovolt-Ampere Ratings**

Kilovolt-ampere ratings shall comply with the requirements of IEEE C57.12.25, Section 3.1 and be 25, 50, 75, 100, 167 kVA, or as specified on the purchase order.

Kilovolt-ampere ratings shall be continuous and based on not exceeding a 55 °C average winding temperature rise.

The transformers shall have a temperature rise insulation system of 65 °C.

**5.2 Voltage Ratings**

Voltage ratings shall be as follows, or as specified on the purchase order:

25 564 GrdY/14 760 -  
240/120 Volts

**6. Construction**

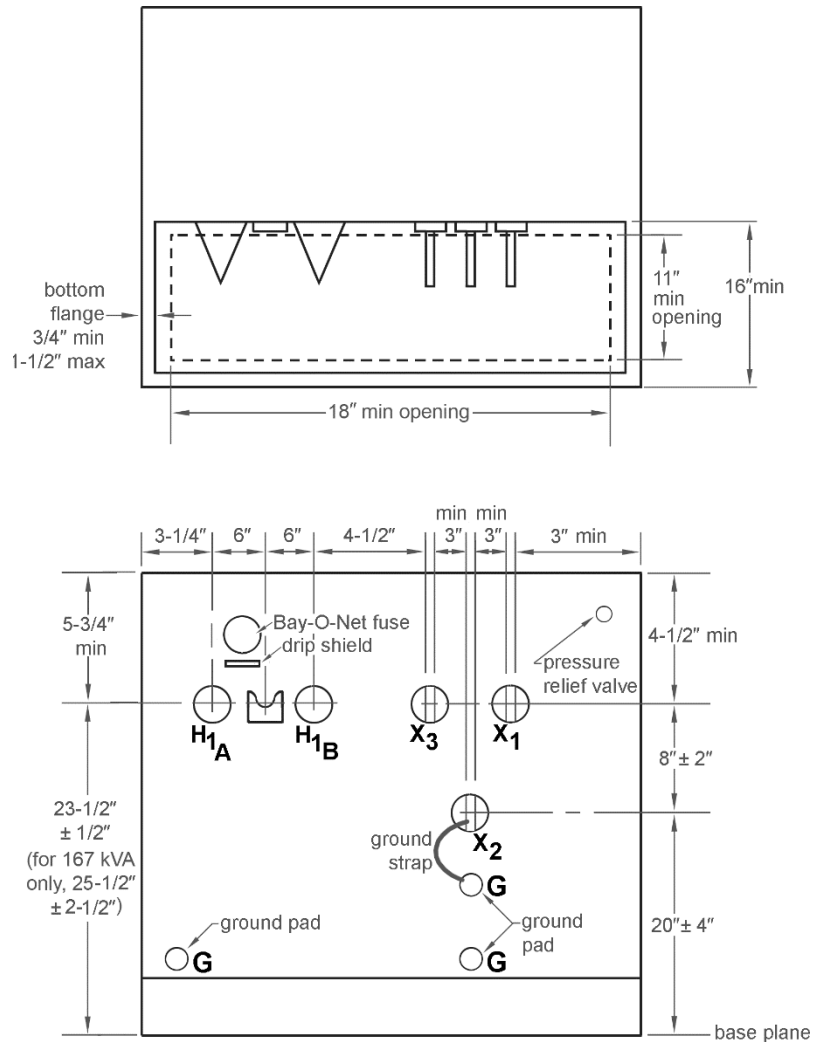
**6.1 General**

Transformers shall be according to the requirements of Figure 6.1 (below) and IEEE C57.12.25 Type 1 arrangement with the following clarifications.

The BIL shall be 125kV per IEEE C57.12.25, Section 4.1.

Polarity shall be subtractive.

**Figure 6.1**, Transformer showing location of the terminals and accessories, based on IEEE C57.12.25 Figure 1 (a).



**6. Construction, continued****6.2 High-Voltage Bushing Wells**

Two 200 amp high-voltage bushing wells shall be supplied and constructed per IEEE 386, Figure 3 and IEEE C57.12.25 Section 6.2.3. Wells shall include a parking stand and be one of the models listed below:

Central Moloney 70191855

Cooper Power:

Well 2638372CO2R and  
Clamp 2606823A04

Each bushing well will be supplied with bail tabs that are compatible with Cooper and Elastimold deadbreak hold down bail assemblies. A tight-fitting dust cap shall be fixed in place with wire run between the bail tabs.

**6.3 Low-Voltage Terminals**

Terminals shall be constructed per IEEE C57.12.25, Section 6.2.5.

Transformers shall be supplied with three low-voltage spades constructed per IEEE C57.12.25 Figure 4(a).

Transformers shall be supplied with a ground pad near the low-voltage neutral and connected via a removable ground strap per IEEE C57.12.25 Section 6.2.6.

**6.4 Overcurrent Protection**

Overcurrent protection shall be a Bay-O-Net fuse assembly installed and furnished with a dual sensing fuse as listed below. Isolation links shall not be installed because each transformer is protected upstream by a backup current limiting fuse. A drip shield shall be provided on each unit.

**Bay-O-Net Fuse Assembly**

Cooper Power Systems 4000361C99MC

**Dual-Sensing Bay-O-Net Fuse**

Transformer, kVA	Cooper Power Systems		
	Catalog No	Stock No.	Amps
25	4000358C05B	685101	8
50	4000358C08B	685102	15
75	4000358C08B	685102	15
100	4000358C08B	685102	15
167	4000358C10B	685103	25

**6.5 Liquid Level Marking**

Liquid level indication shall be provided per IEEE C57.12.25, Section 6.5.2.

**6.6 Lifting Provisions**

Lifting provisions shall be provided per IEEE C57.12.25, Section 6.1.6.

**6.7 Pressure Relief Valve**

A pressure relief valve shall be provided per SCL 4480.10 and IEEE C57.12.20, Section 7.2.5.1 with the following clarifications:

**Figure 6.7**, Pressure relief valve

**6.7a Indicator**

The pressure relief valve shall include an orange or red indicator that becomes visible only after the valve has vented.

**6.7b Cap and pull ring**

The valve shall be covered by a cap with a pull ring. The cap will separate from the assembly during venting, revealing the orange or red indicator and hang down from the valve via a chain or strap.

**6.7c Sealant**

Valve threads shall be sealed with a liquid pipe thread compound such as Rectorseal, liquid Teflon, or similar, not Teflon tape.

**6.7d Approved models**

The pressure relief valve shall be BETA 1712K-4 series, VIAT 302-030-01 series, or equal with approval prior to bid and listed for use with the included transformer fluid.

**6.7e Location**

The valve shall be installed in the low-voltage portion of the terminating compartment as defined in IEEE C57.12.25 Section 6.5.2 and in Figure 6.1.

**6. Construction, continued****6.8 Enclosure Integrity**

The completely assembled transformer enclosure shall comply with IEEE C57.12.28.

Terminal compartment shall be accessed by a single lift-up hood, secured by a captive penta head bolt.

**6.9 Polarity, Terminal Markings, and Angular Displacement**

Polarity, terminal markings, and angular displacement shall be according to the requirements of IEEE C57.12.25, Section 6.2.

Primary terminals, secondary terminals, and ground lugs shall be marked with minimum 1-inch tall letters.

**6.10 Nameplate**

Nameplate shall be according to the requirements of IEEE C57.12.25, Section 6.4 with the following clarifications:

- Class shall be KNAN.
- BIL shall be 125 kV
- Total weight in pounds shall be indicated for each individual transformer.
- Volume in gallons of insulating fluid shall be indicated.
- Manufacturer name and part number of the Bay-o-net fuse assembly shall be indicated.
- Tank design pressures shall be listed to comply with Section 6.13d.
- Manufacturer name and part number of the dual sensing fuse shall be indicated.
- The statement "CONTAINS LESS THAN 1PPM PCB AT TIME OF MANUFACTURE." shall appear on the nameplate.

**Figure 6.10**, Nameplate, PCB statement

**CONTAINS LESS THAN 1PPM PCB  
AT TIME OF MANUFACTURE**

**6.11 kVA Rating**

The kVA rating shall be provided on the tank in numerals approximately 2.5 inches high. These numerals may be applied by stenciling or by any other permanent means.

**6.12 Fluid**

Natural ester insulating fluid complying with IEEE C57.147 shall be provided in the transformer up to the liquid level marking. Fluid shall be Cooper Envirotemp FR3. Each transformer shall have a minimum 5-inch diameter label indicating fluid brand.

**6.13 Tank**

Tank shall meet all the integrity requirements of IEEE C57.12.25, Section 6.6.

**6.13a Cover**

Cover shall comply with IEEE C57.12.28.

**6.13b Tank finish**

Tank finish shall comply with IEEE C57.12.28, Section 5. The tank finish color shall be Semi Gloss Dark Green Munsell Notation 7GY 3.29/1.5.

**6.13c Tank grounding**

Tank grounding provision shall comply with IEEE C57.12.25, Section 6.6.4 and will accommodate #8 solid through #2 stranded copper wire.

**6.13d Strength**

Tank will be designed to withstand negative and positive 7 psig per IEEE C57.12.25 Section 6.6.1.

**7 Tests****7.1 General**

All applicable tests shall be performed as specified in IEEE C57.12.00 and in IEEE C57.12.90.

**7.2 Dielectric Tests**

Dielectric tests shall be performed as specified in IEEE C57.12.25, Section 5.2 and IEEE C57.12.90, Section 10. Dielectric test levels shall be in accordance with the levels specified in IEEE C57.12.00, Section 5.10.

**7.3 Tank and Enclosure Tests**

Tests shall be performed as specified in IEEE C57.12.25, Section 6.6.1 and IEEE C57.12.28.

## 7 Tests, continued

### 7.4 Short Circuit Tests

Short circuit tests shall be performed as specified in IEEE C57.12.90, Section 12.

### 7.5 Audible Sound Levels

Audible sound levels for each unit shall be according to the requirements of NEMA TR-1, Section 0.05. Tests shall be performed per IEEE C57.12.90, Section 13.

### 7.6 Radio Influence Voltage Test

Radio influence voltage shall be according to the requirements of NEMA TR-1, Section 0.03.

### 7.7 Load and No-Load Tests

Load and no-load loss measurements shall be performed at 85 degrees C and 20 degrees C, respectively according to the requirements of IEEE C57.12.00, Section 5.9 and shall comply with IEEE C57.12.90.

### 7.8 Documentation

Tests reports demonstrating conformance to all tests completed shall be submitted in a single electronic document.

All documentation shall be in English and use customary inch-pound units.

### 7.9 Test Tag

A legible weatherproof test tag conforming to the requirements of the Revised Code of Washington RCW 19.29.010, Rule 5 shall be firmly attached to each unit.

Tag shall read "THIS TRANSFORMER HAS BEEN SUBJECTED TO AN INSULATION TEST IN ACCORDANCE WITH THE STANDARDIZED RULES OF IEEE/ANSI. THIS TRANSFORMER HAS BEEN TESTED AT RATED LINE VOLTAGE."

Tag shall indicate:

- transformer serial number
- date on which the test was performed
- name of the person who performed the test.

Figure 7.9, Test tag, example



## 8. Design Changes

Manufacturer shall inform Seattle City Light in writing of all design changes that could affect the transformer's understood or published capabilities.

## 9. Shipping and Handling

Each transformer shall be supplied on its own pallet.

### 9.1 Pallet Material

Pallet and all pallet accessories shall be constructed of unpainted wood and suitable for yard storage through all weather conditions.

### 9.2 Support

Pallet shall be 4 inches high to accommodate lifting by both forklifts and pallet jacks.

The most central pallet stringer shall be centered and a maximum of 7 inches wide to insure picking by pallet jacks.

### 9.3 Orientation

Transformer shall be centered on pallet and secured via its pad attachments.

Transformer shall be oriented on the pallet to prevent transformer enclosure from coming into contact with pallet moving equipment or otherwise shall be enclosed by protective devices to prevent damage.

### 9.4 Arrival Condition

Transformers shall be delivered on enclosed trucks.

Transformers shall be received by Seattle City Light in clean condition.

**10. Seattle City Light Processes****10.1 Bid Process**

Bid process details are available at [www.Seattle.gov](http://www.Seattle.gov).

Bid documentation shall be submitted with details demonstrating conformance to this standard. Submittal details shall be listed to correspond with this standard's section formatting.

Any exceptions taken to the standard shall be summarized in an attached letter, complete with section numbering relating to this standard. Requests for approved equal components must be submitted with first bid documents; all subsequent requests will be rejected.

**10.2 Loss Factors**

Load and no-load loss measurements shall be performed at 85°C and 20°C, respectively according to the requirements of IEEE C57.12.00, Section 5.9 and shall comply with IEEE C57.12.90.

**10.2a Load Loss**

Load losses shall be assessed at \$2.60 per watt.

**10.2b No-load Loss**

No-load "core" losses shall be assessed at \$5.90 per watt.

**10.2c Loss Assessment**

Total Price (\$) = Bid Price + Loss Total

Loss Total = Load Loss + No-load Loss

Load Loss = Losses (Watts) x \$2.60

No-load Loss = Losses (Watts) x \$5.90

The manufacturer will be assessed a penalty for transformers delivered that exceed the total loss value stated and calculated on the bid proposal. The penalty shall be the difference between the total loss values delivered less the total loss value in the bid proposal.

Tolerances will be allowed in accordance with IEEE C57.12.90, Section 9.3, except, tolerances shall apply to transformers of a given size and voltage; i.e., one line item. Individual transformers that exceed these tolerances may be rejected and returned to the manufacturer.

**10.3 Bid Completion**

Upon completion of the bidding process, the successful bidder shall submit in a single electronic file the following:

- Transformer dimensions and spare parts list
- Nameplate
- Loss data
- Instructional materials demonstrating the proper installation, operation, and maintenance of the equipment.
- Certified test data for each transformer type bid and for every category listed in IEEE C57.12.00, Section 8.6. Format test data using numbering system shown in IEEE C57.12.00, Section 8.6.

**10.4 Inspection and Electrical Testing**

Upon delivery, the transformers will be inspected for physical defects and conformance to this standard.

The transformers will be tested electrically for Radio Influence Voltage (per NEMA TR-1, Section 7 at 1MHz and 17.4kV, RIV not to exceed 100 microVolts), losses and a small battery of other tests.

If any transformer fails, the manufacturer will be contacted and given the option to take back the lot or take back the lot except the units that passed during initial testing.

**10.5 Guarantee**

Any transformer failing due to defective design, material, and/or workmanship within 12 months after being energized or 18 months after delivery, shall be repaired or replaced without cost to the City of Seattle. Any defect discovered within this period shall be corrected on all transformers furnished on the order at the manufacturer's expense, either by repair or replacement.

**11. Issuance**

Stock Unit: EA

**12. Approved Manufacturers and Factories**

ABB	Jefferson City, Missouri
Carte International	Winnipeg, Manitoba, Canada
Cooper Power	Nacogdoches, Texas

**13. References**

**SCL Material Standard 4480.10**; "Valves,  
Transformer Pressure Relief"

**14. Sources**

**Hanson, Brett**; SCL Standards Engineering  
Supervisor and subject matter expert for 4220.00

**SCL Material Standard 0028.1**; "Distribution  
Transformer, Single-Phase, Padmount Type 25  
through 167 kVA" (canceled)