

**Network, Three-Phase, Mineral Oil  
 Distribution Transformers**



**1. Scope**

This standard details the manufacturer requirements for three-phase, network transformers from 500 kVA to 2500 kVA as listed in Table 1.

**Table 1**, Three-Phase, Network (S) Transformers by Stock No.

kVA	High Voltage	Type	Low Voltage		Taps
			216Y/125	480Y/277	
500	13 750	DY	386460	386860	5
750	"	DY	386466	386866	5
1000	"	DY	-	386872	5
1500	"	DY	-	386876	5
2000	"	DY	-	386878	5
2500	"	DY	-	386880	5
500	26 400	DY	389460	389860	5
750	"	DY	389466	389866	5
1000	"	DY	-	389872	5
1500	"	DY	-	389876	5
2000	"	DY	-	389878	5
2500	"	DY	-	389880	5
500	26 400GrdY/15 242	YY	380560	380160	5
750	"	YY	380566	380166	5
1000	"	YY	380572	380172	5
1500	"	YY	-	380176	5
2000	"	YY	-	380178	5
2500	"	YY	-	380180	5

**2. Application**

This class of transformers is installed in building vaults in network areas. On the primary side cables are connected to a non-loadbreak switch. On the secondary side, the transformer has provisions to support a throat-mounted network protector. As of this publication, these units make up a few percent of the transformers installed annually in the Seattle City Light distribution system.

**3. Industry Standards**

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

**ASTM D3487-09**; "Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus"

**IEEE C57.12.40-2011**; "IEEE Standard for Secondary Network Transformers, Subway and Vault Types (Liquid Immersed)"

**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 C57.12.32-2002**; IEEE Standard for Submersible Equipment – Enclosure Integrity

### 3. Industry Standards, continued

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

**IEEE C57.12.90-2010**; "Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating 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 C57.12.40, Section 3.1 and be 500, 750, 1000, 1500, 2000, 2500 kVA, or as specified on the purchase order.

Kilovolt-ampere ratings shall be continuous and based on 55°C/ 65° 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:

- 13 750 – 216Y/125 Volts or
- 13 750 – 480Y/277 Volts or
- 26 400 – 216Y/125 Volts or
- 26 400 – 480Y/277 Volts or
- 26 400 GrdY/15 242 – 216Y/125 Volts or
- 26 400 GrdY/15 242 – 480Y/277 Volts

### 6. Construction, General

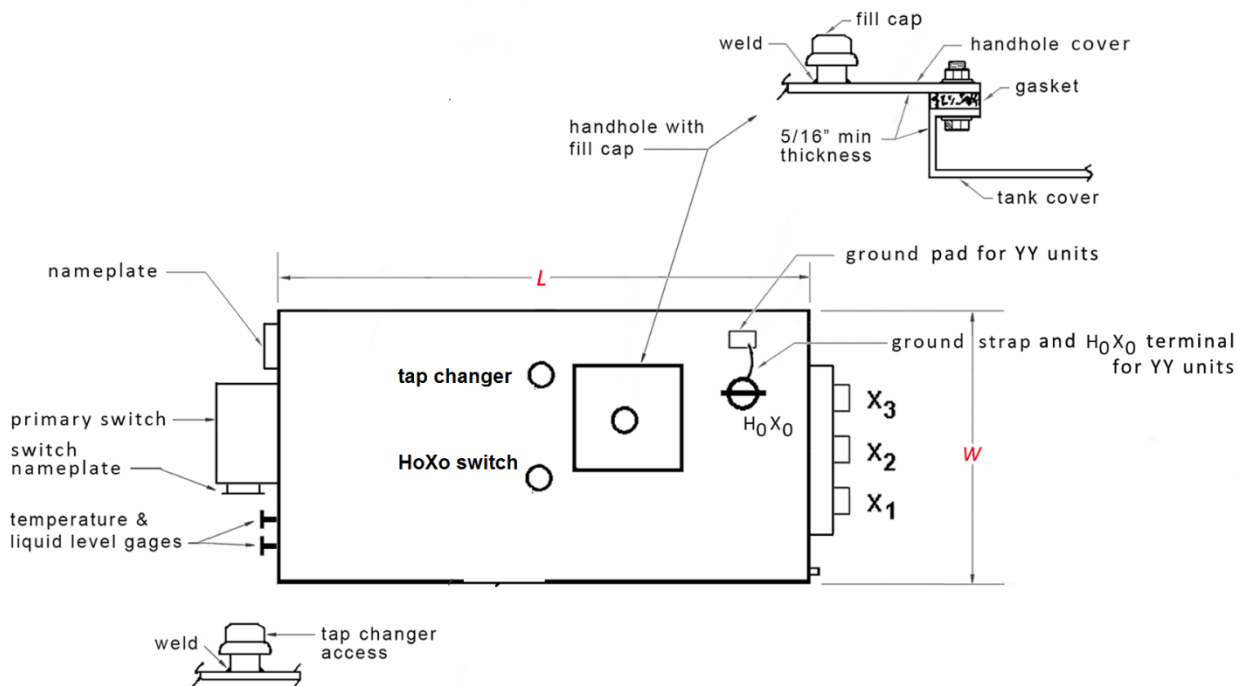
Transformers shall be according to the requirements of Figure 6 and Table 6 of this document.

Transformers shall be suitable for continuous submerged operation and comply with IEEE C57.12.40 Figure 1 with the following clarifications:

- BIL shall be 95kV for 13 750V units per IEEE C57.12.40, Section 3.4.
- BIL shall be 125kV for 26 400V and 26 400GrdY/15 242V units per IEEE C57.12.40, Section 3.4.
- It has been SCL's practice to purchase 26 400V units with a 125kV BIL rating since these aren't shown in IEEE C57.12.40 Section 3.4.
- Polarity shall be subtractive.
- Transformers shall be constructed with either a 5-legged core or a triplex core to mitigate tank heating due to unbalanced loads or faults.

**6. Construction, continued**

**Figure 6**, Transformer showing location of the terminals and accessories, based on IEEE C57.12.40, Figure 1.



**Table 6, Transformer Dimensions**

	kVA					
	500	750	1000	1500	2000	2500
<b>13 750V W x L x H</b> , inches, max, with "H" being the height from base to highest point	44 x 78 x 70	47 x 84 x 74	52 x 86 x 84	56 x 96 x 86	64 x 105 x 96	70 x 105 x 96
<b>13 750V Throat Centerline Height</b> , inches, max	48	55	57	62	70	75
<b>26 400V W x L x H</b> , inches, max, with "H" being the height from base to highest point	46 x 87 x 70	48 x 93 x 74	55 x 97 x 78	60 x 100 x 86	70 x 115 x 89	75 x 129 x 95
<b>26 400V Throat Centerline Height</b> , inches, max	55	61	60	65	70	75

## 7. Primary Bushings and Switch

The primary bushings and primary switch shall be supplied in a combined chamber. See Section 7.6 for chamber paint requirements.

### 7.1 Combined Bushing and Switch Chamber

Combined primary bushing and switch chamber will meet IEEE C57.12.40 Section 6 and 7 and Figures 1 and 2 with the following clarifications:

- Chamber shall have a bolted and gasketed cover similar to the handhole cover in Figure 6. Bolts, nuts, and washers shall be silicon bronze or stainless steel. The gasket will be made from cork and synthetic rubber (Buna-N). Gasket shall be a single piece of material. Cover shall have a means for breaking the seal (seal breaking bolts).
- Chamber shall be shipped drained of oil and filled instead with dry air or nitrogen at 2 psig.
- Chamber shall have the provisions listed in IEEE C57.12.40 Section 5.5 and Figure 2a to facilitate filling, air testing, liquid level indication, and draining. Plugs shall have brass hex heads. Drain valve plug shall be brass with a 13/16-inch square head.
- Primary cable entrance shall be by bushing per IEEE C57.12.40 Section 7.1.3.
- Chamber shall have the provisions listed in IEEE C57.12.40 Section 5.5 to facilitate filling, air testing, liquid level indication, and draining. Plugs shall have brass hex heads. Drain valve plug shall be brass with a 13/16-inch square head.
- Chamber shall include a viewing window sized to provide view to the switch blades in all three positions. Window shall be protected with a metal cover, hinged at the top.
- Primary chamber shall include a cover to protect the bushings during shipment and storage outside.
- Primary bushing components shall not be used to support switch contacts. Flexible cables must connect these components.

Figure 7.1, Bushing and Switch Chamber



### 7.2 Primary Switch Viewing Window

Combined chamber viewing window must permit visual confirmation that primary bushings are in contact with oil in addition to the position of the switch.

### 7.3 Primary Bushings

Three 600 amp high-voltage bushings shall be welded to the chamber and supplied with external removable studs. Bushings shall be the following:

Elastimold K650T1

City Light connects these transformers to 600 amp Elastimold K655BSR straight cable housings. Each bushing shall be supplied with a tight-fitting UV resistant dust cap installed for shipment and storage outside.

### 7.4 Primary Switch

The primary switch shall comply with the requirements of IEEE C57.12.40 Section 6 and be manufactured by Quality Switch with the following clarifications:

- Switch shall be capable of interrupting magnetizing current per IEEE C57.12.40 Section 6.2.3.2.
- One interlock shall be provided per IEEE C57.12.40 Section 6.2.6.2 to prevent moving the switch from closed to open when the feeder is energized. This will lock when de-energized
- A second interlock shall be provided per IEEE C57.12.40 Section 6.2.6.2 to prevent moving the switch to the ground position when it is energized.
- Interlock coils shall be rated 125V for 216Y/125V units and 277V for 480Y/277V units. This rating shall be permanent and visible when the cover is removed.

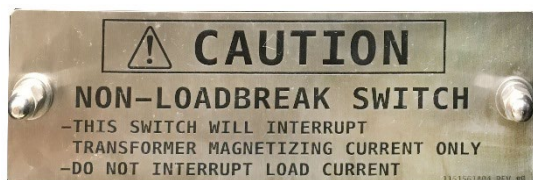
### 7.5 Switch Nameplate

Nameplate shall be stainless steel and affixed to the switch chamber with stainless steel fasteners and state the following in minimum 1/4-inch tall letters:

- CAUTION: NON-LOADBREAK SWITCH
- This switch will interrupt transformer exciting current only. Do not interrupt load current.
- Switch chamber with disconnect and grounding switch.
- Two interlock circuits, single phase.
- Hertz
- Rated Voltage
- Rated Amperes
- Direct current test voltage
- Momentary amperes when closed
- Type of insulating oil
- Switch chamber volume in gallons.
- Serial number
- Switch manufacturer name
- Maintenance manual number

If the information above is listed on the tank nameplate, the short nameplate shown in Figure 7.5 is acceptable.

**Figure 7.5. Short Nameplate**



### 7.6 Chamber Paint

The inside face of the chambers including the flange face shall have the following paint system applied:

- Primer consisting of one coat DuPont 824S light gray Corlar epoxy with a DuPont 826S activator.
- Topcoat consisting of two coats of preservative high-performance coating tripoxy polyamide 88-580 white or black and a preservative 88-101 clear coat.
- Equivalent Strathmore paint system is also allowed.

## 8. Tank Construction

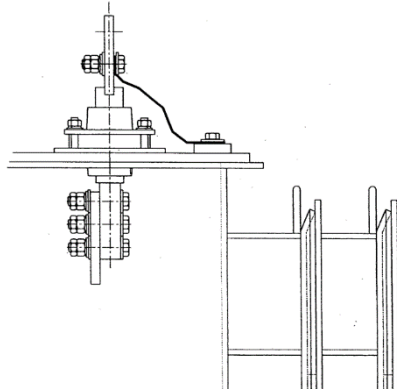
### 8.1 Low-Voltage Terminals

Terminals shall be constructed per IEEE C57.12.40, Section 7.3 and Figures 3 and 4 with the following clarifications:

- Transformers shall be provided with a cover-mounted insulated secondary neutral bushing having a 6-hole spade terminal and positioned per Figure 8.1. An additional ground pad with 2 or 4 positions per Section 8.11c of this document shall be installed nearby. Removeable tin-plated copper straps per IEEE C57.12.40 Section 8.2 shall connect the spade and ground pad.
- The electric interlock bushing in the low-voltage throat shall be furnished with a 10-32 or 1/4-20 threaded stud. Bushing stud shall be furnished with 2 flat brass washers and 2 brass nuts.
- Wye-wye transformers shall be provided with a cover-mounted HoXo switch (Cooper 2237465C01M) to disconnect the primary neutral from the secondary neutral to allow for testing. HoXo switch shall be hand operable without tools and accessible from pipe nipple. Switch shall be externally mounted within a 4-inch pipe nipple welded to the cover and sealed with a brass pipe cap located per Figure 6.

**8. Tank Construction, continued**

**Figure 8.1, H<sub>0</sub>X<sub>0</sub> Terminal and Ground Pad**



**8.2 Taps**

A full-capacity de-energized tap changer shall be supplied and located per Figure 6 of this document. Taps shall comply with C57.12.40 Section 3.2 and Table 8.2 below.

**Table 8.2, Tap Voltages**

Voltage	Taps
13750DY	14438 /14094 /13750 /13406 /13063
26400DY	27720 /27060 /26400 /25740 /25080
26400YY	27060 /26400 /25740 /25080 /24420

Tap changer shall be externally operated via a pipe nipple welded to the cover and a pipe cap located per Figure 6. A stainless steel tap position indicating plate shall be provided next to the operating mechanism. An unpainted stainless steel, galvanized steel, or copper alloy tap changer wrench shall be provided in a holder, mounted near the tap changer.

**Figure 8.2, Tap Changer**



**8.3 Percent Impedance**

The percent impedance for these transformers shall be per IEEE C57.12.40, Section 3.5.

**8.4 Liquid Level Marking**

**8.4a Liquid Level Indicator**

Liquid level indicator shall be provided per IEEE C57.12.40, Section 5.5.5.4 with the following clarifications:

- Indicator shall be welded type.
- Indicator shall have non-grounded alarm contacts suitable for interrupting at 0.2 Amp DC inductive or non-inductive load and 2.5 Amp AC inductive or non-inductive load. Contacts shall be insulated for use on a 250V circuit and calibrated for minimum acceptable liquid level.
- 2.5 Amp AC inductive or non-inductive load. Contacts shall be insulated for use on a 250V circuit and calibrated for minimum acceptable liquid level.

**8.4b Thermometer**

Thermometer shall be provided per IEEE C57.12.40, Section 5.7.4. Securing nut shall be 316 stainless steel to prevent corrosion.

Indicator shall have non-grounded alarm contacts suitable for interrupting at 0.2 Amp DC inductive or non-inductive load and 2.5 Amp AC inductive or non-inductive load. Contacts shall be insulated for use on a 250V circuit and calibrated for 80 °C.

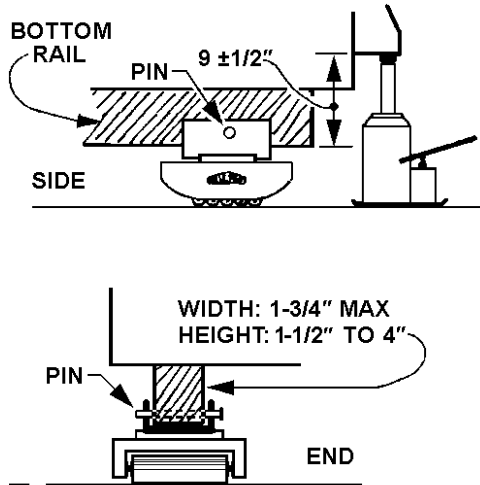
**8.5 Lifting Provisions**

Lifting lugs shall be of adequate strength and size and arranged to provide for lifting and lowering the complete transformer when filled with oil, including the attached network protector, per ANSI C57.12.40, Section 5.3.4 except that the lifting lugs shall be arranged such that they can also be used to strap the transformer to a flat bed truck without damaging the coolers or other accessories. Moving will be done with Hilman rollers. Each rail end (4 locations), shall have a 7/16-inch diameter hole drilled in the subbase bar, centered 4-inches from the end and 5/8-inch from the bottom for the purpose of connecting the Cat Track to the transformer. Each end of the subbase bar shall have a 1-1/4-inch by 8-inch area masked from undercoat paint, centered on the hole to prevent paint and Cat Track interference. Subbase bar shall be 1 inch wide minimum and 1-3/4-inches wide maximum to insure it can fit in the Hilman channel.

**8. Tank Construction, continued**

**8.5 Lifting Provisions, continued**

**Figure 8.5, Lifting Provisions**



**8.6 Pressure Relief**

Pressure relief devices shall not be installed.

**8.7 Enclosure Integrity**

The completely assembled transformer enclosure shall comply with IEEE C57.12.32.

Switch compartment shall be constructed per IEEE C57.12.40 Section 5.3.1.

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

Polarity, terminal markings, and angular displacement shall be according to the requirements of IEEE C57.12.40, Section 7.4.

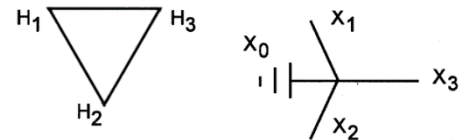
Primary terminals, secondary terminals, and ground pads shall be marked with minimum 1-inch tall letters.

Transformers shall be connected per Figure 8.8.

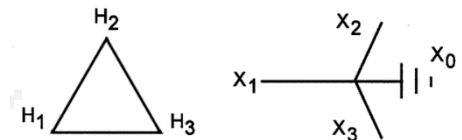
**Figure 8.8, Phase Relationships**

**Rated Voltage:**

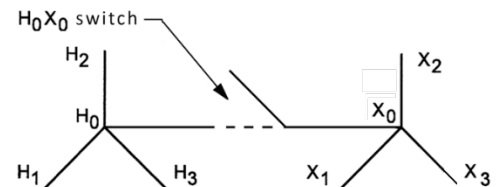
13 750-216Y/125 and 13 750-480Y/277



26 400-216Y/125 and 26 400-480Y/277



26 400Y/15 242-216Y/125 and  
 26 400Y/15 242-480Y/277



**Material Standard**

Network, Three-Phase, Mineral Oil Distribution Transformers

standard number: **4370.00**

superseding: January 23, 2020

effective date: September 15, 2020

page: 8 of 13

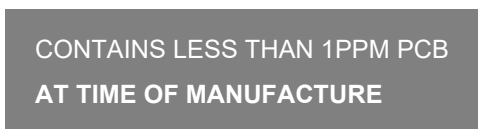
**8. Tank Construction, continued**

**8.9 Nameplate**

Nameplate shall be according to the requirements of IEEE C57.12.40, Section 9 and IEEE C57.12.00, Section 5.12 (Nameplate C for all kVA ratings) with the following clarifications:

- Nameplate shall be 300-series stainless steel and affixed to the transformer with stainless steel or silicon bronze fasteners.
- Class shall be ONAN.
- BIL shall be listed.
- Tested impedance shall be listed.
- Tested X/R ratio shall be listed.
- Total weight in pounds shall be indicated for each individual transformer.
- Volume in US gallons of insulating fluid shall be indicated.
- Tank design pressures shall be listed to comply with Section 8.11d of this document.
- HoXo switch shall be shown in the phasor diagram and schematic.
- The statement "CONTAINS LESS THAN 1PPM PCB AT TIME OF MANUFACTURE." shall appear on the nameplate.

**Figure 8.9, Nameplate, PCB statement**



**8.10 Fluid**

Inhibited naphthenic mineral oil complying with ASTM D3487 Type II shall be provided in the transformer up to the liquid level marking.

**8. Tank Construction, continued**

**8.11 Tank**

Tank shall meet the integrity requirements of IEEE C57.12.40, Section 5.3 and IEEE C57.12.32.

**8.11a Tank material**

Tank shall comply with IEEE C57.12.40 Section 5.2.1 and Table 8.11a.

**Table 8.11a, Material Thickness**

Transformer	Thickness, minimum, in
Tank Wall	0.31
Switch housing	0.31
Auxiliary coolers	0.31
Cover	0.5
Tank bottom	0.5

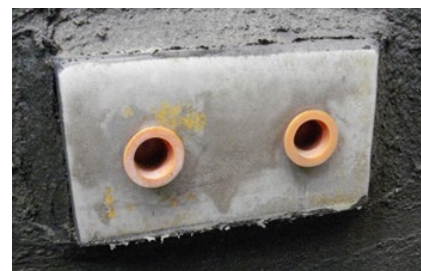
**8.11b Tank finish**

Tank finish shall comply with IEEE C57.12.32 and be black. Finish shall include a minimum of three coats of paint and an automotive-type undercoat that extends up to 12-inches above the base.

**8.11c Tank grounding**

Tank grounding provision shall comply with IEEE C57.12.40, Section 5.7.7 with a pad below the primary bushing compartment and a second pad below the low voltage terminals located to avoid the network protector cabinet. Tapped holes shall be coated with an oxide-inhibiting compound and plugged.

**Figure 8.11c, Ground Pad**





**Material Standard**

Network, Three-Phase, Mineral Oil Distribution Transformers

standard number: **4370.00**

superseding: January 23, 2020

effective date: September 15, 2020

page: 9 of 13

**8. Tank Construction**, continued**8.11d Strength**

Tank shall be designed and tested to withstand negative and positive 7 psig per IEEE C57.12.40 Section 5.3.1.

**8.11e Handhole**

Tank shall include a handhole to access internal components for testing. The handhole shall have a 5/16-inch minimum thickness and be made of 300 series stainless steel. The handhole shall have a minimum opening of 200 to 400 square inches and provide access to the HoXo switch on Wye-wye transformers. Gasket shall be a single piece of cork-rubber material. Cover shall have a means for breaking the seal (seal breaking bolts).

A 1-1/2-inch fill plug shall be located in the center of the handhole cover. Plug shall consist of a pipe nipple welded to the cover and furnished with a pipe cap. See Figure 6.

The inside face of the handhole shall have the following paint system applied:

- Primer consisting of one coat DuPont 824S light gray or black Corlar epoxy with a DuPont 826S activator.
- Topcoat consisting of two coats of preservative high-performance coating tripoxy polyamide 88-580 white or black and a preservative 88-101 clear coat.
- Equivalent Strathmore paint system is also allowed.

**Figure 8.11e, Handhole****8.11f Drain valves**

Each drain valve shall be one-inch and include a 13/16-inch brass plug with square head. The valve shall be installed on a pipe nipple welded to the tank. Filter press connections shall not be installed.

Tank-to-valve threads shall be sealed with a liquid pipe thread compound such as Loctite 592, liquid Teflon, or similar, not Teflon tape. Secondary threads can use Teflon tape.

**Figure 8.11f, Drain valve****8.11g Air Test Provision**

Tank shall be supplied with an air test provision per IEEE C57.12.40 Section 5.7.2. Plug shall be brass with a hex head.

An additional 1/4-inch opening shall be provided and equipped with a 1/4-inch brass plug with a hex head. This opening shall be located on the tank wall, above the 85°C liquid level, on the primary end above the primary terminal chamber extension.

**8.12 Transformer Anchor Beams**

Transformers of a name plate weight of 8100 lb or greater shall be supplied with three anchor beams.

Transformers with a name plate weight of less than 8100 lb shall be supplied with two anchor beams.

Anchor beams shall be constructed per figures 6.14a, 6.14b, and 6.14c with the following clarifications:

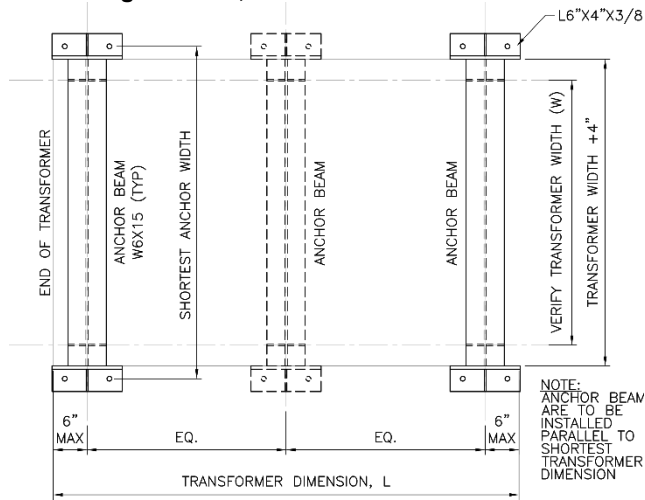
- Structural steel shall meet ASTM A-36.
- Finish shall match tank finish. See Section 8.11b.

**8. Tank Construction, continued**

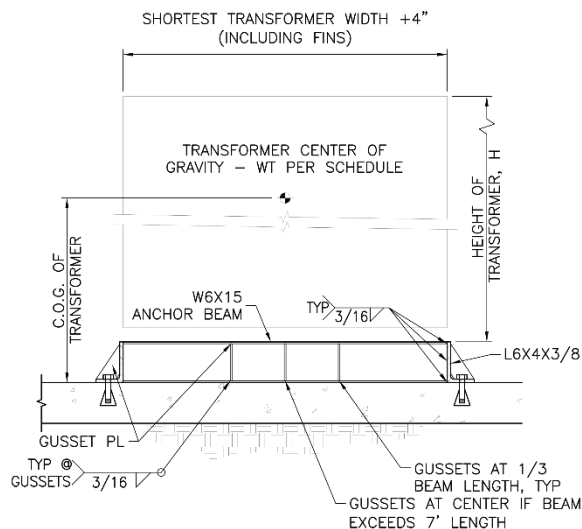
**8.12 Transformer Anchor Beams, continued**

For shipment and storage, the anchor beams shall be securely attached to each transformer tank, in a vertical position to prevent the collection of water and debris. Each end of the anchor beams shall be attached to the transformer via four 5/8-inch x 1-1/2-inch welded-on stud bolts, nuts and washers. The anchor beams shall be positioned and cushioned to prevent damage the transformer finish. See Figure 8.12d. If the transformer dimensions are too small, secure the beams to the pallet.

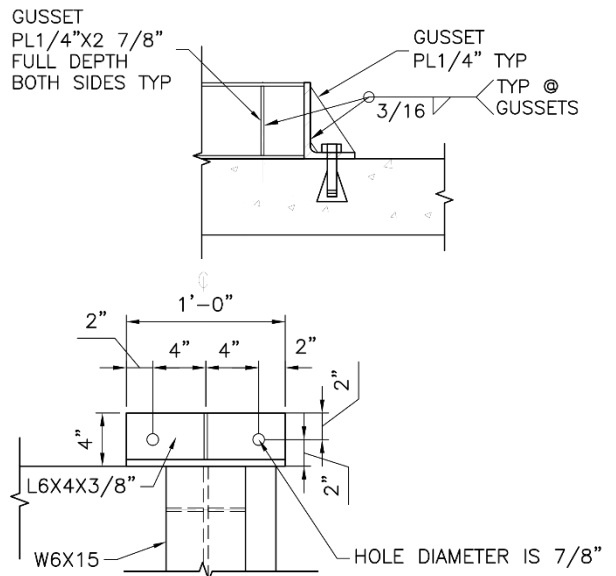
**Figure 8.12a, Beam Plan View**



**Figure 8.12b, Beam Elevation**



**Figure 8.12c, Stiffener Detail**



**Figure 8.12d, Transformer Anchor Beams**



**9. Tests**

**9.1 General**

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

**9.2 Dielectric Tests**

Dielectric tests shall be performed as specified in IEEE C57.12.40, Sections 3.4, 6.2.4, and 6.2.5 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.

**9.3 Tank and Enclosure Tests**

Tests shall be performed as specified in IEEE C57.12.40, Section 4 and IEEE C57.12.32. Units shall be tested on a design basis with 7 psig negative for 30 seconds. Units shall be tested on a routine basis with 7 psig for 6 hours. Any permanent deformation is a failure and will be rejected.

**9.4 Short Circuit Tests**

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

**9.5 Audible Sound Levels**

Audible sound levels for each unit shall be according to the requirements of IEEE C57.12.40 Section 3.6. Tests shall be performed per IEEE C57.12.90, Section 13 on a design basis.

**9.6 Radio Influence Voltage Test**

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

**Table 9.6**

H.V. Rating	Test Voltage	Maximum RIV, microvolts
13 750	9170 V	100
26 400	17605 V	100
26 400Y/15242	17186 V	100

**9.7 Load and No-Load Tests**

Load and no-load loss measurements shall be corrected to 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. Provide the transformer efficiency per DOE 10 CFR Part 431. In addition, provide the transformer efficiency at 50%, 75%, and 100% load, temperatures corrected to the above values.

**9.8 Polarization Index**

A Polarization Index test shall be performed on the high voltage windings to confirm moisture level. This consists of comparing a 1000 V megger test at minute one and later at minute ten. The index shall be 1.5 or higher. Insulation resistance shall be 1 gigaohm minimum.

**9.9 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.

**9.10 Test Tag**

A 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 9.10, Test tag, example**



## 10. Design Changes

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

## 11. Shipping and Handling

Each transformer shall be supplied on its own pallet.

### 11.1 Pallet Material

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

### 11.2 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.

### 11.3 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.

### 11.4 Arrival Condition

Transformers may be delivered on enclosed, covered, or flatbed trucks. If transformers are delivered on flatbed trucks, they shall be side-loaded. Because Washington State law requires a 10-inch minimum side board when driving a forklift or pallet jack onto the bed of a truck or trailer, most flatbed trucks or trailers must be side-loaded to ease off-loading.

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

## 12. Seattle City Light Process

### 12.1 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.

## 12.2 Loss Factors

Load and no-load loss measurements shall be corrected to 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.

### 12.2a Load Loss

Load losses shall be assessed at \$1.30 per watt.

### 12.2b No-load Loss

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

### 12.2c Loss Assessment

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

Loss Total = Load Loss + No-load Loss

Load Loss = Losses (Watts) x \$1.30

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.

Individual transformers that exceed the load loss and no-load loss testing tolerances as stated in IEEE C57.12.90, Section 9.3 may be rejected and returned to the manufacturer.

## 12.3 Bid Completion

Upon completion of the bid 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.

## 12. Seattle City Light Process, continued

### 12.4 Inspection and Electrical Testing

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

Transformers will be tested electrically for Radio Influence, 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.

### 12.5 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.

## 13. Issuance

**Stock Unit:** EA

## 14. Approved Manufacturers and Factories

Carte International      Winnipeg, Manitoba, Canada  
Quality Switch Inc.      Newton Falls, Ohio

## 15. References

**Hanson, Brett;** SCL Standards Engineer and subject matter expert for 4370.00

## 16. Sources

**SCL Material Standard 0038.3** (canceled);  
"Network Transformers – Subway Type 13 kV and 26 kV"