3-Phase Pad mount Transformer
LAST REVISION
DATE: 12-14-2018

DALTON UTILITIES' ELECTRIC DEPARTMENT
MATERIAL OR EQUIPMENT NAME:
TRANSFORMER UNDERGROUND THREE-PHASE PADMOUNT

1.0 SCOPE

This specification covers the electrical characteristics and mechanical features of three-phase, 60 Hertz, wye-wye connected, mineral oil immersed, self-cooled, pad mounted, compartmental type transformers. Transformers shall be dead front only.

2.0 STANDARDS

All characteristics, definitions and terminology, except as specifically covered in this specification, shall be in accordance with American National Standards Institute (ANSI) Standards C57.12.10, C57.12.26, C57.12.70, C57.12.80 and C57.12.90, latest revisions.

3.0 DESCRIPTION

Transformers covered under this specification include 75 kVA through 3500 kVA.

4.0 INSULATION LEVEL

4.1 The high voltage insulation shall be:

Rated High Voltage (Volts)	BIL (kV)	Insulation Class (kV)
12470 GrdY/7200	95	15
24940 GrdY/14400	125	18
12470/7200x24940/14400	95x125	18

4.2 The low voltage insulation level shall be as follows:

Low Voltage Rating (Volts)	BIL (kV)	Insulation Class (kV)
208 GrdY/120	30	1.2
480 GrdY/277	30	1.2
2400 GrdY /1386	60	8.7
4160 GrdY/2400	60	8.7
12470 GrdY/7200	95	15

5.0 HIGH VOLTAGE TAPS

5.1 All voltage ratings shall be provided with high voltage taps – two, 2-1/2% above and two, 2-1/2% below.

NOTE: Dual voltage units will have taps provided on 24940/14400 side only.

5.2 All tap changers shall:

1. Be externally operated.
2. Have the same BIL rating of the highest voltage level when operated at each tap setting.
3. Be provided with positive stops to identify the highest and lowest tap positions.
4. Be located in the high voltage terminating compartment.
5. Be designed to prevent accidental operation by requiring a preliminary step such as loosening a set screw before the tap position can be changed. This positive locking device shall be clearly visible to field personnel operating the tap changer.
6. Have a permanent, clearly marked indicator plate showing tap positions.
7. Have all external components constructed of corrosion resistant material.
8. Have a rotary type tap changer in the high voltage winding, to rotate in a clockwise direction from the high tap voltage to a lower tap voltage.
9. Be clearly marked "Do not operate handle unless in HV position".

6.0 TESTING

6.1 Routine tests on each transformer shall be made as specified in ANSI Standard C57.12.10, latest revision. All testing procedures shall be in accordance with ANSI Standard C57.12.90, latest revision.

6.2 The certified test reports shall include the following data:

1. Percent impedance, corrected to 85°C
2. Load loss – quoted and actual, corrected to 85°C
3. No load loss – quoted and actual, corrected to 25°C
4. Total loss – quoted and actual, corrected per 2 and 3 above
5. Percent excitation current
6. High and low voltage ratings
7. Serial number of unit
8. kVA size
9. Dalton Utilities purchase order number

6.3 The manufacturer shall perform a production line impulse test of each unit prior to shipment. Dalton Utilities reserves the right to request a detailed description of the procedures and test method from the production line impulse test.

7.0 CONSTRUCTION

7.1 The unit shall be constructed such that:

1. It prevents the entry of foreign objects such as sticks, rods or wires.
2. It inhibits dismantling of the equipment.
3. It is free of areas which could provide access by forcing techniques.
4. It has panels which are fastened or hinged to resist disassembly, breaking or prying open from the outside. Normal entry shall be possible only with the use of proper access tools. Latches and other provisions for locking hinged panels shall be furnished.
5. It has no exposed screws, bolts or other fastening or hinging devices which are externally removable (with the exception of hex head bolts provided for extra security) that would provide access to energized parts of the enclosure.
6. It has a close fitting, mating surface, with internal insertion prevention lip that will be shaped to prohibit entry or prying by screwdrivers, wrecking bars, tire irons, single socket lug wrenches or other readily accessible tools.
7. It has a rigid panel which, in conjunction with a handle-linkage-latching mechanism with three (or more) point latching, will resist bending in the event that sufficient force is applied to distort the compartment door(s) and permit prying access to the door edges.
8. The bottom edge of the enclosure shall provide for flush mounting on a flat, rigid mounting surface to prevent wire entry into the compartment.
9. 1500-3500 kVA transformers shall fit on an 85” x 85” x 8” pad with an 18” x 60” cable opening (See Attachment A).
10. 1000 kVA transformers and below shall fit on a 76” x 65” x 8” pad with an 18” x 48” cable opening (See Attachment B).

7.2 The unit shall have a removable sheet steel door sill supported by at least two (2) bolts on either side to prevent sill rotation. The height of the door sill shall be a maximum of twelve inches (12”).

7.3 The finish of the unit shall conform to EEI Finishing Guidelines for Pad mounted Equipment. Certified proof of this conformance must be provided by the manufacturer.

7.4 All exterior nuts and bolts shall be made of a corrosion resistant material.

7.5 There shall be no exposed screws, bolts or other fastening devices which can be removed externally with the terminating compartment doors closed.

7.6 The transformer shall have a five-legged (5) core design unless otherwise specified.

8.0 BUSHINGS AND TERMINALS

8.1 Electrical characteristics of the transformer bushings and terminals shall be as listed below:

Insulation Class (kV)	Basic Impulse Insulation Level Dry Withstand (kV)	60 Cycle Dry One-Minute Withstand (kV)
1.2	30	10
15.0	95	35
18.0	125	40

8.2 Bushings and terminals shall be located on the tank wall that is common to the high voltage and low voltage terminating compartments with the locations and sequence as shown in attachments (See Attachment C).

8.3 Transformer sizes 75 kVA through 3500 kVA will be dead front and shall be provided with 3 ESNA, Permali or Westinghouse high voltage bushing wells meeting ANSI C119.2, externally clamped, to accept load break inserts to permit operating the transformer from a radial primary system. Corpreme, Nitrile or other Dalton Utilities approved gasketing material with limiters shall be provided. Gasketing material shall be installed such that the high voltage bushing wells will continually be in contact with the grounded tank. High voltage leads shall be of such lengths as to permit field replacement of bushing wells.

8.4 Low voltage line and neutral bushings through 480 volt shall be General Electric, Westinghouse, Elastimold, Central Moloney, Howard Industries, McGraw-Edison or RTE externally clamped epoxy or fiberglass polyester material with copper terminals and shall be equipped with tinned copper terminal spades provided with NEMA spaced holes as shown below.

KVA	208Y / 120v	480Y / 277v
75	10 Hole	10 Hole
150	10 Hole	10 Hole
300	10 Hole	10 Hole
500	10 Hole	10 Hole
750	16 Hole	16 Hole
1000	16 Hole	16 Hole
1500	20 Hole	20 Hole
2500	N/A	20 Hole
3000	N/A	24 Hole
3500	N/A	24 Hole

A minimum of 4 ½" shall be maintained between the tank wall and the center of the terminal holes nearest to the tank. These terminals shall be compatible with

the continuous rating of the transformer at maximum kVA and shall be suitable for operation with overload capabilities per ANSI C57.92, latest revision. The bushings shall be marked with the name of the manufacturer externally visible after installation.

8.5 Low voltage terminals 4160 volts and above shall have 6 hole spades.

8.6 Insulated vertical mechanical supports shall be installed on each 10, 16, 20 and 24 hole low voltage terminal spade and shall be attached to a horizontal steel support single brace located above the spades. The horizontal angle brace may or may not be an integral part of the low voltage terminating compartment top. The support system shall be capable of rigidly supporting a minimum of 125 pounds per spade and the horizontal angle brace shall be capable of supporting a minimum total weight of 500 pounds. These supports shall be attached to the ends of each spade.

8.7 The low voltage neutral bushing shall be fully insulated. The high voltage and low voltage neutrals shall be tied together internally by a removable link and shall be brought out through the low voltage Xo bushing. A removable copper ground strap or cable shall be connected between the neutral bushing and a ground pad located on the exterior tank wall inside the low voltage terminating compartment. This strap shall be sized for the ratings of the transformer. The transformer shall be shipped with the ground strap connected to the tank ground pad (See Attachment A).

8.9 The minimum current carrying capabilities of all high voltage terminals and low voltage terminals over 4160 volts shall be 200 amps (continuous) and 10,000 amps symmetrical (momentary).

9.0 ACCESSORIES

9.1 Lifting provisions shall be arranged to provide a distributed and balanced lift for the assembled unit.

9.2 The base of the transformer terminating compartment sill shall be provided with a flange inside the terminating compartments to permit anchoring the compartment on a pad.

The instruction nameplate shall be located per ANSI Standard C57.12.26, latest revision, Section 6.4.3. The BIL rating of the transformer, decoded date the unit is manufactured (Example: MFR DATE 5/06) and notification of current limiting and Bay-O-Net fuses in the circuit diagram shall be included on the nameplate. The nameplate shall be made of corrosion resistant material and attached with corrosion resistant fasteners. The instruction nameplate shall be located such that it can be easily read with the low voltage cables and terminations in place.

9.3 The high voltage compartment of 1000 kVA through 3500 kVA transformers shall contain a three phase load break switch under oil, 300 amperes continuous duty and 10,000 amperes symmetrical, 16,000 amperes asymmetrical (equal to Westinghouse LBOR switch).

9.4 Transformers shall be equipped with a non-resettable device which detects and provides external indication of internal transformer faults. This device also incorporates a pressure relief valve. The approved device is manufactured by IFD Corporation or approved equal. The device shall be located in the secondary cabinet.

9.5 All transformers shall be provided with a dial type thermometer with a maximum reading pointer and a closed oil well, located in the low voltage compartment.

9.6 All transformers shall be provided with an insulating oil magnetic dial type liquid level gauge located on the tank wall inside the secondary compartment.

9.7 The transformer kVA rating shall appear in yellow 2 ½" painted Arabic numbers on the exterior of each transformer in accordance with ANSI Standard C57.12.20, latest revision. Decals are <u>not</u> acceptable.

10.0 TANKS

10.1 A one inch (1") drain valve equipped with a built-in insulating oil sampling device shall be provided on the tank wall inside the high voltage terminating compartment on all units. (See Attachment C).

10.2 The tank grounding provisions on all units shall consist of two (2) unpainted, copper-faced steel or stainless steel pads, conforming to ANSI Standard C57.12.26, latest revision, Section 6.6.4. (See Attachment A)

10.2 The transformer shall be provided with a hand hole located at the center of the tank cover the bolted hand hole covers shall be made tamper-proof by providing false covers which are secured inside the terminating compartments.

11.0 DOORS

11.1 A one-half inch (1/2") penta-head flange stainless steel AISI Type 300 Series spring-loaded bolt with NC Class 2 threads and tapered end shall be installed on the low voltage terminating compartment door adjacent to the door handle so that it will be accessible only after the shackle pad-lock is removed. The bolt shall be held captive with a non-corrosive roll pin. A one-half inch (1/2") stainless steel AISI Type 300 Series nut with NC Class 2 threads shall be attached to the low

voltage terminating compartment door in a manner that will allow the nut to float thereby facilitating bolt to nut alignment. The nut shall be installed in a manner that will allow it to be replaced. The method of containing the nut shall be designed to prevent a foreign object from being inserted into the terminating compartment when the bolt is not in place.

11.2 The transformer shall be furnished with conventional, vertically hinged terminating compartment doors.

11.3 Each door shall be provided with a hold-open device, which is held captive at one end, for latching the door in the open position.

11.4 Primary and secondary voltages and kVA to be stenciled or marked with a decal on top right hand corner of secondary door exterior.

12.0 FUSING

12.1 The transformer shall be furnished with three (3) current limiting fuses.

12.2 The current limiting fuses shall be mounted horizontally in the immediate vicinity of the high voltage bushings. The current limiting fuses shall be rigidly mounted to eliminate shifting of the fuses and the possibility of fuse to ground contact. A current limiting fuse becoming dislodged will result in the manufacturer's immediate removal from Dalton Utilities Standards.

12.3 The current limiting fuse size, voltage rating and kVA rating for each unit shall be indicated with oil resistant yellow paint or Dalton Utilities approved decals on the inside surface of the low voltage terminating compartment door of all units 480 volts and below. All units with low voltage of 4160 volts and above shall have the same information indicated on the high voltage insulating barrier.

EXAMPLE: 150 kVA 12470 v 120/208v
Current limiting fuse 40 amp RTE

NOTE 1: 2500 – 3500 kVA transformers will not have Bay-O-Net fuse option installed on 12470 GrdY/7200.

NOTE 2: 75 – 3500 kVA transformers will have Bay-O-Net fuse option on the 24940 GrdY/14400 and 12470 GrdY/7200 x 24940 GrdY/14400.

NOTE 3: Bay-O-Net fusing will be located in High Voltage Compartment. (See Attachment C)

13.0 INSULATING OIL

13.1 The transformer shall be filled with Type II mineral oil per ASTM D3487, latest revision, and shall be certified to contain less than one part per million (1ppm) Polychlorinated Biphenyls (PCB's) as measured on a dry weight basis. A notice to this affect shall be included on the transformer nameplate. No non-PCB labels shall be attached to the unit.

14.0 SHIPPING

14.1 All three phase units shall be placed on hardwood pallets with four inch (4" x 4") minimum skids to facilitate handling with forklifts. The outside pallet cross-members shall be bolted (not nailed) to the four inch by four inch (4" x 4") skids.

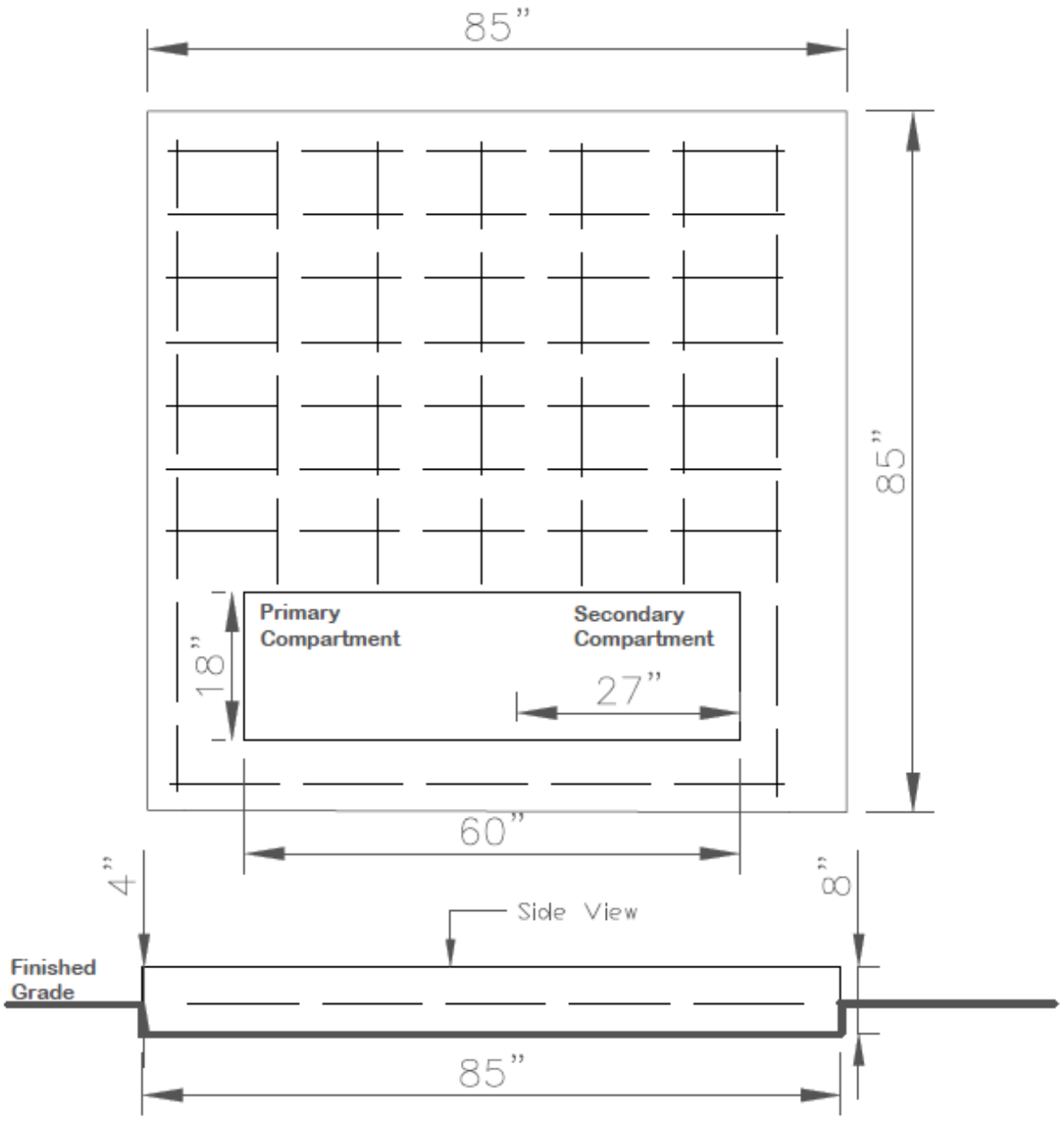
14.2 Transformers shall be shipped on pallets on a flat-bed trailer. Loaded in such a way to facilitate unloading from the sides with a forklift.

15.0 LOSS ADJUSTMENT PROCEDURES

15.1 Transformer losses shall meet DOE minimums and shall not exceed tolerances specified in ANSI Standard C57.12.10, latest revision.

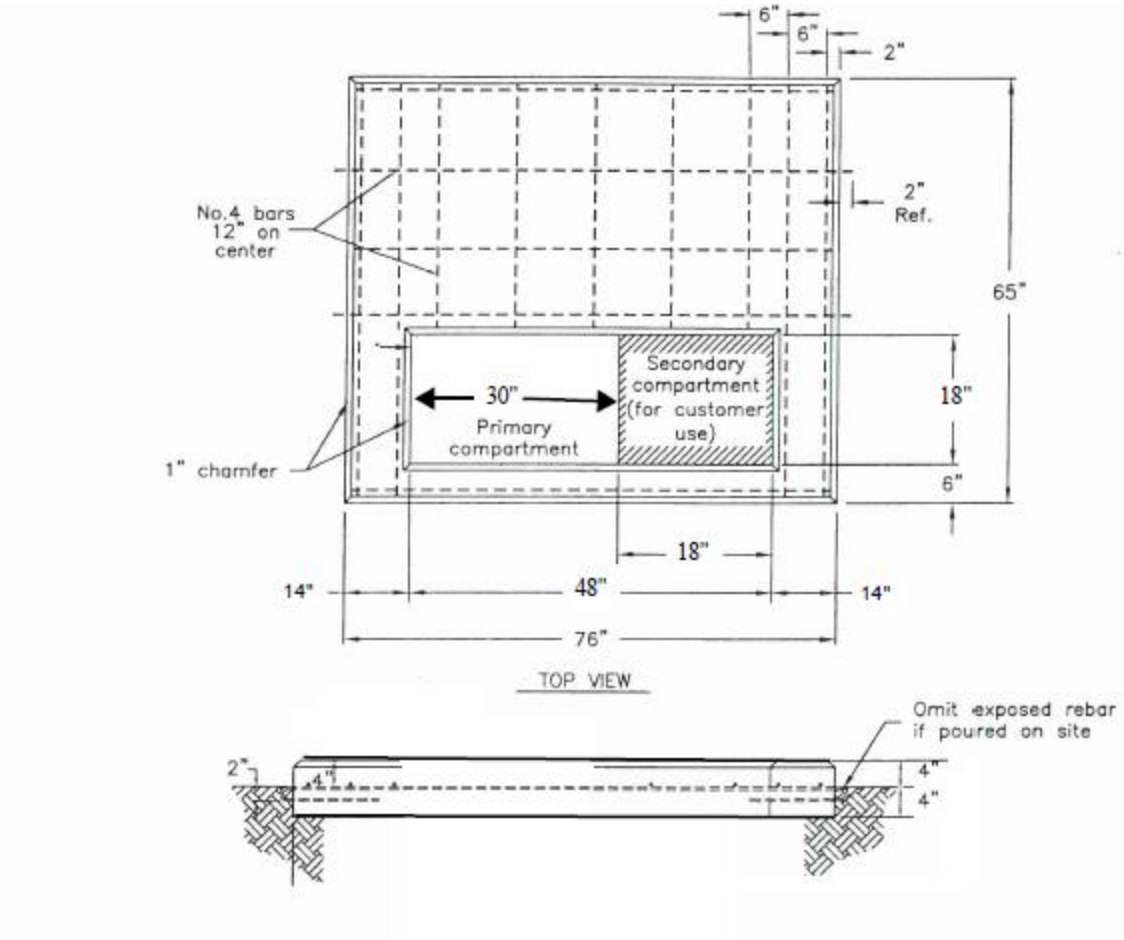
Attachment "A"

85" X 85" X 8" Concrete Pad
18" X 60" X 8" Opening

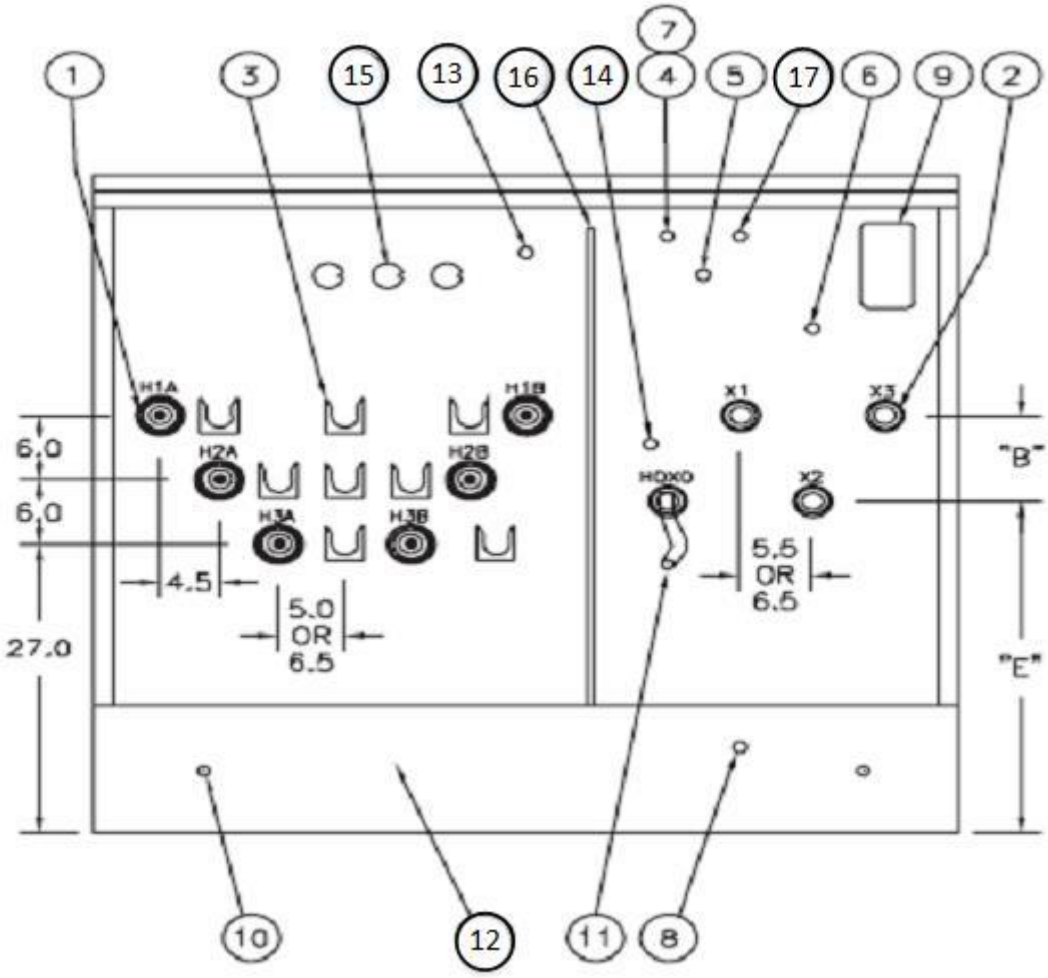


Attachment "B"

76" x 65" x8" Concrete Pad
18" x 48" x 8" Opening



Attachment "C"



1 – H.V. bushing wells
2 – L.V. bushing wells
3 – Parking stands
4 – Pressure relief valve
5 – Provision for liquid level gauge
6 – Provision for liquid temperature gauge
7 – 1" NPT oil fill plug
8 – Oil drain
9 – Nameplate
> 1" NPT plug (75-500 kVA)
11 – L.V. neutral ground strap
> 1" NPT valve with side sampler (750 kVA & above)
12 – Removable lower front sill
10 – Grounding
13 – Tap changer handle
> 1-hole ground pad (75-500 kVA)
14 – HoXo
> 2-hole ground pads (750 – 3500 kVA)
15 – Bay-O-Net fusing
16 – High-Low barrier
17 – Provision for pressure vacuum gauge