Addendum 1 for RFB921700-01

Project Name: WRC Transformer Installation
DAS RFB #: 921700-01
DAS Project #: 9217.00
Date: 1/26/2022

Questions Due: February 3, 2022 at 10:00 am
Bids Due: February 8, 2022 at 2:00 pm

QUESTIONS DUE DATE CHANGED TO THURSDAY, FEBRUARY 3, 2022.
BIDS DUE DATE CHANGED TO TUESDAY, FEBRUARY 8, 2022.

CHANGES TO BID SUBMITTAL AND OPENING

Due to the circumstances surrounding COVID-19, the State is amending the bid submittal and public opening procedures of the above RFB.

BID SUBMITTAL

The Bid shall be submitted to the Issuing Officer through the Iowa VSS electronic bidding system. The link to VSS is: https://vss.iowa.gov/webapp/VSS_ON/AltSelfService.

VSS should be accessed via Internet Explorer. Bidder will need to register regardless of whether it has already done business with the State of Iowa. Click the Register button on the left side of the VSS screen to start the registration process. If you have any issues with registration, please call the helpdesk at 515-281-6614. **Bidders should complete the registration process and ensure the ability to log in as soon as possible to ensure Bids can be submitted on the due date as the helpdesk is not available 24/7.** Bids should be split into several files if the bid exceeds the 10MB threshold. There is no limit on the number of files which can be uploaded. Please make sure the electronic documents submitted contain all of the required signatures. Digital signatures will be accepted. Bidders without access to electronic means should contact the issuing officer at 515-322-2893.

PUBLIC OPENING

The public opening will be held via conference call only. The call details are below.

Call time: 3:00pm on (February 8, 2022)
Call number: 617-675-4444
Pin: 516 059 868 4070#

QUESTIONS FROM BIDDERS

Q1. Is there an estimate for how deep the tunnel is?
A1. Actual depth of tunnel is unknown, although portions of the tunnel cap are exposed at grade in several locations, indicating that the top of the tunnel is at or near the surface.

Q2. Would it be acceptable to bore more than is currently shown on drawings (such as start boring closer to the new transformer pad)?
A2. Yes.

Q3.Will Alliant Energy be providing the transformer?
A3. The contractor is responsible to procure and install the transformer. Alliant Energy is one possible supplier. Please note lead times may vary among suppliers and the deadline for substantial completion of 9/30/2022 in the documents must be met.

Q4. Please clarify what needs to happen with the fresh water/CDC building feeder conduit and wiring.
A4. The wiring needs to be demolished as shown in the drawings. The conduit may be re-used at the contractor's option.

SPECIFICATION CHANGES:

1. Specification Section 26 12 13 – Medium Voltage Liquid Filled Transformers
    a. Replace this section with the attached specification. Note that it is the intent of the Engineer that the transformer supplied meet Alliant Energy Specifications.

DRAWING CHANGES:

1. Sheet E401 – Electrical Risers and Schedules
    a. General Electrical Schedule, TR-MAIN: Change “2500 MVA” to “2500 KVA”.

END OF DOCUMENT

SECTION 26 1213

LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SCOPE

A. This specification covers the minimum requirements for distribution step-tie transformers designed three-phase, grounded-Wye-Wye, mineral oil-immersed self-cooled (OISC), high efficiency, pad-mounted, compartmental-type, dead front, radial-feed for use with 600 Ampere Bolted, Dead-Break insulated high-voltage (HV & LV) connectors; and having the following ratings:

1. 2500 KVA
2. Primary Voltage: 24,940V/14,400V (Wye)
3. Secondary Voltage: 13,200/7,620 (Wye)

1.2 REFERENCES

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All design, materials, installation and testing pertaining to grounding and bonding system shall comply with the latest edition of applicable requirements and standards addressed within the following references:

1. Section 260500 Common Work Results for Electrical.

2. Section 260553 Identification for Electrical Systems.

3. Alliant Energy Electrical Equipment and Material Specification (Issued 8/3/2018), attached as Exhibit A.

4. ANSI – American National Standards Institute:

   a. ANSI/NFPA 70 National Electrical Code.
   b. ANSI/IEEE C57.12.00 General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
   c. ANSI C57.12.10 Requirements for Transformers 230000 Volts and Below; 833/958 Through 8333/10417 kVA, Single-Phase, and 750/862 Through 60000/80000/100000 kVA, Three-Phase (includes supplement ANSI C57.10.10a).
   d. ANSI C57.12.13 Conformance Requirements for Liquid-Filled Transformers Used in Unit Installations, Including Unit Substations.
   e. ANSI C57.12.26 Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors.
   f. ANSI C57.12.27 Conformance Requirements for Liquid-Filled Distribution Transformers Used in Pad-Mounted Installations, Including Unit Substations.
   g. ANSI C57.12.70 Terminal Markings and Connections for Distribution and Power Transformers.

h. ANSI/IEEE C57.12.90 Test Code for Liquid-Immersed Distribution and Power Transformers.
i. ANSI/IEEE 386 Separable Insulated Connector Systems for Power Distribution Systems Above 600 V.

5. ASTM International:

a. ASTM D877 Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.

6. NEMA – National Electrical Manufacturers Association:

a. NEMA TR 1 Transformers, Regulators and Reactors.
b. NEMA TR 11 Small Power Transformers with 65 C Average Winding Rise and Distribution Characteristics.
c. NEMA 260 Safety Labels for Pad mounted Switchgear and Transformers Sited in Public Areas

1.3 SUBMITTALS

A. Submit shop drawings indicating outline dimensions, connection and support points, weight, specified ratings and materials.

B. Submit certified transformer nameplate diagram.

C. Submit certified test data:

1. Factory test data, including but not limited to the following:

a. Resistance measurements of all windings
b. Ratio tests
c. Polarity and phase relation tests
d. No-load loss at rated voltage
e. Impedance
f. Voltage and load loss at rated current
g. Dielectric tests

2. Previous test data on similar unit, in lieu of factory tests on actual units furnished, including but not limited to the following:

a. Impulse tests
b. Temperature rise tests
c. Sound tests
d. Power factor tests
e. Bushing tests
f. Short circuit tests

D. Submit manufacturer's installation instructions.

E. Submit approved Material Safety Data Sheet (MSDS) for cooling liquid.

F. Additional information as required in Exhibit A.

G. Operation and Maintenance Data:

1. Submit operation and maintenance manuals.

2. Include procedures for sampling and maintaining fluid, cleaning unit, and replacing components.

3. Furnish a list of, and prices for, any recommended special tools and spare parts to permit proper maintenance and repair of the transformer.

1.4 QUALITY ASSURANCE

A. Products shall be tested, approved and labeled/listed by Underwriters Laboratories, Inc., or by a nationally recognized testing laboratory (NRTL) as listed in Section 260500 - Common Work Results.

B. Electrical equipment and materials shall be new and within one year of manufacture, complying with the latest codes and standards. No used, re-built, refurbished and/or re-manufactured electrical equipment and materials shall be furnished on this project.

C. Design and test transformers in accordance with the applicable ANSI/IEEE, NEMA and ASTM standards listed in the References Article. Refer to Attachment A for additional testing requirements.

D. Manufacturer's Qualifications: Company specializing in distribution transformers with 10 years of experience.

1.5 DELIVERY, STORAGE AND HANDLING

A. Handle and store equipment in accordance with manufacturer’s Installation and Maintenance Manuals. One (1) copy of this document to be provided with the equipment at time of shipment.

B. Refer to Division 0 and Division 1 for equipment lead time requirements. Note that transformer can be purchased directly from the local utility company as long as it meets the requirements of these specifications.

C. Refer to Attachment A for additional delivery, storage and handling requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Siemens Transmission & Distribution

B. Eaton

C. Square D

D. General Electric

E. ABB

F. Engineer Pre-Approved Equal

2.2 TECHNICAL REQUIREMENTS

A. Refer to Attachment A for technical requirements for the transformer.

B. Winding Characteristics

1. All windings and internal connections shall be aluminum.

2. The windings shall be tightly wound utilizing tension devices to place the conductor into the coils.

3. Sheet conductor shall be used in secondary winding to minimize vertical short circuit forces.

4. Insulation between layers of the windings shall be Insuldur paper or equal.

5. The transformer shall be designed and constructed to be completely self protected by its ability to withstand the external short-circuits, as defined by ANSI C57. 12.00.

6. Evidence of compliance to these short-circuit requirements as required in C57.12.00 and C57.12.90 shall be submitted to the Buyer at the time of quotation.

7. The transformer design shall be capable of operating above rated voltage or below rated frequency in accordance with ANSI C57.12.00.

8. The impedance shall be a minimum of 5.75%IZ @ 85°C.

C. Sound Level

1. The pad mounted transformer shall be designed and constructed to minimize the audible noise generated with the transformer energized at rated voltage and with all auxiliary cooling equipment in operation. The acceptable noise level shall be in accordance with NEMA standard TR 1. The measurement procedure shall be as specified in ANSI C57.12.90.

D. Bushings

1. High voltage and low voltage bushings shall be furnished with the ratings shown on the plans.

2. The bushings shall be sidewall mounted and suitable for high and low voltage terminations as indicated on the Transformer Data Sheet.

E. Core

1. The core shall be clamped and braced to resist distortion caused by short-circuit stresses within rating or transportation handling and to prevent the shifting of core laminations.

2. The core shall be constructed of high-grade, grain oriented, silicon steel laminations, with high magnetic permeability. Core construction shall include step-lap mitered joints to keep core losses, excitation current and noise level at a minimum.

F. De-Energized Tap Changer

1. A manually operated de-energized tap changer shall be provided for changing the primary winding taps.

2. Full capacity taps shall be located in the high voltage windings and shall be in accordance with the Transformer Data Sheet.

3. The tap changer shall be capable of carrying the full transformer short-circuit current without damage or contact separation.

4. The sidewall mounted tap changer shall be gang operated from a single operating point and shall have a position indicator.

5. The tap changer operating mechanism shall include provisions for pad locking in each tap position.

G. Insulating Fluid And Preservation System

1. The fluid preservation system shall be a sealed tank type.

2. The insulating fluid shall be mineral oil.

3. The transformer insulating fluid shall be certified to contain no detectable PCB's at the time of shipment and the tank shall be so labeled. Certification shall also be provided that the transformer and components have not been contaminated with PCB's prior to shipment.

4. The transformer insulating fluid shall meet or exceed the requirements of the appropriate ANSI and ASTM fluid Standards. The transformer fluid shall be tested for dielectric breakdown and moisture content just prior at the time of shipment.

H. Tank Design

1. The transformer tank, cooling equipment and compartments subject to pressures shall be designed to withstand, without permanent deformation, pressures of at least twenty-five percent greater than maximum operating pressures. The maximum design withstand pressure shall be indicated on the nameplate.

2. Tank design shall include sufficient expansion volume to allow operation under specified load conditions.

3. The main cover shall be of welded onto the tank.

4. One or more handholds shall be provided in the tank cover for access to bushing connections and current transformers, when required. The opening shall be of sufficient size to allow removal of any CT.

5. The transformer base shall be suitable for rolling or skidding in the direction of either tank base centerline.

6. The base shall be designed so the center of gravity of the transformer as assembled for transport does not fall outside the base for a tilt of fifteen degrees.

7. Lifting lugs shall be provided at each corner of the tank. The lifting lugs shall be designed to provide a minimum safety factor of 5.

8. Jacking area, pads or bosses shall be provided.

9. Pulling provisions, for towing the transformer parallel to either centerline, shall be provided.

I. Gaskets

1. The gaskets shall be compatible for the insulating fluid in the transformer tank.

2. Gaskets in contact with Silicone fluid or vapors shall be Viton material.

3. Metal surfaces to which gaskets are applied shall be smooth, and shall have sufficient rigidity to assure proper compression of the gaskets.

J. Cooling System

1. The transformer shall be self-cooled.

2. Cooling tubes or radiators shall be rigidly supported to the tank wall, either through pipes or brackets.

K. Grounding Provisions

1. All non-energized metallic components of the transformer shall be grounded.

2. Tank grounding provisions shall consist of two ground pads, welded to the base or to the tank wall near the base on diagonal corners.

3. A copper-faced or stainless steel ground pad with two holes spaced horizontally at 1.75-inch centers and tapped for 0.5 inch 13-UNC tread shall be provided.

L. Wiring

1. All devices mounted on the transformer, including current transformer secondary circuits, shall be wired to the control cabinet.

2. All control wiring shall be a minimum of #14 AWG type SIS and #12 AWG for current transformers.

3. Wiring shall be terminated with a ring-type insulated compression lug.

4. Each wire shall be identified with a wire marker.

5. All symbols and wiring identification systems shall be in accordance with the applicable ANSI standard.

M. Nameplates

1. Transformer shall be furnished with a non-corrosive diagrammatic nameplate, permanently attached with non-corrosive hardware. The diagrammatic nameplate shall include the name of the manufacturer of the equipment as well as the location where the transformer was manufactured and tested. In addition, the transformer manufacturer and location of manufacture is to be supplied at the time of quotation.

2. The nameplate shall contain all connection and rating information in accordance with ANSI C57.12.00 nameplate C, plus the approximate weight of parts to be lifted for un-tanking, type and quantity of oil, and the date of manufacture.

3. A non-corrosive nameplate located next to the operating handle of the de-energized tap changer shall be provided which states the following: “Warning - Do not operate this tap changer unless the transformer is de-energized.”

N. Exterior Finish

1. The transformer painting system shall be the Seller’s standard. The transformer shall be thoroughly cleaned and phosphortized, paint with at least one corrosion inhibiting primer and one finish coat to provide a minimum total dry-film thickness of not less than 3 mils.

2. The finish shall be ANSI 61.

3. Supply one quart of touch up paint.

2.3 ACCESSORIES

A. Accessories as noted in Attachment A.

B. The transformer shall be equipped with a complete set of standard accessories plus optional alarm contacts.

1. Magnetic liquid level gauge with alarm contacts.

2. Dial type thermometer with alarm contacts.

3. Pressure-vacuum with alarm contacts.

4. A 1-inch upper filter press connection with pipe cap.

5. A 1-inch drain valve and bottom filter press connection with drain valve plug

C. Optional accessories to be included are as follows:

1. Winding hot-spot temperature indicator with alarm contacts.

2. Mechanical relief device with alarm contacts.

2.4 ENGINEERING DATA REQUIREMENTS

A. Engineering data requirements as outlined in Exhibit A.

B. Outline Drawings

1. The outline drawings shall be completely dimensioned and, as a minimum, show the following:

a. Plan, and all elevations, including clearance for bushing and core and coil removal.
b. High voltage and low voltage bushing details.
c. Location of all hand-holes.
d. Location and identification of all accessories.
e. Size and location of all conduit entrances for Buyers connections.
f. Anchoring details.
g. Ground pad locations.

h. Weight of core and coil, transformer tank and fittings, weight and gallons of fluid, and total shipping weight.

C. Wiring Diagrams

1. Interconnecting wiring of all components of the forced cooling equipment.

2. Wiring of all devices with switches and relays, or electrical connections, including current transformers.

3. Identification of all terminal blocks and all connections to be made by Buyer.

D. Nameplate Drawing

1. A nameplate drawing showing required ANSI information shall be provided

E. Installation, Operating, And Maintenance Instructions

1. The seller shall provide an instruction, operating and maintenance manual covering all equipment furnished.

F. Parts

1. The Seller shall provide a renewal parts list to the Buyer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pads are ready to receive work.

B. Verify field measurements are as shown on Drawings.

C. Verify that required utilities are available, in proper location and ready for use.

D. Observe all restrictions imposed by safety tags and locks.

3.2 INSTALLATION

A. Install transformer as shown on Project Drawings and in accordance with manufacturer's Instruction/Installation Manual.

B. Provide concrete pad with sufficient structural support and in accordance with local codes and standards. Concrete pad requirements should be coordinated with transformer manufacturer.

C. Grounding should be per Project Drawings and in accordance with local codes and standards and in compliance with the NEC.

3.3 ADJUSTMENTS AND CLEANING

A. Remove debris from jobsite and wipe dust and dirt from all components.

B. Repaint marred and scratched surfaces with touch up paint to match original finish.

C. Adjust primary taps so that secondary voltage is within 2 percent of rated voltage.

3.4 TESTING

A. Testing shall be as described in Exhibit A.
   1. Exception: Section 19B (Certified Test Results). Certified Test Results shall be provided to the Engineer of Record.
   2. Exception: Omit all Alliant specific labeling or identification requirements.

~~B. Each transformer shall receive all standard routine tests as required by ANSI C57.12.00 and performed as specified by ANSI C57.12.90.~~

~~C. Short Circuit withstand capability shall be verified by full short circuit tests on similar or larger units in accordance with the latest revision of ANSI C57.12.00 and ANSI C57.12.90. Short Circuit withstand verification shall be submitted to the purchaser, upon request, prior to shipment of the transformers.~~

~~D. Test dielectric liquid to ASTM D877, using 25,000 volts minimum breakdown voltage, after installation and before being energized.~~

~~E. Device functionality test shall be performed.~~

~~F. The test facility used to perform loss tests shall utilize test equipment with calibration traceable to NIST or an approved equal 3rd party laboratory.~~

~~G. A certified test report shall be submitted and shall contain the test data for each transformer serial number manufactured. The certified test report shall as a minimum contain the data as specified in ANSI C57.12.90.~~

3.5 WARRANTY

A. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for one year from date of initial operation, but not more than eighteen months from date of shipment.

END OF SECTION

EXHIBIT 'A'

ELECTRICAL EQUIPMENT AND MATERIAL SPECIFICATION

TRANSFORMER, STEP-TIE, THREE-PHASE, PAD-MOUNT, 600 AMPERE BUS

**SPECIFICATION FOR DISTRIBUTION STEP-TIE TRANSFORMERS:
CONFIGURED GROUNDED-WYE, THREE-PHASE, PAD-MOUNT,
COMPARTMENTAL, DEAD-FRONT; RADIAL FEED, WITH
HIGH VOLTAGE 24940 GY/14400 VOLTS with or without SADDLE Taps;
LOW VOLTAGE 13200 GY/7620 VOLTS with or without J-Taps;
5000 - 10000 KVA
and
HIGH VOLTAGE 24940 GY/14400 VOLTS;
LOW VOLTAGE 4160 GY/2400 VOLTS with NO-Taps;
3750 KVA
and
HIGH VOLTAGE 13200 GY/7620 VOLTS with or without J-Taps;
LOW VOLTAGE 4160 GY/2400 VOLTS;
2500 KVA
and
HIGH VOLTAGE 14,400 DELTA with 6-Taps-Down;
LOW VOLTAGE 4,160 GY/2,400 VOLTS;
2500 KVA**

Section — TABLE of CONTENTS — Pages

FIGURES — Pages

1. SIGNIFICANT CHANGE SUMMARY

A. 04/19/2004

1) For 5000 KVA added 13200 GY/7620 J-Tap Voltage to Scope and Table 2 (2 & 4E)
2) Added 2500 KVA at 4160 GY/2400 Volt Primary to Scope and Table 2 (2 & 4E)
3) Changed Pad Dimension from 108 to 117 inches wide (7B)
4) Added Second Nameplate to outside of Cabinet door (10B6).
5) Added Safety Labels (10D)
6) Replaced grounding bar with Two (2) NEMA vertically spaced 1/2 inch-13 UNC tapped nut-pairs (11B1).
7) Taps shall be made to High-Voltage Winding referenced to 13200 GY/7620 Voltage (13E).
8) The Tap Changer handle shall be in the 13200 GY/7620 Bay (13E).
9) Added Under-Oil Arresters (13J)

B. 06/01/2005

1) Added Bid Quotation Sheet to end of Spec.
2) Revised Section 10.B., Labeling Nameplate.
3) Revised Section 10.C., Labeling Bar Code
4) Changed Figures 4 A&B to Figures 4 and 5.

C. 11/20/2009

1) Added 14.4 kV and 6-Taps-Down to scope in Section 2. Table 1.
2) Added C57.147-2008, Guide for Acceptance and Maintenance of Natural Ester Fluids in Transformers to Section 3. A. 10.
3) Added Item ID# 150687, 14.4 kV Delta with 6-Taps-Down to Table 2, Section 5. D.
4) Added FR3 Fluid Tear Drop Label requirement in Section 10. A. 5.
5) Added requirement for switches to be indicated on nameplate in Section 10. B. 4.
6) Added 14.4 kV to Table 5 - Bushing Ratings in Section 12. B.
7) Added requirement for switches to operate in FR3 Fluid for Cold start-up operation in Section 14 and 15.
8) Added 6-Taps-Down to Section 14. B.
9) Added arrester rating for 14.4 kV in Table 7 of Section 17.
10) Removed Mineral-Oil from Section 18.
11) Add requirement for FR3 Fluid in Section 18.

D. 10/27/2010

1) Added Item I.D. Numbers to Section 9.E 1-4.
2) Added operating temperature requirement for under-oil no-load switches, Section 16.A.
3) Added requirement of electronic submission for Certified Test Reporting in Section 18.B

E. 09/30/2013

1) Updated Applicable Documents Section 3.
2) Added Faceplate Layout to Section 6.A.2.
3) Added Penta-head Bolt and Latching and Padlocking to Section 7.A.1.
4) Added Stainless Steel Cabinet Section 7.C.
5) Added Mineral Oil to Section 17.
6) Added PCB regulation in Section 17.B.3.
7) Added Full Wave Impulse Test to Section 18.B.1.b.6
8) Added production test requirements in Section 18.B.1.b.
9) Added regulation on short-circuit withstand capabilities in Section 18.B.1.c.3.
10) Added Quarterly Reports to Section 18.B.2
11) Added NOTE to Section 20.B about the approval drawing for bid quotation packages.
12) Added examples of accessories provided for features listings of approval drawings in Section 20.B.7.
13) Added quotation requirements to Section 20.D.

F. 11/22/2013

1) Deleted Bid Quotation Summary Appendix A from the Table of Contents.
2) Changed Section 20 from Bid Quotation to Specification Requirements.
3) In Section 20, deleted D. Warranty delivery lead-time.
4) In Section 20, deleted F, Bid Quotation Form.
5) In Section 20, added L, Special Orders from Section 21 that was deleted.
6) Deleted Section 21, Bid Quotation Award.
7) Deleted Section 22, Quality Requirements.

G. 10/21/2014

1) Added a column to Table 1 – SCOPE to account for the requirements for Item ID# 155795.
2) Added line 4 to Table 2 - RATINGS AND INVENTORY DESIGNATIONS for Item ID# 155795.
3) Revised Figure 3 – LABEL LOCATION
4) Added to Section 11, B & C for Item ID# 155795.
5) Added two rows to Table 5 - BUSHING RATINGS for Item ID# 155795.

H. 11/09/2015

1) Added three rows to Table 5 - Item ID# 156038, 155846 and 155847.
2) Removed UOA's from Figure 2.
3) Added two rows to Table 5.
4) Section 10. E. 4, One "Under Oil Arresters" label shall be located on the outside front upper right-hand corner of the cabinet, under the second nameplate, was deleted.
5) Deleted UOA's from Section 15.

I. 05/15/2017

1) Added 10000 KVA class to 24940 GY/14,400 in Table 1.
2) Added Saddle (Split) taps to high voltage in Table 1.
3) Added 10000 KVA class to Table 5.
4) Added Saddle (Split) Taps to section 13.
5) Added 10000 KVA to Table 6.
6) Added 10000 KVA to Figure 5.
7) Increased height of Figure 5 to 120 inches max.
8) Added Item ID#157094.

J. 08/03/2018

1) Section 3, revised Applicable Documents by adding latest revision.
2) Section 10, revised Item E, added item 5, Notice label "PVP Partial Vacuum Flashover Protected, IEEE 386 Vented Rings Installed", and revised Figure 3 b.
3) 3) Section 12, revised Item C, 1, Added note "Bushing inserts shall meet IEEE 386".

2. SCOPE

This specification covers the minimum requirements of Alliant Energy for distribution **step-tie** transformers designed three-phase, grounded-Wye-Wye, mineral oil-immersed self-cooled (OISC), high efficiency, pad-mounted, compartmental-type, deadfront, radial-feed for use with 600 Ampere Bolted, Dead-Break insulated high-voltage (HV & LV) connectors; and having the following ratings:

TABLE 1 - SCOPE

PARAMETERS	24,940 GY/14,400 to 13,200 GY/7,620	24,940 GY/14,400 to 4,160 GY/2,400	14,400 DELTA or 13,200 GY/7,620 to 4,160 GY/2,400
kVA Size	5000 - 10000 kVA	3750 kVA	2500 kVA
High Voltage (HV)	24,940 GY/14,400 with or without Saddle Taps or 12470 GY/7200 Volts	24,940 GY/14,400 Volts	14,400 DELTA with 6-Taps Down or 13,200 GY/7,620 Volts with J-Taps
Low Voltage (LV)	13,200 GY/7,620 Volts with or without J-Taps or 12470 GY/7200 without Taps	4,160 GY/2,400 Volts	4,160 GY/2,400 Volts
Basic Impulse Insulation Level (BIL)	125 kV BIL for **both** the 25 kV GY class high and 15 kV GY class low voltage windings	125 kV BIL for the 25 kV GY class high and 95 kV BIL for the 15 kV GY class low voltage windings	95 kV BIL for **both** the 15 kV GY class high and 5 kV GY class low voltage windings
TAPS **(WHEN SPECIFIED)**	**6-Taps-Down**: A=14,400, B=13,800, C=13,500, D=13,200, E=12,840, F=12,470 & G=12,160 DELTA **J Taps**: A=8170, B=7968, C=7794, D=7620, E=7413, F=7200, & G=7020 **Saddle Taps**: Two 2-1/2% TAPS ABOVE AND BELOW THE RATED HIGH VOLTAGE.		
Impedance Range @ 85°C	6.5%, +/- 7.5% (6.01 - 6.99)		
Thermal	65°C continuous average winding temperature rise, 80°C hot spot; 65°C maximum top oil temperature rise.		
X/R Ratio Range	Not specified		
Regulation @ 85°C	Not to exceed 5.2% @ .8pf, and 1.4% @ 1.0pf.		
Through-Fault	Short Circuit Withstand **certified** per ANSI/IEEE.		
Frequency	60 Hz		
Separable Connectors	Ratings as listed in **Table 5** herein.		

3. APPLICABLE DOCUMENTS

A. All transformers purchased under this specification shall meet the requirements of this document and the Latest Revision of:

1) American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE) 386-2016, Separable Insulated Connectors for Power Distribution Systems Above 600 V; [Copyright-IEEE].
2) American National Standards Institute (ANSI) C57.12.00-2015, General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers.
3) American National Standards Institute (ANSI) C57.12.26-1992, Requirements for Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for use with Separable Insulated High-Voltage Connectors, High-Voltage, 34500 Grd Y/19920 Volts and Below: 2500 kVA and Smaller; {incl. 1990 corrections}.
4) American National Standards Institute (ANSI) C57.12.28-2005, Switchgear and Transformers - Pad-mount Equipment - Enclosure Integrity. (Correction - April 1988).
5) American National Standards Institute (ANSI) C57.12.70-2010(R2006), Terminal Markings and Connections for Distribution and Power Transformers (R 1987).
6) American National Standards Institute (ANSI) C57.12.80-2010, Standard Terminology for Power and Distribution Transformers (R 1992); [copyright IEEE].
7) American National Standards Institute (ANSI) C57.12.90-2015, Test Code for Liquid-Immersed Distribution, Power and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers; [copyright IEEE].
8) American National Standards Institute (ANSI) C57.91-2011, Guide for Loading Mineral-Oil-Immersed Overhead and Pad-Mounted Distribution Transformers Rated at 500 kVA and Less with 65°C or 55°C Average Winding Rise (R 1991); [copyright IEEE].
9) American National Standards Institute (ANSI) C57.98-2011, Guide for Transformer Impulse Tests (Appendix to C57.12.90) (R 1992); [copyright IEEE].
10) American National Standards Institute (ANSI) IEEE C57.147-2008, Guide for Acceptance and Maintenance of Natural Ester Fluids in Transformers. [Copyright IEEE]
11) American National Standards Institute (ANSI) C57.109-1993, Guide For Transformer Through-Fault-Current Duration; [copyright IEEE].
12) American Society for Testing and Materials (ASTM) D3487-09, Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus.
13) American Society for Testing and Materials (ASTM) D4059 E1-10-2017, Standard Specification for Analysis of Polychlorinated Biphenyls in Mineral Insulating Oils By Gas Chromatography.
14) Institute of Electrical and Electronics Engineers (IEEE) IEEE C57.12.35-2013, Standard for Bar Coding for Distribution Transformers.
15) National Electrical Manufacturers Association (NEMA) TR 1-2013, Transformers, Regulators, and Reactors.

B. If this specification conflicts with any of the documents listed, the requirements of this specification shall apply.

4. GENERAL

A. System Configuration

Step-tie, or inter-tie, two-winding transformers **(not to be confused with an autotransformer)** are used to interface distribution system voltages from one primary level to another, operable in both step-up and step-down mode (bi-directional). Operation is on a three-phase, 60 Hz, alternating current, solidly grounded-Wye power system having 7,620 volts phase to ground, 13,200 volts phase to phase and nominally classed 15 kV to 2,400 volts phase to ground, 4,160 volts phase to phase and nominally classed 5kV; or 14,400 volts phase to ground, 24,940 volts phase to phase and nominally classed 25 kV to 7,620 volts phase to ground, 13,200 volts phase to phase nominally classed 15kV.

B. Tilt

To preclude exposing internal parts designed to be under oil, the transformer shall be capable of operation without derating when placed on a flat surface up to four degrees (4°) out of level in any direction.

5. RATINGS AND ITEM IDENTIFICATION

A. Ratings

Unit voltage and kVA size designations are listed in **Table 2**, herein.

B. Item Identification

Alliant Energy assigned **Item ID Numbers** are given in **Table 2**, herein, for the designated unit ratings and sizes. For order quotation and completion requirements refer to Sections **17 and 18**, herein. Item ID# 155847 has a 180º phase-shift.

TABLE 2 - RATINGS AND INVENTORY DESIGNATIONS

LINE	Item ID	Primary Voltage	Sec-Voltage	KVA	Bush Amp	Taps
1	154826	12470 GY/7200	2400 DELTA	2500	900	YES
2	104195	13200 GY/7620	4160 GY / 2400	2500	600	J
3	150687	14400 DELTA	4160 GY / 2400	2500	600	6DN
4	155795	24940 GY/14400	4160 GY / 2400	3750	200 / 600	NO
5	156038	13200 GY/7620	4160 GY / 2400 LF	5000	600 / 1200	YES
6	151796	12470 GY/7200	7200 DELTA	5000	900	YES
7	155846	12470 GY/7200	12470 GY/7200	5000	600	NO
8	155847	7.2 X 14.4 KV	12470 GY/7200	5000	600	NO
9	150304	24940 GY/14400	13200 GY / 7620	5000	600	J
10	157094	24940 GY/14400	13200 GY / 7620	10000	600	SADDLE

6. EXCEPTIONS AND DEVIATIONS

A. Variance at Quotation. The manufacturer shall include with their quotation any deviation from this specification, referring to paragraph number; this extends to requirements of listed applicable documents.

B. Variance in Process. The manufacturer shall promptly notify the Transformer Standards Engineer and the Buyer of any deviation, design, or process change to any material manufactured to or required by this specification. Alliant Energy reserves the right to evaluate the

~~deviation or change prior to shipment or manufacture as appropriate. Deviation or change without prior approval of Alliant Energy will be sufficient cause for rejection of the material furnished, without charge or penalty to Alliant Energy and/or removal of the manufacturer as authorized supplier.~~

7. DIMENSIONS AND STYLING

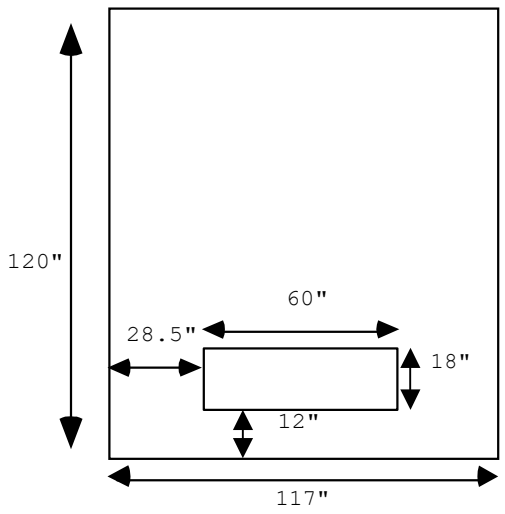
A. Construction. Configuration and dimensions shall comply with enclosure integrity requirements of ANSI C57.12.28; ANSI C57.12.26 Specific Dimensions for Radial-Feed Transformers, Figures 5A and 7, Figures 4 A&B herein, applied to **both** the high and low voltage compartment arrangements except as modified and detailed herein (make reference to):

1) Transformer Pad Dimensions, **Figure 1** herein.
2) Transformer Faceplate Layout, **Figure 3**.
3) Faceplate and Compartment Configuration, **Figures 4 or 5**, herein.

B. Pad Mounting. The unit shall be designed to be set symmetrically on the pad of **Figure 1**, herein, to optimize the alignment of the transformer cable compartment and the cable window:

1) No part of the unit shall extend beyond the pad perimeter.
2) The entire width of the cable opening in the pad shall be enclosed within the cable compartment and unobstructed for the full depth and height of the transformer cable compartment, this includes the doorjamb and sill.

FIGURE 1 - PAD DIMENSIONS



8. TANK AND COMPARTMENT CONSTRUCTION

Enclosures shall be of outdoor sealed tank construction with a segmented HV-LV cable terminating compartment. Units shall be rectangular in shape.

A. Transformer Tank

1) **Oil Tank**. Transformers shall be welded tank, and welded or bolted main cover construction, with welding in accordance with recognized AWS and ASME standards. The tank top shall be designed for water runoff.

a) **Handhole(s).** Provisions for ready access to the tank interior shall be via handhole(s) of adequate dimensions and located so all terminal connections and other accessories are easily accessible. Handhole(s) shall have gasketed and bolted covers.
b) **False Cover**. A bolted removable false cover shall be provided over the handhole(s), designed to be removable by one person only after the cable termination compartments are opened.
c) **Bolted Main Covers**. Shall be removable by one person only after the cable terminating compartments have been opened.
d) **Penta-Head Bolt:** A stainless-steel or silicon-bronze recessed, captive, penta-head bolt shall be provided.
e) **Latching and Padlocking:** The penta-head bolt cup and hasp shall have 1/2 inch minimum diameter holes for the padlock shackle.

2) **Anchoring, Lifting, and Jacking**. Adjustable provisions shall be made for anchoring to the pad from within the cable compartment; hardware included. Safe, permanent lifting and jacking provisions shall be supplied and installed on the transformer prior to shipment.
3) **Faceplate**. The tank front wall shall be of sufficient strength to resist deflection during connector operation. The faceplate shall be arranged and configured per ANSI C57.12.26, Figure 6A, and Figures 4 A & B. Accessory operating devices and gauges are to be optimally located; shaded areas are suggested general locations.
4) **Finish**. All surfaces of the unit shall be Munsell 7GY3.29/1.5 green paint applied in accordance with ANSI C57.12.28.

B. Cable Terminating Compartment

The cable connection compartment shall be removable and assembled to the tank as an integral unit for mounting on a pad. The compartment top shall be designed for water run-off. The compartment shall be full height and separate the tank faceplate into HV and LV bushing segments by a mid-partition located as depicted in ANSI C57.12.26, Figure 7; and detailed per Figures 4 A & B.

1) **Mid-partition**. The HV-LV rigid barrier shall be constructed of 13 gauge minimum metal or 1/8 inch minimum GP03 fiberglass, and securely fastened to prevent warping to both the doorjamb and tank faceplate.
2) **Cabinet Doors**. Front opening separately hinged steel doors shall be provided with built-in door holders that will hold doors securely in the open position. The LV compartment door shall open first.
   a) **Hinges**. Door hinges shall be stainless steel and designed to resist accidental removal of doors during opening and closing.
   b) **Doors**. The doors shall have adequate strength and bracing to prevent warping and excessive flexing. The separate HV doorjamb fasteners shall be slotted, penta- or hex head, captive, self-aligning bolts.
3) **Depth**. The cabinet shall be a minimum of 30 inches in depth.
4) **Doorjamb**. A metal front strut shall be provided onto which the HV and LV compartment doors will close, fasten and latch.
5) **Finish**. All surfaces of the unit shall be Munsell 7GY3.29/1.5 green paint applied in accordance with ANSI C57.12.28.

C. Stainless Steel Cabinet

Item ID# 151409, the transformer tank, cable compartment covers, radiators and sill shall all be constructed of 304l stainless steel; and all tank compartment covers and sill attachments and hardware including, but not limited to, lifting attachments, hinges, door stops, hand hole covers and associated hardware, compartment latching and handle hardware and barriers together with any baffles, if required, shall be constructed of 304l stainless steel. All tank welding shall be performed with mig welders using stainless steel wire.

9. ENCLOSURE INTEGRITY AND SECURITY

A. Ingress and Penta-Head Bolt

1) **Ingress**. Transformers shall be tamper-resistant meeting the enclosure integrity requirements of ANSI C57.12.28..

2) Pentahead Bolt. A stainless steel or silicon-bronze recessed captive pentahead bolt as shown in ANSI C57.12.25, Fig. 3 shall be provided.

B. Security

1) **Padlocking**. Means to padlock the hinged doors shall be provided such that the pentahead bolt must be completely threaded in before the padlock can be put into place, which shall in turn obstruct access to the pentahead bolt.

1) **Cup and Hasp**. In addition to the regular locking provision, all access doors or hood shall be secured by a recessed, captive, pentahead bolt that meets the dimensions set forth in ANSI C57.12.28.

2) **Latching**. The recessed captive pentahead bolt shall hold a three point latching system that shall remain captive until the pentahead bolt is fully backed out.

10. LABELING AND IDENTIFICATION

A. Labeling

The manufacturer shall provide all labeling. Labeling, required as follows, shall be highly visible day or night, of any uniformly contrasting color, stenciled or in weather-resistant decals designed to remain legible and affixed for the life of the transformer.

1) **Unit Rating** shall be located on the outside front-upper-left corner of the HV compartment door. The kVA size shall be one inch high letters and numerals, **Figure 3,** herein.

2) **General.** As may be present on the transformer, all bushings, terminals, switches, gauges, and devices shall be identified on the tank faceplate as detailed and illustrated elsewhere in this specification.

3) **Other.** No other stencils, decals, labels or markings of any kind, or exterior nameplates shall be attached to the transformer beyond that required by Standard or elsewhere in this specification.

4) The Disconnect Switch shall be indicated on the nameplate schematic as DS.

5) **FR3** Filled Transformers

All **FR3** filled transformers shall have the FR3 Fluid Tear Drop decal installed to the left of the second nameplate.

TABLE 3 - LABELING SCHEME

Ratings-Arrangement	Format-Form	Example (left-justified)
kVA Size	zzzz (numeric)	5000 kVA
Voltage	aa - bb (numeric)	15 - 25 kV
Style Modifier	BBBBBB (alpha UCase)	STEP-TIE
Winding Connection	A - B (alpha UCase)	Y - Y
Stock Code Number	zzzzzz (numeric)	123456

B. The **Nameplate** shall be inscribed such that it will remain legible for the life of the transformer. In addition to standard ANSI requirements, the Nameplate shall contain the following:

1) **Insulating fluid volume** in gallons.
2) **PCB content** indicated by the statement "Insulating Fluid is Non-PCB Contaminated" or similar language.
3) **Taps**, listed in **actual voltage** rather than percent of nominal.
4) All **protective devices** as may be required such as under-oil arresters and switches shall be indicated on the nameplate schematic. Designators shall be "**LFS-A**", "**LFS-B**" for A&B Switches.
5) Alliant Energy's **Item ID Number**
6) Permanent **Bar Code** containing the unique **Serial Number** preceded by the Two Letter Mfg. Code.

C. Bar Code

1) All transformers shall be supplied with permanent bar coding on the nameplate and a temporary bar code containing the manufacturer's identification initials followed by the manufacturer's serial number and Corresponding Bar Code.
2) A temporary bar code label, with the manufacturer's catalog number and manufacturer's serial number shall be installed by the manufacturer on the back of the transformer in the upper left-hand corner, **Figure 3a**, herein. Alliant Energy's **Item ID** Number shall appear after the Manufacturer's Serial Number.

TABLE 4 - TEMPORARY BAR CODE LABEL

Bar Code
Manufacturer's Catalog Number
Manufacturer's Serial Number
Alliant Energy's **Item** ID Number

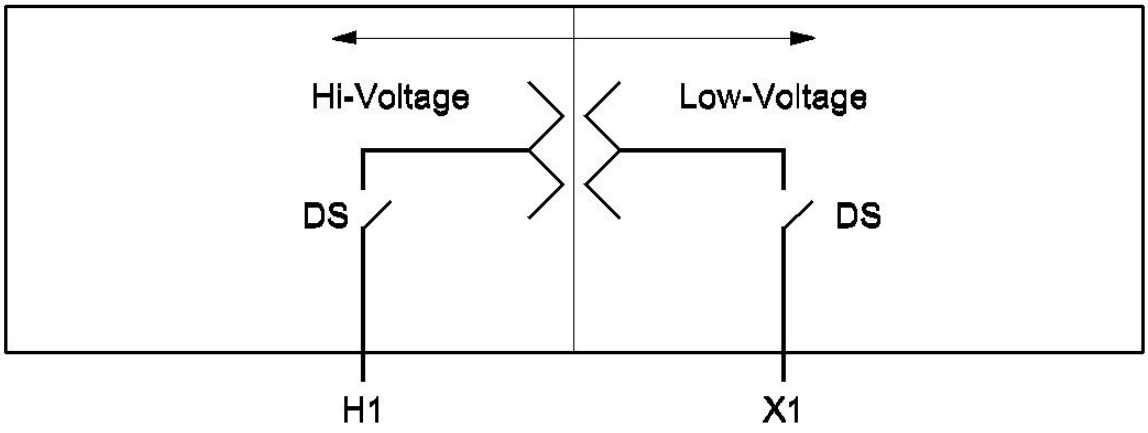
D. A **second** Nameplate shall be supplied and installed by the manufacturer on the front upper right-hand corner of the cabinet, **Figure 3**, herein.

E. Safety Labels

1) One 3 in 1 Combination Sign, "Warning - Underground Cable Before Digging Call: . . . . . ", "Warning - High Voltage Inside - Keep Out Can Shock, . . . " and “Don’t Fence Me In”. The sign shall be center on the front of the lift-up hood, above the entry latch and mounted approximately one inch from the top. Signs shall be supplied by transformer manufacturer and meet the requirements of Alliant Energy’s Item ID# 151747.
2) Two "**Warning - High Voltage Inside - Keep Out Can Shock**, . . ." signs shall be mounted and centered on the high-voltage cable compartment door and on the low-voltage cable compartment door, **Figure 3a,** herein. The signs shall be supplied by the transformer manufacturer and meet the requirements of Alliant Energy Electrical & Material Specification #0075, Item ID# 106878.
3) **Switching Schematic**. Located top center, on the inside of **both** the HV and LV doors (Figure 3b herein), shall be plate etched, stenciled or decaled a one-line wiring schematic, as depicted in **Figure 2,** herein. The nameplate styled, highly legible, contrast surface etched plate, bracket welded to each door is the preferred method.
4) One “**Under Oil Arresters**” label shall be located on the outside front upper right-hand corner of the cabinet, under the second nameplate, **Figure 3a,** herein.

FIGURE 2 - ONE-LINE DIAGRAM

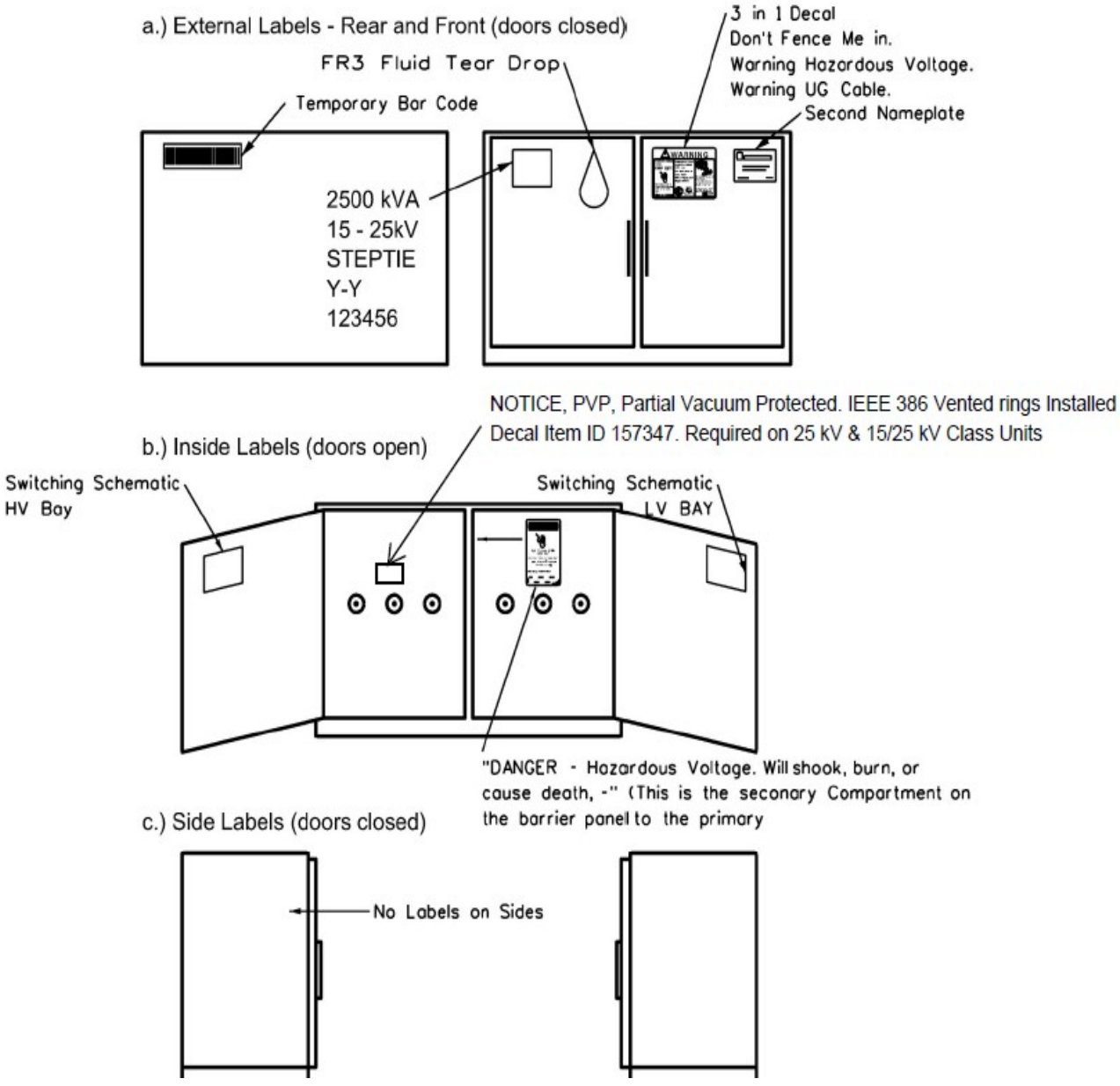
SWITCHES



0126-F2.dgn

5) **PVP Notice Decal** ID# 157347 “NOTICE PVP Partial Vacuum Flashover Protected, IEEE 386 Vented Rings Installed” shall be on the inside of the cabinet by the High Voltage Bushings. This decal is required on High Voltage bushing inserts rated 25 kV and 15 /25 kV transformers.. **Figure 3.b.**, herein.

FIGURE 3 - LABEL LOCATIONS



11. HIGH- AND LOW-VOLTAGE COMPARTMENT

Figures 4 or 5, herein, depict the requirements of the transformer faceplate and cable terminal compartments.

A. **Pressure Venting**

A pressure relief device shall be installed on the transformer in a readily accessible location in the LV compartment.

1) Automatic pressure venting per requirements of ANSI C57.12.26, Paragraph 7.5.2, shall be accomplished using a replaceable pressure relief valve with manual pull ring permanently attached for hook-stick operation and 1/4 inch - 18 NPT threads.
2) The relief valve shall be positioned such that venting is not directly over any cable or terminal.

B. **Grounding Provisions**

1) Supplemental Nuts. Two (2) NEMA vertically spaced 1/2 inch-13 UNC tapped nut-pairs shall be securely welded to the faceplate for supplemental grounding and mounting of devices and brackets. Nut-pairs shall be centered within the HV and LV compartments; one pair in both the HV and LV side; **Figures 4 or 5**, herein.
2) Thread Caps. All tapped nuts, bosses and holes shall be protected with easily removable inserts.

C. **Accessory Devices and Fittings**

Transformers, per ANSI C57.12.26, Par. 7.6.1, shall be provided with the following devices located in the LV compartment so as not to impede or interfere with the use of other parts or devices:

1) All transformers: a 1- inch upper filter press and filling cap.
2) All transformers: a 1- inch NPT drain and bottom filter valve with built-in sampling device.
3) Additionally, all transformers:
   a) Top oil temperature dial thermometer.
   b) Liquid oil level gauge.
   c) Vacuum-pressure gauge.

D. **Labeling**

1) Compartment Bays. Per Figures 4 A&B herein, the designations "HV SIDE" and "LV SIDE" shall mark the HV and LV compartments; located on the faceplate near top center of each.
2) Devices. Accessory devices and gauges shall be marked **per Figures 4 or 5,** herein, with the following designators:

PRV	Pressure Relief Valve	OTG	Oil Temperature Gauge
OLG	Oil Level Gauge	VPG	Vacuum Pressure Gauge

12. HIGH-VOLTAGE AND LOW-VOLTAGE TERMINALS

A. Faceplate Arrangement

The transformer front wall shall be dead-front design having the HV and LV terminals and parking stands located in accordance with ANSI C57.12.26, Figure 5A, Specific Dimensions for Radial-Feed Transformers; with modifications herein described and depicted by **Figures 4 and 5**, herein.

B. Bushing Wells

For Item ID# 155795 only, for the HV compartment only, per **Table 5**, herein, six (6) approved replaceable stud, universal bushing wells shall be provided; thermo set epoxy or thermoplastic, straight well style, shielded with ground provision; meeting all applicable requirements of ANSI/IEEE 386.

C. Bushing Inserts

For Item ID# 155795 only, for the HV compartment only, per **Table 5**, the Manufacturer shall

provide six (6) 200 Amp, loadbreak bushing inserts. Bushing inserts shall be suitable for cable system connection with loadbreak separable insulated connectors having the following ratings:

1) 15.2 kV phase to ground and 26.3 kV phase to phase for 25 kV GY class transformer primaries (125 kV BIL). Bushing inserts to be vented on 25 kV and 15 /25 kV rated transformers and are required to meet all applicable requirements of ANSI/IEEE 386.

   a) Bushing inserts shall be grounded to transformer using #14AWG copper in accordance with bushing manufacturer's requirements.

   b) Transformers shall be shipped with dust covers on the bushing inserts.

D. Integral Apparatus Bushings

For both the HV and LV there shall be provided in each compartment, per Table 5 herein, three (3) approved removable, deadbreak universal integral bushings; thermoset epoxy or thermoplastic, inline style for use under oil, replaceable threaded copper stud, shielded with ground provision, and with mating clamp-gasket assembly; meeting all applicable requirements of ANSI/IEEE 386.

TABLE 5 - BUSHING RATINGS

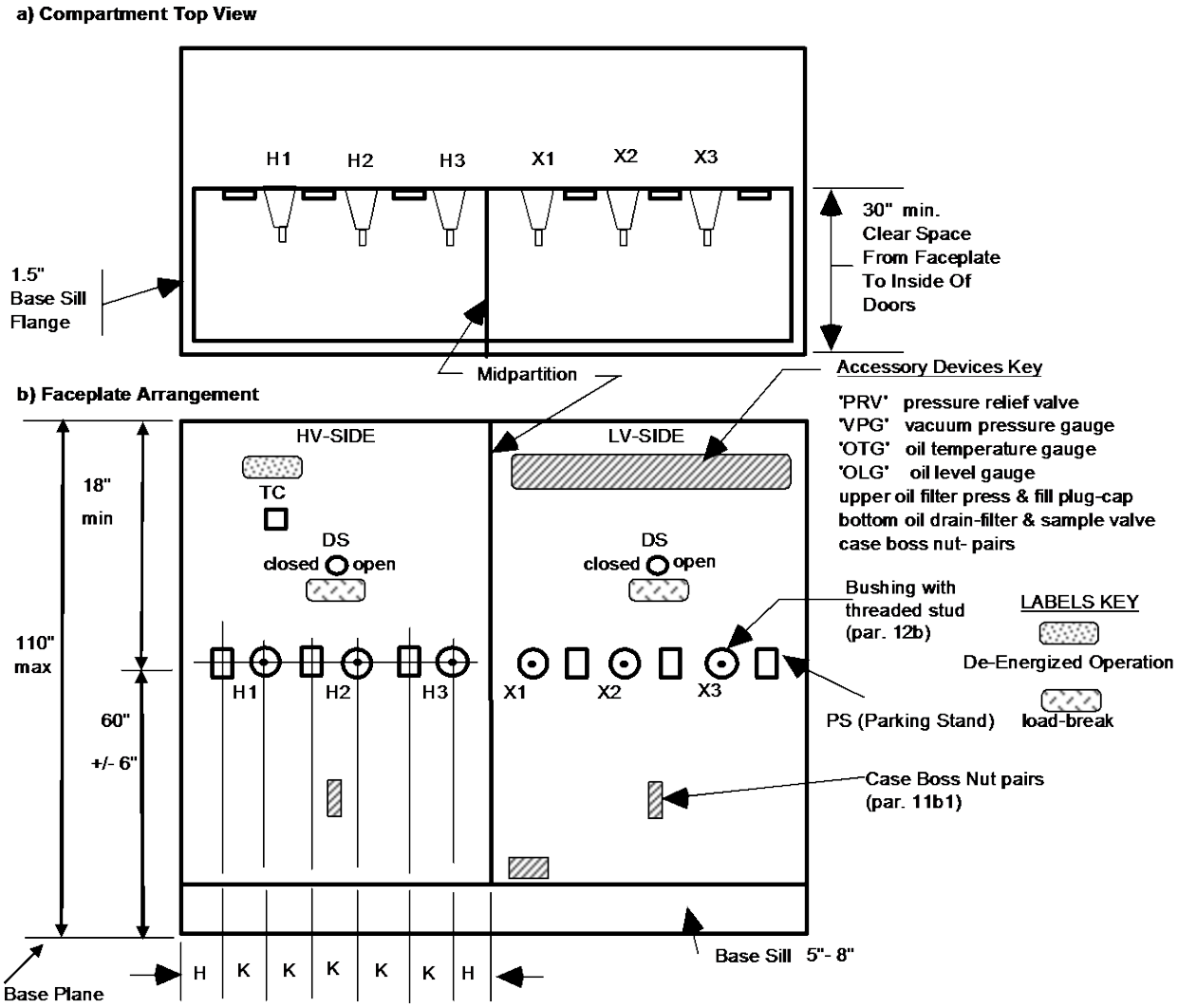
<table>
<tr><th colspan="2">System Operating</th><th colspan="4">Connector Ratings</th></tr>
<tr><th>Voltage (kV)</th><th>Nominally Classed</th><th>KVA</th><th>Voltage (kV)</th><th>Current (A)</th><th>BIL (kV)</th></tr>
<tr><td>4160 GY/2400</td><td rowspan="2">15kV</td><td rowspan="2">2500</td><td rowspan="3">8.3/14.4</td><td rowspan="3">600</td><td rowspan="3">95</td></tr>
<tr><td>14,400 Delta or 13200 GY/7620</td></tr>
<tr><td>4160 GY/2400</td><td rowspan="2">3750</td></tr>
<tr><td>24940 GY/14400</td><td>25kV</td><td>15.2/26.3</td><td>200</td><td>125</td></tr>
<tr><td>4160 GY/2400 LF</td><td rowspan="3">15 kV</td><td rowspan="3">5000</td><td rowspan="2">8.3/14.4</td><td>1200</td><td rowspan="2">95</td></tr>
<tr><td>7200 Delta</td><td>900</td></tr>
<tr><td>13200 GY/7620</td><td rowspan="2">15.2/26.3</td><td rowspan="2">600</td><td rowspan="2">125</td></tr>
<tr><td>24940 GY/14400</td><td>25kV</td><td>5000 - 10000</td></tr>
</table>

1) Clamping. Bushings shall be **externally clamped** with a stainless steel, 3 or 4 hole-bolted and gasketed clamp; and made **replaceable** with extensible lead connections **FULLY** accessible externally and without requiring access through the tank interior.
2) Labeling. HV and LV bushings shall be labeled on the tank faceplate (H1, H2, H3, X1, X2, X3) meeting requirements of **Figures 4 or 5**, herein.
3) Caps. Protective shipping caps shall cover bushings and threaded studs.

E. Parking Stands

Three (3) approved parking stands shall be provided for each HV and LV bushing arrangement; bracket or wall mounted, and positioned as shown in **Figures 4 or 5,** herein.

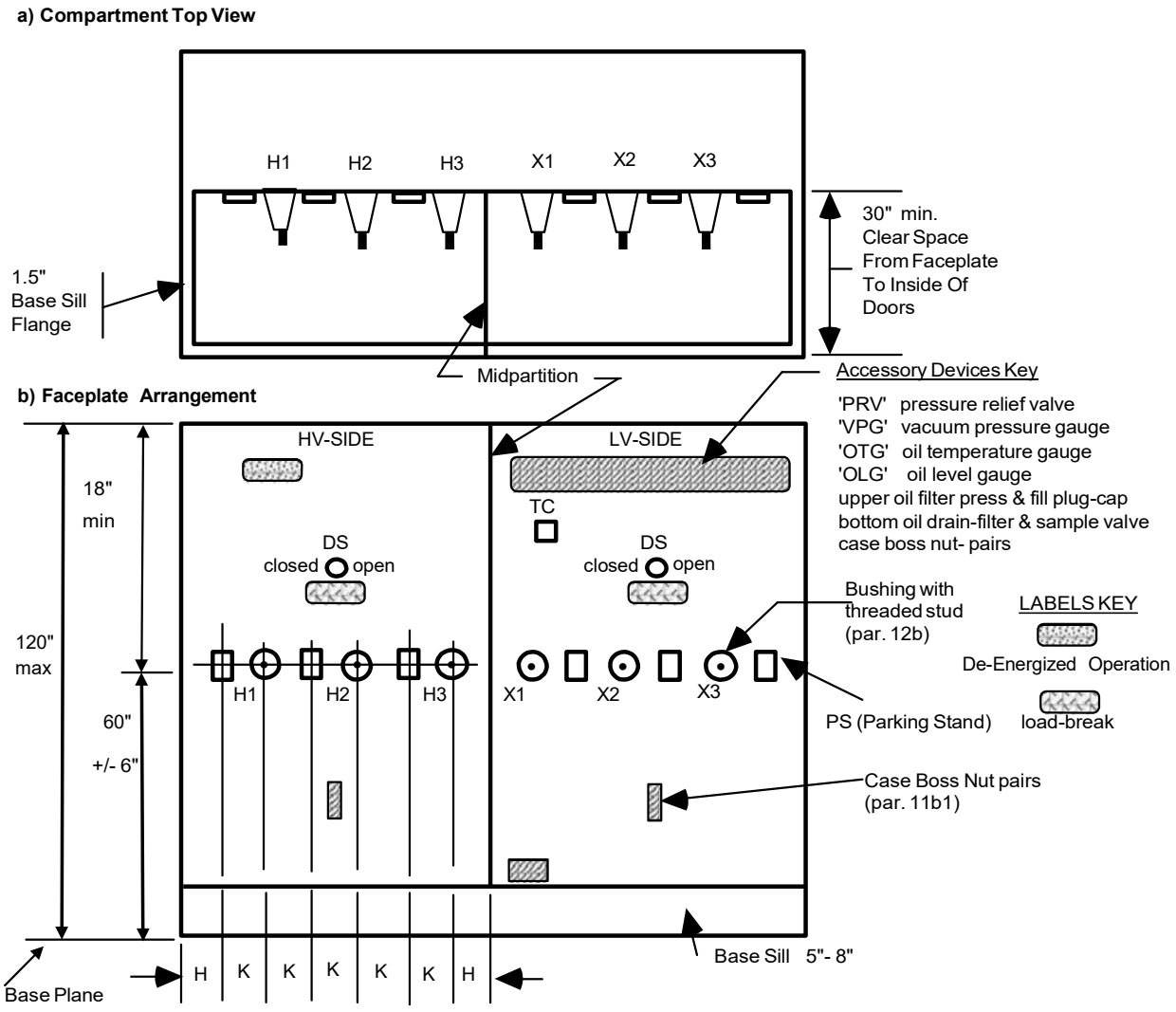
FIGURE 4 – 2500 kVA FACEPLATE AND COMPARTMENT CONFIGURATION



H (min)	K
5.5"	6.5"

(1) Tolerance = 0.25" all dimensions.
(2) Locate Accessories in shaded areas
(3) LV is mirror of HV arrangement.

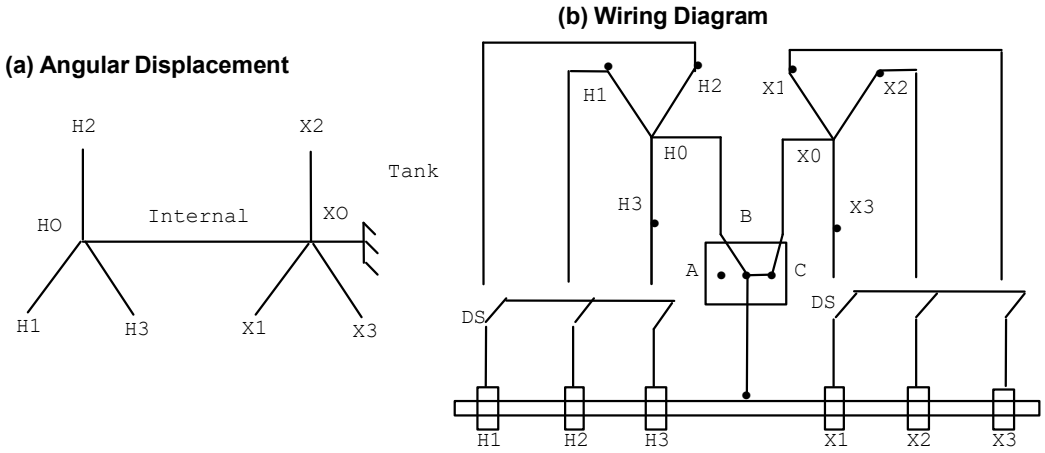
FIGURE 5 – 5000 & 10000 kVA FACEPLATE AND COMPARTMENT CONFIGURATION



H (min)	K
5.5"	6.5"

(1) Tolerance = 0.25" all dimensions.
(2) Locate Accessories in shaded areas
(3) LV is mirror of HV arrangement.

FIGURE 6 – WINDING SCHEMATIC



13. WINDINGS AND ELECTRICAL

A. Core - Coil. The core design shall be **five-legged** construction (single phase cores). Coils shall be two-winding design (not autotransformer).

B. Short Circuit Withstand, Thru-Fault. Transformers shall be designed for reliable performance against severe through-fault duty. Units are required to be essentially self-protecting from any through-fault and comply with short-circuit withstand and testing per: ANSI C57.12.00-Sect. 7, C57.12.90-Sect. 12 and Part II; and C57.109.

1) Tests shall be performed with **more severe** asymmetric current in excess of the test code requirement.
2) Units shall be **short circuit withstand certified**; and have passed full dielectric tests at the 100% level, including impulse tests, before and after short circuit.
3) Units shall meet the criteria listed in ANSI C57.12.90, Sect. 12.5 for **proof of satisfactory performance**.

C. Impedance and Regulation. As measured on the rated voltage connection, the percent impedance voltage shall be as given in **Table 1,** herein. Range tolerance is absolute minimum and maximum impedance values. Regulation shall not exceed the values given in **Table 1**, herein.

D. Winding Schematic. Figure 6a and 6b, herein, indicates:

1) Angular displacement, per ANSI C57.12.26, Figure 10(b).
2) Terminal connections and markings, per ANSI C57.12.70.
3) Neutral Connections. The HV and LV neutrals (HO and XO) shall be connected internally together and to the tank interior, with provision for opening the connection for testing. This shall be done as indicated in **Figures 6a and 6b**, herein.
   a) The terminal block shall be securely mounted and positioned for ready access through the tank handhole.
   b) The lead to the tank wall shall be electrically and mechanically secure for fault conditions.
   c) All units shall be shipped with the jumper in the "B-C" position.
   d) The nameplate schematic shall indicate the connection requirement.

14. TAPS AND TAP CHANGER

A. **Qualification of Under Oil Components in Envirotemp® FR3™ Dielectric Fluid** (CPS - October 16, 2009)
FR3 Filled Transformers – Cold Ambient Performance and Mechanical Operation of No-Load Switches
Cold start-up operation:
All under-oil no-load switches (tap changer and dual voltage) shall be capable of operating when the Envirotemp FR3 fluid temperature is -20°C (-4°F).

B. Taps shall be made on the HIGH voltage winding only, but the Nameplate shall be referenced to the 13200 GY/7620 winding, with seven J-Taps at A=8170, B=7970, C=7794, D=7620, E=7413, F=7200 & G=7020, which is one roughly 2.5% tap above & below the three 15 KV base voltages, and rated for full kVA capacity; 6-Taps Down at A=14,400, B=13,800, C=13,500, D=13,200, E=12,840, F=12,470 & G=12,160 DELTA, WHICH IS ONE 4.17% TAP AND FIVE ROUGHLY 2.5% TAPS, ALL DOWN from the Base Voltage of 14,400 DELTA; or Saddle (Split) Taps with Two 2-1/2% TAPS Above and Below the Rated Base Voltage.

C. An externally operated tap changer shall be located inside the HV compartment of the 2500 kVA unit and inside the LV compartment of the 5000 kVA unit, so as not to be blocked by cables and parking stands. Refer to **Figures 4 or 5**, herein.

D. The gang-operated tap changer shall be hook-stick operable and **designed to be operated de-energized**.

E. The tap changer mechanism shall snap into position at each setting, and be visibly indicating from 2 feet. Provision shall be made for assuring that accidental operation of the tap changer will not occur.

F. Labeling. The tap changer shall be positively identified and labeled on the faceplate, per **Figures 4 & 5**, herein, designated by "**TC**". Markings shall indicate **de-energized operation**; and tap positions in **actual voltage**, space permitting - otherwise positions shall be indicated to correlate as listed on the nameplate.

15. FUSING

A. No overcurrent fuse protection shall be provided.

B. Operating characteristic curves of external protective devices must be coordinated with comparable curves applicable to the transformers that relate duration and fault magnitude to withstand capability. **Protection curves reflecting both thermal and mechanical damage considerations shall be provided individuality for the different transformer sizes.** Reference to ANSI/IEEE C57.109.

16. ARRESTERS

All Three-Phase, Pad-Mounted STEP-TIE Transformers, shall have no arresters.

17. DISCONNECT SWITCHES

Qualification of Under Oil Components in Envirotemp® FR3™ Dielectric Fluid (CPS - October 16, 2009). FR3 Filled Transformers – Cold Ambient Performance and Mechanical Operation of No-Load Switches

A. **Cold start-up operation:**
All under-oil no-load switches (tap changer and dual voltage) shall be capable of operating when the Envirotemp FR3 fluid temperature is -20°C (-4°F).
All under-oil loadbreak devices shall be capable of operating under load when the Envirotemp FR3 fluid temperature is -20°C (-4°F).

B. As depicted in **Figure 5b**, herein, the transformer HV and LV windings shall each be provided with a hook-stick operable, three-phase, two-position, under-oil loadbreakable switch. Switches shall perform 'open' and 'close' functions. Switch ratings are indicated in Table 6, herein.

1) The switches shall be located one each in the HV and LV compartment and above the bushings, per **Figures 4 & 5**, herein.
2) Switches shall snap into position at each setting.
3) Switches shall be sealed through the tank wall to prevent oil leakage.
4) Labeling. The switches and positions shall be positively identified and labeled per **Figures 4 & 5,** herein; designated **'DS"**, **'CLOSED'**, and **'OPEN'**, respectively.
5) The nameplate schematic shall indicate the switches in the wiring schematic.

TABLE 6 - SWITCH RATINGS

KVA	2500	2500 & 5000	5000 & 10000
Winding Rating	**2,400**	**7,620**	**14,400**
Voltage, kV, phase-phase, nominal	14.4	14.4	26.3
Voltage, kV, phase-ground, maximum	8.3	8.3	15.2
Basic Impulse Withstand, kV	95	95	125
60 HZ, 1 min. Withstand, kV	40	40	40
Continuous Current, Amps, Minimum	600	600	300
Loadbreak, Amps	600	600	300
Momentary, 10 HZ, Fault Withstand, Amps	12,000	12,000	12,000
Two (2) second Fault Withstand, Amps	12,000	12,000	12,000

18. INSULATING - OIL

A. MINERAL-OIL

1) The insulating oil used shall meet ASTM 3487 for **Type II oil** and manufacturers' own insulating oil specifications as minimum requirements. It shall be certified to contain two parts per million or less PCB and no inorganic chlorides or sulfates as tested per ASTM D4059.
2) The insulating oil shall be handled in accordance with IEEE C57.106.
3) The nameplate of each transformer shall be stamped with the PCB status statement per Section 9.B.2., herein.

B. ENVIROTEMP FR3 FLUID FILLED TRANSFORMERS

1) This specification describes a non-toxic, fire resistant, bio-based natural ester dielectric fluid. It is intended for use in electrical equipment as a high fire point insulating and cooling medium.
2) The fluid shall be a bio-based biodegradable electrical insulating and cooling liquid. The base fluid shall be 100% derived from edible seed oils. The performance enhancing additives shall be food grade.
3) It shall be certified to contain two parts per million or less PCB.

19. ELECTRICAL TESTING

A. Required Tests. Testing and calculations for distribution class transformers shall be conducted in compliance with the most recent editions of ANSI C57.12.00, C57.12.26, C57.12.90, and NEMA TR1.

1) **Production Tests**. All tests per ANSI C57.12.26-Par. 6 shall be performed per ANSI C57.12.00-Table 16. Dielectric testing shall include both the Applied and Induced Potential tests (refer to Par. 12d3 herein for neutral connection scheme); and Full Wave Impulse test. See 'Additional Special Tests', Section. 18.A.3., herein.

2) **Design Tests**. All tests per ANSI C57.12.00-Par. 8.2, Table 16 shall be performed.

3) **Additional Special Tests**. To be run as individual **design** tests per ANSI C57.12.00-Par. 8.2.2, all "Other" tests listed in Table 16 shall be performed on a unit reflecting **current production design**. Full Dielectric tests at the 100% level, including Impulse tests, shall be run before and after Short Circuit Withstand.

B. Certified Test Results (Production and Design) Reporting. Tested and/or calculated results of all required tests, Section 18.A., herein, shall be certified and supplied electronically, as prescribed in Table 7 herein, to the Alliant Energy Electrical Standards Engineer for all transformers within 30 days of each shipment or **quarterly for blanket contract** shipments. . Certified Test Reports shall include the following:

Mailing Address:

Transformer Standards Engineer
Electrical Engineering Standards
Alliant Energy
16th Floor - Alliant Tower
200 1st Street S.E.
Cedar Rapids, IA 52401-1409

1) **Testing and Informational Requirements**. Certified Testing and Reporting shall incorporate the following:

a) Identification Information.

(1) Manufacturer name
(2) Transformer Type (step-tie pad-mount, STPAD3)
(3) kVA and Voltage Ratings
(4) Serial Number (list separately for each transformer)
(5) Alliant Energy Material Specification Number and Issue Date
(6) Alliant Energy Purchase Order Number (including the release number)
(7) Alliant Energy Item ID Number

b) Production Tests.

(1) Excitation (Core loss, No-Load) Losses at 85°C
(2) Winding (Coil, Load loss) Losses at 85°C
(3) Total Losses at 85°C (Excitation + Winding losses)
  (a) The basis for the determination of transformer losses represented by test shall be the excitation loss (no-load, core) and the total losses (total = excitation + winding losses) at 85°C.
  (b) The tested losses of a transformer, or transformers, of a given kVA rating on a given purchase order shall meet the requirements of ANSI/IEEE C57.12.00, Par. 9.3, Table 18.
(4) Percent Regulation at 85°C at 85°C for 0.8 pf and 1.0 pf.
(5) X/R at 100% E
(6) Percent Impedance at 85°C
(7) Weight
(8) Core Construction.
(9) Core Material. (10)Full wave impulse test

c) Design Tests. (for each kVA design)

(1) Audible Mechanical Noise levels shall not exceed those defined in Table 0-2 of NEMA TR1-0.05.
(2) Radio Influence Voltage (RIV) levels shall not exceed 100 microvolts as defined in NEMA TR1-0.03.A.
(3) Short-circuit withstand capabilities in accordance with ANSI C57.12.00 and ANSI C57.12.90.

2) **Quarterly Reports**. Certified Test Data shall also be supplied electronically, on a quarterly basis, in Microsoft Excel format. File format is prescribed in Table 7, herein.

TABLE 7 - TEST DATA FILE RECORD LAYOUT

	Description	Format	Start Col	Field Size	Sequence	Example
1	Serial Number	Alphanumeric	1	12	1	91GY7003
2	Operating Company	Character	13	22	2	IP&L or WP&L
3	Requisition Number	Alphanumeric	35	16	3	91BA42
4	Catalog Number	Alphanumeric	51	14	4	PM21876
5	Quoted No-Load	Numeric	65	6	5	15000
6	Quoted Load	Numeric	71	6	6	75000
7	Quoted Total	Numeric	77	6	7	90000
8	Core Loss Factor	Numeric	83	5.3	8	403
9	Wind'g Loss Factor	Numeric	88	5.3	9	1791
10	P.O. Number	Alphanumeric	93	16	10	GO91817
11	Shipping Date	Character	109	6	11	YYMMDD
12	Tested No-Load	Numeric	115	8.2	12	14984
13	Tested Load	Numeric	123	8.2	13	74727
14	Tested Total	Numeric	131	8.2	14	89711
15	Tested %IZ	Numeric	139	4.2	15	575
16	Tested %Exciting	Numeric	143	4.2	16	38
17	Material ID Number	Character	147	15	17	123456
18	HV Description	Character	162	35	18	24940GY/14400
19	LV Description	Character	197	25	19	12470GY/7200
20	Qty on P.O.	Numeric	222	4	20	28
21	KVA	Numeric	226	5.1	21	25000
22	Phase	Numeric	231	1	22	3
23	Transformer Type	Alphanumeric	232	8	23	STPAD3
24	Quote Inquiry No.	Alphanumeric	240	10	24	QI91740
25	Ref. Temperature	Numeric	250	2	25	85
26	Frequency (HZ)	Numeric	252	2	26	60
27	Mfgr. Name ID	Character	254	2	27	CP
	Record Length = 257; * Column 256 = End of Line; Column 257 = Carriage Return					

Notes:

1. No periods, commas or quotes delimiters.
2. Alphanumeric fields shall be left aligned within their field size; if the descriptor length is less than the field size, the remainder shall be filled in with blank spaces.
3. Numeric fields shall be right-aligned within their field size.
4. For information not available for any given field, the field size must be filled with blank spaces.
5. Missing fields and null fields are not allowed without prior approval.

20. PACKING AND SHIPPING

A. Transformers shall be shipped on an open flatbed trailer packaged on pallets. Units are to be securely mounted on skids or similar construct, capable of supporting the unit and providing for lift-truck handling without damage to the bottom surface; dimensions of which are to exceed the finned perimeter (if fins are present) of the transformer; and substantially constructed to support the unit and provide for lift-truck handling.

B. Pallets shall have a minimum fork lift clearance of 3.5 inches. The minimum distance between the inside of the stringers shall be 22 inches. The units shall be secured to the pallet so as not to damage painted surfaces.

C. Shipping and transportation shall be as stipulated in the purchase order.

D. Serial numbers of all units shipped against any purchase order, or release thereof, shall be provided to the Buyer along with the invoicing of the order.

21. SPECIFICATION REQUIREMENTS

A. **Specification Compliance.** Written guarantee that all units furnished under this specification are of first class material and workmanship throughout, and meet all requirements of this specification. **Any variances shall be stated in writing as exceptions to this specification.**

B. **Production Approval Drawings** shall be provided on all first time built items all items listed in Section 5 - Exceptions & Deviations, herein, called for in the bid invitation, and shall include the following information with sufficient detail for making pre-bid appraisal:

1) Manufacturer name.
2) Drawing number dated with latest revision.
3) Applicable kVA size(s) and voltages.
4) Applicable Alliant Energy Material Item ID number(s).
5) Applicable Alliant Energy Material specification number.
6) Respective style number cross-referenced to drawing number.
7) Features listing including options and accessories provided (i.e., mounting bracket type, cooling fins (quantity), taps [yes/no], Nameplate type, etc.)..
8) Makes and model numbers of all major devices and accessories.
9) Nameplate layout and data (including wiring diagram).
10) Full dimensional data of tank fabrication and bushing arrangements.
11) Position and dimensions of handhole(s), radiators, and lift provisions.
12) Approximate weights with and without oil, gallons of oil.
13) Core Construction and Core Material.

NOTE: Only one of the bid quotation packages needs a set of production approval drawings.

C. **Routine (Production) Tests.** A description of production line electrical tests performed on a completed transformer shall be provided. Minimum acceptance test values shall be included.

D. Quote Information. The following required electrical and mechanical guaranteed data must be provided:

1) Excitation (Core loss, No-Load) loss at 85°C.
2) Winding (Coil, Load loss) loss at 85°C.
   a) Total losses at 85°C. (Excitation + Winding losses)
   b) The basis for the determination of transformer losses represented by test shall be the excitation loss (no-load, core) and the total losses (total = excitation + winding losses) at 85°C.
   c) The tested losses of a transformer, or transformers, of a given kVA rating on a given purchase order shall meet the requirements of ANSI/IEEE C57.12.00, Par. 9.3, Table 18.
3) Percent regulation at 85°C for both 0.8 pf and 1.0 pf.
4) X/R at 100% E
5) Percent impedance at 85°C.
6) Weight
7) Core Construction.
8) Core Material.

E. Safety Data. OSHA material safety data for the insulating oil shall be provided.

F. Upon receiving an order, percent exciting current and X/R data at 100% E, core-coil design type, total weight with oil, gallons of oil and oil specification with list of approved suppliers shall be supplied to the Transformer Engineer for each Alliant Energy Item ID number on the order prior to the first shipment

G. Record drawings shall be supplied for each of Alliant Energy's Item ID Numbers purchased, with a revised drawing furnished, following any approved design changes. Drawings shall be sent to the Transformer Standards Engineer.

H. All units supplied outside the blanket requirements shall be subject to this specification in its entirety.

1) Drawings for production approval shall be submitted for these units prior to their release to production. These drawings will be reviewed as stated in Section 20.B.
2) Certified test data shall be submitted for these units as stated in Section 18.B.
3) **Any variances from this specification shall be communicated as exceptions, in writing**.

I. All inquiries regarding this specification shall be referred to Alliant Energy's Transformer Standards Engineer, and all purchasing and account inquiries to Alliant Energy's Transformer

J. Special Orders. All units supplied outside the annual blanket requirements shall be subject to this specification in its entirety.

1) Drawings for production approval shall be submitted for these units prior to their release to production.
2) Certified test data is required on these units per Section 18, herein.

(END)