



Document Title:

**Loop Feed Three Phase Submersible Distribution Transformers**

Document Type:

**Specification**

Engineering Type

**Equipment Specification**

Document No.:

**4350.012**

Department

**Distribution**

Version:

**03**

Effective Date:

**Dec 2, 2024**

**Shared document with: N/A**

*\*Select the Departments impacted by the document*

**For others, specify here**

**Author**

Jose R. Torres Irizarry, EIT (14613)  
Engineer 2, Distribution Standards & Materials

Signature and Date

Nov 21, 2024

**Reviewer**

Miguel J. Rios López, PE (Lic. 16636)  
General Engineer, Distribution Standards & Materials

Signature and Date

Nov 21, 2024

**Reviewer**

Rodolfo A. Flores Ortiz, PE (Lic. 27131)  
General Engineer, Distribution Standards & Materials

Signature and Date

Nov 21, 2024

**Approver**

Ricardo Castro Gómez, PE (Lic. 12135)  
Manager, Distribution Standards & Materials

Signature and Date

Dec 2, 2024

**Management Approval (If apply)**

**Approver**

Name  
Position

Signature and Date

N/A

**Related/Referenced Documents**

N/A

**Version History**

Version	Date	Revision Comments
01	Dec. 21, 2021	Initial release.
02	Oct. 11, 2022	Added items 012-83611 and 012-09048. Low voltage bushings requirements modified.
03	Nov. 21, 2024	General format modifications, Sections 3, 4, 8, and 9 modified, and sections order rearranged.



### Item Version History

Warehouse Catalog #	Asset Suite #	Version	Date
012-83611	83611	5	Nov. 21, 2024
012-09048	59239	5	Nov. 21, 2024
012-08982	59236	5	Nov. 21, 2024
012-08941	59233	5	Nov. 21, 2024
012-08958	59234	5	Nov. 21, 2024
012-08966	59235	5	Nov. 21, 2024



## 1. Introduction

This is a general specification that covers the loop feed three phase submersible transformer to be used in the distribution system in Puerto Rico. Further information will be provided by LUMA Energy at the time of order placement and will provide information on site specific conditions, quantity, and other requirements. This document includes the general electrical and mechanical characteristics of the equipment/material.

## 2. Special Requirements

Samples shall be furnished as requested by LUMA Energy. Vendors that have supplied this equipment/material to LUMA on previous orders will not have to furnish samples at bid opening. The equipment/material will be received at LUMA's general warehouse (011) at Palo Seco, Puerto Rico. Shipping will include transportation and unloading at the indicated warehouse.

## 3. Literature

- 3.1. Descriptive and technical literature must be supplied by the vendor at time of bidding. This literature must include, but is not limited to details of material, drawings, documented testing, and instructions for use and installation. **The literature must be an official document from and certified by the manufacturer.** Failure to submit documents on time and duly certified by the manufacturer will cause bidder disqualification.
- 3.2. If required by LUMA, final drawings and documentation shall be submitted by the vendor before the manufacturing and shipping process for approval.

## 4. Compatible with

- 4.1. Eaton and Vantran.
- 4.2. These models are examples of the equipment/material described in this document and do not represent a preference. LUMA will evaluate equally any model not listed here during any acquisition event.

## 5. Markings

- 5.1. Containers shall be marked outside with LUMA Energy purchase order and item number.
- 5.2. Transformers shall be marked on the cover with the point of delivery and purchase order number using a removable label. In the case of LUMA the point of delivery shall be the district, or any other facility designated by LUMA.
- 5.3. Packaging labels and tags shall be waterproof.

## 6. Packaging

- 6.1. Transformers shall be shipped completely assembled except for items of equipment which must be removed to meet transportation clearances or for protection from damage. At the time of shipment, the supplier shall promptly inform the purchaser concerning the accessories which were removed for this purpose. These items shall be in the same shipment as the transformer and when the order covers more than one transformer, the unmounted equipment/accessories shall be boxed separately for each transformer and marked accordingly.
- 6.2. Each unit shall be banded to a two-way entry disposable pallet of the manufacturer's own design. The pallet shall be of such dimensions as to provide a minimum of two inches (2") clearance at the transformer's widest outside measurements, on all four sides. It shall provide a minimum of four inches (4") of fork under clearance.
- 6.3. The transformer shall be banded to the pallet, using non-metallic banding, to prevent any movement of the unit during transit, while allowing the unit to be handled by sling or fork truck without removing the banding.
- 6.4. LUMA shall allow the use of metallic banding ONLY if such banding is protected in the places in which the band is in direct contact with the transformer tank.
- 6.5. The banding method to be used shall be submitted by the awarded bidder for LUMA Energy's approval.

## 7. Number Per Package (Logistics)

One (1) unit per standard package or as required by LUMA Energy.

## 8. Acceptance Criteria and Test

- 8.1. Tests required shall be certified by qualified external laboratories.
- 8.2. Product shall be manufactured in accordance with the latest issue below (section 8.3). When conflicts occur between purchaser's specifications and the latest issue below, the purchaser's specification shall prevail.
- 8.3. Latest applicable codes, standards, and other regulations:
  - a. C57.12.00: IEEE Standard General Requirements for Liquid- Immersed Distribution, Power and Regulating Transformers.

- b. C57.12.10: IEEE Standard Requirements for Liquid-Immersed Power Transformers.
  - c. C57.12.24: IEEE Standard for Submersible, Three-Phase Transformers, 3750 kVA and Smaller; High-Voltage, 34,500GrdY/19,920 Volts and Below; Low Voltage, 600 Volts and Below.
  - d. C57.12.32: IEEE Standard for Submersible Equipment - Enclosure Integrity.
  - e. C57.12.35: IEEE Standard for Bar Coding for Distribution Transformers and Step-Voltage Regulators.
  - f. C57.12.70: IEEE Standard for Standard Terminal Markings and Connections for Distribution and Power Transformers.
  - g. C57.12.80: IEEE Standard Terminology for Power and Distribution Transformers.
  - h. C57.12.90: IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and IEEE Guide for Short-Circuit Testing of Distribution and Power Transformers.
  - i. C57.91: IEEE Guide for Loading Mineral-Oil-Immersed Transformers and Step-Voltage Regulators.
  - j. NEMA TR1: Transformers, Regulators and Reactors.
  - k. ANSI Z535: Sign Standards for Utility Installations.
- 8.4. If any other standards different from the ones indicated in this document are used, the supplier must provide information showing compatibility with the required ones.
- 8.5. Samples of typical routine and design tests for the units to be quoted shall be submitted together with the drawings for the approval of LUMA Energy. The bidder shall submit a written certification stating that all tests have been performed according to the latest codes, standards, and regulations to provide a product of quality. In addition, the brand and models of the equipment to be used for those tests must be submitted.
- 8.6. All tests shall be performed in accordance with ANSI/IEEE C57.12.00 and C57.12.90.
- 8.7. Routine tests that SHALL be performed on EACH UNIT are the following:
- a. Temperature at which the tests are performed
  - b. Voltage ratio
  - c. Polarity
  - d. Phase relationship
  - e. Core losses (no-load losses)
  - f. Excitation current
  - g. Winding losses (load losses)
  - h. Leaks

- i. Impedance
  - j. Applied potential
  - k. Induced potential
  - l. Impulse tests
- 8.8. Typical design tests data include the following:
- a. Insulation resistance
  - b. Power factor
  - c. Temperature rise
  - d. Over excitation
  - e. Radio interference
  - f. Oil tests
  - g. Noise tests as per NEMA TR1 and/or ANSI C57.12.90, latest revision.
  - h. Tank pressure withstand
  - i. Temperature at which the tests are performed
  - j. Winding & core insulation resistance
- 8.9. Any exceptions to the tests mentioned in 8.7 shall be specified at bid opening.
- 8.10. The tests mentioned at 8.7 shall be performed on the fully assembled unit at the manufacturer's location. TESTS SHALL BE PERFORMED ON THE UNITS WITH ALL ITS ACCESSORIES AND PARTS INSTALLED.
- 8.11. The table with the parameters of resistance (%R), reactance (%X), impedance (%Z), and weight is attached for the bidders to include the specific values for each transformer and certified by manufacturer's test engineer (Appendix 2). LUMA does not accept the certificate by representing sales or marketing manager or group.
- 8.12. Routine tests - The contractor, project owner or person in charge of the project shall be responsible for providing LUMA Energy with the results of the tests mentioned on Section 8.7 above by an ORIGINAL document CERTIFIED by the manufacturer of the transformers. Routine tests shall be done for each of the units installed in the project. Test Report data shall include the tested X/R Ratio of each unit.
- 8.13. Design tests - The contractor, project owner or person in charge of the project shall submit the design tests mentioned on Section 8.8 CERTIFIED by the manufacturer of the transformers, if requested.
- 8.14. These documents shall be submitted to LUMA Energy BEFORE delivery of the transformer and shall be part of the project file.



8.15. If requested, the buyer or his representative shall be given free access to the manufacturing facilities to inspect and report on work in all phases of design, manufacture, examination, and testing.

**9. Description**

9.1. The submersible transformers are used to provide the final voltage transformation in the electric power distribution system and to step down the voltage used in the distribution lines to the level used by the customer in their home, businesses, and commercial buildings.

9.2. These transformers must be suitable to be installed in underground vaults exposed to water and humidity.

9.3. The transformer shall be a 60 Hertz oil immersed distribution transformer with an average winding rise of 65°C. The transformer shall consist of a tank, core, bushings, insulating oil, tap changer, etc.

9.4. The transformer shall be designed in accordance with this specification and shall have one of the following kVA ratings:

KVA RATINGS	
<b>150</b>	<b>300</b>
<b>500</b>	<b>750</b>

All kVA ratings are continuous and shall be based on not exceeding either a 65°C average winding temperature rise of an 80°C hot spot temperature rise. LUMA Energy reserves the right to specify units with different capacities in kVA.

9.5. Voltage Ratings and Connections

a. Primary voltage and basic insulation level (BIL) shall be as follows in accordance with IEEE C57.12.00:

PRIMARY VOLTAGE (V)	BIL (KV)
<b>13200 Delta</b>	<b>95</b>
<b>8320 Delta</b>	<b>75</b>

b. Secondary voltage rating and basic insulation level (BIL) shall be as follows:

SECONDARY VOLTAGE (V)	BIL (KV)
<b>208Y/120</b>	<b>30</b>
<b>120/240</b>	<b>30</b>

l. Refer to ANSI C57.12.24 for further information.

- m. The transformers shall be supplied with a high-power factor and low core and winding losses. Section 9.10 of this specification list the maximum losses allowed in the transformers per kVA. Note that the winding losses specified are corrected to 85°C.

#### 9.6. Painting

- a. Tank and covers shall be protected against severe environmental conditions and corrosion by means of an adequate process of painting. Must comply with ANSI C57.12.32.
- b. Paint shall be suitable for tropical severe climate conditions as per ANSI C57.12.32. The paint shall have a great retention of brightness and color in surfaces like aluminum and ferrous and non-ferrous materials. It shall be resistant, during long term, to ultraviolet rays, humidity, corrosion due to acids, salts, organic solvents, gases, and others. It shall comply with federal regulations on temperature and environment.
- c. The painting shall be light gray No. 70, Munsell Notation 5 BG 7.0/0.4.

#### 9.7. Nameplate

- a. The nameplate shall be mounted in such a manner that there are no sharp edges exposed. Shall be made of a corrosion resistant material such as stainless steel, aluminum, or copper. The material (aluminum or copper) used in each winding, date of manufactured, total weight, among all the other information as per ANSI C57.12.00 requirements, shall be shown on the nameplate.
- b. Nameplate C, as per ANSI C57.12.00.5.12, shall be used for transformers described in this specification.
- c. The information on the nameplate shall be engraved or stamped. Any of these two processes shall ensure legibility for the life of the transformer.
- d. The manufacturer's part number, if any, shall be on or adjacent to the nameplate. This number shall be a permanent marking and not a painted stencil. Numbers shall not be less than five-thirty-two inches (5/32") high.
- e. The nameplates shall include the true date of manufactured, month-year (example: 03-88). No code will be acceptable.
- f. The supplier shall provide one record nameplate for each transformer shipped.
- g. A sample of the nameplate in this section shall be submitted by the awarded bidder.

#### 9.8. Welding

- a. Welds to be used shall be in accordance with the material that will be welded and as per American Welding Society (AWS) 1.1 or latest revision.
- b. LUMA does not permit the use of externally clamped bolted devices on the top of the transformer. Only welded fittings for transformer attachment components are accepted.

- c. All welds at the exterior of the tank shall be continuous. It shall include the welding, **ON ALL SIDES**, of lifting lugs, mounting brackets, grounding provisions, etc., to prevent accumulation of humidity. Therefore, spot, tack, or skip welds are not acceptable for attaching hinges, brackets, grounding buses, mounting studs, etc.

#### 9.9. Core and Coil Windings

##### a. Core

- 1. The core shall be made from high quality grain-oriented silicon steel with flat, rolled, and low loss permeability laminations.
- 2. The core shall be made free of buckles and wave surface defects.

##### b. Windings

- 1. The windings shall be non-telescoping with high and low-tension coils assembly forming an integral unit.
- 2. Winding Polarization Index shall be 2.0 or more as per ANSI C57.125-2015
- 3. Luma priority is to ensure compliance with the DOE Efficiency Standards for distribution transformers. Alternatives can be considered if they adhere to these standards.

- c. The bidder shall specify the material of the primary and secondary windings in the bid offer.

- d. Noise: The design and construction of the transformer shall be such that the noise from the energized transformer and its accessories will be as low as possible in accordance with ANSI C57.12.24 and tested as per NEMA TR1 and/or ANSI C57.12.90.

#### 9.10. Transformer Losses and Bidding Procedure

- a. The bidder shall submit the no load losses at 20°C, load losses at 85°C full load and load losses at 55°C at 50% of load to calculate the efficiency and life cycle cost.
- b. The bidder shall specify the winding material of the primary and secondary at the bid opening.
- c. All losses information will be used to evaluate the life cycle cost (LCC) of each bidder according to the following formula,

$$LCC = (UC) + (\$8.95) * NLL + (\$4.73) * LL, \text{ where}$$

UC = unit cost (\$)

NLL = No load losses (W) at 20°C

LL = Load losses (W) at 85°C full load

- d. Shall follow Chapter II - Department of Energy (latest issue) 10 CFR PART 431 minimum requirements.
  - 1. The efficiency shall be no less than that required for their kVA rating in the table below defined at 50% of load with no load losses at 20°C and load losses at 55°C.

Energy Conservation Standards for 3Ø Liquid-Immersed Distribution Transformers	
kVA	Efficiency (%)
150	99.16
300	99.27
500	99.35
750	99.40

9.11. Tap Changer

- a. The tap changer shall be of the no-load rotating type with an externally operated handle designed for de-energized operation.
- b. The tap changer shall be located under the oil level with five (5) taps, including the nominal voltage tap as described below.

TRANSFORMER VOLTAGE	TAP RANGE ACCORDING TO ANSI C57.12.10
8320/4800	FOUR (4) 1/2% TAPS BELOW RATED PRIMARY VOLTAGE
13200	TWO (2) 1/2% TAPS ABOVE AND BELOW RATED PRIMARY VOLTAGE

- c. The tap changer shall have stops at each position to set the desired voltage.
- d. A label shall be placed below the tap changer indicating that the transformer must be de-energized prior to the operation of the tap changer.
- n. The tap changer shall be suitable to be operated with a hot stick.
- o. The tap changer shall be located at a place not exposed to possible damage due to the handling of the transformer.

9.12. Insulating Oil

- a. Each transformer shall be furnished with its tank filled with oil with a Polychlorinated Biphenyl (PCB) concentration of less than 1 PPM (NO-PCB). The nameplate shall indicate this compliance.
- b. For transformers that are sold in Puerto Rico through local distributors, a label shall be affixed to the transformer in the upper right corner indicating that the unit is a NO-PCB transformer. This label shall be of the same size as the “Peligro - Alto Voltaje” label described in Section 9.15.c.1 and 9.15.c.2.

The label shall have the same duration of the transformer under normal operating conditions.

- c. The insulating oil shall comply with ANSI/ASTM D3487, and LUMA Energy requirements. In addition, it shall comply with the following requirements:

1. 30 kV minimum breakdown voltage.
2. Neutralization number of 0.25
3. Viscosity:
  - a. 181.25 centistokes at 25°C as per ASTM D445-86.
  - b. 15.00 centistokes at 100°C as per ASTM D445-86.
- d. LUMA will only assess parameters that meet or surpass the D3487 standard.
- e. The bidder shall submit with its offer the following:
  1. Certificate stating that the transformers to be supplied to LUMA Energy will have a concentration of less than 1 PPM of PCB.
  2. Safety Data Sheet (SDS) of the oil.

#### 9.13. Pressure Relief Valve

The transformer shall be equipped with a pressure relief valve with the following characteristics:

- a. The body of the pressure relief valve shall be an internal fault detector type compatible to IFD Corporation model IFD Orca, 10PSI-A.
- b. The body of the pressure relief valve shall be bronze or stainless steel.
- c. Venting on rising pressure shall occur between eight (8) and twelve (12) psi. Resealing on falling pressure shall occur between five (5) and eight (8) psi.
- d. The valve shall have provisions for manual venting with the use of a live line hook stick.
- e. The valve shall be threaded into a smaller boss welded to the tank above the 140°C top oil level.
- f. The relief valve shall be situated so that such relief will be in a safe direction.
- g. The relief valve shall allow the pressure inside the tank to be released but not allow air to enter when the unit is cool or lightly loaded.

#### 9.14. Insulation

- a. The insulation shall be made with, at least, Class A (105°C) insulation system as per ANSI C57.12.80.
- b. The insulation tests shall be as per ANSI C57.12.90.
- c. Technical information on the insulation shall be submitted at bid opening.

#### 9.15. Additional Labels

- a. The labels shall have a margin of approximately 1/2" on each side.
- b. Each number and letter shall have a width between 0.75" and 1", and 2" of height.

- c. The transformer shall have the following labels made as per section 9.16 below:
1. A label in Spanish indicating “Peligro - Alto Voltaje”. This is a descriptive information. The information regarding this label shall be as specified by the regulatory agencies (ANSI, IEEE, etc.).
  2. This label shall be placed on the upper left corner of the transformer besides the NO-PCB label described in section 9.12.b. It shall be the same size as the NO-PCB label. Sizing shall be in accordance with ANSI Z535 Sign Standards for Utility Installations.
  3. A label indicating the kVA rating of the transformer shall be placed on the top of the transformer where it does not conflict with the placement of the bushings and other equipment.
  4. LUMA's Property Number  
This label shall be placed on the top of the transformer. The supplier must ask for the sequence of property numbers to the LUMA’s Distribution Material Section before shipment. See Appendix 4 for label details.
- a. All labels shall be provided and installed by the factory. Any other label not mentioned in this specification but necessary to comply with the regulatory agencies (ANSI, IEEE, etc.) requirements shall be included.

b. The following table summarizes the dimensions of the required labels:

SECTION	LABEL DESCRIPTION	WIDTH (IN.)		HEIGHT (IN.)	
		MIN.	MAX.	MIN.	MAX.
9.11.d.	TAP CHANGER	INDUSTRY STANDARD			
9.12.b.	NO-PCB	INDUSTRY STANDARD			
9.15.c.1.	“PELIGRO – ALTO VOLTAJE”	INDUSTRY STANDARD (Preferably of the same size as “NO-PCB” label)			
9.15.c.3.	KVA RATING	INDUSTRY STANDARD			
9.15.c.4.	PROPERTY NUMBER	12 (approx.)		4 (approx.)	
FOR DETAILS ON THESE LABELS REFER TO THE SECTIONS MENTIONED.					

#### 9.16. Thermal Transfer Polyester Label Characteristics

1. Substrate specifications
  - a. Material: Polyester
  - b. Shall resist heat, UV rays, oil, abrasion, acids, chemicals, solvent, moisture and humidity, cold, and tearing.
  - c. Temperature range: 0°C to 50°C (32°F to 122°F)
2. Adhesive specifications
  - a. The adhesive type shall be acrylic.

- b. Shall be compatible with dirt, high-energy and low-energy plastics, painted metal, polyethylene, metals and untreated metals, and irregular surfaces.
3. Color: The numbers will be black over a white base to assure legibility from about 35 ft.
4. The label shall last a minimum of 20 years when installed on the transformer under normal operating conditions.

#### 9.17. Tank

- a. The tank must adhere to IEEE Std C57.12.24-latest issue, ensuring that the entire unit—including the tank, sill, lifting lugs, cover, doors, hinges, hinge pins, nuts, bolts, and washers—is constructed from Stainless Steel 304L. The specified minimum material thicknesses are as follows:
  1. Tank Wall: 6.4 mm
  2. Cover: 9.7 mm
  3. Tank Bottom: 9.7
- b. entire unit including the tank, sill, lifting lugs, cover, doors, hinges and/or hinge pins, nuts, bolts, and washers, etc., shall be made of Stainless Steel 304L gauge 11.
- c. The supplier shall ship each of the transformers' main tanks with an internal nitrogen blanket of 2-3 PSI.
- d. Tanks characteristics:
  1. The transformer shall be suitable for outdoor use.
  2. The transformers shall be sized to fit a standard foundation 12'L x 6'W x 8'H underground transformer vault. See Section 10.1 for spacing inside the vault. The transformer size, clearances, and bushing arrangements shall conform to the drawings included with this specification (Appendix 5).
  3. Shall be suitable for mounting on flat surfaces.
  4. Lifting lugs and ground provisions permanently affixed.
  5. Grounding facilities shall consist of a tin-plated copper connector suitable for 2/0 AWG conductor welded to the tank.
  6. Stainless steel alloy grounding pads, NEMA 2-holes, shall be welded to the tank. The grounding pads shall be located on the top near the X-0 low voltage terminal and at the bottom, in the corner closest to the X-0 terminal.
  7. Constructed in accordance with the latest revisions of ANSI C57.12.32.
  8. No wood materials shall be used inside the tank.

9. The construction of the unit shall be such that it can be lifted skidded or slip into place on the mounting pad without disturbing the entrance cables.
10. Only transformers without cooling fins and radiators shall be accepted by LUMA. The drawings included with this specification describe the dimensions of the transformer without cooling fins and radiators.
11. Transformer designs, which minimize pocket and crevices where corrosion may occur, shall be preferred.
12. All external hardware such as transformer's corners, lifting lugs, padlock provisions, and jacking facilities, among others, shall be provided in such a manner that there are no sharp edges exposed.

9.18. High Voltage Bushings and Terminals

- a. Six (6) each cover mounted dead front welded in bushing wells arranged for loop-feed with high voltage stainless steel parking stands and 8.3/14.4kV load-break bushing well inserts.
- b. The transformer shall be supplied with six (6) removable load-break bushing inserts, all rated 200 amps, for three-phase loop-feed arrangement.
- c. The bushing wells shall be oriented so that the elbows can be operated with a hot stick.
- d. Primary bushing wells shall have a dust cover in place for shipment.

9.19. Low Voltage Bushings and Terminals

- a. The low voltage line and neutral bushings shall be an epoxy design and must be externally welded on. The neutral bushing shall be welded to the tank through a stainless-steel neutral ground pad.
- b. Three (3) cover mounted parallel connected low voltage bushing with 1-inch threaded studs and one (1) cover mounted parallel connected low voltage neutral bushings with 1-inch threaded studs and removable grounding strap shall be supplied.
- c. Four (4) mole connectors, specifically designed to fit 1-inch threaded stud bushings, will be supplied along with jam nuts and EPDM bushing covers. These connectors are rated for 1200 Amps and ensure compatibility with the **Homac system 125 series**, specifically model **FTU1-4N**, which features four outlets.
- d. Sixteen (16) force fit rocket sleeves for cable sealing shall be supplied. Shall be compatible with **Homac # CSN2011**.
- e. **Suppliers are required to notify Luma if they will not be supplying the Homac system #CSN2011.**
- f. Secondary bushings shall have adequate strength to support the cables and prevent oil leaks.

#### 9.20. Loop-Feed

- a. The transformer shall be equipped for loop-feed connection.
- b. Shall include incoming and outgoing load-break 200A bushing inserts.

#### 9.21. Protection

- a. The transformer shall be provided with three (3) drywell current limiting fuse canisters with current limiting fuses and one spare fuse.
- b. The fuses shall be current limiting type, externally replaceable, with interlock load break switch.
- c. Suppliers must inform Luma if they will not be providing the Drywell limiting fuse and suggest an alternative fuse option. LUMA will evaluate other options.

#### 9.22. Accessories

Transformers shall be provided with the following accessories:

- a. Temperature gauge on the top of the transformer.
- b. Liquid level gauge on the top of the transformer.
- c. Dial type thermometer on the top of the transformer.
- d. A pressure/vacuum gauge with a gas filling and sampling valve.
- e. One inch (1") minimum stainless steel fill valve.
- f. One inch (1") minimum drain valve.

### 10. Design Parameters

10.1. The transformer shall be sized to fit a standard foundation 12'L x 6'W x 8'H underground transformer vault (Appendix 5, images are not in scale). When installed, it shall comply with the minimum spacing distances between the transformer and the interior of the vault as follows:

- a. 21" (53.34 cm) from the highest bushing to the roof of the vault (height section).
- b. 19" (48.26 cm) on each side of the shortest side of the transformer (wide section).
- c. 32" (81.28 cm) on each side of the longest side of the transformer (long section).

10.2. Refer to URD-33 from the Underground Distribution Standards manual for further information.

10.3. Requirements for allowable design parameters and weights:



DISTRIBUTION TRANSFORMERS DESIGN PARAMETERS		
KVA	Max. Values %Z	MAXIMUM WEIGHT (LBS.)
150	3.50	4000
300	4.00	7000
500	5.00	8000
750	5.75	10000

## 11. Warranty

- 11.1. The supplier shall guarantee, for a period of twenty (24) months after delivery or twelve (12) months from installation and energizing by LUMA Energy, that the equipment supplied is free from defects in material and workmanship. The supplier shall be responsible for complying with this guarantee clause.
- 11.2. If, during the warranty period, the unit or its components are proved to be defective, the supplier shall replace or repair the unit at no cost to the buyer.
- 11.3. Any expenses by LUMA Energy due to the malfunction of the equipment during the guarantee period shall be invoiced to the contractor, project owner, or person in charge of the project.

## 12. Documentation, Drawings, and Approval

- 12.1. To ensure that the transformers to be supplied conform to the specific provisions and general requirements of this specification, the contractor, project owner or person in charge shall submit detailed drawings and design descriptions for approval. The contractor, project owner or person in charge shall make any documentation changes that are necessary to construct the transformers in conformance with the provisions in this specification without cost to the Buyer.
- 12.2. The contractor, project owner or person in charge shall submit three copies for approval to the buyer prior to manufacturing the equipment. Any drawings returned to the contractor, project owner or person in charge marked "Not Approved" must be resubmitted for an approval after making corrections. Drawings returned to the contractor, project owner or person in charge marked "Approved" or "Approved as noted" need not be resubmitted for approval but must be corrected and returned as final drawings. All transformers shipped must be in accordance with the approved drawings.
- 12.3. The contractor, project owner or person in charge shall provide the buyer with 1 set of final drawings during the order period and before transformers are shipped. These drawings shall include:
  - a. Transformers outline drawings showing physical dimensions and location of accessories.
  - b. Nameplate and connection diagram.
  - c. Detail drawings of bushings and accessories.



### 13. Inspection

The acceptance of any equipment/material shall in no way relieve the vendor from his responsibility to meet all the requirements of this specification, and it would not prevent subsequent rejection if such equipment/materials were found later to be defective.

### 14. Proposal Information

14.1. Submitted proposals must include:

- a. Technical information, tests, and drawings.
- b. Table of Compliance completed by the bidder with reference (see Appendix 1).

### 15. Table 1: Warehouse and Asset Suite Identification Number

Warehouse Catalog #	Asset Suite #	Primary Voltage (kV)	Secondary Voltage (V)	Capacity kVA
012-83611	83611	13.2 Δ	120/240 Δ	150
012-09048	59239	13.2 Δ	120/240 Δ	300
012-08982	59236	8.32 Δ	120/208 Y	300
012-08941	59233	13.2 Δ	120/208 Y	300
012-08958	59234	13.2 Δ	120/208 Y	500
012-08966	59235	13.2 Δ	120/208 Y	750

- End of Specification -



## Appendix



## Appendix 1: Table of Compliance

Line	Description	Pass/Fail (P / F)	Comments
1	Complies with the specification document 4350.12.		
2	Industry Standards: IEEE C57.12. (00, 10, 24, 32, 35, 70, 80, 90), IEEE C57.91, NEMA TR1, ANSI Z535.		
3	Tech. info., drawings, and tests provided.		
4	Tests as per IEEE C57.12.00 and IEEE C57.12.90.		
5	3 $\phi$ Submersible XFMR		
6	kVA, HV/LV, (H & L kVBIL), 60Hz		
7	No load losses at 20°C, load losses at 85°C full load, and load losses at 55°C at 50% of load provided.		
8	DOE (latest edition) compliance (efficiency as per table in Section 9.10).		
9	The entire unit shall be made of stainless steel, 304L gauge 11 (section 9.17.a).		
10	Tank and covers shall be protected against environmental conditions and corrosion. Paint shall be light gray No. 70, Munsell Notation 5 BG 7.0/0.4, as per ANSI C57.12.32		
11	The transformer shall be sized to fit a standard foundation 12' x 6' x 8' transformer vault (URD-33). See Section 10.		
12	The nameplate with information as per ANSI C57.12.00.5.12. (Nameplate C)		
13	SS, AL or CU Nameplate		
14	5-positions Tap Changer. Each tap shall be 2.5% of rated primary voltage. As per Section 9.11.		
15	Tank filled with oil, complying with ANSI/ASTM D3487 and LUMA requirements, with a PCB concentration of less than 1 PPM (NO-PCB).		
16	CU or AL Windings		
17	Meet the requirements for the core and windings as stated in Section 9.9.		
18	Internal fault detector type pressure relief valve as per Section 9.13.		
19	Insulation system: at least, Class A (105 °C) as per ANSI C57.12.80.		
20	Labels as per Sections 9.15 & 9.16.		
21	High Voltage Bushings and Terminals: Six (6) each cover mounted dead front welded in bushing wells arranged for loop feed with high voltage stainless steel parking stands and 8.3/14.4 kV 200A loadbreak bushing well inserts.		
22	Low Voltage Bushings and Terminals following characteristics 9.19 section. approved equal to Homac 125 series # FTU14N with 4 outlets.		
23	Grounding connector and grounding pads as per Sections 9.17.c5 & 9.17.c.6.		
24	Suitable for Loop Feed connection.		
25	Protection as per Section 9.21.		
25	Accessories as per Section 9.22.		

**NOTE: This table is only a checklist for reference. The compliance must be with the complete document. Filling out the table with "PASS" won't be accepted as a compliance without the technical information required to certify it.**



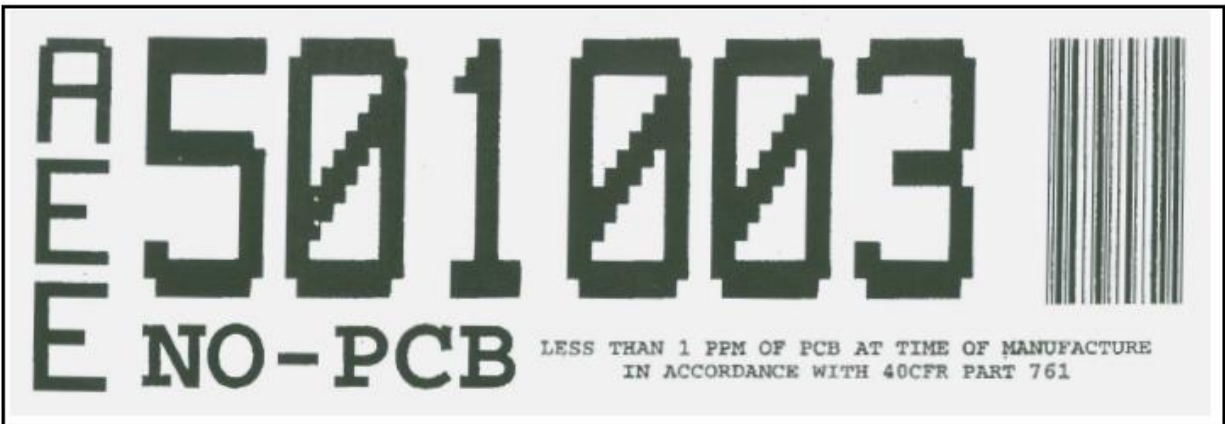
### Appendix 2: Table of Compliance for Impedance Parameters

Item	%R	%X	%Z	Weight
1				
2				
3				
4				
5				
6				
7				

### Appendix 3: Required Information for Request for Quotation or Bidding

Item	Primary Voltage	Secondary Voltage	Capacity KVA	No Load Losses @ 20°C W	Load Losses @ 85°C W	Load Losses @ 55°C W

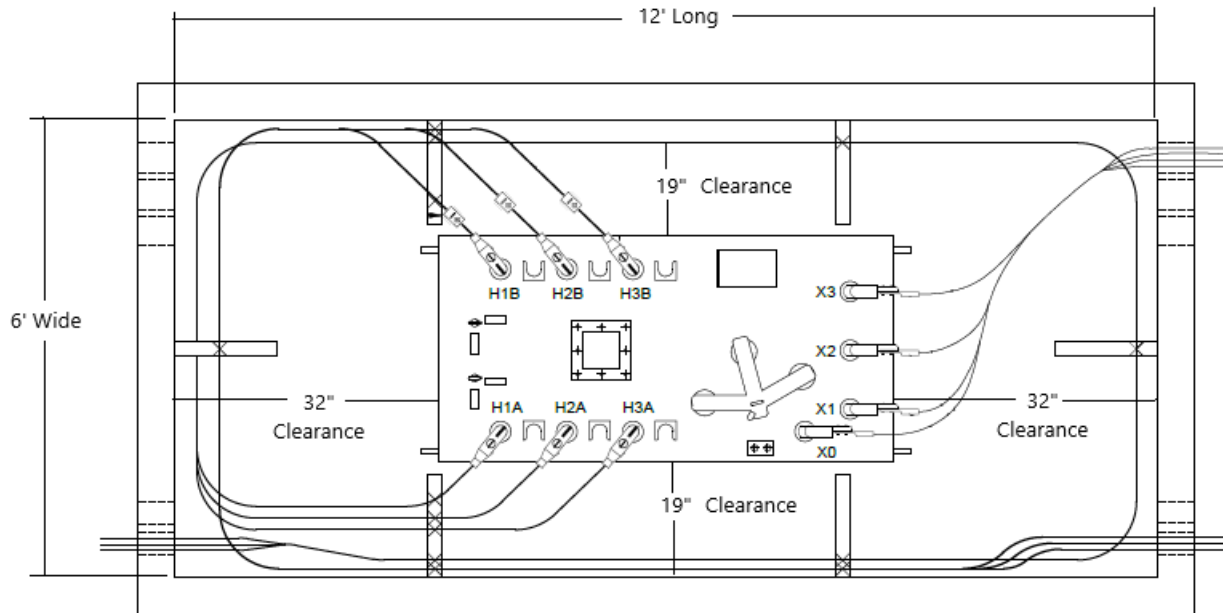
## Appendix 4: LUMA's Property Number Label



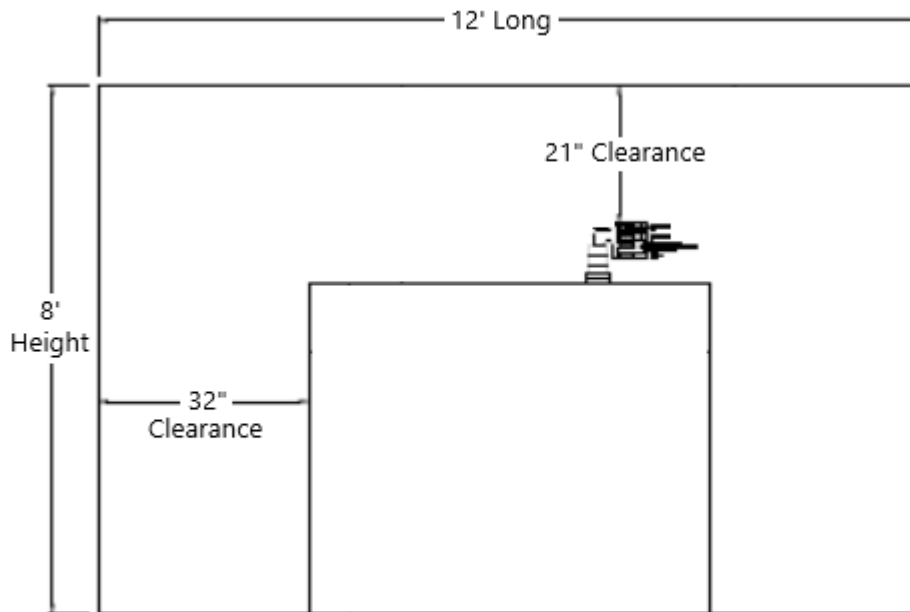
This label is an example and is not made to scale. The dimensions shown in the table of section 9.14.f. for this label are approximate. The dimensions could be adjusted to accommodate the actual information.

1. The property numbers shall have a 0.25" thickness, 1.125" width, and 2.125" height.
2. The letters "AEE" shall have a 0.25" thickness, 0.75" width, and 0.075" height.
3. The label shall have 0.5" margins at right, left, top, and bottom.
4. The bar code shall have a 2.125" height.
5. The word "NO-PCB" shall be written below the property number. This word shall begin under the first digit of such a number. The letters shall have a 0.125" thickness, 0.5" width, and 0.5" height. This word shall have a separation of 0.125" from the property number. A separation between 0.0625" and 0.125" shall be provided between each letter.
6. The phrase "LESS THAN 1 PPM AT TIME OF MANUFACTURE IN ACCORDANCE WITH 40CFR PART 761" shall be placed as per the drawing. The letters shall have a 0.125" height and the thickness shall be according to their size. This phrase shall be placed in the space remaining between the word "NO-PCB" and the last line of the bar code, beginning at 0.25" from the word "NO-PCB" as shown in the drawing.
7. Label Approximate Final Size: 12" long X 4" high
8. Color: Black numbers over a white base.

### Appendix 5: Vault Dimensions and Minimum Clearances from the Transformer



TOP VIEW  
12' L x 6' W x 8' H



SIDE VIEW











# 4350.012 Loop Feed 3 Phase Submersible Dist Xmers (11-21-24)p1


Final Audit Report

2024-12-02

Created:	2024-11-21
By:	jose torres (JoseR.Torreslrizarr@Lumapr.com)
Status:	Signed
Transaction ID:	CBJCHBCAABAAAtRMMIlyxKRanigmceqyzNXr5G2PZgCU

## "4350.012 Loop Feed 3 Phase Submersible Dist Xmers (11-21-24)p1" History

-  Document created by jose torres (JoseR.Torreslrizarr@Lumapr.com)  
2024-11-21 - 5:59:14 PM GMT
-  Document emailed to jose torres (JoseR.Torreslrizarr@Lumapr.com) for signature  
2024-11-21 - 5:59:20 PM GMT
-  Email viewed by jose torres (JoseR.Torreslrizarr@Lumapr.com)  
2024-11-21 - 6:00:56 PM GMT
-  Document e-signed by jose torres (JoseR.Torreslrizarr@Lumapr.com)  
Signature Date: 2024-11-21 - 6:01:16 PM GMT - Time Source: server
-  Document emailed to Miguel Rios (miguel.rioslopez@lumapr.com) for signature  
2024-11-21 - 6:01:17 PM GMT
-  Email viewed by Miguel Rios (miguel.rioslopez@lumapr.com)  
2024-11-21 - 6:23:47 PM GMT
-  Document e-signed by Miguel Rios (miguel.rioslopez@lumapr.com)  
Signature Date: 2024-11-21 - 6:24:16 PM GMT - Time Source: server
-  Document emailed to Rodolfo Flores (rodolfo.floresortiz@lumapr.com) for signature  
2024-11-21 - 6:24:19 PM GMT
-  Email viewed by Rodolfo Flores (rodolfo.floresortiz@lumapr.com)  
2024-11-21 - 6:53:01 PM GMT
-  Document e-signed by Rodolfo Flores (rodolfo.floresortiz@lumapr.com)  
Signature Date: 2024-11-21 - 7:08:21 PM GMT - Time Source: server

 Document emailed to Ricardo Castro (ricardo.castro@lumapr.com) for signature

2024-11-21 - 7:08:22 PM GMT

 Email viewed by Ricardo Castro (ricardo.castro@lumapr.com)

2024-11-21 - 7:18:38 PM GMT

 Email viewed by Ricardo Castro (ricardo.castro@lumapr.com)

2024-12-02 - 11:22:51 AM GMT

 Document e-signed by Ricardo Castro (ricardo.castro@lumapr.com)

Signature Date: 2024-12-02 - 11:23:16 AM GMT - Time Source: server

 Agreement completed.

2024-12-02 - 11:23:16 AM GMT