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Control Power Overhead Transformer

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Related/Referenced Documents

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Version History

Version	Date	Revision
01	07/15/2022	Initial release
02	12/02/2022	Cover page added. Efficiency and losses requirements modified. General corrections.
03	02/27/2023	Modify primary voltages requirements for items 012-83172, 012-83173, and 012-83174. Removed 012-83175 from specification.
04	11/20/2023	Removed efficiency and losses requirement and added arrester bracket provision requirement.
05	02/07/2024	Added 012-83175 to the specification and general revision.
06	05/08/2025	New hardware added (3KVA transformers)

Warehouse Catalog #	Asset Suite #	Version	Date
012-83172	83172	6	05/08/2025
012-83173	83173	6	05/08/2025
012-83174	83174	6	05/08/2025
012-83175	83175	4	05/08/2025
012-87503	87503	1	05/08/2025
012-87504	87504	1	05/08/2025
012-87505	87505	1	05/08/2025
012-87506	87506	1	05/08/2025

1. Introduction

This is a general specification that covers the minimum requirements for the control power overhead, class OA, transformers 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 material.

2. Special Requirements

2.1. Samples shall be furnished as requested by LUMA Energy. All documented testing required by applicable specifications and standards shall be submitted with product samples, including mechanical and electrical drawings, prior to approval. Vendors that have supplied this material to LUMA on previous orders will not have to furnish samples at bid opening. If any material or design changes were made to an approved product, it must be re-submitted to the Material Specification engineer for approval before shipping.

2.2. The product shall be furnished as described here in this specification or as amended by the purchase order. Any changes or updates to the Supplier's procedures, quality routines, and/or inspection layout shall be liable for all costs incurred for a product that is refused or rejected.

2.3. Upon inspection of incoming equipment/material, the purchaser reserves the right to refuse product shipments and to determine the acceptability or rejection of product received. The Supplier shall be liable for all costs incurred for a product that is refused/rejected.

2.4. All equipment/materials shall be warranted for a period of one year from date of installation or 18 months from the date of shipment or whichever comes first, against material defects and workmanship. The warranty shall include parts and labor to repair the defective component at the supplier's facility. The supplier also warrants that all equipment and materials supplied there under are new.

2.5. The equipment/material will be received at the 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

For compatible manufacturer and model see Table 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's purchase order and item number.

5.2. Individual package(s) shall be clearly marked with manufacturer name and item information (part number, serial number, quantity, etc.). Packaging labels and tags shall be waterproof.

5.3. Transformers shall be marked on the cover with the point of delivery (district) and purchase order number using a label.

5.4. Packaging labels and tags shall be waterproof.

6. Packaging

6.1. All equipment/material shall be packaged and marked in such a way as to facilitate handling and protection from damage and that the receiving warehouse can readily identify it and send it, in one complete unit, to a field location without opening crates or boxes to sort items and/or parts.

6.2. A list of all parts included in the container and/or package must be provided at the time of delivery so that the receiving personnel can verify that everything requested is present, avoiding any delay in the receiving process.

6.3. Each unit shall be banded to a two-way entry, disposable pallet, or crate of the manufacturer's own design. The pallet/crate shall be of such dimensions as to provide a minimum of one inch (1") clearance at the transformers widest outside measurements, on all four sides. It shall provide a minimum of two and a half inches (2 1/2") of fork under clearance.

6.4. The transformer shall be banded to the pallet or crate, using non-metallic banding, to prevent rust and shifting of the unit during transit, while allowing the unit to be handed by sling or fork truck without removing the banding.

6.5. LUMA Energy shall allow the use of metallic banding ONLY if the transformer surface is protected from band contact.

7. Number Per Package (Logistics)

7.1. The supplier shall indicate the logistics regarding the opening bid or as required by LUMA Energy, as outlined in Table 2, or as otherwise specified by LUMA.

7.2. Nine (9) transformers per pallet or crate, or as requested by LUMA.

8. Acceptance Criteria

8.1. All characteristics, definitions, and terminology, except as specifically covered in this specification, shall be in accordance with the latest revision of the following ANSI Standards.

a. C57.12.00 IEEE Standard General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers.

b. C57.12.20 IEEE Standard for Overhead-type Distribution Transformers 500 KVA and Smaller; High Voltage, 34,500 Volts and Below: Low Voltage, 7970/13,800Y Volts and Below.
c. C57.12.31 IEEE Standard for Pole-Mounted Equipment--Enclosure Integrity.
d. C57.12.35 IEEE Standard for Information Coding for Distribution Transformers and Step-Voltage Regulators.
e. C57.12.70 IEEE Standard for Standard Terminal Markings and Connections for Distribution and Power Transformers.
f. 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.
g. C57.91 IEEE Guide for Loading Mineral-Oil-Immersed Transformers and Step-Voltage Regulators.
h. C57.125: Guide for failure investigation, documentation, analysis, and reporting for power transformers and shunt reactors.
i. D3487 ANSI/ASTM Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus.

8.2. Must comply with the followings NEMA Standard:

a. NEMA TR 1 – Standard for Transformers, Regulators and Reactors.
b. NEMA B117 - Standard for Salt Spray Test.

8.3. Also, it shall comply, but shall not be limited to, with the latest revision of applicable codes, standards, and other regulations.

8.4. The routine and design tests shall be done in accordance with ANSI C57.12.00. The routine test samples performed on the units shall be submitted at Bid Opening. The design test samples will be submitted only when the supplier requires approval for the equipment. The bidder shall submit a written certification stating that all tests shall be performed according to the latest codes, standards, and regulations to provide a product of quality.

8.5. Routine tests that shall be performed on EACH UNIT are the following:

a. Voltage ratio
b. Polarity
c. Phase relationship
d. Core losses (no-load losses)
e. Exciting current

f. Winding losses (load losses)
g. Tank leaks
h. Impedance
i. Applied potential
j. Induced potential
k. Impulse tests

8.6. Typical design tests data include the following:

l. Insulation resistance
m. Power factor
n. Temperature rise
o. Over excitation
p. Radio interference
q. Oil tests
r. Noise tests as per NEMA Standard TR 1, latest revision
s. Tank pressure withstand.
t. Temperature at which the tests were performed.

8.7. Any exceptions to the tests mentioned in sections 8.3 to 8.5 shall be specified at Bid Opening.

8.8. The tests mentioned at 8.4 shall be performed on the fully assembled unit at manufacturer's location.

8.9. A report of the tests performed on 8.4 shall be provided for each transformer according to the requirements of the purchases.

9. Description

9.1. Control power overhead transformers are a small pole type, single phase, fixed load, oil immerse transformers used to supply power to small loads like control power for capacitor banks switches, and recloser installations.

9.2. The transformer shall consist of tank, cover, core, windings, bushings, insulating oil, etc.

9.3. Must have an internal weak link fuse.

9.4. Must have the following electrical system characteristics:

a. Transformer capacity: 1 KVA & 3 KVA
b. System frequency: 60 Hertz

c. Primary voltage: Single or Dual voltage, as per Table 1
d. Secondary output voltage: 120 Vac.
e. Basic Impulse Insulation Level (BIL): 95 KV BIL

9.5. Control power transformers must have high power factor, low core, and winding losses.

9.6. Core and Coil

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

b. Winding:
   3. Shall be non-telescoping with high and lower tension windings assembly forming and integral unit.
   4. The Winding Polarization Index shall be 2.0 or more as per ANSI C57.125-2015.

9.7. Insulation

a. Shall be made with, at least, Class 105 insulation system.
b. The insulation power factor shall be as per ANSI C57.12.20 (60 Hz).
c. Technical information on the insulation shall be submitted by the awarded supplier.

9.8. Bushings

a. Must be high and low tension insulated and in accordance with NEMA standards.
b. Shall be either cover type or sidewall type, according to voltage class as per ANSI C57.
c. High and low voltage bushings provided must be porcelain in accordance with Table 6 of ANSI C57.12.20.
d. The color of bushings shall be light gray no. 70, Munsell Notation 5 BG 7.0/ 0.4.
e. Transformers shall have one (1) high voltage bushing. In the low voltage side, the transformer shall have one (1) bushing for single voltage transformers and three (3) bushings for dual voltage transformers. For dual voltage transformers, the Supplier must provide schematics and/or instructions of the proper connection for the corresponding operating voltage.
f. High voltage bushing terminals provided shall be tin-plated to accommodate both aluminum and copper conductors. The size of these terminals shall be in accordance with Table 8 of ANSI C57.12.20.

g. Low voltage terminals provided should be tin-plated to accommodate both aluminum and copper conductors. The size of the terminals shall be in accordance with Table 9 of ANSI C57.12.20.
h. Shall be provided with the appropriate wildlife protection covers to protect bushing connection terminals from animal and vegetation interactions.
i. Primary protection incorporated at the high voltage bushing to safeguard against overcurrent and ensure reliable operation.

9.9. Transformer's tank:

a. Must be a cylindrical shape made of stainless-steel type 304 gage 14 for severe corrosion (salt spray) areas.
b. It must be suitable for outdoor use and for mounting on flat surfaces, capacitor bank frames, or poles.
c. It must be fitted with lifting lugs, mounting brackets, and ground provisions permanently affixed.
d. Constructed in accordance with the latest revisions of ANSI C57.12.20 and ANSI C57.12.31.
e. Shall have a recessed tank bottom which offers protection when sliding over rough surfaces.
f. Shall have an internal mark, which indicates the proper oil level per Section 7.2.3 of ANSI C57.12.20.

9.10. Transformer's tank cover:

a. Shall be dome type, insulated, and not welded to the tank.
b. Shall be coated with a dielectric finish.
c. Shall be of the bolted clamp, center bolted, or bolted fastening ring type. Bolts, nuts, and washers used, together with the base in which they will be mounted, shall be stainless steel.
d. Shall be made of the same material as the tank.

9.11. Painting

a. Transformers shall have "special paint finishes" suitable for tropical climate conditions and to be used near the seashore and industrial plants.
b. Coating shall meet all requirements in ANSI C57.12.31.
c. Paint shall be light gray no. 70, Munsell Notation, 5BG 7.0/0.4.
d. This 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 terms, to ultraviolet rays, humidity, corrosion due to acids, salts, organic solvents, gases, and others. It shall comply with federal regulations on temperature and environment.

e. These paint finishes shall be capable of withstanding the ASTM B117 1500 hrs./ 5% Salt Spray Test without significant loss of adhesion or under film corrosion.
f. Manufacturer shall specify paint finishes and provide certified test results that the relevant standards have been met. This information shall be submitted with the bid.
g. Technical and descriptive literature shall be supplied at Bid Opening for evaluation. This literature shall include, but shall not be limited to, the process, type of paint, description, certified test results, material safety data sheet, etc.

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. Also, for transformers that are sold on the island through distributors, a label shall be affixed to the transformer in a visible place indicating that the unit is a NO PCB transformer.
c. The label shall have the same duration as the transformer under normal operating conditions.
d. The insulating oil shall comply with ANSI/ASTM D3487 and IEEE C57.91. The oil must comply, in addition, with the following:
    1. 30 KV minimum breakdown voltage
    2. Neutralization number of 0.25
    3. Viscosity of:
        - 81.25 centistokes at 25ºC as per ASTM D445-86
        - 15.00 centistokes at 100ºC as per ASTM D445-86
e. The awarded bidder shall submit:
    1. A certificate stating that, at all moments, the transformers supplied to LUMA shall have a concentration of less than 1 PPM of PCB.
    2. Safety Data Sheet (SDS) of the oil.

9.13. Pressure Relief Valve

a. The body of the pressure relief valve shall be an internal fault detector type equal or approved equal to IFD Corporation and in accordance with ANSI C57.12.20.
b. The relief valve shall allow the pressure inside the tank to be released but no air is admitted when the unit is cool or lightly loaded.

9.14. Nameplate

a. Nameplate A, as per ANSI C57.12.00, shall be used for transformers covered in this specification.
b. Shall be mounted on one side of the mounting brackets in such a manner that there are no sharp edges exposed.
c. The information shown on nameplate must include: the material (aluminum or copper) used in each winding, date of manufacture, total weight, serial number, among all the other information as per ANSI requirements.
d. The information on the nameplate shall be engraved or stamped. Any of the two processes shall ensure legibility for the life of the transformer.
e. Nameplate shall be made of corrosion resistant material.
f. A sample of the nameplate as requested in this section shall be submitted by the awarded bidder.

9.15. 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. 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.

9.16. Surge Arrester Mounting Bracket Provision

a. Shall be manufactured with two stainless steel bosses attached to the transformer. The top boss will be two inches below top edge of the tank and the second to 2 ½ inches below the first one.

9.17. Additional Labels

a. Dimensions for any of the label's numbers shall have a width of a minimum of 0.75 inches and a maximum of one (1) inch. The height shall be two (2) inches.
b. Labels must comply with section 9.18 on this document.
c. Transformers must include a label indicating the KVA rating of the transformer. This label shall be placed, whenever possible, below the secondary voltage bushings. This label shall have a minimum dimension of three (3) inches width by three (3) inches height and a maximum dimension of four (4) inches width by four (4) inches height.
d. For stainless steel transformers, a label with the words "STAINLESS STEEL", made from the same material as the KVA rating label, shall be used. This label shall be placed directly under the KVA rating label. This label shall have the same width of the KVA rating label.
e. A label with LUMA's property number (see Section 10.8). The label shall be affixed on the top of the transformer in a visible place without conflicting with the bushings or any other equipment. LUMA will provide the sequence of numbers to be used as property numbers.

9.18. Thermal transfer polyester label shall have the following characteristics:

a. Substrate specifications:
   1. Material: Polyester
   2. Shall resists abrasion, acids, chemicals, corrosives, solvent, moisture, and humidity, cold, and tearing.
   3. Temperature range: 0°C to 50°C (32°F to 122°F)

b. Adhesive specifications:
   1. Adhesive type shall be acrylic.
   2. 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.

c. The label shall last a minimum of 20 years installed on the transformer under normal operating conditions.

10. Inspection

10.1. Upon inspection of incoming equipment/material, the purchaser reserves the right to refuse product shipments and to determine the acceptability or rejection of the product received. The supplier shall be liable for all costs incurred for a product that is rejected.

10.2. 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.

11. Proposal Information

11.1. Submitted proposals must include:

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

Table 2: Warehouse and Asset Suite Identification Number.

Warehouse Catalog #:	Asset Suite #:	Voltage Type	CPT Primary Voltages L-N (kV)	Secondary Voltage (V)	kVA Rating (kVA)	Compatible Manufacturer & Model
012-83172	83172	Dual voltage	2.4/7.62	120	1	Mid-Central Electric, Inc
012-83173	83173	Dual voltage	4.16/7.62	120	1	Mid-Central Electric, Inc
012-83174	83174	Dual voltage	4.8/7.62	120	1	Mid-Central Electric, Inc
012-83175	83175	Single Voltage	7.62	120	1	Mid-Central Electric, Inc
012-87503	87503	Dual voltage	2.4/7.62	120	3	Mid-Central Electric, Inc
012-87504	87504	Dual voltage	4.16/7.62	120	3	Mid-Central Electric, Inc
012-87505	87505	Dual voltage	4.8/7.62	120	3	Mid-Central Electric, Inc
012-87506	87506	Single Voltage	7.62	120	3	Mid-Central Electric, Inc

—End of Specification —

Appendix

Appendix 1: Table of Compliance

Line	Description	Pass/Fail	Comments
1	The Proponent complies with the corresponding specification document (4350.196).		
2	The Proponent complies with the industry standards established in the specification document. (ASTM, IEEE, NEMA, NEC, EQB-PUERTO RICO, EPA, DOT, AWS)		
3	• Tank: Stainless Steel • Windings: Copper or Aluminum • Nameplate: Stainless Steel or Aluminum (Section 9.14)		
4	• All welds at the exterior of the tank shall be continuous. (Section 9.15) • The transformer shall include a Pressure Relief Valve. (Section 9.13)		
5	• Each transformer shall be furnished with its tank filled with oil with a PCB concentration of less than 1 PPM (NO PCB). • Complies with Section 9.12.		
6	Meets all electrical characteristics see section 9.4		
7	• Shall be manufactured with two stainless steel bosses attached to the transformer. The top boss will be two inches below top edge of the tank and the second to 2 ½ inches below the first one. • Section 9.16		
8	• Color and coating shall meet all requirements in ANSI C57.12.31. • Complies with Section 9.11		
9	• Shall be either cover type or sidewall type, according to voltage class as per ANSI C57. • Color grey • Complies with Section 9.8		
10	• "No PCB" shall be indicated in the nameplate. • All labels shall be made of Thermal Transfer Polyester. (Section 9.18) • Complies with Section 9.17		
11	Primary protection incorporated at the high voltage bushing.		

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.

4350.196 Control Power Overhead Transformer V06

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