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Capacitor Unit Single Phase & Double Bushings

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Document History

Date	Revision Comments
Sep. 20, 2022	Initial Release
Feb. 16, 2023	Table of Compliance (TOC) added and general format modifications.
Feb. 21, 2023	Changing catalog number for item 032-83493 to 032-83596.
Sep. 01, 2023	General format and TOC modifications.

Warehouse Catalog #	Version	Date
032-83481	4	09/01/2023
032-83482	4	09/01/2023
032-83483	4	09/01/2023
032-83484	4	09/01/2023
032-83485	4	09/01/2023
032-83486	4	09/01/2023
032-83487	4	09/01/2023
032-83488	4	09/01/2023
032-83489	4	09/01/2023
032-83490	4	09/01/2023
032-83491	4	09/01/2023
032-83492	4	09/01/2023
032-83596	4	09/01/2023
032-83494	4	09/01/2023
032-83495	4	09/01/2023
032-83496	4	09/01/2023
032-83497	4	09/01/2023
032-83498	4	09/01/2023



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1. Introduction

This is a general specification that covers the minimum requirements for single phase, double bushing capacitor units 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

- 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 equipment/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. Documentation from any regulating agency pertaining to disposal requirements (other than landfill) for any component of the capacitor, now and in the future, shall be submitted to the material specification engineer for further review.
- 2.4. 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 refused/rejected.
- 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.



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3. Literature

Descriptive and technical literature must be supplied by the vendor at time of bidding. This literature may include, but is not limited to details of material, drawings, documented testing, and instructions for use and installation. Failure to submit documents on time will cause bidder disqualification. For products described in this specification as requiring qualification, awards will be made only for such products that, prior to the time for opening of bids, had been tested and/or approved by LUMA Energy. Evidence of LUMA Energy's approval of the equipment/material shall be supplied by the vendor if requested by LUMA Energy.

4. Markings

- 4.1. Wooden crates or packages must be clearly marked on the outside with LUMA Energy's purchase order, warehouse item number, and supplier's part number.
- 4.2. Packaging labels and tags shall be waterproof.

5. Compatible with

- 5.1. For compatible manufacturer and model see Table 1.
- 5.2. 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.

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. All individual capacitor units shall be shipped with a shorting connection between the bushings.

7. Number Per Package (Logistics)

Standard package: Eighteen (18) units per wooden crate or as required by LUMA Energy.

8. Acceptance Criteria

- 8.1. Test required: certified by external laboratories.



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- 8.2. Product shall be manufactured in accordance with the latest issue ASTM, NEMA, IEEE and ANSI specification. When conflicts occur between purchaser's specifications and the ASTM, NEMA, IEEE, or ANSI specifications, the purchaser's specification shall prevail.
- 8.3. Latest applicable codes, standards, and other regulations:
 - a. IEEE 18-2012: Standard for shunt power capacitors
 - b. IEC 60871-1: Shunt capacitors for AC power systems having a rated voltage above 1000V.

9. Description

- 9.1. Medium voltage, single phase, double bushing, heavy duty capacitor units to be used on continuous (fixed) or controller (switched) capacitor banks in pole mounted frame, substation banks or metal enclosure.
- 9.2. The capacitor units will be connected to the electrical distribution system having the following characteristics:
 - a. System Voltages: 4.16kV to 15.0kV LL (2.4/4.16kV, 4.16/7.2kV, 4.8/8.32kV, & 7.62/13.2kV)
 - b. System Frequency: 60 Hz
 - c. System Connection: Grounded Wye (4 wires)
 - d. Fault Current (minimum): 10,000 amps
- 9.3. The capacitors must be suitable for switched or continuous operation at voltage up to 125% of rated voltage and 135% of rated RMS voltage.
- 9.4. Each capacitor tank must be made of stainless-steel type 409 with light gray finish for resistance to severely corrosive atmospheres. The tank rupture curve must be defined through 10 kA.
- 9.5. Must have 2 light gray porcelain bushings hermetically sealed to the capacitor tank and terminal cap. The bushings must be glazed for high strength and durability.
- 9.6. Must have stainless-steel mounting brackets with industry-standard 15.62 in (39.67 cm) mounting center for unit interchangeability. The brackets must be solidly welded to the tank. The underside of brackets shall not be painted so that proper grounding connection to the frame or hook can be established.
- 9.7. Each capacitor unit must not have more than 0.10 Watt/KVAR of total losses including dielectric losses.



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- 9.8. The capacitor must be heavy duty (HD Type) designed and tested to conform with IEEE standard 18 (IEEE Standard for shunt power capacitors) latest revision. Test shall be performed by the manufacturer to several capacitors to demonstrate compliance of the design with this standard. The design test must include the following:
 - a. Impulse withstand test
 - b. Bushing test
 - c. Thermal stability test
 - d. Radio influence voltage (RIV) test
 - e. Decay test
- 9.9. The capacitor unit must be designed to withstand outdoor operation in a humid tropical zone with altitude ranging from 15 to 3,000 ft above sea level, under ambient temperature between 10° C and 40° C and subject to be installed close to seashore with a heavy corrosive environment.
- 9.10. The basic insulation level (BIL) must conform values in Section 9.19 Capacitor Unit Rating Table for common voltage and reactive power ratings.
- 9.11. The capacitor bushings must conform to values in Section 9.20 Capacitor Unit Electrical Characteristics of Bushings Table.
- 9.12. The bushing must include a clamp connector suitable for copper and aluminum conductors with a minimum size range from solid #8 AWG to stranded #2 AWG.
- 9.13. All capacitors shall be clearly and permanently marked with all required nameplate markings as stated in ANSI/IEEE Std 18. The stainless-steel nameplate must include the following information:
 - a. Manufacturer's name
 - b. Manufacture Month/Year
 - c. Voltage and KVAR unit rating
 - d. Basic Insulation Level (BIL)
 - e. Frequency (Hz)
 - f. Dielectric Losses (Watt/KVAR)
 - g. Serial Number
 - h. Maximum fault current withstands



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- i. Capacitor normal range (μF - Micro Farad)
- 9.14. The dielectric fluid must be non-PCB and the capacitor tank must have a blue decal or stick-on label to designate "Non-PCB".
- 9.15. The equipment reliability must meet an expected life of twenty-five (25) years with survival rate of at least ninety (90%) percent.
- 9.16. The manufacturer must state the failure capacitance (μF) range of the capacitor.
- 9.17. The capacitors must be equipped with an internal discharge device which reduces the residual voltage to 50V or less in five (5) minutes after disconnection from the rated voltage.
- 9.18. All capacitor units shall be designed to resist wildlife entry.
- 9.19. Capacitor Unit Ratings Table:

Common Voltages and Reactive Power			
Volts (RMS) L - G	kVAR	Number of Phases	BIL (KV)
2,400 for 4.16KV LL	50, 100, 150 and 200	1	95
4,160 for 7.2KV LL	50, 100, 150 and 200	1	95
4,800 for 8.32KV LL	50, 100, 150 and 200	1	95
7,620 for 13.2KV LL	50, 100, 150, 200, 300 and 400	1	95

- 9.20. Capacitor Unit Electrical Characteristics of Bushings Table:

Electrical Characteristics of Bushings				
Range of Capacitor Voltage Ratings Terminal to Terminal (V RMS)	Minimum Insulation Creepage Distance (in)	Withstand Test Voltage		
		60 Hz dry 1 min, kV rms	60 Hz wet 10 s, kV rms	Impulse 1.2/50 or 1.5/40 full wave kV crest
1,200 - 5,000	2 (5.08 cm)	10	6	30
5,001 - 15,000	5.5 (13.97 cm)	27	24	75



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10. 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/material were found later to be defective.

11. Proposal Information

11.1. Submitted proposals must include:

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

12. Table 1: Warehouse and Asset Suite Identification Number

Capacitor Units						
Medium Voltage, 60 Hz, Single Phase, Double Bushings, Unfused, and Heavy Duty						
Warehouse Catalog #	Asset Suite #	Voltage (kV rms) L - G	kVAR	BIL	Compatible Manufacturer	Compatible Model
032-83481	83481	2.4	50	95	Copper Power System.	CEP420A1
032-83482	83482	2.4	100	95		CEP431A1
032-83483	83483	2.4	150	95		CEP432A1
032-83484	83484	2.4	200	95		CEP440A1
032-83485	83485	4.16	50	95	Copper Power System.	CEP420A3
032-83486	83486	4.16	100	95		CEP431A3
032-83487	83487	4.16	150	95		CEP432A3
032-83488	83488	4.16	200	95		CEP440A3
032-83489	83489	4.8	50	95	Copper Power System.	CEP420A4
032-83490	83490	4.8	100	95		CEP431A4
032-83491	83491	4.8	150	95		CEP432A4
032-83492	83492	4.8	200	95		CEP440A4
032-83596	83596	7.62	50	95	Copper Power System.	CEP420A7
032-83494	83494	7.62	100	95		CEP431A7
032-83495	83495	7.62	150	95		CEP432A7
032-83496	83496	7.62	200	95		CEP440A7
032-83497	83497	7.62	300	95		CEP460A7
032-83498	83498	7.62	400	95		CEP470A7

— End of Specification —



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Appendix



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Appendix 1: Table of Compliance

Line	Criteria	Description	Pass/Fail (P / F)	Comments
1	Specification	The Proponent complies with the corresponding specification document (4350.181).		
2	Industry Standards	The Proponent complies with the industry standards established in the specification document (ANSI, NEMA, ASTM, IEEE 18-2012, IEC 60871-1).		
3	Type	Single-Phase Double Bushings Heavy-Duty Fixed Capacitors		
4	Material	Tank: Stainless-Steel 409		
		Bushings: Light Gray Porcelain		
		Mounting Brackets: Stainless-Steel		
5	Product Requirement (Capacitor Units)	Two Bushings ea. with parallel groove connectors for #8 to 2 AWG.		
		Electrical Characteristics as per tables on Sections 9.19, 9.20, and 12.		
		Tank Rupture Curves defined through 10kA.		
		Discharge Resistors to 50V within 5 minutes.		
		Dielectric Fluid: Non-PCB		
		Mounting brackets with industry-standard 15.62" mounting center.		
		Nameplate as per Section 9.13.		











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Final Audit Report

2023-09-01

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