GUAM POWER AUTHORITY

Post Office Box 2977
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Transmission and Distribution Specification

Specification No. E-055

AUTOMATIC VOLTAGE REGULATOR (AVR)

FOR

SUBSTATION POWER TRANSFORMER

EFFECTIVE DATE:	ISSUED:	APPROVED:

AUTOMATIC VOLTAGE REGULATOR (AVR) FOR SUBSTATION POWER TRANSFORMER

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1.0 SCOPE:

This specification covers Guam Power Authority's requirement for an Automatic Voltage Regulator (AVR) to be used to control and monitor the substation power transformer low voltage automatic Load Tap Changer (LTC).

2.0 SERVICE CONDITIONS AND OPERATION:

2.1 The Automatic Voltage Regulator (AVR) is intended for use in an average ambient temperature of 20-32 deg. C (70-90 deg. F) with corrosive, salt air environment, sustained wind strengths of 170 MPH, and subject to seismic zone 4 condition.

2.2 The AVR shall reside within an indoor marshalling cabinet, or when required shall be installed within the transformer control cabinet.

3.0 CONFORMANCE TO SPECIFICATION REQUIREMENTS:

3.1 Applicable Standards

The equipment shall comply with UL 508/508A and IEEE 1686-2022 Standard for Intelligent Electronic Devices Cybersecurity as well as the following type tests and standards.

IEC 60255-22-5	Surge Immunity	±2,000 V pk
IEEE C37.90.2	Radiated Field Immunity	80 MHz - 1000 MHz @ 35 V/M
IEC 60255-22-3		80 MHz - 2700 MHz @ 10 V/M
IEC 60255-22-6	Conducted Field Immunity	150 kHz - 80 MHz @ 10 V emf
IEC 60068-2-2	Atmospheric Environment	Dry Heat, +85° C
IEC 60068-2-78		Damp Heat, +40° C @ 95%RH
IEC 60068-2-30		Damp Heat Condensation Cycle, 25° C, +55° C @ 95%RH
IEC60255-21-1	Mechanical Environment	Vibration response Class 1, 0.5 g
		Vibration endurance Class 1, 1.0 g
Temperature :	Controls should operate between +10° C to +85° C with either the LCD or optional Vacuum Fluorescent Display.	

IEC 60255-5	Dielectric Withstand	1,500 Vac for 1 minute applied to each independent circuit to earth
		1,500 Vac for 1 minute applied between each independent circuit
	Impulse Voltage	5,000 V pk, +/- polarity applied to each independent circuit to earth
		5,000 V pk, +/- polarity applied between each independent circuit
		1.2 by 50 µs, 500 ohms impedance, three surges at 1 every 5 seconds
		> 100 Mega ohms
IEC 60255-22-2	Electrostatic Discharge Test	Class 4 (±8 kV)—point contact discharge
		Class 4 (±15kV)–air discharge
IEC 60255-22-4	Fast Transient Disturbance Test	Class A (±4 kV, 2.5 kHz, 5 kHz)
ANSI/IEEE C37.90.1-1989	Surge Withstand Capability	2,500 V pk oscillatory applied to each independent circuit to earth
		2,500 V pk oscillatory applied between each independent circuit
		5,000 V pk Fast Transient applied to each independent circuit to earth
		5,000 V pk Fast Transient applied between each independent circuit
IEEE C37.90.1-2002		2,500 V oscillatory applied to each independent circuit to earth
		2,500 V oscillatory applied between each independent circuit
		4,000 V pk Fast Transient burst applied to each independent circuit to earth
		4,000 V pk Fast Transient burst applied between each independent circuit

3.2 Deviations and Non - Conformance Requirements

3.2.1 Deviations from this specification, changes in the material or design after the purchase order has been placed must be approved and issued by the Guam Power Authority's Engineering Department and acknowledge by a Purchase Order Agreement issued by Guam Power Authority.

3.2.2 Units received with deviations or non – conformances that are not acknowledged per Section 3.2.1, are subject to rejection. The Supplier of rejected units is responsible for any corrective action including but not limited to materials, labor and transportation necessary to dispose of or make the units conform to this specification.

3.2.3 Defective Units that are found to be inherent to manufacturing flaws or poor workmanship, whether detected prior to or following installation, must be notified and reported to the supplier. The description of the item, documentation of the problem and desired information, disposition and/or follow-up (as appropriate) that Guam Power Authority expects from the supplier will be specified. The Supplier's response shall be made within thirty (30) days unless an extension is acknowledged and approved in writing by the Guam Power Authority's Engineering Department.

4.0 DESIGN AND CONSTRUCTION:

The Automatic Voltage Regulator shall have the following standard features:

a. Supports DNP3.0, MODBUS and IEC 61850 Communications Protocols.
b. Control Voltage Input at 120 VAC.
c. Operating Frequency at 60 Hz.
d. LCD Display.
e. COM-1 Serial Communications: RS-485 & ST Fiber Optics.
f. COM-2 Serial Communications: Standard RS-232.
g. Ethernet Selection: 10/100 Mbps RJ-45.
h. DNP and IEC 61850 with Ethernet Com Port.
i. Paralleling Methods: Standard Circulating Current.
j. Tap Position Knowledge.
k. Sequence of Events Recording.
l. Source PT Voltage Input.
m. Line Drop Compensation by R & X or Z.
n. Harmonic Analysis.
o. Compatible with Beckwith 2025D Tap Position Sensor or its latest version.
p. Adapter panels to retrofit popular industry tap changer controls.
q. Shall have USB Communications Port for quick field-updatable programming.
r. Smart Reverse Power detection/operation with VT configuration for source and load sides.
s. Demand metering/ Data logging with Date/ Time Stamp(Single/Three-Phase).
t. SCADA Controllable Auto/Manual Pushbutton Adapter Panel Auto/Manual Switch State can be changed by SCADA Command.
u. Smart Flash SD Card.
v. CBEMA Monitoring.
w. Shall have comprehensive cyber security tools to implement NERC CIP requirements, including IPsec and RADIUS server security.

x. VAr Bias for downstream coordination with capacitor controls.
y. Model Number: **M-2001D-6L4S20C0S00** or newer version.
z. Preferred Manufacturers: Beckwith Electric and Hubbell.

5.0 OPERATION AND MAINTENANCE MANUALS:

5.1 The Supplier shall provide Guam Power Authority with five (5) sets of hardcopies and one (1) soft file copy of full operating and maintenance manuals for each unit, at least three (3) weeks prior to delivery.

5.2 One (1) additional operation and maintenance manual shall be placed with each unit within the transformer control or marshalling cabinet.

6.0 TESTING:

6.1 The Supplier shall supply two (2) hardcopies and one (1) soft file of the certified Factory Test Reports.

6.2 When installed as part of the fabrication of a new substation power transformer, the AVR unit shall be included in the Factory Acceptance Test (FAT) as well as the Site Acceptance Testing program and procedures of the power transformer. Tests may include functional and operational tests

7.0 PREPARATION FOR SHIPMENT:

The Supplier shall have sufficient work and inspection instructions for handling, temporary storage, preservation, packaging, and shipping to protect the quality of this equipment and its accessories as well as to prevent damage, loss, deterioration and substitution of products.

8.0 STATEMENT OF COMPLIANCE:

The Supplier shall provide a signed statement verifying that the products being supplied fully comply with the specification stated herewith. Items not in full compliance with this specification will be identified with a description of the deficiency and any proposed substitutions must be approved by the Guam Power Authority's Engineering Department, as described in Section 3.2.1.

9.0 WARRANTY:

The Supplier shall warrant the satisfactory and successful operation of the equipment furnished under this specification at the rating, under the conditions, and for the service specified. The Supplier shall further warrant this equipment against defects of design, material and workmanship. All workmanship and parts shall have a warranty of at least (1) year from the date of equipment's commissioning.