

JAMAICA PUBLIC SERVICE COMPANY LIMITED

**TECHNICAL SPECIFICATIONS FOR
DISTRIBUTION STEP VOLTAGE REGULATOR**

JPS Specification: STEPVOLTAGEREGULATOR-2023

Supersedes: None



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1. SCOPE

- 1.1 This specification covers single phase, step voltage regulators, capable of being secured to elevating structure, and base suitable for securing to pad, for use on fifty (50) Hertz Distribution System, complete with insulating oil and spare parts.

2. GENERAL REQUIREMENTS

2.1 INFORMATION

- 2.1.1 Refer to “Submittal of Information” section 2 paragraph 2.1 of “Technical Specifications, General Requirements.”

2.2 DRAWINGS ETC. BY SUPPLIER

- 2.2.1 Refer to ‘Submittal of Information’ section 3 of ‘Technical Specifications, General Requirements.’
- 2.2.2 Manufacturer shall provide drawings of regulators showing principal dimensions and weight of components.
- 2.2.3 All information requested in this specification shall be supplied at the time of tendering.

3. STANDARDS AND SERVICE CONDITIONS

3.1 STANDARDS

- 3.1.1 Refer to “Codes and Standards” section 3 of “Technical Specifications. General Requirements.”
- 3.1.2 Applicable parts of the following standards shall be observed in the design, manufacture, performance and task.
- 3.1.2.1 “NEMA” Standards Publications No. TR-1
- 3.1.2.2 ‘ANSI” C57.15 General Requirements for Step Voltage Regulators.
- 3.1.2.3 “ANSI” C57.15-1986 Step Voltage Regulator Terminology.
- 3.1.2.4 “ANSI” C57.12.90 Test code for Distributor Power and Regulating Transformer.

3.1.2.5 “ANSI” C57.95 Guide for Loading Mineral-Oil-Immersed Step Voltage Regulator.

3.1.2.6 “ANSI” Z55.1 Grey finishes for industrial apparatus and equipment.

3.1.2.7 “ASTM” B117 salt spray test.

3.1.2.8 “ANSI/IEEE” C62.11 1993

3.1.2.9 “ANSI/IEEE” C62.22

3.1.2.10 “NEMA” Publication No. LA 1

3.1.2.11 “ASTM” D-3487 ANSI Type 11 Mineral Oil

3.1.3 CONFLICTS

In the event of conflicts between any referenced standards/specification mentioned herein and this specification, the more stringent specification shall have precedence and shall govern. However, the bidder shall point out these conflicts in his bid **at the time of tendering.**

3.2 SERVICE CONDITIONS

3.2.1 Refer to “Geographic Conditions’ Section 4 of “Technical Specifications, General Requirements.”

3.2.2 Regulators are required for operation in an environment as noted in 3.2.1 and in addition, will be installed between 24 metres and 1.6 km from the sea. The regulators may also be installed in close proximity to industrial plants emitting atmospheric pollutants in the form of acidic or alkaline dusts and corrosive fumes. These plants may include those manufacturing caustic soda, amount or processing bauxite and lime stone. Regulators require special paint finishes (see section 4.7.4.2) and Special Primary Bushings (see section 4.7.3.1).

4 DETAILED REQUIREMENTS

4.1 TYPE

4.1.1 Oil immersed, self-cooled, outdoor step type voltage regulator, voltage regulator shall be completely self-contained and provide 10% regulation in thirty-two (32) steps of approximately 5/8% each.

Regulators shall be primary rated 13800/23900 GRDY and is required for operation on either a 13800V Delta or 13800/23900V grounded Wye, solidly multi grounded primary distribution system. The above rated regulator shall be provided with taps for operation at 14400, 13800, 13200, 12000, 7970, 7620, 7200 and 6930V

- 4.1.2 The regulator shall be designed such that they can be partially or completely untanked for inspection and maintenance without disconnecting any internal electrical or mechanical connection. After the unit is untanked, it shall be possible to operate the regulator mechanism and to test the control panel from an external 120 Vac source without any reconnections between the control and the regulator.

The tap changing mechanism shall be motor-driven, quick beat type, and shall be completely oil-immersed.

The regulator shall be of a sealed-tank construction to permit operation at 85°C rise without increasing the oxidation rate of the oil. A pressure relief device shall be supplied which vents at approximately 4 psig. The regulator coil shall include thermally-upgraded insulation to permit operation of the regulator up to 85°C rise without loss of life to the insulating system. At 85°C rise, the regulator shall provide 16% extra current capacity over the base current rating. A suitably patterned, epoxy-coated insulation paper shall be used in the winding. Prior to assembly of the core and the coil assembly, the winding shall be baked with sufficient mechanical pressure exerted on the winding to assure a complete bonding of the insulation to improve its short-circuit current withstanding capabilities.

- 4.1.3 The regulators shall be supplied with clamp-type connectors capable of carrying up to 600 AMPS, and capable of accommodating conductor sizes from #2 to 750 MCM conductor.

All regulators shall be provided with an external (MOV) bypass arrester connected across the series winding.

An external position indicator shall be installed to indicate tap changer position.

4.2 REGULATOR CONTROL

- 4.2.1 The regulator control shall be mounted in a weather-resistant enclosure, which is capable of being padlocked.

The control shall be able to be controlled by a SCADA Master Station via a suitable communication medium. Provisions shall be made to operate the control locally, and the remote feature disabled when operating locally.

The control shall be microprocessor based and shall be able to accept commands received from the master station, perform address recognition, assemble response messages in accordance with received command messages and transmit these messages to the master station. The processor shall perform data acquisition and execute control requests.

Check before operate verification of control point station shall be performed and an appropriate select acknowledge response issued to the master station prior to executing a control. Circuiting shall be provided to prevent control operation if more than one control point has been selected. The RTU shall automatically reset a previously received control selection if the next following received command is not the valid execute command. It shall also reset a previously received control selection if the valid execute command has not been received within 30 seconds of the selected command. The RTU shall feature a 16-bit [minimum] microprocessor. The processor shall provide diagnostic information in the message structure that the master station computer shall monitor. A flag shall be set if the RTU performs a restart for any reason including power failure. Turning off the RTU for maintenance shall be treated the same as power failure. The regulator control shall be able to provide instantaneous, demand, min./max demand of load voltage, compensated voltage, current, KVA load, KW load, KVAR load and power factor. Provisions shall be made to reset these valves where applicable. Metering valves must be available for both forward and reverse power flow conditions.

4.3 COMMUNICATION PORTS

The RTU will support at least two [2] RS 232C serial I/O ports. One port will be used to report scanned data to the master station using the DNP 3.0 protocol. A separate port will be available for configuration, diagnostics and operational testing.

All ports will function independently of each other and will be capable of communicating through a modem or digital radio. The baud rate for each port will be software configurable from 1200 to 9600.

4.4 RATINGS

Continuous rated capacity at 65°C temperature rise (kVA)	Number of phases	Primary BIL (kV)	Frequency (Hz)	Load current ratings (A)	Regulation (%)
300	single	150	50	200	±10
450	single	150	50	300	±10

4.5 PERFORMANCE

4.5.1 TEMPERATURE RISE

The temperature rise measured by resistance method shall not exceed 65 degrees Celsius at a maximum amount of 40 degrees Celsius. Start time overload characteristics shall be such that the unit can be loaded with loss of life in accord with applicable ANSI C57-92 tables.

4.6 DATA TO BE FURNISHED BY BIDDER

4.6.1 Bidder must attach to his proposal the “Regulator Data Form” included in the “Schedule of Technical Data” as Exhibit ‘A’ duly completed for each KVA rating of transformer offered. Any deviations from this specification should be clearly identified by the bidder. All sections of the data form shall be completed and all information requested in this specification shall be submitted at the time of tendering.

4.7 CONSTRUCTION

4.7.1 OVERLOAD INDICATOR

4.7.1.1 Regulators shall be equipped with a suitable device (resettable), which will indicate an overload condition. Manufacture shall provide technical details on the device, which is proposed for purchasers evaluation.

4.7.2 OVERLOAD PROTECTIVE DEVICE

4.7.2.1 Regulator shall be equipped with a suitable overload protective device. Manufacture shall provide technical details on the device, which is proposed for purchasers evaluation.

4.7.3 BUSHINGS

4.7.3.1 Bushings shall be of silicone rubber type and shall be cover mounted and located in the segment of cover according to ANSI C57.15. Bushings shall be equipped with solderless connectors sized according to ANSI C57.15 suitable for either copper or aluminum conductors.

Bushings for all regulators shall have a minimum leakage distance of 762 mm.

4.7.4 TANK AND FINISH

4.7.4.1 Regulator oil preservation system be of the sealed tank type and tank shall be welded, construction made of high grade steel plate. The tank shall be non corrugated.

4.7.4.2 The painting process shall be of present day manufacturing process and such that the finish coat forms a moisture solid and abrasion resisting coating.

Regulators shall have “Special paint finishes” suitable for use in close proximity to the sea and industrial plants. (See section 3.2.2 of this specification). These paint finishes shall be capable of withstanding the ASTM B117 1500hrs/ 5% salt spray test without significant loss of adhesion of under film corrosion. **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.**

4.7.4.3 The tank finish color match light gray No. 70 Munsell Notation 5BG.7.0 10.4 as specified in ANSI Z55.1.

4.7.4.4 The kVA rating in Arabic numeral 64mm high shall be stenciled in black paint on the tank.

4.7.5 GROUNDING TERMINAL

4.7.5.1 A tank grounding connector of the solderless connector type capable of accepting either copper or aluminum conductors sized and located according to ANSI C57.15 shall be furnished.

4.7.6 NAME PLATE

4.7.6.1 A name plate of type, material and location on the regulator complying with ANSI C57.15 shall be furnished. English language and metric

system units shall be used. Name plates shall be bar coded and contain the name of the manufacturer and regulator serial number.

4.8 REGULATOR OIL

- 4.8.1 Each regulator shall be delivered filled with new unused mineral oil meeting the requirements of ANSI c57.15.
- 4.8.2 The manufacturer shall affix a blue label to each regulator to indicate that the oil is PCB free. The label states that the oil is certified to be PCB free shall have approximate dimension 50mm X 20mm. The label shall be positioned in such a manner as to be easily visible with the regulator installed.
- 4.8.3 The manufacturer shall provide a certificate indicating that the oil used in the regulators to be supplied is PCB free.

4.9 SPARE PARTS

The manufacturer shall provide their recommended spare parts list with a recommended quantity for each item. This list shall be priced and its cost shown as a separate item in the bid.

Spare parts shall be individually quoted and priced to be delivered with the quantity of regulators required. However, the purchaser at time of award may elect to increase or decrease the quantity of spare parts to be ordered or contracted at the unit prices quoted.

5. TESTS

- 5.1 Refer to “Tests’ section 5 of Technical Specifications General Requirements.”
- 5.2 Manufacturer shall invite purchaser’s representatives. [2] at manufacturer’s expense to witness the tests. The invitation shall be extended at least two [2] weeks before commencement of such tests. This condition may be waived at the discretion of the purchaser.

The cost to the purchaser for the witnessing of such tests shall be shown as a separate item in the bid.

- 5.3 certified test reports shall be provided for each regulator supplied. Test reports shall be in accordance with NEMA Standards in both content and format. Test reports shall be provided before delivery of regulators and will be required at the time of inspection by purchaser’s representatives.

- 5.4 All regulators which are ready for delivery shall be made available for physical inspection and random selection of samples for testing.

6 PACKAGING AND MARKING

- 6.1 All regulators shall be individually packaged in wood crates.
- 6.2 The spare parts shall be separately crated.
- 6.3 All crates shall be suitably constructed to offer protection to its contents.
- 6.4 The crated regulators and spares shall be shipped in containerized cargoes.
- 6.5 For 'Export Marking' refer to section 8 of "Technical Specifications General Requirements.

7 SHIPMENT

- 7.1 Manufacturer shall await written authorization of purchaser before commencing shipment of regulators.