

TECHNICAL SPECIFICATIONS
SHUNT CAPACITOR AND CAPACITOR SWITCHING EQUIPMENT
JPS SPECIFICATION No. 1053-S-10

PART INDEX

1.	Scope	2
2.	General Requirements.....	2
3.	Standards and Service Conditions	4
4.	Detailed Requirements	5
4.1	Capacitors Unit	5
4.2	Capacitor Oil Switch	6
4.3	Automatic Control Device	7
4.4	Capacitor Bank Construction.....	9
5.	Tests	11
6.	Export Packaging.....	11
7.	Shipment.....	11

The “Technical Specifications, General Requirements” forms a part of this specification.

1. SCOPE

This specification covers the design, manufacture, testing and delivery of Shunt Capacitors and Capacitor Switching Equipment for Jamaica Public Service Company Limited. All works listed previously shall be as described in this specification and in accordance with the latest issues of the following standards and other publications referred to, except for the special provisions of the specifications stated herein.

2. GENERAL REQUIREMENTS

2.1 SUBMITTALS

2.1.1 Information to Accompany Tender

The supplier shall submit the following information with the tender.

- 2.1.1.1 General standard layout drawing of the capacitors, banking arrangement and switching equipment showing details of construction, principal dimensions and weights.
- 2.1.1.2 Manufacturer's guaranteed certified ratings, performance data and nameplate.
- 2.1.1.3 Separate optional prices for performing selective tests as stated in this specification.
- 2.1.1.4 Paint specifications and detail of finishes.
- 2.1.1.5 Insulating fluid specifications including guarantee that the PCB level of the insulating fluid is less than two (2) parts per million (< 2ppm).
- 2.1.1.6 National Standard(s) used for design, manufacture and testing.
- 2.1.1.7 Bidder **MUST** complete and submit with his Bid, the attached Technical Specification "Data Forms". Bids submitted without the completion of the applicable forms will not be evaluated. All forms shall be signed by the manufacturing engineer to be considered complete.

All information accompanying the tender shall be bound with and form part of the contract should an order be placed.

- 2.1.2 Refer to "Submittal of Information" Section 2 paragraph 2.1 of "Technical Specifications, General Requirements."

2.2 DRAWINGS, ETC. BY SUPPLIER

2.2.1 Submission of Drawings

Three (3) copies of the following drawings of one bank of shunt capacitor from each group of identically rated capacitors in an order shall be submitted for review by JPSCo after ordering but before manufacturing commences:

2.2.1.1 Capacitor drawings indicating dimensions and the locations of all attachments and accessories, inclusive of;

2.2.1.1.1 Capacitor Bank rack detail.

2.2.1.1.2 Capacitor terminals and bushing detail.

2.2.1.1.3 Oil Switch and bushing detail.

2.2.1.1.4 All nameplate detail.

2.2.1.1.5 The name of the paint manufacturer and types of paint to be used (product number with catalogue references) and the painting/finish process.

2.2.2 Submission of Test Results

Three (3) copies of the certified test results shall be submitted to JPSCo for review after fabrication. JPS shall provide suppliers with a permit to ship after a satisfactory review process. Under no circumstances shall shipment commence without written approval from JPS.

2.2.3 Instruction Manuals

An instruction manual shall be supplied for each capacitor bank. The instruction manuals shall be supplied to JPSCo with the delivery of the capacitors.

2.2.4 Exceptions to Specifications

Nothing contained in the tender shall be construed as permitting any modification to the requirements of this specification unless JPSCo grants approval in writing. Accordingly, bidders are free to submit tenders on equipment differing from this specification provided they clearly define the differences they propose in a separate document entitled "**Exceptions to Specifications**".

2.2.5 Warranty

The minimum warranty period shall be 18 months from date of payment or 12 months in service, whichever occurs first. The capacitor shall be guaranteed for a minimum of 3 years in normal operating conditions, against any manufacturing defects or design anomalies.

2.2.6 Omissions

Notwithstanding any omissions in this specification, the equipment as specified herein is to be delivered, ready for operation on JPSCo Distribution System without additional charge.

3. STANDARDS AND SERVICE CONDITIONS

3.1 STANDARDS

3.1.1 Design, construction, performance and testing of the equipment shall conform to all applicable provisions and requirements of the following standards:

- NEMA Standard Publication (CP-1) Shunt
- IEEE Standard for Shunt Capacitors, STD 18 - 2002
- IEC Publication 871-1 Shunt Capacitors for A.C. Power Systems
- ANSI C37.66 Standard Requirements for Capacitor Switches for AC Systems
- NEMA SG4 - 2009
- ASTM D1816 Test method of dielectric fluid
- CSA C50 Insulating Oil, Electrical for transformers and switches.
- EEMAC B6-1 Insulating mineral oil for new electrical apparatus.
- American Welding Standard, AWS D1.1/D1.1 M: 2008
- ANSI C57.12.31 Pole Mounted Transformer Enclosure Coating Integrity

3.2 CONDITIONS OF OPERATION

Capacitor shall be suitable in all respects for operation on JPSCo. 50 Hz, 23,900GRDY/13,800V, multi- grounded neutral system and 13,800V ungrounded delta system; the capacitors are typically installed in banks of three. The equipment will be installed at an altitude below 1,800 meters and may be subjected to severe lightning, high humidity, salty atmosphere and occasional hurricanes.

The supplier shall acquaint himself with the conditions under which the capacitors will operate, and therefore shall assume full responsibility for understanding conditions of supply, operation and service.

3.3 CONFLICTS

In case of conflicts between this specification and any standards referenced herein, the more stringent shall have precedence and shall govern. The bidder is obligated to indicate all conflicts at the time of bid submission.

4. DETAILED REQUIREMENTS

4.1 CAPACITOR UNIT

Capacitor Rating

Unit Capacity, 1 phase (kVAR)	100	200
Bank Capacity, 3 phase (kVAR)	300	600
Primary Voltage (kV)	13.8	13.8
BIL (kV)	125	125
Insulation Class (kV)	25	25
Number of Bushings	2	2
Frequency (Hz)	50	50
Maximum Watts Loss per kVAR (including losses of discharge device and fuses)	0.20W	0.20W

4.1.1 CONSTRUCTION OF CAPACITOR UNIT

The Capacitor Dielectric System shall use materials designed to produce low losses and provide the best fuse co-ordination to clear faults. Fluid used to impregnate the element and fill the case shall be Non-PCB and Biodegradable.

PCB FLUIDS ARE NOT ACCEPTABLE AND UNDER NO CIRCUMSTANCES WILL BE APPROVED.

4.1.2 Capacitor Cases shall be AISI# 409 stainless steel suitable for outdoor service, painted with a zinc chromate primer coat and finished with an acrylic enamel (heat cured) preferably light grey in color.

4.1.3 Capacitor bushings shall be wet porcelain, light grey in color, solder-sealed to the top of the capacitor case. The bushings shall be furnished with clamp type parallel groove terminal connectors to accommodate one or two conductors (copper or aluminum) from 8 mm² – 35 mm² stranded. The nut shall be plated with a soft brass to strip, if excess torque is applied, before damage is done to the bushing or stud. Bushings shall have a minimum creep distance of 457 mm (18”). Each bushing shall be fitted with an insulating cap.

4.1.4 Nameplates, lifting eyes, mounting brackets, grounding provisions, impregnate identification etc. for each capacitor unit shall be supplied in accordance with provisions of ANSI/IEEE 18-2002.

4.2 CAPACITOR OIL SWITCH

4.2.1 TYPE

4.2.1.1 Outdoor, oil-immersed, single pole, single throw, electrically operated switch for switching pole mounted capacitor banks.

4.2.2 RATINGS

- 4.2.2.1 Nominal System (kV) 23.9 GRDY/13.8 kV
- 4.2.2.2 Frequency (Hz) 50
- 4.2.2.3 Nominal Switch Rating (kV) 14.4
- 4.2.2.4 Switch BIL (kV) 125
- 4.2.2.5 10 Sec. Withstand, 50 Hz Wet (kV) 50
- 4.2.2.6 One minute withstand, 50 Hz Dry (kV) 50

4.2.2.7 Current Ratings in Amperes

Continuous Current	200
Maximum 50 Hz Capacitor Switching	150
Momentary (RMS-ASTM)	9000
Short time 1 Sec. (RMS-SAM)	4500
Short time .5 Sec. (RMS-SAM)	6000
Rated Making Current (RMS-ASYM)	9000
Maximum Peak - Inrush	12000

4.2.2.8 Control Operating Supply 110 volt, 50 Hz

4.2.3 CONSTRUCTION AND OPERATION OF OIL SWITCH

- 4.2.3.1 Tank and mechanism housing shall be made completely weather proof. The tank shall be of oil tight construction. External surfaces shall be galvanized and painted with a red primer coat, an intermediate coat that dries to form a moisture, salt, and abrasion resistant coating, and a final coat of light gray polyurethane.
- 4.2.3.2 Bushings shall be wet process porcelain, light gray color. Bushings supplied with 125 kV BIL equipment shall have a minimum of 406 mm (16") creep. Each bushing shall have solderless connectors for aluminum or copper conductors up to 70 mm².
- 4.2.3.3 Oil Switch shall be furnished with transformer type mounting for directly bolting to the capacitor rack detailed in Paragraph 4.4.2.
- 4.2.3.4 Oil Switch shall be delivered assembled and filled with standard grade non-PCB insulating oil.
- 4.2.3.5 Oil Switch shall be equipped with an electrical operating device for remote opening and closing of the switch. This device may be solenoid operated or motorized.
- 4.2.3.6 The top cover of the switch shall be capable of rotating as required for bushing alignment and clearance.
- 4.2.3.7 Oil Switch shall be furnished with grounding lug, nameplate with rating details, and all necessary appurtenances as required by ANSI C37.66.
- 4.2.3.8 The oil switch lever shall be protected by a weather shield of high-visibility while permitting complete access for manual operation.
- 4.2.3.9 **Supply of Accessories**
 - 4.2.3.9.1 The oil switches will be used to control three phase capacitor banks. Three (3) switches will be installed at one (1) location and will be controlled by one (1) automatic control device.
 - 4.2.3.9.2 A weather proof junction box, complete with pin connectors, weather proof connecting control cable, mounting hardware and other items necessary to bring the control circuits to a central terminal block on the capacitor bank frame shall be furnished with every three (3) oil switches supplied.

- 4.2.3.9.3 Bidder shall furnish with his bid; the type, size and location of connection provisions on the junction box required for connection to the control device; if this is not supplied with the capacitor units.

4.3 AUTOMATIC CONTROL DEVICE

4.3.1 TYPE

Adaptive capacitor controller suitable for use outdoors; manufactured with time and voltage over-riding capabilities for use with standard 4-plug meter socket, to control capacitor oil switches.

4.3.2 RATINGS

- 4.3.2.1 Source supply 120 volt, 50 Hz, single phase.
- 4.3.2.2 PCC Power and RMS Sensing Range 95-135 volts.
- 4.3.2.3 Switching Relay capacity 10 Amps continuous, 50A, 50% pf, 6 cycles in-rush.
- 4.3.2.4 Contact closure period -programmable 1-1000 seconds in 1-second increment.
- 4.3.2.5 RS232 communication port, DB9 female connector optical port type 2

4.3.3 CONSTRUCTION AND OPERATION

- 4.3.3.1 The automatic control device shall be designed to measure single phase line voltage and as a function of that quantity control a single pole, double throw (spot) relay, which in turn operates capacitor bank oil switches specified in Paragraph 4.3.
- 4.3.3.2 Device shall be weather proof and tamper resistant, suitable for use with a standard four (4) terminal meter socket. The sensing elements, switches, other elements and accessories shall be mounted in a cast aluminum case, with locking hardware and provision for padlocking.
- 4.3.3.3 Device shall be an electronic response type, with an adjustable time delay feature (approximately 15 to 120 seconds).

- 4.3.3.4 Device shall have responding bandwidth of 95 to 135 volts capable of adjustment within 2 volts.
- 4.3.3.5 Device shall be manufactured with the following additional features;
 - 4.3.3.5.1 Two position switch for either "manual" or "auto" operation.
 - 4.3.3.5.2 Three (3) position switch for manual operation "open", "neutral" and "closed".
 - 4.3.3.5.3 Operation Counter
 - 4.3.3.5.4 Source voltage test terminals.
 - 4.3.3.5.5 Nameplate with complete ratings and data.

4.3.4 OTHER PROVISIONS

If device is not suitable for use with a standard four (4) terminal meter socket, then a suitable socket with all necessary accessories shall be provided. The socket, if furnished, shall have one (1) inch threaded pipe hubs, top and bottom, a grounding lug, and mounting holes.

4.4 CAPACITOR BANK CONSTRUCTION

Capacitor Banks shall be designed for outdoor, pole mounting utilization. The capacitor bank shall be supplied with three (3) single phase shunt capacitor units, assembled in an "inline" direct mounting aluminum rack; three (3) capacitor oil switches, and one (1) high impact polymer junction box to bring the control circuits to a central terminal block. The capacitor mounting rack shall have provisions for attaching all stated equipment and provisions for attaching a small power transformer (maximum 3 kVA).

- 4.4.1 A pole mounted capacitor rack frame shall be provided to mount the capacitor units. The rack frame shall be made using lightweight, all-aluminum (ASTM 6061-T6). The capacitor rack frame shall include the following features:
 - 4.4.1.1 Pole mounting plate with 10 inch hole spacing for direct pole mounting. The pole mounting plate shall also have provision for the use of pole bands (2). The pole-mounting bracket shall be supplied with a grounding connector and with jump-proof lips.

The pole mounting plate shall allow for mounting of the pole mounted capacitor rack to round poles, either wooden or concrete.

- 4.4.1.2 Legs that allow the capacitor rack (with all accessories installed) to sit level on the ground.
- 4.4.1.3 Four lifting eyes/lugs that will enable level lifting.
- 4.4.1.4 Appropriate mounting bracket for the mounting of a small power transformer; no more than 3 kVA.
- 4.4.1.5 Capacitor Rack shall be capable of supporting three (3) single-phase capacitor units as rated in paragraph 4.1 and three (3) capacitor oil switches rated as per 4.2. Proper sized weather resistant bolts, nuts, washers, locknuts etc. shall be furnished with each frame for attaching capacitor units, oil switches with a junction box, and a power transformer to the frame. Purchaser will furnish all pole attachment hardware.

4.4.4.1 **Nameplate and Markings**

All equipment shall be provided with nameplates containing all information, connection diagrams, etc., in accordance with the standards listed in Section 3.1. The nameplates shall be bar coded with all manufacturing information.

In addition to the information to be contained in the nameplate and connection diagram as outlined in the Standards, the nameplate shall contain the following information:

- Jamaica Public Service Company Ltd.
- Purchase Order Number
- Total weight of the insulating liquid in kilograms
- Total volume of the insulating liquid in litres
- PCB content
- Protective devices information

5. TESTS

- 5.1 Tests shall be made in accordance with the applicable standards in Section 3.1 above.
- 5.2 Manufacturers' standard production and quality control tests shall be made.
- 5.3 All tests shall be conducted at the place of final manufacture by and at the expense of the Supplier for the entire contract quantity.
- 5.4 Certified copies of test reports made in accordance with 5.1, 5.2 above shall be submitted by Supplier to the purchaser along with required documents for each shipment.
- 5.5 Manufacturer shall invite the purchaser's representatives (2) at manufacturers' expense to witness the tests. This 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 be borne by the purchaser for the witnessing of test shall be shown as a separate item in the bid.
- 5.6 Refer to "Tests" section 5 of "Technical Specifications, General Requirements"

6. EXPORT PACKAGING

- 6.1 Materials shall be securely crated or otherwise protected against damage in transit for ocean and land shipment.
- 6.2 Commodities normally packaged in cardboard containers shall be packed in wooden crates.
- 6.3 Refer to "Export Packaging" and "Export Marking" Section 7 and section 8 of "Technical Specifications, General Requirements"

7. SHIPMENT

- 7.1 Manufacturer/Supplier shall await written instruction of purchaser before the shipping of any equipment or materials.

All queries on this specification shall be directed to:

**Manager
Engineering Department
Jamaica Public Service Co. Ltd.
693A Spanish Town Road
Kingston 11, Jamaica**

TECHNICAL SPECIFICATIONS

SHUNT CAPACITOR AND CAPACITOR SWITCHING EQUIPMENT

JPS SPECIFICATION No. 1053-S-10

Effective: June 15, 2010

Prepared by: _____ Hugh Hamilton Engineering Department	Approved by: _____ Lloyd Blackwood Manager (Actg), Engineering
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Shunt Capacitor Data Sheet

The completion of this sheet is mandatory; it forms part of the Bid Evaluation Process

Manufacturer Name	
Country of Origin	
Catalogue Number	
Size (kVAR Rating)	
Frequency (Hz)	
Voltage (kV)	
Capacitance (µF)	
Impulse Withstand Voltage (kV)	
Rated Current (A)	
Residual Voltage (V)	
Discharge Time (s)	
Standards used for designing capacitor	
Standards used for manufacture	
Standards used for testing	
Insulating Fluid PCB Level (Is certification provided) (PPM)	
Dielectric withstand voltage for insulating oil	
Protection for Capacitor	
Watt loss per kVAR, including losses of discharge device & fuses (W/kVAR)	
Dielectric Material	
Number of Bushings	
Creepage Distance of Bushings	
Connection of capacitor bank	
Capacitor housing Material	
Color of finish	
Mounting Rack Material	
Attached drawing indicating all relevant dimension and weight?	
Guaranteed delivery time (weeks)	
Warranty Period	
Exceptions	
Manufacturing Engineer	Signature _____

Oil Switch Data Sheet

The completion of this sheet is mandatory; it forms part of the Bid Evaluation Process

Manufacturer Name	
Country of Origin	
Catalogue Number	
Rated Maximum Voltage (kV)	
Nominal Voltage Class (kV)	
Frequency (Hz)	
Impulse Withstand Voltage, BIL (kV)	
Continuous Current (A)	
Capacitive Switching Current (A)	
Momentary Current Rating (A, Asym)	
Short Time Current Ratings: 0.5s and 1s (A, Asym)	
Motor Current Rating (A)	
Operating Voltage (V)	
Insulating Fluid	
PCB Level (PPM)	
Weight (Kg) and Volume (cm ³) of Oil	
Tank Material	
Paint Manufacturer and Process	
Minimum Creep Distance of Bushings	
Attached drawing indicating all relevant dimension and weight?	
Guaranteed delivery time (weeks)	
Warranty Period	
Exceptions	
Manufacturing Engineer	Signature _____

Capacitor Controller Data Sheet

The completion of this sheet is mandatory; it forms part of the Bid Evaluation Process

Manufacturer Name	
Country of Origin	
Catalogue Number	
Input Voltage (V)	
Frequency (Hz)	
Sensing Accuracy	
Voltage Transformer Ratio (including increments)	
Maximum Power Consumption (VA)	
Switching Relays Capacity (A)	
Max. Line Current Sensor Input (A)	
Load Fuse Rating / Controller Fuse Rating (A)	
Communication Port/s	
Material Type of Enclosure	
Weight	
Meter Socket (4 Jaw or 6 Jaw)	
Counter/Display	
Guaranteed delivery time (weeks)	
Warranty Period	
Exceptions	
Manufacturing Engineer	Signature _____