TECHNICAL SPECIFICATIONS

THREE PHASE DEAD FRONT DISTRIBUTION AND POWER TRANSFORMER

JPS NO. 6950-S-04

(Revised August 2022)

PART INDEX

THE "TECHNICAL SPECIFICATIONS, GENERAL REQUIREMENTS" FORMS A PART OF THIS SPECIFICATION.

1. SCOPE

1.1 This specification covers the design, manufacture, testing and delivery of Three Phase, Dead Front, Pad Mounted Distribution and Power Transformers for the 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 by these standards except for the special provisions of these specifications stated herein.

All general details of construction must be approved before or as construction proceeds, but delay in such approval shall not be permitted to interfere with the time of shipment that has previously been agreed on. Additionally, delay in such approval shall not relieve the contractor from his full responsibility to furnish the equipment that is consistent with this specification. Satisfactory operation in service shall be the only basis of final acceptance, and no prior approval of drawings, etc. shall relieve the contractor from making good, free from all cost or expense to JPSCo, any defects in design, workmanship or material that may subsequently develop.

1.2 CONDITIONS OF OPERATION

Transformer shall be suitable in all respects for operation on a 50 Hz. Multi-grounded neutral system and ungrounded delta system.

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

2. GENERAL REQUIREMENTS

2.1 Submittals

2.1.1 Information to Accompany Tender

In addition to the information requested in the 'Request for Quotation' bidders shall submit the following information with the tender.

a. General standard layout drawing of the transformers showing overall dimensions, location of all bushings and external attachments.

b. Standard nameplate drawing including approximate weight and quantity of insulating liquid.

c. Separate optional prices for performing type tests as stated in this specification.

d. Paint specifications.

e. Guarantee that the insulating fluid will not contain more than 2 ppm of PCB's.

f. Details of whether the transformer windings and end connections of the secondary windings are copper or aluminum, and the method of connection to the secondary terminal bushing.

g. Guaranteed average no-load and load losses.

h. Bidder MUST complete and submit with his Bid, for each rating and type of transformer, the "**Transformer Data Form**" (Exhibit "A") included in the "Schedule of Technical Data."

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

2.2.2 Submission of Drawings

Three (3) copies of the following drawings of one transformer from each group of identically rated transformers in an order shall be submitted for approval by JPSCo after ordering but before manufacturing commences:

1. Transformer outline indicating dimensions and the locations of all attachments and accessories;
2. Low-voltage phase terminal and bushing detail;
3. Low-voltage neutral terminal detail;
4. High-voltage bushing detail;
5. Nameplate detail
6. The name of the paint manufacturer and types of paint to be used (product number with catalogues).
7. The name and type of transformer protective device used including the product catalogue.
8. High voltage load break switch detail and design

2.2.3 Submission of Test Results

Three (3) copies of the certified test results after production shall be submitted to JPSCo for review after manufacture, **but before delivery.**

2.2.4 Instruction Manuals

An instruction manual shall be supplied for each transformer. The instruction manual shall be supplied to JPSCo before the delivery of the transformers.

2.2.5 Exceptions to Specifications

Nothing contained in the tender shall be construed as permitting any modification to the requirements of this specification, unless JPSCo approves such modification 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 letter entitled "**Exceptions to Specifications**".

2.2.6 Warranty

Information on the **Transformer Data Form** shall include the guarantees the manufacturer is prepared to make and shall be signed by the manufacturing engineer.

The minimum warranty period shall be 18 months from date of payment or 12 months in service, whichever occurs first. The transformer shall be guaranteed for a minimum of 3 years against sweating or leaking.

2.2.7 Omissions

Not withstanding any omissions in this specification, the equipment as specified herein is to be delivered, ready for operation on JPSCo's Distribution System without additional charge. Any incidentals, extra work or alterations of any kind which may be required for fulfillment of this contract, or that the manufacturer may now, or during the guarantee period, deem expedient or desirable to be furnished for the successful operation of the Transformer, shall be assumed to have been included in the price submitted by the bidder.

2.2.8 Delivery

The Manufacturer/Supplier shall state in weeks the shipment time from the date of award of contract. The location within Kingston, Jamaica to which the delivery is to be made will be specified by the time of shipment. Transformers shall only be delivered after the JPSCo has approved the transformer drawings, test results and the instruction manual.

2.2.9 Basis for Penalties and Rejection

2.2.9.1 Transformers may, notwithstanding any payments which may have been made upon delivery, be rejected based on the certified test report submitted, or on subsequent tests made after delivery.

2.2.9.2 The basis for rejection of a transformer or entire order shall be based on the transformer not meeting requirements specified in this document and on the following:

a. Transformers, including accessories, leaking within a period of 3 years, when not brought about by rough handling or abuse after installation, shall be considered rejected unless the Contractor agrees to repair or replace subject units free of all cost and expense to JPSCo.

b. If the transformer temperature rise exceeds the guarantee value during full load head run.

c. If the audible sound level exceeds the guaranteed and specified level.

d. If the voltage ratio and tap ratio vary by more than 0.5%.

e. If during normal service operation, the winding insulation shows signs of rapid deterioration, dissolving in the insulating liquid or carbonizing.

f. If the PCB content of the transformer insulating fluid exceeds two parts per million.

g. If the transformers tank and parts thereof show signs of premature rust resulting from improper exterior finishing or scratching of the paint during shipment by manufacturer.

h. If the final average measured losses of “identical", units comprising the order exceed the guaranteed values by 10% for no load loss and/ or 6% for quoted total loss, i.e. no load + load loss.

i. If the full load impedance at 85°C is less than the guaranteed value.

2.2.9.3 If there are no grounds for rejection based on the above, but an order of transformers exceeds loss guarantees on an average basis, a penalty may be imposed. Penalties imposed for excess losses will be calculated on the basis of the average of the order, and the calculation will be based on the same Present

Worth of Losses formula that is used to evaluate tenders, and is given in the accompanying inquiry.

2.10 Witnessing of Test and Production

During the period of manufacture, the contractor shall provide JPSCo Representatives with safe and proper facilities for inspection of work at the factory or factory of a sub-contractor at all reasonable time until completion.

The contractor shall provide JPSCo with at least fourteen (14) days notice, plus travel time, in writing before any shop tests for acceptance are carried out in case it is decided to have a JPSCo Representative witness the testing procedure. **Regardless of whether or not a Representative witnesses the tests, the manufacturer is required to submit certified test results to JPSCo for approval before any transformers are shipped.**

See section 5 for further stipulations on testing.

At any time during the guarantee period, any or all of the previously performed tests may be repeated on the premises of JPSCo, whether or not there is any reason to doubt the accuracy of previously performed tests. If material differences exist between the certified tests and the repeated tests, JPSCo shall retain the right to reject all or any of the transformers.

2.11 Refer to “Submittal of Information” Section 2 paragraph 2.2 of “Technical Specifications, General Requirements.” for other information

3. STANDARD AND SERVICE CONDITIONS

3.1 STANDARDS

3.1.1 Refer to “Codes and Standards” Section 3 of “Technical Specifications, General Requirements.”

3.1.2 The Equipment being supplied shall conform to the latest editions of all relevant articles of the **IEEE C57 – Power, Distribution and Regulating Transformers Standards**. All applicable parts of the standards shall be observed in the design, manufacture, performance and testing.

Where equipment, components or materials are not covered by the IEEE C57 standards, relevant sections of the following standards shall apply:-

- ANSI Z55.1 Gray finishes for Industrial Apparatus and Equipment.
- ASTM D1816 Test method of dielectric oil
- CSA C50 Insulating oil, electrical for transformers and switches.
- EEMAC B6-1 Insulating mineral oil for new electrical apparatus.
- NEMA TR-1 Transformers, Regulators and Reactors.
- NEMA TR-P9
- WUG 2.13 Rev 4
- ANSI/IEEE 386-1977
- NETA Inter-National Electrical Testing Association

3.2 SERVICE CONDITIONS

3.2.1 Equipment will be installed outdoors in a tropical climate, subject to severe lightning, high humidity, and occasional hurricanes. The atmosphere is salty.

The general conditions are:

a. Altitude above sea level: Less than 1,524 m (5,000 ft).
b. Relative humidity (Annual Average): 80 %.
c. Minimum extreme temperature: 4.4 degrees C.
d. Maximum extreme temperature: 40 degrees C.
e. Avg. Temp. Over any 24 hr period shall not exceed: 30º C.
f. Annual average temperature: 26º C.
g. Within 30 meters from the sea

3.3 CONFLICTS

3.3.1 In case of conflicts between this specification and any other specification to which it refers, this specification shall have precedence and shall govern. However, the bidder shall point out these conflicts in his bid at the time of tendering.

4. DETAILED REQUIREMENTS

4.1 TYPE & VOLTAGE RATINGS

4.1.1 Three Phase, Oil immersed, self-cooled, outdoor, dead front, pad-mounted transformer suitable for loop feed applications with high voltage bushing well/ Insert combination as per IEEE 386.

Primary and Secondary Voltage as indicated:

4.1.1.1	Primary volts:	6900/11950V GRD Y X 13800 /23900V GRD Y X 13800V Delta. Transformer to be connected 23.9kV Wye, 11.95kV Wye or 13.8kV Delta.
	Secondary volts:	240/415V GRD Y X 240V Delta. Required for operation on 240/415V-wye solid grounded system. Re-connectable for operation on 240V Delta System, centre tap required on one winding to provide 120V-0-120V when connected delta. When connected Delta the tapped phase must be able to supply 15% more load than either of the two phases.
4.1.1.2	Primary volts:	13800 /23900V GRD Y X 13800V Delta. Transformer to be connected 23.9kV Wye or 13.8kV Delta.
	Secondary volts:	See secondary volts of 4.1.1.1
4.1.1.3	Primary volts:	13800/23900V GRD Y. Required for operation on 13800/24000V Wye solid multi-grounded systems only.
Option 1	Secondary volts:	See Secondary volts of 4.1.1.1
4.1.1.4	Primary volts:	13800/23900V GRD Y. Required for operation on 13800/24000V Wye solid multi-grounded systems only.
Option 1	Secondary volts:	6900/11950V GRD Y X 13800V Delta.
Option 2	Secondary volts:	4000 GRDY/2300 V
4.1.1.5	Primary volts:	6900/11950V GRDY X 13800/23900V GRD Y. Transformer to be connected 23.9kV Wye or 11.95kV Wye.
	Secondary volts:	See secondary volts of 4.1.1.1

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4.2 OTHER RATINGS

Conforming to Paragraph		4.1.1.1	4.1.1.2	4.1.1.3	4.1.1.4 Option 1	4.1.1.4 Option 2	4.1.1.5
A	No. of phases	Three (3)					
B	Primary Voltage	23.9 kV Grd Y or 11.95kV Grd Y or 13.8 kV Delta	23.9 kV Grd Y or 13.8 kV Delta	13.8/24 kV GrdY	23.9 kV Grd Y	23.9 kV Grd Y	23.9 kV Grd Y or 11.95kV Grd Y
C	BIL (kV)	125	125	125	125	125	125
D	Insulation Class (kV)	25	25	25	25	25	25
E	Secondary Voltage	240/415 V Grd Y or 240 V Delta	240/415 V GrdY or 240 V Delta	240/415 V GrdY or 240 V Delta	6.9/11.95 KV Grd Y or 13.8 kV Delta	4000 Grd Y	240/415 V GrdY or 240 V Delta
F	BIL (kV)	30	30	30	110	110	30
G	Insulation Class (kV)	1.2	1.2	1.2	15	15	1.2
H	Frequency (Hz)	Fifty (50)					
I	Displacement Delta-Wye	30 º	30 º				
J	Delta- Delta	0 º	0 º				
L	Wye- Delta	30 º	30 º	30 º	30 º		30 º
K	Wye-Wye	0 º	0 º	0 º	0 º	0 º	0 º
M	Continuous rated capacity at 65º C Temp. Rise	See Material Schedule for Quantities and Sizes					
N	Primary Taps	Two (2) 2.5% above and two (2) 2.5% below normal tap					
O	Impedance	5.75 %±7.5%	5.75 %±7.5%	5.75 %±7.5%	5.75 %±7.5%	5.75 %±7.5%	5.75 %±7.5%

4.3 PERFORMANCE

4.3.1 TEMPERATURE RISE

The temperature rise measured by resistance method shall not exceed 65°C at a maximum ambient temperature of 40°C when operating continuous at rated capacity.

4.3.2 DIELECTRIC STRENGTH

The transformers shall be designed, tested and constructed to withstand the induced voltage, the applied voltage and the impulse voltage tests in accordance with the recommendations of ANSI C57.90 for this class of transformers.

4.3.3 OVERLOAD CAPACITY

The transformers shall be able to carry overloads in accordance with requirements of ANSI C57.92, with moderate sacrifice of life expectancy.

4.4 AUDIBLE SOUND

The audible sound level of transformers when operating at rated voltage, and measured as per ANSI C57.12.90 shall not exceed the stipulated sound levels indicated below.

Transformer Size (kVA)	**Audible sound level (dB)**
50	48
100	51
150	55
200	55
300	56
500	56
750	57
1000	58
1500	60
2000	61
2500	62
3000	63

4.5 CONSTRUCTION

Mechanical design shall be to ANSI requirements, unless otherwise specified below.

A. Dimensions

The overall dimensions of the transformer and compartment shall be kept to a minimum.

B. Exterior Finish

Modestly sculptured corners and round edges are encouraged.

1. The transformer and compartments shall be painted standard Seafoam Green or Munsell Green 70 or owner approved equivalent.

   Manufacturers must specify details of the paint system being offered. The inside of the compartments, the underside of the roofs and the side of the transformer facing into the compartment shall also be painted Seafoam Green or Munsell Green 70 or owner approved equivalent.

2. The finish shall conform to ANSI C57.12.28; with the exception of the salt spray test that shall be of 1500 hours duration.

3. There shall be no plates or exterior stenciling positioned on the outside of the transformer tank or switching compartment except for a small plate or decal showing the name of manufacturer and high voltage warning labels.

C. Tank and Compartment Assembly:

1. Provision for lifting shall be provided and shall be adequately strengthened, sized and arranged on the tank to provide a suitable lift for the completely assembled unit. The transformer base shall be arranged so that the tank bottom does not touch the pad.

2. The welding shall conform to AWS Standard.

3. Diagonal break marks on large surfaces sharp edges and protruding parts shall be avoided where possible.

4. The strength of the transformer shall be as such as to withstand a minimum gauge pressure of 70 kPa without leakage or permanent distortion of the tank exceeding 0.25% of the diagonal dimension of the surface so affected.

5. A pentahead bolt, used in addition to a safety latch, shall be provided so that the door cannot be padlocked unless the pentahead bolt has been fastened down. The locking arrangement shall be recessed into the enclosure panel, as per ANSI C57.12.26-1987 (or latest edition) figure 11. The penta head bolt shall

be held captive to prevent removal and thread damage during operation of the door including forceful closing.

6. Furnished with side mounted parking stands for each high voltage bushing furnished, minimum three per phase. The parking stands in the middle for Loop Feed shall have sufficient space around them to accommodate Elastimold Cat. #163FTR or equivalent feed-thrus. Bushing spacing shall meet the minimum dimension of ANSI C57.12.26 figures 2 and 4.

7. The switching compartment door shall be capable of being closed and locked when elbows of the H.V. cable and grounding elbows are inserted into the feed-thru connectors.

8. Provided with a pull-ring type automatic pressure relief system with means for manual operation in accordance to ANSI.

9. Provided with two 25mm (1-inch) minimum brass pipe plugs or fittings for filling, draining, and pressure testing.

10. Provided with a thermometer or temperature gauge, maximum indicating type.

11. Provided with a magnetic type insulating fluid level gauge. The fluid gauge shall not show residual liquid when fluid is below the gauge.

D. Insulating Fluid

1. Furnish unused mineral oil. The dielectric strength of the fluid, when shipped inside the transformer, shall not be less than 45 kV, when tested with ASTM D1816 using 2mm electrode spacing.

2. Provide insulating fluid containing no more than two parts per million of PCB's when tested in accordance with Ontario Hydro Specification M -104M-85.

   The type of insulating fluid used is to be stenciled on the inside of the transformer switching compartment cover in white bold 25mm letters.

E. Drip Tray

1. A fixed tray, designed to retain 100ml of insulating fluid and prevent the fluid from dripping down the tank wall or onto accessories, shall be installed below the location of each withdrawable fuse. Owner approved removal oil-absorbent material shall be installed in the tray. Water running down the tank wall shall not collect in the trays.

2. In all instances, the design of the withdrawable fuse assembly shall be such that repeated insertions and withdrawal of the fuse cannot result in loosening or detachment of any parts.

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F. Tap Changer

All tap leads shall be brought to a tap changer inside the transformer tank. Tap changer shall be externally operated and provided with a lockable handle and plate clearly designated by number or letters the tap setting. Such designation will be easily identified with voltage of the tap shown on the name- plate. The operating handle shall be installed in the cable entrance compartment at such a location that it is visible and accessible with cables in place and handle shall be capable of being locked in any position.

Tap changer will be operated only with the transformer de-energized. Tap changer shall meet requirements of ANSI C57.12.10 paragraph 9.2.1.

All transformers are required to have taps of 2.5 percent and 5 percent above and below nominal rated primary voltage, which shall operate on all voltage positions for multi-voltage units.

The tap position must be clearly identified in the cable compartment by a suitable method such that, the identification marks provided and furnished with a separate warning sign mounted close to the operating handle, cannot be removed under any operating conditions and last the life of the transformer under normal operating conditions. Letterings are to be 15 - 25 mm high.

G. CONNECTIONS AND TERMINATIONS

General

Each unit shall be supplied with terminals for loop feed pad mounted transformers. Six high-voltage bushing wells equipped with parking stands shall be supplied.

Low-voltage bushings and high-voltage bushing wells shall be replaceable without removing the core and coil assembly from the tank.

1. High Voltage Terminations

Each transformer shall be equipped with six (6) 200A fully insulated high-voltage bushing wells complete with inserts, two per phase, to facilitate a loop-feed arrangement. The bushing well shall be Elastimold catalogue # K1601PC-S1 (or -T1) or approved equivalent and the insert Elastimold catalogue # 2701A4 or approved equal.

The high-voltage neutral of the GrdY primary shall be brought out the tank wall through an insulated neutral bushing designated H_o to facilitate testing. The H_o terminal is not to be grounded internally to the tank wall. The neutral terminal shall be connected externally to the grounding spade terminal, which is grounded to the transformer tank cover or wall (see section 3.4).

2. Low Voltage Terminations

Each transformer shall be equipped with either four (4) or seven (7) low-voltage tinned copper terminals of the spade-type, in accordance with ANSI Standards.

The secondary terminals shall be capable of withstanding a minimum vertical cantilever force of 750N continuously applied at the outermost hole of the terminal without any fluid leakage, damage or permanent distortion to the terminal.

The low-voltage neutral shall be connected to an insulated neutral terminal designated x_o having a **current-carrying capacity equal to the other low-voltage terminals**. The x_o terminal is not to be grounded internally to the tank cover or wall.

Low voltage bushings, 2.3 kV and above, shall be equipped with solderless connectors sized as in paragraph above.

Low voltage bushings, 600 volts and below, shall be equipped with spade type terminals, NEMA drilled. Spade size and ampacity to be determined by transformer rating. Clamp type terminals, complete with non-ferrous bolts, nuts, washers, and lock washers for attaching these terminals to the spade shall be furnished. The clamp type terminals shall be of the "Cable Range" type with maximum range exceeding the ampacity of cable(s) required to continuously carry full load to the transformer, and shall be suitable for either copper or aluminum conductors.

All Transformers having seven (7) low voltage terminals shall come configured and connected with suitable connectors for 240V DELTA. All connectors for reconfiguring the secondary for 240/415V GRDY shall be supplied separately, attached to the transformers via suitable straps.

3. Grounding

A copper ground bus shall be mounted horizontally in the cable compartment on the lower front of the tank wall. The ground bus shall be drilled with four 15-mm diameter holes to allow ground connections.

H. NAMEPLATE, LABELS AND MARKINGS

1. Nameplate

The transformer shall be provided with a nameplate containing all information, connection diagrams, etc., in accordance with ANSI C57.12.00 paragraph 5.12.2. Nameplate shall be bar coded.

In addition to the information to be contained in the combination nameplate and connection diagram as outlined in ANSI, 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

The transformer nameplate and connection diagram shall be mounted on the cable entrance compartment of the transformer and shall be engraved such that the lettering will last the life of the transformer.

2. Warnings and Labels

a. Switching Compartment Plate

Each of the high voltage switches shall have a nameplate stating, “3 Phase gang-Operated Switch” and with markings identifying its purpose (i.e. Loop Feed A, Loop Feed B and Transformer Switch). The “OPEN” and “CLOSE” positions of each switch shall also be clearly identified.

The switch designations shall be clearly marked on the switch with the 25mm high lettering that will be legible for the life of the transformer under normal usage.

b. Warning Label - Tap Changer

A warning sign shall be mounted close to the tap changer handle and shall have engraved on it in bold 10mm minimum letters in red over white background:

OPERATE TAP CHANGER SWITCH ONLY WHEN TRANSFORMER IS DE-ENERGISED.

Centre lettering vertically and horizontally with 3mm between lines.

c. Warning label - Withdrawable fuse

A warning sign shall be mounted close to the withdrawable bayonet fuse holder handle and shall have engraved on it in bold 10mm minimum letters in red over white background:

DO NOT OPERATE FUSE ASSEMBLY UNLESS TRANSFORMER IS DE-ENERGISED.

OPERATE PRESSURE RELIEF DEVICE FIRST BEFORE PULLING OUT BAYONET FUSE HOLDER.

Centre lettering vertically and horizontally with 3mm between lines.

d. Hazard Warning Labels

Hazard warning signs conforming to EEMAC Standard L16-1 shall be affixed to the inside and outside of the compartment doors

Exterior markings

A self-adhesive tag shall be externally attached to the side of the transformer in the upper left corner. It shall contain the following information:

i. serial number

ii. kVA

iii. manufacturer's name or logo

iv. kV

v. stock code number

High voltage and Low voltage Terminal Markings

The high and low voltage terminals shall be stenciled H1, H2, H3, H0 and X1, X2, X3, X0 respectively in minimum 60mm high white lettering.

4.4.5 CORE

Cores shall be four (4) or five (5) leg cores made from cold rolled silicon steel with preferred grain orientation.

I. TRANSFORMER INSULATING OIL PRESERVATION SYSTEM AND OIL

The transformer shall be equipped with "Sealed Tank" Insulation Oil Preservation System and new, unused mineral oil meeting the requirements of ANSI C57.12.00 paragraph 6.6.1 (a). No further drying shall be required before putting the unit into operation.

J. EARTHLING PADS AND TERMINALS

Tank grounding or earthling pads shall be provided according to ANSI C57.12.10 paragraph 9.28. One terminal suitable for both aluminum and copper conductors to permit the earthling of the transformer shall be furnished for range of sizes from 70 mm^2 to 120 mm^2 (2/0 AWG to 250 KCMIL) conductor.

K. ACCESSORIES

All standard accessories required by ANSI shall be furnished, in size and location on the units as detailed in ANSI C57.12.10 paragraph 9.2.

Each transformer shall be equipped with the following accessories:

1. Pressure Relief Device

An automatic pressure relief device (a valve or its equivalent), with means of manual operation, is mandatory. If a valve is used it shall have a minimum flow rate of sixteen (16) L/S at a gauge pressure of 100kPa. The opening pressure of the relief device shall be less than the withstand pressure of the tank structure.

2. High Voltage Load Break Switches

The transformer shall contain three (3) high voltage three-phase gang-operated, liquid-immersed, load break switches - two for the loop feed and one for the transformer primary winding tap (see Figure 1).

The high voltage switch handles shall be installed inside the transformer tank with the operating handles extending into the high voltage compartment. The operating handle of the transformer switch shall be located away from the handles of the other two switches. Each switch shall be operable with a switch stick by an operating personnel standing in front of the compartment. The operating handles shall be capable of locking with a standard ANSI/IEC padlock in all positions.

The manufacturer shall allow sufficient spacing between the loadbreak switches or locating them such that a low insulating fluid level will not cause a flashover between switches or between phases.

The switches shall have the following minimum electrical characteristics:

A	Voltage class:	25 kV
B	BIL:	150 kV
C	Continuous and Loadbreak current:	300A
D	Interrupting Current:	300A
E	Momentary, 10 cycle	Current: 12,000A rms sys. (X/R ratio = 30) 19,200A rms. asym.
F	Close and Latch Current:	12,000A rms. sys. (X/R ratio = 30) 19,200A rms. asym.
G	Operating Temperature:	17^0C to 120^0C
The contact speed of the switches shall be independent of operator speed.		

3. Protective Devices

Each phase of the transformer shall be protected by a two-fuse protection system consisting of a replaceable bayonet fuse and an under oil, partial range, back-up current limiting fuse. The back-up current limiting fuse of dual voltage transformer shall have voltage rating suitable for the higher voltage and current

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rating adequate for the lower voltage. Expulsion fuses for both voltages and corresponding currents shall be provided. The **lower voltage-rating** fuse shall be installed, unless otherwise specified.

The locking clips of the fuse holders, when locked in any position shall not be damaged when closing the transformer hood.

The fuse rating and manufacturer's Cat. No. of the bayonet fuse and current limiting fuse shall be identified on the combination nameplate.

The overall arrangement of the load break and protective devices shall allow loop feed to the transformer and prevent closing of the switch unto internal faults.

In addition to standard accessories the following shall be furnished:

Provision for Pressure gauge.

5. TESTS

5.1 All Routine Tests defined in latest ANSI C57-12.00 section 8 shall be made in accordance with ANSI C57.12.90 by and at the expense of the manufacturer.

Routine/Production Tests

The manufacturer shall carry out all the standard Routine/Production Tests and, before shipment; the manufacturer shall furnish certified copies of the test results for approval. No transformer shall be shipped until tests results are approved.

The manufacturer shall furnish certified copies of the test results for approval. No transformer shall be shipped until tests results are approved.

Loss Data

Bidder shall provide guarantee average no-load and load losses as defined under the latest version of ANSI C57.12.90 unless otherwise specified.

No load losses shall be provided at 85°C. Use the following formula and instructions for temperature correction to 85°C:

$P_{85} = P_c (T_m)[1+(T_m-85)k_T]$ where

P_{85} = the no-load losses corrected to 85°C

$P_c(T_m)$ = no load losses corrected for waveform at temperature T_m in °C.

K_T = an empirically derived per unit change in no-load loss per °C.

If the actual value of k_T is not available, a value of 0.00065 per unit change per °C should be used. This value is typical for cores constructed of grain oriented Silicon steel and is satisfactory as a correction for no-load losses over the temperature range normally encountered in transformer testing.

Load losses shall be provided at 85°C as described in ANSI C57.12.90, section 9.4 “Calculation of impedance voltage and load loss from test data”. The losses shall include all losses, excluding no-load losses.

1. Percent impedance at 100% rated voltage and 85^0C.
2. Resistance in ohms at 85^0C at 90% and 100% power factor.
3. Percent regulation at 85^0C at 90% and 100% power factor.
4. Applied and Induced Potential Tests in accordance with ANSI Standard
5. Efficiencies at 85^0C at ¼, ½, ¾, 1 and 1-1/4 load. Maximum efficiency desired be at ½ load and should not be less than 98% by wattmeter method.

5.2 Certified Test reports shall be provided for each transformer supplied. Test report shall be in accordance with NEMA Pub TR 1, “TR 1-7.02 Transformer Test Report in both content and format. Test certificate shall be provided to purchaser before shipping transformers.

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5.3 Manufacturer shall invite the Purchaser's Representatives (2) at the 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 the purchaser for the witnessing of the tests shall be shown as a separate cost item in the bid.

5.4 Refer to "Tests" Section 5 of "Technical Specifications, General Requirements" for further details.

6. BID COMPARISON AND PRICE ADJUSTMENT

Evaluation of Tenders:

Tenders will be evaluated based on the following:

1. Unit price of each type of transformer;
2. Present worth of losses;
3. Delivery period;
4. Warranty and service.

6.1 COMPARISON OF BIDS

6.1.1 For the purpose of comparing Bids, the transformer losses will be evaluated on the following basis:-

Evaluated Cost of transformer (EC)

$EC = P+5.064*L_1 + 1.234*L_2$

Where:
EC is the evaluated cost in US$
P is CIF price of transformer in US$
L_1 is No Load Loss in Watts
L_2 is Load Loss in Watts,

(Section 6.1, 6.2 of "Transformer Data Form" Losses quoted shall be maximum at specified voltage configuration.)

For the purposes of making an award, if the evaluated cost (EC) difference between the apparent lowest cost unit and any other units is less than 3% then these units will be considered equal. The basis for making an award will be determined by the actual purchase cost. As deemed appropriate by the purchaser, in addition to estimated evaluated cost, quoted deliver time and past performance of the bidder and/ or manufacturer with respect to other bid awards shall be considered in evaluating and awarding bids.

6.1.2 Bids received in currencies other than US Dollars, will, for the purposes of comparison, be converted at the Bank of Jamaica's posted selling exchange rates at it's opening for business on the day the Bids are opened.

(Refer to "Evaluation of BIDS" Section 18 of "Instruction to Bidders" for further information).

6.2 CONTRACT OR ORDER PRICE ADJUSTMENT

6.2.1 During witnessing of the tests, one (1) transformer or five percent (5%) (to the nearest integer) whichever is greater, of the quantity of transformers from each rating contracted or ordered shall be taken arbitrarily and tested in the presence of the Purchaser's Representatives. An arithmetic average of the actual measured losses for the number of transformers tested for each rating shall be derived. In case the average measured losses exceeds the guaranteed figures by values not exceeding the stipulation of 2.1.1.7, the following action shall be exercised:

Invoice, or receive a credit memo from the bidder toward the purchase order issued for the award, for liquidated damages based upon 1.2 times the excess evaluated cost for the total order to be incurred by the purchaser in accepting the transformers supplied by the bidder; i.e.,

Liquidated Damages= 1.2 x (Delivered EC – Quoted EC)

No credit shall be applied toward delivery and acceptance of transformers of an order with a delivered EC below the quoted EC.

OW

Payment of all damages by the bidder shall be in the form of a credit memo to be applied against the purchase order. The purchaser will not accept substitution of the additional transformers or credit toward future purchases.

In addition, the purchaser may, at its opinion, remove the manufacturer and/ or distributor from its approved manufacturer and/ or bidder list until all damages are paid and the purchaser is convinced that the manufacturer and/ or bidder can meet all performance requirements and other obligations prescribed by the purchaser.

Currency exchange rates used to evaluate the Bid (Paragraph 6.1.2) will be used to make any price adjustment for failure to meet guarantees.

7. PACKAGING AND MARKING

7.1 Transformer shall be individually packaged in wood crates.

7.2 All crates shall be suitable constructed to facilitate lifting by forklift.

7.3 For “Export Marking” refer to Section 8 of “Specifications and Requirements.”

8. SHIPMENT

8.1 Manufacturer/supplier shall await the written authorization of the purchaser before shipment of transformers. Approval for shipment will be given after the receipt of test results for all transformers.

8.2 No collect freight shipments will be accepted all quotations are solicited on a “delivered price” (CIF Kingston) basis.

MISCELLANEOUS

Aside from compliance with transformer loss requirements, the purchaser will not accept transformers that are found to be damaged upon delivery or fail to otherwise meet all other bid specifications and requirements.

TECHNICAL SPECIFICATIONS THREE PHASE PAD-MOUNTED DISTRIBUTION AND POWER TRANSFORMER

JPSCo NO. 6950-S-04

Effective: August 16, 2022 **Revision No.: 8**

INDEX OF REVISIONS

Revision Number	Date of Revision	Revision Made	Checked By
3	2004/04/13	Revised clauses 2.2.9.2.3& 8, 3.1.2, 4.1.1, 4.2.8. Add clause 4.4. Revised clauses 4.5.C.4& 5, add clause 4.5.C.3, revised clauses 4.5.E, C, 4.5.K.1, K.2.g, K.3, 5.1.8, 6.1, 6.2, add clauses 8.2, miscellaneous and data sheet.	
4	2010/10/20	Addition of 100, 150, 200 and 300 kVA Transformers. Changes made to the Transformer Data Sheet	
5	2015/07/29	Addition of Clause 3.1.1.3 Option 2; Single Voltage 13.8kv/24kV GRDY x 240/415 GRDY Option	
6	2017/07/03	Revised clause 3.1.2. Updated clause 2.2.9.1.2 to include power factor testing and winding resistance testing. Added Clause 4.1.1.5	
7	2018/02/26	Multiple revisions Revised clauses 4.1, 4.2, 4.4 & 4.5.D.1 Removed Clauses 2.2.9.2 E&F	
8	2018/02/05	Additional of Insulation Power Factor Tests	
9	2022/08/19	Remove the Special Tests	

Originated By: Jeffrey Blair	Date: January 1998
Revised By: Craig Francis	Date: April 2004
Revised By: Hugh Hamilton	Date: October 2010
Revised By: Daniel Tomlinson	Date: July 2015
Revised By: Neville Brackett	Date: July 2017
Revised By: Neville Brackett	Date: February 2018
Revised By: Uton Tobin	Date: August 2022

Prepared By:	Approved By:
U. Tobin Aug-16-2022	Aug-16-2022
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Pad-Mounted Transformer Data Sheet

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

Manufacturer Name	
Country of Origin	
Type (Single, Three)	
Size (kVA)	
Frequency (Hz)	
Primary Voltage (V)	
Impedance	
Temperature Rise	
Feed (Loop or Radial)	
Primary Taps	
Primary BIL (kV)	
Primary Termination	
Secondary Voltage (V)	
Secondary BIL (kV)	
Secondary Termination	
Guaranteed No Load Loss (W) at 85°C	
Guaranteed Load Loss (W) at 85°C	
Guaranteed Total Loss (W) at 85°C	
Guaranteed Audible Sound Level (dB)	
Insulating Fluid	
PCB Level (PPM)	
Core Steel Grade/Type	
Tank Material	
Color of finish	
Attached drawing indicating all relevant dimension and weight?	
Cost per unit (US$)	
Guaranteed delivery time (weeks)	
Warranty Period	
Exceptions	
Manufacturing Engineer	Signature _____