

JAMAICA PUBLIC SERVICE COMPANY LIMITED

**TECHNICAL SPECIFICATIONS
POLE MOUNTED SINGLE PHASE
DISTRIBUTION TRANSFORMER WITH ENERGY
GUARD CABINET**

JPS SPECIFICATION NO. 6939-S-11-EG

Prepared by _____
Engineering Department

March 8, 2011

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POLE MOUNTED SINGLE PHASE
DISTRIBUTION TRANSFORMER WITH ENERGY GUARD CABINET**

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The "Technical Specifications, General Requirements" forms a part of this specifications.

1. **SCOPE**

- 1.1 This specification covers single phase distribution transformers, overhead pole type, with Primary taps, with/without primary arrestors and overload protective device; for use on JPS 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 Specification, 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 transformers 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 tests.
- 3.1.2.1 "NEMA" Standards publications No. TR-1
- 3.1.2.2 "ANSI" C57.12.00 General Requirements for Distribution Power and Regulating Transformer.
- 3.1.2.3 "ANSI" C57.12.20 Requirements for Overhead type Distribution Transformers 67 kV and below, 500 kVA and smaller.
- 3.1.2.4 "ANSI" C57.12.70 Terminal Markings and Connection for Distribution and Power Transformers.

- 3.1.2.5 "ANSI" C57.12.80 Transformer Terminology.
- 3.1.2.6 "ANSI" C57.12.90 Test Code for Distribution Power and Regulating Transformer.
- 3.1.2.7 "ANSI" C57.91 Guide for loading Mineral-oil-Immersed Transformers.
- 3.1.2.8 "ANSI" Z55.1 Gray finishes for Industrial Apparatus and Equipment.
- 3.1.2.9 "ASTM" B117 Salt Spray Test
- 3.1.2.10 "ANSI/IEEE" C62.11 1993
- 3.1.2.11 "ANSI/IEEE" C62.22
- 3.1.2.12 "NEMA" publication No. LA1

3.1.3 CONFLICTS

In the event of any conflicts between referenced standards/specification mentioned herein and this specification, the more stringent specification shall have precedence and shall govern. In addition, the bidder shall outline these conflicts in their 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 Transformers are required for operation in an environment as noted in 3.2.1 and in addition, will be installed between 24m and 1.6km from the sea. The transformers 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, Cement or processing Bauxite and Limestone.

Transformers require special paint finishes (See Section 4.5.6.2) and special Primary Bushings (See Section 4.5.5.1) and as per ASTM B117-85E1 and ASTM D165-79A.

4. DETAILED REQUIREMENTS

4.1 TYPE

- 4.1.1 Oil immersed, self-cooled, outdoor, two primary high voltage bushings, direct mounting, pole-type transformer, with/without primary and/or secondary protective device, and with two (2) 2 1/2% primary taps above and below normal voltage.

Transformer shall be Primary rated 13800/23900V GRD Y and is required for operation on either a 13800V Delta or 13800/23900V Grounded Wye, solidly multi-grounded Primary Distribution system.

Secondary rated voltage: 120/240 Volts.

- 4.1.2 Oil immersed, self-cooled, outdoor, two primary high voltage bushing, direct mounting, pole-type conventional transformer, with/without primary and or secondary protective device, and with two (2) 2 1/2% primary taps above and below normal voltage.

Transformer shall be primary rated 13800/23900V GRD Y X 6900/11950V GRD Y and is required for operation on either a nominal 13800V Delta or 13800/23900V or 6900/11950 Grounded Wye, solidly multi-grounded primary distribution system.

Secondary rated voltage: 120/240 Volts.

- 4.1.3 Oil immersed, self-cooled, outdoor, one fully insulated primary high voltage bushing, direct mounting, pole-type transformer, with/without primary and/or secondary protective device, and with two (2) 2 1/2% primary taps above and below normal voltage.

Transformer shall be Primary rated 13800/23900V GRD Y and is required for operation on 13800/23900V Grounded Wye, solidly multi-grounded Primary Distribution system.

Secondary rated voltage: 120/240 Volts.

- 4.1.4 Oil immersed, self-cooled, outdoor, one fully insulated primary high voltage bushing, direct mounting, pole-type conventional transformer, with/without primary and or secondary protective device, and with two (2) 2 1/2% primary taps above and below normal voltage.

Transformer shall be primary rated 13800/23900V GRD Y X 6900/11950V GRD Y and is required for operation on a 13800/23900V or 6900/11950V Grounded Wye solidly multi-grounded primary distribution system.

Secondary rated voltage: 120/240 Volts.

- 4.1.5 Oil immersed, self-cooled, outdoor, one fully insulated primary high voltage bushing, direct mounting, pole-type conventional transformer, with/without primary and or secondary protective device, and with two (2) 2 1/2% primary taps above and below normal voltage.

Transformer shall be primary rated 4160/2400V GRD Y and is required for operation on a 4160/2400V Grounded Wye solidly multi-grounded primary distribution system.

Secondary rated voltage: 120/240 Volts.

4.2 RATINGS ETC.

- | | | |
|-------|---|--|
| 4.2.1 | Number of Phases : | Single |
| 4.2.2 | Primary B.I.L. : | 125 kV |
| 4.2.3 | Secondary B.I.L. : | 30 kV |
| 4.2.4 | Frequency : | 50 Hertz |
| 4.2.5 | Polarity : | Subtractive |
| 4.2.6 | Continuous rated :
capacity at 65 °C
temperature rise | 3, 5, 10, 15, 25 |
| 4.2.7 | Taps, full capacity : | Two (2) 2.5 percent above and two (2) 2.5 percent below nominal voltage rating. Taps shall operate at both voltage positions for dual voltage transformers |
| 4.2.8 | Maximum Values | The maximum acceptable losses, weights and dimensions shall be as outlined in Tables 4.2.8 and 4.2.9 |

Table 4.2.8 Maximum Acceptable Losses for Pole Mounted Distribution Transformers

CATEGORY A - 13.8 kV:120/240 Volts

LOSSES (WATTS)

SIZE (KVA)	No Load	Full Load (@ 85 ° C)
3	21	51
5	30	60
10	50	89
15	58	161
25	74	283

CATEGORY B - 13.8/6.9 kV:120/240 Volts

LOSSES (WATTS)

SIZE (KVA)	No Load	Full Load (@ 85 ° C)
3	21	51
5	30	60
10	50	89
15	58	161
25	74	283

N.B. Transformer losses shall be tested at the higher voltage level. The values indicated above is a guide and, meeting them does not guarantee an order. Evaluation will be based on Clause 6.1 of specifications.

Table 4.2.9 Maximum Acceptable Weights & Dimensions for Pole Mounted Distribution Transformers

TRANSFORMER SIZE IN KVA	WEIGHT OF TRANSFORMER (KG)	HEIGHT TO TOP OF TANK (mm.)	DIAMETER OF TANK (mm)
3	150	700	480
5	170	750	500
10	204	863	558
15	261	888	584
25	318	914	609

4.3 PERFORMANCE

4.3.1 Temperature Rise

4.3.1.1 The temperature rise measured by resistance method shall not exceed 65 degrees C at a maximum ambient of 40 degrees C. The short time overload characteristics shall be such that units can be periodically overloaded without significant loss of life in accordance with applicable ANSI C57.91 Tables.

4.4 DATA TO BE FURNISHED BY BIDDER

4.4.1 Bidder must attach to his proposal the "Transformer 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/outlined 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.

4.5 CONSTRUCTION

4.5.1 Core

4.5.1.1 The Transformer shall be Core or Shell type, made from cold rolled, silicone steel with preferred grain - orientation. *Manufacturer shall specify the type and grade of steel used in the construction of the core.* (Any alternative material or design used, and its effect on the transformer

shall be clearly outlined in the bid proposal for the purchasers consideration)

4.5.2 **Overload Indicator**

4.5.2.1 No overload indicator device is required.

4.5.3 **Tap-Changer**

4.5.3.1 All Tap leads shall be brought to an externally operated Tap-Changer with an appropriate turning handle.

4.5.3.2 Each Tap shall be clearly indicated by a number or letter on the Tap-Changer plate. This designation shall be easily identified with the given Tap Voltage shown on the nameplate. The Tap-Changer will be operated only when the Transformer is de-energized.

A suitable warning decal with black writing on a yellow background shall be affixed to the tank in the vicinity of the Tap-Changer handle, informing Servicemen that the Transformer must be de-energized before the Tap-Changer is operated.

4.5.3.3 All transformers are required to have Tap-Changers and they shall be operable on both voltage positions for dual voltage transformers.

4.5.4 **Overload Protective Device**

No internal overload protective device is required.

4.5.4.2 **Lightning Arrester**

4.5.4.2.1 Transformers shall be fitted with primary gapless type MOV arrester(s) of suitable ratings to protect the device at its primary operating voltage. The primary arrester shall be suitably attached to the tank to enable replacement. Only one primary arrester shall be fitted to each transformer and it shall be positioned at the HI bushing.

4.5.4.2.2 Primary arrestors shall be externally mounted and be of such design that there are visible indications of failures of the devices.

4.5.4.2.3 Provisions for mounting primary arrester should be made on the tanks.

Specifications for Arresters shall be provided at the time of tendering.

4.5.5 **Bushings**

4.5.5.1 Primary bushing/s shall be cover mounted and located in the segment of the cover according to ANSI C57.12.20 Fig 7 or Fig. 9. Primary bushings shall be equipped with solderless connectors sized according to ANSI C57.12.20 Table 7, suitable for either copper or aluminum conductors.

Primary Bushing/s for all transformers shall have a minimum leakage distance of 762 mm.

4.5.5.2 Secondary bushings shall be side wall mounted type, mounted singly, located according to ANSI C57.12.20 Fig 7 or Fig 9. Secondary bushings shall be equipped with solderless connectors sized according to ANSI C57.12.20 Table 9, suitable for either copper or aluminum conductors.

Clamp type terminals, complete with non-ferrous bolts, nuts, washers and lock washers for attaching these terminals to the spade shall be furnished installed, utilizing appropriate joint compound. These clamp type terminals shall be of the "Cable Range" type with maximum range exceeding the ampacity of cable required to continuously carry full load of the Transformer and shall be suitable for either copper or aluminum conductors.

4.5.5.3 Number and arrangement of Secondary bushings shall be as required by ANSI C57.12.20 Table 6.

4.5.5.4 The color of all bushings shall match light gray No. 70 Munsell Notation 5BG 7.0/0.4 as specified in ANSI Z55.1.

4.5.6 **Tank and Finish**

4.5.6.1 Transformer oil preservation system shall be of the sealed tank type and tank shall be welded, construction made of high grade steel plate. The tank shall not be corrugated.

4.5.6.2 The painting process shall be of present day manufacturing process and such that the finish coat form a moisture, salt and abrasion resisting coating.

Transformers 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 1500 hrs/ 5% Salt Spray Test without significant loss of adhesion or underfilm 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.

4.5.6.3 The tank finish color shall match light gray No. 70 Munsell Notation 5BG.7.0/0.4 as specified in ANSI Z55.1

4.5.6.4 One (1) set of support lugs shall be provided, located opposite the Secondary terminals. Type of support lugs and their vertical location and spacing shall conform to single - position mounting shown in ANSI C57.12.20 Figure 1.

4.5.6.5 The kVA rating in Arabic numeral 64 mm high shall be stenciled in black paint on the tank below the Secondary bushings.

4.5.7 Grounding Terminal

4.5.7.1 A tank grounding connector of the solderless connector type capable of accepting either aluminum or copper conductor sized and located according to ANSI C57.12.20 Paragraph 6.5.4.3 shall be furnished.

4.5.7.2 A low-voltage grounding connection consisting of an external copper link of adequate size securely connecting the low-voltage neutral terminal to the tank according to ANSI C57.12.20 Paragraph 6.5.4.4 shall be furnished.

4.5.8 Nameplate

A nameplate of type, material and location on the Transformer complying with ANSI C57.12.20 Paragraph 6.3.4 shall be furnished. English language and metric system units shall be used. Nameplates shall be bar coded and contain the name of the manufacturer and transformer serial number.

4.5.9 Accessories

All standard accessory equipment, type, size, location, etc. according to ANSI C57.12.20 Paragraph 6.2 shall be furnished. A definite means to relieve excess pressure in Transformer tank resulting from normal operation, shall be provided, meeting requirements of ANSI C57.12.20 Paragraph 6.2.7.

4.5.10 Transformer Oil

4.5.10.1 Each Transformer shall be delivered filled with new, unused mineral oil meeting the requirements of ANSI C57.12.00 Paragraph 6.6.1. (1).

4.5.10.2 The manufacturer shall affix a blue label to each transformer to indicate that the oil is PCB free. The label state that the oil is certified to be PCB free shall have approximate dimensions 50 mm x 70 mm. The label shall be positioned in such a manner as to be easily visible with the transformer installed.

4.5.10.3 The manufacturer shall provide a certificate indicating that the oil used in the batch of transformers to be supplied is PCB free.

4.6 **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. The following is a guide as to the purchasers anticipated requirements.

One (1) high voltage bushing with internal conductor for every fifty (50) transformers or fraction thereof each rating purchased.

One (1) low voltage bushing with internal conductor for every fifty (50) transformers or fraction there of each rating purchased.

Spare parts enumerated above (or manufacturer recommended list) shall be individually quoted and priced to be delivered with the quantity of transformers 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.

4.7 **ENERGY GUARD CABINET**

SPECIFICATIONS:

- Rain testing classification NEMA type 3R, equivalent to rainproof.
- Designed for outdoor installations.
- Protection against rain and accidental contact.
- Ventilated enclosure.
- Bottom drainage provided by a screen and filter.
- Bottom is stamped with perforations to facilitate the installation of compression gland connectors to seal cable insertions.

FABRICATION SPECIFICATIONS:

- Metal cabinet shall be fabricated with sheets of cold-rolled, ASTM A366 steel, 1.4mm thick, provided with lateral vents for air circulation.
- Vents are equipped with screens and filters to prevent the entrance of dust and foreign objects.
- The top edge of the cabinet has a gutter to keep water out.
- The door is hinged and equipped with rubber seal on all four sides, and has two triangular key-style locks, and a pin/bolt for bridging the post to ground.
- The cabinet finish color shall match light gray No. 70 Munsell Notation 5BG.7.0/0.4 as specified in ANSI Z55.1
- Triangular key locks are made from Zamac 5, finished in polished chrome.
- Round latch for security seal made of cast iron with baked-on electrostatic powder coat and Bolt-on hinges.

ACCESSORIES

- One PG-42 compression gland for incoming feeder cables.
- 24 PG-16 compression glands for outgoing supply cables.
- One kit for neutral connection: 1" x ¼" electrolytic copper bar with 24 #6 terminals and two #1/0 heel-style terminals.

5. TESTS

- 5.1 Refer to "Tests" Section 5 of "Technical Specifications General Requirements".
- 5.2 Manufacturer shall invite 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 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 transformer supplied. Test reports shall be in accordance with NEMA standards, in both content and format. (refer to NEMA Pub. No. TR1, TR-7.02 Transformer Test Report). Tests reports shall be provided before delivery of transformers and will be required at the time of inspection by Purchasers representatives.
- 5.4 All transformers which are ready for delivery shall be made available for physical inspection and random selection of samples for testing.

6. **BID COMPARISON AND PRICE ADJUSTMENT**

6.1 **COMPARISON OF BIDS**

Only transformers that have satisfied clauses 4.2.8 and 4.2.9 of specifications will be evaluated.

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

Evaluated Cost of Transformer:

$$EC = P + 8.245*L1 + 0.748*L2$$

Where, EC is the evaluated cost of transformer in US\$,

P is Price of Transformer in US\$ (CIF Kingston)

L1 is No Load loss in Watts of the "Transformer Data Form".

L2 is Load loss in Watts of the "Transformer Data Form".

- 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 its 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 At the time of witnessing the tests, five percent (5%) (to the nearest integer) 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, the following amounts will be deducted from the Contract CIF unit price of every rating under test:-

6.2.1.1 US \$8.245 equivalent, for each watt or part thereof if the actual no load losses exceeds the guaranteed no load losses of the "Transformer Data Form". US \$0.748 equivalent, for each watt or part thereof if the actual load losses exceeds the guaranteed load losses of the "Transformer Data Form".

6.2.2 The same currency exchange rates used to evaluate bid (Paragraph 6.1.2) will be used to make any price adjustment for failure to meet guarantees.

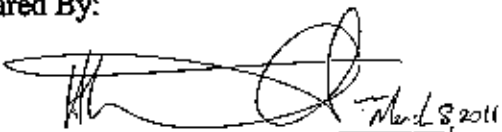

7. PACKAGING AND MARKING

All transformers shall be individually packaged in wood crates and spare parts separately packaged in wood crates. The transformers and spares shall be shipped in containerized cargoes. All crates shall be suitably constructed to offer protection to its contents. For "Export Marking" refer to Section 8 of "Technical Specifications. General Requirements".

8. SHIPMENT

8.1 Manufacturer shall await written authorization of purchaser before commencing shipment of transformers.

INDEX OF REVISIONS

Revision Number	Date Revision	Of	Revision Made	Checked By
Prepared By: Hugh Hamilton			March 8, 2011	
Prepared By:  Hugh Hamilton Distribution Engineer			Approved By:  Lloyd Blackwood, P.E. Manager -Engineering	

Single Phase Pole-Mounted Transformer with Energy Guard 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 (Over 25°C ambient)	
Primary Taps	
Primary BIL (kV)	
Secondary Voltage (V)	
Secondary BIL (kV)	
Maximum No Load Loss at 20°C (W)	
Maximum Load Loss at 85°C (W)	
Maximum Total Loss (W)	
Efficiency (%)	
Insulating Fluid	
PCB Level (PPM)	
Core Steel Grade/Type	
Tank Material	
Color of finish	
Attached drawing indicating all relevant dimension and weight?	
Attached arrester specification?	
Cost per unit (US\$)	
Guaranteed delivery time (weeks)	
Warranty Period	
Exceptions	
Manufacturing Engineer	Signature _____





JPS
#

NO PCB

10

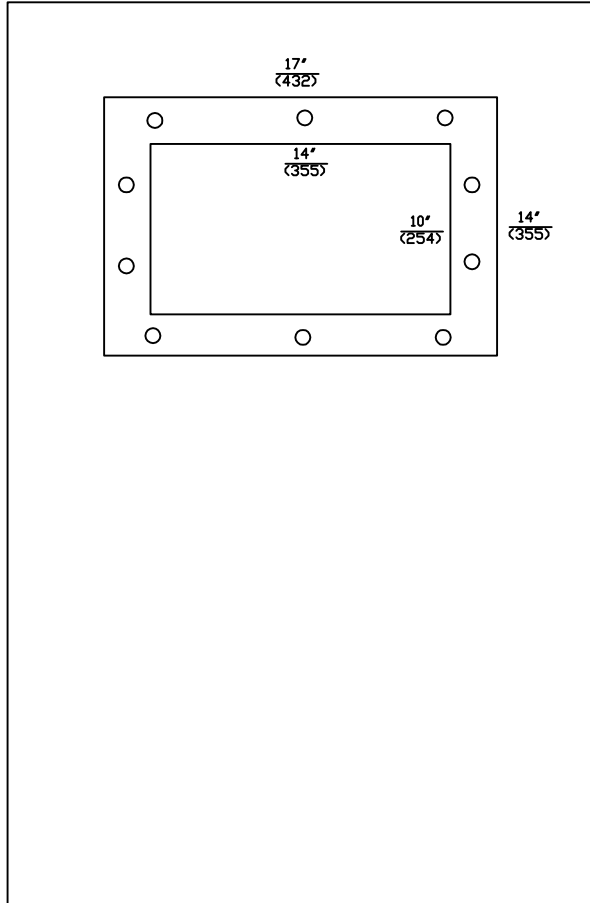
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120/240

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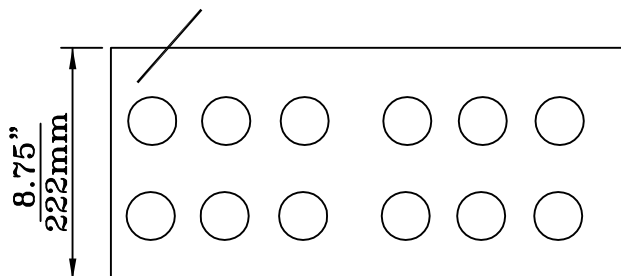
20"
(510)

**TRANSFORMER/CABINET
INTERFACE DETAILS**



**LAYOUT OF BOTTOM
PERFORATIONS**

**FEEDER EXIT:
PG16 COMPRESSION GLAND**



MEMORANDUM

TO: MANAGER MATERIAL PLANNING AND LOGISTICS
FROM: MANAGER ENGINEERING DEPARTMENT
DATE: March 8, 2011
SUBJECT: Single Phase Pole Mounted Distribution Transformer with Energy Guard Cabinet

Please find attached forms on the following:

- Material to be added to authorized line
- Material information/instruction form
- Material requires correction to its description

This form:

- Introduces a new material to be added to authorized line
- Identifies material to be removed from authorized line
- Identifies material for which information or action is required

You are requested to:

- Assigned a stock number for the item
- Initiate a purchase requisition for the item
- Discontinue issuing the item
- Issue item until stock is depleted
- Advice Engineering on existing stock levels
- Advice Engineering on the assigned stock number and the date material is received at stores
- Update purchase specifications as per attached
- Take action on the matter as per attached



LLOYD BLACKWOOD, P.E.
MANAGER - ENGINEERING

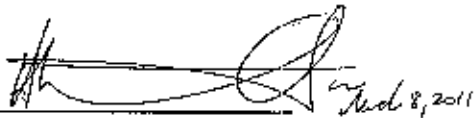
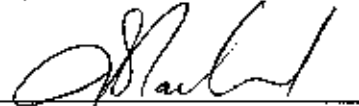
Copy: Vice President- Customer Operations
Head of Department- Engineering Services
General Manager - Materials Management
Manager - Warehousing and Stores
Manager - Purchasing

ENGINEERING DEPARTMENT
693A Spanish Town Road, Kingston 11
Tel 937-9320-5, Fax 937-9259
T & D MATERIAL SPECIFICATION

MATERIAL TO BE ADDED/PURCHASING

SUBJECT: Single Phase Pole Mounted Distribution Transformer with Energy Guard Cabinet

MATERIAL	Transformer, Pole-Mounted, Single Phase, with Energy Guard Cabinet				
DATE OF INTRUCTION	March 8, 2011	USER DEPARTMENT	Loss Reduction & COPS		
COMMENT					
JUSTIFICATION	Transformers are being introduced for the installation of Residential Automated Meter Infrastructure throughout the island to improve the success of JPS Loss Reduction Project.				
PURCHASING DESCRIPTION	See JPS Specification No. 6939-S-11-EG.				
PURCHASING SPECIFICATIONS	See JPS Specification No. 6939-S-11-EG.				
Special Instruction	The transformers currently required are 10 and 15kVA. It is expected that for this year (2011) One Thousand (1000) of each type will be utilised. The quantities in stock will require monitoring as time progress; it is expected that beyond 2011 the required quantities will decrease as the loss reduction should decrease.				
Estimated Annual Usage	2000	Initial Order	1300	Re-Order Level	800

Recommended by:  Hugh Hamilton Distribution Engineer Engineering Department	Approved by:  Lloyd Blackwood, P.E. Manager Engineering Department
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FOR MATERIALS INVENTORY USE

STOCK #		
REMARKS		
SIGNATURE		DATE

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