



# **JAMAICA PUBLIC SERVICE COMPANY, LTD.**

## **NORTH EAST COAST VOLTAGE SECURITY IMPROVEMENT PROJECT**

**Bid Document 940747**

**The Supply of -**

**30 MVARs OF OPEN AIR RACK AND METAL ENCLOSED  
SUBSTATION CAPACITOR BANKS**

**Instructions to Bidders  
General Conditions of Contract  
Special Conditions of Contract  
Exhibits  
Bid Form  
Technical Specifications  
Schedules**

**May 2023  
Engineering Services Department  
Jamaica Public Service Company Ltd.  
693A Spanish Town Road  
Kingston, Jamaica**

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**PART 1**  
**INSTRUCTIONS TO BIDDERS**

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# Introduction

## IB.01 a. Background

The Jamaica Public Service Company (JPS) will be installing an additional 30 MVARs of capacitor banks (open air rack and metal enclosed units) at three (3) substations along the north east coast of Jamaica.

In order to satisfy the demand and to improve the reliability of supply it has been agreed that **30 MVARs of open air rack and metal enclosed capacitor banks** should be purchased and be installed.

### TIME IS OF THE ESSENCE FOR THE EXECUTION OF THIS CONTRACT

## b. Source of Funds

The Jamaica Public Service Company Limited (JPS) will fund the purchase of the 30 MVARs of open air rack and metal enclosed capacitor banks to be installed on the JPS network in 2024.

An International Bank mutually agreed between JPS and the successful tenderer will effect payments to the Contractor.

## c. Subject of Bid

The subject of this invitation consists of the supply of 30 MVARs open air rack and metal enclosed capacitor banks, complete with fittings, accessories and spare parts. The 30 MVARs shall be distributed as shown below for capacitors rated at 50 Hz only. Bidders are required to submit bids for Option A (open air type capacitor banks), Option B (metal enclosed type capacitor banks with roll-out type circuit breaker) and Option C (metal enclosed type capacitor banks with outdoor type circuit breaker)

Substation Location	System Voltage Rating L-L (kV)	Bank Size (MVARs)	Option A	Option B	Option C
Ocho Rios	24	2 x 5.0	Open Air	Metal Enclosed with Roll-Out Type Circuit Breaker as part of the unit	Metal Enclosed with Outdoor Circuit Breaker separate from the enclosed unit
Roaring River					
Cardiff Hall					

**IB.02 Eligible Bidders**

IB.02.1 This invitation for Bids is open to all suppliers from eligible source countries as defined under the Guidelines for Procurement of the JPS Purchasing Department list of suppliers.

**IB.03 Eligible Goods and Services**

IB.03.1 All goods and ancillary services to be supplied under the Contract shall have their origin in eligible source countries, be as defined under the Guidelines for Procurement of the JPS Purchasing Department and all expenditures made under the Contract will be limited to such goods and services.

IB.03.2 For purposes of this clause, "origin" means the place where the goods are mined, grown or produced or from which the ancillary services are supplied. Goods are produced when, through manufacturing, processing or substantial and major assembling of components, a commercially recognized product results that is substantially different in basic characteristics or in purpose or utility from its components.

IB.03.3 The origin of goods and services is distinct from the nationality of the Bidder.

**IB.04 Cost of Bidding**

IB.04.1 The Bidder shall bear all costs associated with the preparation and submission of its bid, and the Jamaica Public Service Company Limited (JPS), hereinafter referred to as "the Purchaser," will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

**The Bidding Documents****IB.05 Content of Bidding Documents**

IB.05.1 The goods required, bidding procedures and contract terms are prescribed in the bidding documents. In addition to the invitation for Bids, the Bidding Documents include:

- (a) Instructions to Bidders;
- (b) General Conditions of Contract;
- (c) Special Conditions of Contract;
- (d) Exhibits:     Form of Bid Bond  
                      Form of Performance Bond  
                      Form of Agreement  
                      Form of Purchase Order

- (e) Bid Form
- (f) Schedules: Schedule of Requirements  
 Schedule of Transformers  
 Schedule of Information  
 Schedule of Prices  
 Schedule of Deliveries  
 Schedule of Technical Data
- (g) Technical Specifications

IB.05.2 The Bidder is expected to examine all instructions, forms, terms and specifications in the Bidding Documents. Failure to furnish all information required by the Bidding Documents or submission of a bid not substantially responsive to the Bidding Documents in every respect will be at the Bidder's risk and may result in the rejection of its bid.

**IB.06 Clarification of Bidding Documents**

IB.06.1 A prospective Bidder requiring any clarification of the Bidding Documents may notify the Purchaser in writing or by telefax or by cable at the Purchaser's mailing address indicated in the Invitation for Bids. The Purchaser will respond in writing to any request for clarification of the Bidding Documents, which it receives no later than seven (7) days prior to the deadline for submission of bids prescribed by the Purchaser. Written copies of the Purchaser's response (including any explanation of the query but without identifying the source of inquiry) will be sent to all prospective Bidders that received the Bidding Documents.

**IB.07 Amendment of Bidding Documents**

IB.07.1 At any time prior to the deadline for submission of bids, the Purchaser may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective bidder, modify the Bidding Documents by amendment.

IB.07.2 The amendment will be notified in writing or by telefax or cable to all prospective Bidders, which have received the Bidding Documents and will be binding on them.

IB.07.3 In order to afford prospective Bidders reasonable time in which to take the amendment into account in preparing their bids, the Purchaser may, at its discretion, extend the deadline for the submission of bids.



## Preparation of Bids

### **IB.08 Language of Bid**

IB.08.1 The Bid prepared by the Bidder and all correspondence and documents relating to the bid exchanged by the Bidder and the Purchaser, shall be written in the English language.

### **IB.09 Documents Comprising the Bid**

IB.09.1 The bid prepared by the Bidder shall comprise the following components:

- (a) A Bid Form and a Schedule of Prices completed in accordance with Clauses IB.10, IB.11 and IB.12;
- (b) Documentary evidence established in accordance with Clause IB.13 that the Bidder is qualified to perform the contract if its bid is accepted;
- (c) Documentary evidence established in accordance within Clause IB.14 that the goods and ancillary services to be supplied by the Bidders conform to the Bidding Documents; and
- (d) Bid security furnished in accordance with Clause IB.15.
- (e) Drawings

### **IB.10 Bid Form**

IB.10.1 The Bidder shall complete the Bid Form and the appropriate Schedule of Prices furnished in the Bidding Documents, indicating for the goods to be supplied, a brief description of the goods, quantity and prices.

IB.10.2 For the purpose of granting a margin of domestic preference pursuant to Clause IB.27, the Purchaser will classify a bid, when submitted, in one of three groups, as follows:

- (a) Group A: Bids offering goods manufactured in the Purchaser's country for which the domestic value added in the manufacturing cost is not less than 40% of the ex-factory price;
- (b) Group B: Bids offering goods manufactured in the Purchaser's country for which the domestic value added in the manufacturing cost is less than 40% of the ex-factory price, and for goods of foreign origin already located in the Purchaser's country; and
- (c) Group C: Bids offering goods of foreign origin to be imported by the Purchaser directly or through the supplier's local agent.

**IB.11 Bid Prices**

IB.11.1 The Bidder shall indicate on the Schedule of Prices attached to these documents the unit prices and total Bid Prices of the goods it proposes to supply under the Contract:

IB.11.2 Prices indicated on the Schedule of Prices shall be entered separately in the following manner:

(A) For goods offered from abroad:

- (i) the price of the goods quoted CIF port-of-entry in the Purchaser's country (excluding import duties, consular fees and port taxes);
- (ii) estimated charges for port handling charges, inland transportation, insurance and other local costs incidental to delivery of the goods from the port of entry to their final destination.

**IB.11.3 The preferred method of payment is through an open account. 5% of CIF value will be added to bid value in the bid evaluation process, if the chosen method of payment is via an open account.**

IB.11.4 **Fixed Price.** Prices quoted by the Bidder shall be fixed during the Bidder's performance of the Contract and not subject to variation on any account. A bid submitted with an adjustable price quotation will be treated as non-responsive and rejected, pursuant to Clause IB.24.

**IB.12 Bid Currencies**

IB.12.1 Prices shall be quoted in the following currencies:

- (a) For goods and services which the Bidder will supply from outside the Purchaser's country, the prices shall be quoted home country, or in US dollars.

IB.12.2 Further, a Bidder expecting to incur a portion of its expenditures in the performance of the Contract in more than one currency, and wishing to be paid accordingly, shall so indicate in its bid. In such case, either

- (i) The bid shall be expressed in different currencies and the respective amounts in each currency together making up the total price, or
- (ii) The total bid price shall be expressed in one currency and payments required in other currencies expressed as a percentage of the bid price along with the exchange rate used in such calculation.

**IB.13 Documents Establishing the Bidder's Eligibility and Qualifications**

IB.13.1 Pursuant to Clause IB.09, the Bidder shall furnish, as part of its bid, documents establishing the Bidder's qualifications to perform the Contract if its bid is accepted.

IB.13.2 The documentary evidence of the Bidder's Qualifications to perform the Contract if its bid is accepted, shall establish to the Purchaser's satisfaction:

(a) That, in the case of a Bidder offering to supply goods under the Contract which the Bidder did not manufacture or otherwise produce, the Bidder has been duly authorized by the goods' manufacturer or producer to supply the goods in the Purchaser's country;

**(b) That the Bidder has the financial, technical and production capability necessary to perform the Contract.**

**IB.14 Documents Establishing Goods' Eligibility and Conformity to Bidding Documents**

IB.14.1 Pursuant to Clause IB.09, the Bidder shall furnish, as part of its bid, documents establishing conformity to the Bidding Document of all goods and services, which the Bidder proposes to supply under the Contract.

IB.14.2 The documentary evidence of the goods and services shall consist of a statement in the Schedule of Prices stating the origin of the goods and services offered and shall be confirmed by a certificate of origin issued at the time of shipment.

IB.14.3 The documentary evidence of the goods' and services' conformity to the Bidding Documents may be in the form of literature, drawings and data, and shall furnish:

(a) a detailed description of the goods' essential technical and performance characteristics;

(b) a list giving full particulars, including available sources and current prices, of all spare parts, special tools, etc., necessary for the proper and continuing functioning of the goods for a period of two years, following commencement of the goods used by the Purchaser; and

(c) a clause-by-clause commentary on the Purchaser's Technical Specifications demonstrating the goods' and services' substantial responsiveness to those specifications or a statement of deviations and exceptions to the provisions of the Technical Specifications.

IB.14.4 For purposes of the commentary to be furnished pursuant to Clause IB.14.3(c) above, the Bidder shall note that standards for workmanship, material and equipment, and references to brand names or catalogue numbers designated by the Purchaser in its Technical Specifications are intended to be descriptive only and not restrictive. The Bidder may substitute alternative standards, brand names and/or catalogue numbers in its bid, provided that it demonstrates to the Purchaser's satisfaction that the substitutions are substantially equivalent or superior to those designated in the Technical Specifications.

## **IB.15 Bid Security**

Not Applicable.

## **IB.16 Period of Validity of Bids**

IB.16.1 Bids shall remain valid for ninety (90) days after the date of bid opening prescribed by the Purchaser, pursuant to Clause IB.19. A bid valid for a shorter period may be rejected by the Purchaser as non-responsive.

IB.16.2 In exceptional circumstances, the Purchaser may solicit the Bidder's consent to an extension of the period of validity. The request and responses thereto shall be made in writing (or by cable or telefax). The bid security provided under Clause IB.15 shall also be suitably extended. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request will not be required nor permitted to modify its bid.

## **IB.17 Format and Signing of Bid**

IB.17.1 Only **Electronic submissions** will be accepted, using ShareFile by Citrix. All uploads will be confidential. Upload should be place in the appropriate folder (TECHNICAL OR Commercial). Document should be PDF format.

IB.17.2 The bid shall be signed by the Bidder or a person or persons duly authorized to bind the Bidder to the Contract. The latter authorization shall be indicated by written power-of-attorney accompanying the bid. All pages of the bid, except for un-amended printed literature, shall be initialed by the person or persons signing the bid.

IB.17.3 The bid shall contain no interlineations, erasures or overwriting except as necessary to correct errors made by the Bidder, in which case such corrections shall be initialed by the person or persons signing the bid.

## Submission of Bids

### IB.18 Upload and Labeling of Bids

IB.18.1 **Only Electronic submissions will be accepted, using ShareFile by Citrix. All uploads will be confidential.**

- 1) Respondents must confirm their intention to bid by June 2, 2023, in order to be setup in JPS ShareFile folder.
- 2) Access to individual vendor folders will be given 1 weeks before the bid closes to eliminate any issues for bid upload by RFP deadline.
- 3) Files must be accurately labelled/named. Commercial Information must be a separate file from your Technical Proposal.
- 4) ShareFile Access will be removed when the bid closes.

Additional information on this software can be accessed by clicking the links below:

- Basic Client Guide <https://citrix.sharefile.com/share/view/s1bff52f8d434781a>
- Training (video) <https://www.sharefile.com/support/training>

### IB.19 Deadline for Submission of Bids

IB.19.1 Bids must be received by the Purchaser as outline under para. IB.18.1 no later than Thursday June 15, 2023

RFP CALENDAR		
ACTIVITY	DUE DATE	RESPONSIBILITY
RFP date	May 18, 2023	JPS
Bidder submits questions on RFP	May 24, 2023	Bidder
Final date to respond to all queries	May 30, 2023	JPS
Bidders provide their intention to bid	June 2, 2023	Bidder
Completion of RFP and deadline for submission of bids to JPS	June 15, 2023	Bidder
Bid Opening	June 16, 2023	JPS

IB.19.2 The Purchaser may, at its discretion, extend this deadline for the submission of bids by amending the Bidding Documents in accordance with Clause IB.07, in which case all rights and obligations of the Purchaser and Bidders previously subject to the deadline will thereafter be subject to the deadline as extended.

**IB.20 Late Bids**

IB.20.1 Any bid received by the Purchaser after the deadline for submission of bids prescribed by the Purchaser, pursuant to Clause IB.19, will be rejected and/or returned unopened to the Bidder.

**IB.21 Modification and Withdrawal of Bids**

IB.21.1 The Bidder may modify or withdraw its bid after the bid's submission, provided that written notice of the modification or withdrawal is received by the Purchaser prior to the deadline prescribed for submission of bids.

IB.21.2 The Bidder's modification or withdrawal notice shall be prepared, sealed, marked and dispatched in accordance with the provisions of Clause IB.18. with the inner envelopes additionally marked **Modification** or **Withdrawal** as appropriate. A withdrawal notice may also be sent by telefax or cable but followed by a signed confirmation copy, post marked not later than the deadline for submission of bids.

IB.21.3 No bid may be modified subsequent to the deadline for submission of bids.

IB.21.4 No bid shall be withdrawn in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Bid Form. Withdrawal of a bid during this interval may result in the Bidder's forfeiture of its bid security, pursuant to Clause IB.15.7.

**Bid Opening and Evaluation**

**IB.22 Opening of Bids by Purchaser**

IB.22.1 The Purchaser will open bids privately, within the year 2023. At the following location:

**Purchasing Department  
113 Washington Boulevard  
Kingston 20, Jamaica, W.I.**

IB.22.2 The Bidders' names, bid prices, modifications, bid withdrawals and the presence or absence of the requisite bid security and such other details as the Purchaser, at its discretion, may consider appropriate will be announced at the opening.

IB.22.3 The Purchaser will prepare the minutes at the bid opening.

**IB.23 Clarification of Bids**

- IB.23.1 To assist in the examination, evaluation and comparison of bids the Purchaser may, at its discretion, ask the Bidder for a clarification of its bid. The request for clarification and the response shall be in writing and no change in the price or substance of the bid shall be sought, offered or permitted, except as required to confirm the correction of arithmetical errors.

**IB.24 Preliminary Examination**

- IB.24.1 The Purchaser will examine the bids to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed, and whether the bids are generally in order.
- IB.24.2 Arithmetical errors will be rectified on the following basis. If there is a discrepancy between the unit price and the total price obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected. If the supplier does not accept the correction of errors, its bid shall be rejected. If there is a discrepancy between words and figures, the amount in words shall prevail.
- IB.24.3 Prior to the detailed evaluation, pursuant to Clause IB.26, the Purchaser will determine the substantial responsiveness of each bid to the Bidding Documents. For purposes of these Clauses, a substantially responsive bid is one which conforms to all the terms and conditions of the Bidding Documents without material deviations or reservations. A material deviation or reservation is one which affects in any substantial way the scope, quality or performance of the contractual obligations or which limits in any substantial way or is inconsistent with the bidding documents and the rectification of which deviation or reservation would affect unfairly the competitive position of other bidders presenting substantially responsive bids. The Purchaser's determination of a bid's responsiveness is to be based on the contents of the bid itself without recourse to extrinsic evidence.
- IB.24.4 A bid determined as not substantially responsive will be rejected by the Purchaser and may not subsequently be made responsive by the Bidder by correction of the non-conformity.
- IB.24.5 The Purchaser may waive any minor informality or non-conformity or irregularity in a bid which does not constitute a material deviation, provided such waiver does not prejudice or affect the relative ranking of any Bidder.

**IB.25 Conversion to Single Currency**

- IB.25.1 To facilitate evaluation and comparison, the Purchaser will convert all bid prices expressed in the amounts in the various currencies in which bid price is payable, to the United States Dollar currency equivalent and at the selling exchange rate published by an official source and

applicable to similar transactions on the day bids are opened or at such later date (30 or 60 days after bid opening) as shall be specified in the call for bids.

**IB.26 Evaluation and Comparison of Bids**

IB.26.1 The Purchaser will evaluate and compare the bids previously determined to be substantially responsive, pursuant to Clause IB.24.

IB.26.2 The Purchaser's evaluation of a bid will exclude and not take into account:

- (a) in the case of goods manufactured in the Purchaser's country or goods of foreign origin already located in the Purchaser's country, sales and other similar taxes, which will be payable on the goods if a contract is awarded to the Bidder; and
- (b) in the case of goods of foreign origin offered from abroad, customs duties and other similar import taxes which will be payable on the goods if the Contract is awarded to the Bidder.

IB.26.3 The comparison shall be of ex-factory/ex-warehouse/off-the-shelf price of the goods offered from within the Purchaser's country, such price to include all costs as well as duties and taxes paid or payable on components and raw material incorporated or to be incorporated in the goods, and the CIF port-of-entry price of the goods offered from outside the Purchaser's country.

IB.26.4 The Purchaser's evaluation of a bid will take into account, in addition to the bid price and the price of incidental services, the following factors, in the manner and to the extent indicated in para. IB.26.5 and in the Technical Specifications:

- (a) Delivery schedule offered in the bid;

IB.26.5 Pursuant to para. IB.26.4 the following evaluation methods will be followed:

- (a) *Delivery Schedule:*

The purchaser shall receive the goods covered under the invitation, at the time specified in the Schedule of Deliveries. The estimated time of arrival of the goods should be calculated for each bid after allowing for reasonable ocean transportation time. Treating the bid offering the scheduled time of arrival as the base, a delivery "adjustment" will be calculated for other bids at 5% of the ex-factory/CIF price for each month of delay beyond the base and this will be added to the bid price for evaluation.



**IB.27                    Margin of Preference**  
"THIS SECTION WAS INTENTIONALLY LEFT BLANK"

**IB.28                    Contacting the Purchaser**

IB.28.1                    Subject to Clause IB.23, no Bidder shall contact the Purchaser on any matter relating to its bid, from the time of the bid opening to the time the Contract is awarded.

IB.28.2                    Any effort by a Bidder to influence the Purchaser in the Purchaser's bid evaluation, bid comparison or contract award decisions shall result in the rejection of the Bidder's bid.

**Award of Contract**

**IB.29                    Post-qualification**

IB.29.1                    In the absence of pre-qualification, the Purchaser will determine to its satisfaction whether the Bidder selected as having submitted the lowest evaluated responsive bid is qualified to satisfactorily perform the Contract.

IB.29.2                    The determination will take into account the Bidder's financial, technical and production capabilities. It will be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to Clause IB.13, as well as such other information as the Purchaser deems necessary and appropriate.

IB.29.3                    An affirmative determination will be a prerequisite for award of the Contract to the Bidder. A negative determination will result in rejection of the Bidder's bid, in which event; the Purchaser will proceed to the next lowest evaluated bid to make a similar determination of that Bidder's capabilities to perform satisfactorily.

**IB.30                    Award Criteria**

IB.30.1                    Subject to Clause IB.32, the Purchaser will award the Contract to the successful Bidder whose bid has been determined to be substantially responsive and has been determined as the lowest evaluated bid, provided it has been determined that the Bidder is qualified to perform the Contract services satisfactorily.

**IB.31 Purchaser's Right to Vary Quantities at Time of Award**

IB.31.1 The Purchaser reserves the right at any time of award of Contract to increase or decrease by up to 10% the quantity of goods and services specified in the Schedule of Requirements without any change in price or other terms and conditions.

**IB.32 Purchaser's Right to Accept Any Bid and to Reject Any or All Bids**

IB.32.1 The Purchaser reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the Purchaser's action.

**IB.33 Notification of Award**

IB.33.1 Prior to the expiration of the period of bid validity, the Purchaser will notify the successful Bidder in writing by registered letter or by cable or by telefax, to be confirmed in writing by registered letter, that its bid has been accepted.

IB.33.2 The notification of award will constitute the formation of the Contract.

IB.33.3 Upon the successful Bidder's furnishing of performance security pursuant to Clause IB.35, the Purchaser will promptly notify each unsuccessful Bidder and will discharge its bid security, pursuant to Clause IB.15.

**IB.34 Signing of Contract**

IB.34.1 At the same time as the Purchaser notifies the successful Bidder that its bid has been accepted, the Purchaser will send the Bidder the Contract Form provided in the Bidding Documents, incorporating all agreements between the parties.

IB.34.2 Within fourteen (14) days of receipt of the Contract Form, the successful Bidder shall sign and date the Contract and return it to the Purchaser.

**IB.35 Performance Security**

IB.35.1 Within fourteen (14) days of the receipt of notification of award from the Purchaser, the successful Bidder shall furnish the performance security in accordance with the Conditions of

Contract, in the Performance Security Form provided in the Bidding Documents or another form acceptable to the Purchaser.

IB.35.2

If the performance Security to be provided by the successful bidder is in the form of a bank guarantee it shall be issued either:

- (a) as at the Bidder's option, by a bank located in the country of the Purchaser or by a foreign bank through a correspondent bank located in the country of the Purchaser, or
- (b) with the prior written agreement of the Purchaser, directly by a foreign bank acceptable to the Purchaser.

If the Performance Security is to be provided by the successful Bidder in the form of a bond, it shall be issued by a bonding insurance company which has been previously approved in writing to be acceptable by the Purchaser.

IB.35.3

Failure of the successful Bidder to comply with the requirement of Clause IB.34 or Clause IB.35 shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security, in which event the Purchaser may make the award to the next lowest evaluated bidder or call for new bids.

**PART 2**

**GENERAL CONDITIONS OF CONTRACT**

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## GC.01 Definitions

In this Contract, the following terms shall be interpreted as indicated:

- (a) "The Contract" means the agreement entered into between the Purchaser and the Supplier, as recorded in the Contract Form signed by the parties, including attachments and appendices thereto and all documents incorporated by reference therein;
- (b) "The Contract Price" means the price payable to the Supplier under the Contract for the full and proper performance of its contractual obligations;
- (c) "The Goods" means all of the equipment, machinery, and/or other materials, which the Supplier is required to supply to the Purchaser under the Contract;
- (d) "Services" means services ancillary to the supply of the Goods, such as transportation and insurance, and any other incidental services, such as installation, commissioning, provision of technical assistance, training and other such obligations of the Supplier covered under the Contract;
- (e) "The Purchaser" means the Organization purchasing the Goods;
- (f) "The Supplier" means the individual or firm supplying the Goods under this Contract;
- (g) IFI means the International Financial Institution and stands for the bank agreed on by both the purchaser and the supplier.
- (h) "Approved" means approved by the Purchaser or its delegated representatives; and
- (i) "Specified" means specified by the Purchaser; either on drawings, in the Technical Specifications, or in writing.
- (j) "Delivery" means delivered CIF Kingston, Jamaica unless otherwise specified.
- (K) "Days" means calendar days acceding to the Gregorian calendar.

**GC.02            Application**

GC.02.1            These General Conditions shall apply to the extent that provisions in other parts of the Contract do not supersede them.

**GC.03            Country of Origin**

GC.03.1            All Goods and Services supplied under the Contract shall be as defined under the guidelines of procurement of the JPS Purchasing Department. These rules are explained under the Special Conditions of Contract.

GC.03.2            For purposes of this Clause "origin" means the place where the Goods were mined, grown or produced, or from which the Services are supplied. Goods are produced when, through manufacturing, processing or substantial and major assembling of components, a commercially recognized new product results that is substantially different in basic characteristics or in purpose or utility from its components.

GC.03.3            The origin of Goods and Services is distinct from the nationality of the Supplier.

**GC.04            Standards**

GC.04.1            The Goods supplied under this Contract shall conform to the standards mentioned in the Technical Specifications, and, when no applicable standard is mentioned, to the authoritative standard appropriate to the Goods' country of origin and such standards shall be the latest issued by the concerned institution.

**GC.05            Use of Contract Document and Information**

GC.05.1            The Supplier shall not, without the Purchaser's prior written consent, disclose the Contract, or any provision thereof, of any specification, plan, drawing,

pattern, sample or information furnished by or on behalf of the Purchaser in connection therewith, to any person other than a person employed by the Supplier in the performance of the Contract. Disclosure to any such employed person shall be made in confidence and shall extend only so far as may be necessary for purposes of such performance.

GC.05.2 The Supplier shall not, without the Purchaser's prior written consent, make use of any document or information enumerated in para. GC.05.1 except for purposes of performing the Contract.

GC.05.3 Any document, other than the Contract itself, enumerated in para. GC.05.1 shall remain the property of the Purchaser and shall be returned (in all copies) to the Purchaser on completion of the Supplier's performance under the Contract if so required by the Purchaser

**GC.06 Patent Rights**

GC.06.1 The Supplier shall indemnify the Purchaser against all third party claims of infringement of patent, trademark or industrial design rights arising from the use of the Goods or any part thereof in the Purchaser's country.

**GC.07 Performance Security**

GC.07.1 Within fourteen (14) days after the Supplier's receipt of notification of award of the Contract, the Supplier shall furnish performance security to the Purchaser in the amount specified in the Special Conditions of Contract.

GC.07.2 The proceeds of the performance security shall be payable to the Purchaser as liquidated damages for the Supplier's failure to satisfactorily perform its obligations under the Contract and not as a penalty.



- GC.07.3 The Performance Security shall be denominated in the currency of the Contract or in freely convertible currency acceptable to the Purchaser, and shall be in one of the following forms:
- (a) A bank guarantee or irrevocable Letter of Credit, issued by a bank located in the Purchaser's country or abroad acceptable to the Purchaser, and in the form provided in the Bidding Documents or another form acceptable to the Purchaser; or
  - (b) A cashier's check or certified check.
- GC.07.4 The performance security will be discharged by the Purchaser and returned to the Supplier not later than 30 days following the date of completion of the Supplier's performance obligations, including any warranty obligations, under the Contract.

**GC.08 Inspections and Tests**

- GC.08.1 The Purchaser or its representative shall have the right to inspect and/or to test the Goods to confirm their conformity to the Contract. The Special Conditions of Contract and/or the Technical Specifications shall specify what inspections and tests the Purchaser requires and where they are to be conducted. The Purchaser shall notify the Supplier in writing of the identity of any representatives retained for these purposes.
- GC.08.2 The inspections and tests may be conducted on the premises of the Supplier or its subcontractor(s), at point of delivery and/or at the Good's final destination. Where conducted on the premises of the Supplier or its subcontractor(s), all reasonable facilities and assistance - including access to drawings and production data - shall be furnished to the inspectors at no charge to the Purchaser.

- GC.08.3        Should any inspected or tested Goods fail to conform to the Specifications, the Purchaser may reject them and the Supplier shall either replace the rejected Goods or make all alterations necessary to meet specification requirements free of cost to the Purchaser.
- GC.08.4        The Purchaser's right to inspect, test and, where necessary, reject the Goods after the Good's arrival in the Purchaser's country shall in no way be limited or waived by reason of the Goods having been previously inspected, tested and passed by the Purchaser or its representative prior to the Goods' shipment from the country of origin.
- GC.08.5        Risk in the Goods passes to the Purchasers after the Goods arrival in the Purchaser's Country and the Purchaser has inspected, tested and accepted the goods.
- GC.08.6        Nothing in Clause GC.08 shall in any way release the Supplier from any warranty or other obligations under this Contract.

**GC.09        Packing**

- GC.09.1        The Supplier shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to their final destination as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the Goods' final destination and the absence of heavy handling facilities at all points of transit.
- GC.09.2        The packing, marking and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly

provided for in the Contract and, subject to Clause GC.18, in any subsequent instructions ordered by the Purchaser.

## **GC.10 Delivery and Documents**

GC.10.1 Delivery of the Goods shall be made by the Supplier in accordance with the terms specified by the Purchaser in its Schedule of Deliveries and the Special Conditions of Contract. Delivery of the Goods takes place after the goods have been tested, inspected and accepted by the Purchaser upon arrival of the Goods in the Purchasers Country.

GC.10.2 Subject to SC-7 For the purposes of this Contract, **FOB, C&F, CIF** and other trade terms used to describe the obligations of the parties shall have meanings assigned to them by the current edition of the International Rules for the Interpretation of the Trade Terms published by the International Chamber of Commerce, Paris, and commonly referred to as INCOTERMS.

## **GC.11 Insurance**

GC.11.1 The Goods supplied under the Contract shall be fully insured in a freely convertible currency against loss or damage incidental to manufacture or acquisition, transportation, storage and delivery in the manner specified in the Special Conditions of Contract.

GC.11.2 Where delivery of the goods is required by the Purchaser on a CIF basis, the Supplier shall arrange and pay for marine insurance, naming the Purchaser as the beneficiary. Where delivery is on an FOB or C&F basis, marine insurance shall be the responsibility of the Purchaser.

## **GC.12 Transportation**

GC.12.1 Where the Supplier is required under the Contract to deliver the Goods FOB, transport of the Goods, up to and including the point of putting the Goods on board the vessel at the specified port of loading, shall be arranged and paid for by the Supplier, and the cost thereof shall be included in the Contract Price.

- GC.12.2 Where the Supplier is required under the Contract to deliver the Goods **C&F or CIF, Kingston, Jamaica** or to a specified destination within the country, transport of the Goods to the port of discharge or such other point in the country of destination as shall be specified in the Contract shall be arranged and paid for by the Supplier, and the cost thereof shall be included in the Contract Price.
- GC.12.3 Where the Supplier is required to effect delivery under any other terms, for example, by post or to another address in the same source country, the Supplier shall be required to meet all transport and storage expenses until delivery.
- GC.12.4 In all of the above cases, transportation of the Goods after delivery shall be the responsibility of the Purchaser.
- GC.12.5 Where the Supplier is required under the contract to deliver the Goods CIF, shipment shall be made in a carrier operating under the flag of the purchaser's country. Where the Supplier is required in the Contract (i) to deliver the Goods FOB, and (ii) to arrange on behalf and at the expense of the Purchaser for ocean transportation on specified conference vessels or on national flag carriers of the Purchaser's country, the Supplier may arrange for such transportation on alternative carriers if the specified conference vessels or national flag carriers are not available to transport the Goods within the time period(s) specified in the Contract.

### **GC.13 Incidental Services**

- GC.13.1 As specified in the Special Conditions of contract, the Supplier may be required to provide any or all of the following services:
- (a) Performance or supervision of on-site assembly and/or start up of the supplied Goods;
  - (b) Furnishing of tools required for assembly and/or maintenance of the supplied Goods;
  - (c) Furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied Goods;
  - (d) Performance or supervision or maintenance and/or repair of the supplied Goods, for a period of time agreed by the parties, provided that this service shall not relieve the Supplier of any warranty obligations under this Contract; and

- (e) Conduct of training of the Purchaser's personnel, at the Supplier's plant and/or on-site, in assembly, start-up, operation, maintenance and/or repair of the supplied Goods.

GC.13.2 Prices charged by the Supplier for the preceding incidental services, shall not be included in, shall be quoted separately in the Contract Price for the Goods, shall be agreed upon in advance by the parties and shall not exceed the prevailing rates charged by other parties by the Supplier for similar services.

**GC.14 Spare Parts**

GC.14.1 As specified in the Special Conditions of Contract, the Supplier may be required to provide any or all of the following materials and notifications pertaining to spare parts manufactured or distributed by the Supplier:

- (a) Such spare parts as the Purchaser may elect to purchase from the Supplier, provided that this election shall not relieve the Supplier of any warranty obligations under the Contract; and
- (b) In the event of termination of production of the spare parts:
- (c) advance notification to the Purchaser of the pending termination, in sufficient time to permit the Purchaser to procure needed requirement; and
- (d) following such termination, furnishing at no cost to the Purchaser, the blueprints, drawings and specifications of the spare parts, if and when requested.

**GC.15 Warranty**

GC.15.1 The Supplier warrants that the goods supplied under the Contract are new, unused, of the most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the Contract. The Supplier further warrants that the Goods supplied under this Contract shall have no defect arising from design, materials or workmanship (except insofar as the design or material is required by the Purchaser's Specifications) or from any act or omission of the Supplier, that may develop under normal use of the supplied Goods in the conditions obtaining in the country of final destination.

GC.15.2 This warranty shall remain valid for twelve (12) months after the Goods, or any portion thereof as the case may be, have been delivered (and commissioned) to the final destination indicated in the Contract.

GC.15.3 The Purchaser shall promptly notify the Supplier in writing of any claims arising under this warranty.

GC.15.4 Upon receipt of such notice, the Supplier shall, depending on which of the methods can be achieved more expeditiously with reasonable speed, repair or replace the defective Goods or parts thereof, without costs to the Purchaser and under the terms and conditions as if the replacement Goods or parts were being delivered to the Company for the first time.

GC.15.5 If the Supplier, having been notified, fails to remedy the defect(s) within a reasonable period, the Purchaser may proceed to take such remedial action as may be necessary, at the Supplier's risk and expense without prejudice to any other rights which the Purchaser may have against the Supplier under the Contract.

**GC.16 Payment**

GC.16.1 The method and conditions of payment to be made to the Supplier under the Contract shall be as specified in the Special Conditions of Contract.

GC.16.2 The Supplier's request(s) for payment shall be made to the Purchaser in writing, accompanied by an invoice describing, as appropriate, the Goods delivered and Services performed, and by shipping documents, submitted pursuant to Clause GC.10, and upon fulfillment of other obligations stipulated in the contract.

GC.16.3 Payments shall be made promptly by the Purchaser within sixty (60) days of submission of an invoice/claim by the Supplier.

GC.16.4 The currency or currencies in which payment is made to the Supplier under this Contract shall be as specified in the Special Conditions of Contract subject to the following general principle: Payment will be made in the currency or currencies in which the Contract Price has been stated in the Supplier's bid, as well as in other currencies in which the Supplier had indicated in its bid that it intends to incur expenditures in the performance of the Contract and wishes to be paid.

**GC.17 Prices**

GC.17.1 Prices charged by the Supplier for Goods delivered and Services performed under the Contract shall not, with the exception of any price adjustments authorized by the Special Conditions of Contract, vary from the prices quoted by the Supplier in its bid.

**GC.18 Change Orders**

GC.18.1 The Purchaser may at any time, by a written order given to the Supplier pursuant to Clause GC.31, make changes within the general scope of the Contract in any one or more of the following:

- (a) drawings, designs or specifications, where Goods to be furnished under the Contract are to be specifically manufactured for the Purchaser;
- (b) the method of shipment or packing;
- (c) the place of delivery; or
- (d) the Services to be provided by the Supplier.

GC.18.2 If any such change causes an increase or decrease in the cost of, or the time required for, the Supplier's performance of any part of the work under the Contract, whether changed or not changed by the order, an equitable adjustment shall be made in the Contract Price or delivery schedule, or both, and the Contract shall be amended accordingly. Any claims by the Supplier for adjustment under this clause must be asserted within thirty (30) days from the date of the Supplier's receipt of the Purchaser's change order.

**GC.19 Contract Amendments**

GC.19.1 Subject to Clause GC.18, no variation in or modification of the terms of the Contract shall be made except by written amendment signed by the duly authorized agents of both parties.

**GC.20 Assignment**

GC.20.1 The Supplier shall not assign, in whole or part, its obligations to perform under the Contract, except with the Purchaser's prior written consent.

**GC.21 Subcontracts**

GC.21.1 The supplier shall notify the purchaser in writing of all subcontracts awarded under the Contract if not already specified in his bid. Such notification, in his original bid or later, shall not relieve the supplier from any liability or obligation under the Contract with the Purchaser.

GC.21.2 Contracts with Subcontractors must comply with the provisions of Clause GC.03, GC.05, GC.09 and GC.15.

**GC.22 Delays in the Supplier's Performance**

GC.22.1 Delivery of the Goods and performance of Services shall be made by the Supplier in accordance with the time schedule specified by the Purchaser in its Schedule of Deliveries.

GC.22.2 A delay by the Supplier in the performance of its delivery obligations shall, subject to the provisions of clause GC.25, render the Supplier liable to any or all of the following sanctions: forfeiture of its performance security, imposition of liquidated damages, and/or termination of the Contract for default, unless the reason for such delay is acceptable to the Purchaser.

GC.22.3 If at any time during the performance of the Contract, the Supplier or its subcontractor(s) should encounter conditions impeding timely delivery of the Goods and performance of Services, the Supplier shall promptly notify the Purchaser in writing of the fact of the delay, its likely duration and its cause(s). As soon as practicable after receipt of the Supplier's notice, the Purchaser shall evaluate the situation and may at its discretion extend the Supplier's time for performance, in which case the extension shall be ratified by the parties by amendment of the Contract, or terminate the Contract in accordance with the provision of clause GC.22.2.

**GC.23 Liquidated Damages**

**GC.23.1 TIME IS OF THE ESSENCE FOR THE EXECUTION OF THIS CONTRACT.**

Subject to Clause GC.25, if the Supplier fails to deliver any or all of the Goods or perform the Services within the time period(s) specified in the Contract, the Purchaser shall, without prejudice to its other remedies under the Contract, deduct from the Contract Price, as liquidated damages, a sum equivalent to two percent (2.0%) of the delivered price of the delayed Goods or unperformed Services for each week of delay until actual delivery or performance, up to a maximum deduction of fourteen percent (14%) of the delayed Goods or Services contract price. Once the maximum is reached, the Purchaser may consider termination of the Contract.

**GC.24 Termination for Default**

GC.24.1 The Purchaser may, without prejudice to any other remedy for breach of contract, by written notice of default sent to the Supplier, terminate the Contract in whole or in part:



- (a) if the Supplier fails to deliver any or all of the Goods within the time period(s) specified in the Contract, or any extension thereof granted by the Purchaser pursuant to Clause GC.22; or
- (b) if the supplier fails to perform any other obligation(s) under the Contract.

GC.24.2 In the event the Purchaser terminates the Contract in whole or in part, pursuant to para. GC.24.1, the Purchaser may procure, upon such terms and in such manner as it deems appropriate, Goods similar to those undelivered, and the Supplier shall be liable to the Purchaser for any excess costs for such similar Goods. However, the Supplier shall continue performance of the Contract to the extent not terminated.

**GC.25 Force Majeure**

GC.25.1 Notwithstanding the provisions of Clauses GC.22, 23, 24, the Supplier shall not be liable for forfeiture of its performance security, liquidated damages or termination for default, if and to the extent that, its delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure.

GC.25.2 For the purposes of this clause, "Force Majeure" means an event beyond the control of the Supplier and not involving the Supplier's fault or negligence and not foreseeable. Such events may include, but are not restricted to, acts of the Purchaser either in its sovereign or contractual capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and freight embargoes.

GC.25.3 If a Force Majeure situation arises, the Supplier shall promptly notify the Purchaser in writing of such condition and the cause thereof. Unless otherwise directed by the Purchaser in writing, the Supplier shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.

**GC.26 Termination for Insolvency**

GC.26.1 The Purchaser may at any time terminate the Contract by giving written notice to the Supplier, without compensation to the Supplier, if the Supplier becomes bankrupt or otherwise insolvent, provided that such termination will not prejudice or affect any right of action or remedy which has accrued or will accrue thereafter to the Purchaser.

**GC.27 Termination for Convenience**

GC.27.1 The Purchaser, may by written notice sent to the Supplier, terminate the Contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for the Purchaser's convenience, the extent to which performance of work under the Contract is terminated, and the date upon which such termination becomes effective.

GC.27.2 The Goods that are complete and ready for shipment within 30 days after the Supplier's receipt of notice of termination shall be purchased by the Purchaser at the Contract terms and prices. For the remaining goods, the Purchaser may elect:

- (a) to have any portion completed and delivered at the Contract terms and prices; and/or
- (b) to cancel the remainder and pay to the Supplier an agreed amount for partially completed Goods and for materials and parts previously procured by the Supplier.

**GC.28 Resolution of Disputes**

GC.28.1 The Purchaser and the Supplier shall make every effort to resolve amicably by direct informal negotiation any disagreement or dispute arising between them under or in connection with the Contract.

GC.28.2 If, after thirty (30) days from the commencement of such informal negotiation, the Purchaser and the Supplier have been unable to resolve amicably a Contract dispute, either party may require that the dispute be referred for resolution to the formal mechanisms specified in the Special Conditions of Contract. These mechanisms may include, but are not restricted to, conciliation mediated by a third party, adjudication in an agreed national or international forum, and/or international arbitration. The mechanism shall be specified in the Special Conditions of Contract.

**GC.29 Governing Language**

GC.29.1 The Contract shall be written in the language of the bid, as specified by the Purchaser in the Instructions to Bidders. Subject to Clause GC.30, that language version of the Contract shall

govern its interpretation. All correspondence and other documents pertaining to the Contract which are exchanged by the parties shall be written in that same language.

**GC.30           Applicable Law**

GC.30.1           The Contract shall be interpreted in accordance with the laws of the Purchaser's country.

**GC.31           Notices**

GC.31.1           Any notice given by one party to the other pursuant to the Contract shall be sent in writing or by telegram or telefax and confirmed in writing to the address specified for that purpose in the Special Conditions of Contract.

GC.31.2           A notice shall be effective when delivered or on the notice's effective date, whichever is later.

**GC.32           Taxes and Duties**

GC.32.1           A foreign Supplier shall be entirely responsible for all taxes, stamp duties, license fees, and other such levies imposed outside the Purchaser's country.

GC.32.2           A local Supplier shall be entirely responsible for all taxes, duties, license fees, etc., incurred until delivery of the contracted Goods to the Purchaser.

**PART 3**

**SPECIAL CONDITIONS OF CONTRACT**

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## **SC General**

The following Special Conditions of Contract shall supplement the General Conditions of Contract. Whenever there is a conflict, the provisions herein shall prevail over those in the General Conditions of Contract. The corresponding clause number of the General Conditions is indicated in parentheses.

### **SC.01 Definitions (Clause GC.01)**

- (a) The Purchaser is The Jamaica Public Service Company Limited
- (b) The Supplier is the successful Bidder
- (c) The Bank is the Bank agreed on by the purchaser and the supplier.
- (d) Delivery is delivered CIF Kingston, Jamaica, W.I. PROVIDED THAT risk in the Goods arrival in the Purchasers' Country and the Purchaser has inspected, tested and accepted the Goods.

**SC.02** "THIS SECTION WAS INTENTIONALLY LEFT BLANK"

### **SC.03 Country of Origin (Clause GC.03)**

All member countries as per JPS Purchasing Department pre-qualification list.

**SC.04 - 06** "THESE SECTIONS WERE INTENTIONALLY LEFT BLANK"

### **SC.07 Performance Security (Clause GC.07)**

The Performance Security shall be in the amount of 10% of the Contract price.

### **SC.08 Inspection and Tests (Clause GC.08)**

The required inspection and tests are specified in the Technical Specifications.

**SC.09** "THIS SECTION WAS INTENTIONALLY LEFT BLANK"

**SC.10 Delivery and Documents (Clause GC.10)**

## (a) For Imported Goods

Prior to shipment, the Supplier shall notify the Purchaser and its Insurance Company by cable or telefax the full details of the shipment including contract number, description of Goods, quantity, the vessel, the bill of lading number and date, port of loading, date of shipment, port of discharge, date of arrival at port of discharge or other information which may be relevant to the purchaser or insurance company. The Supplier shall mail the documents listed in clause 3 of the Purchaser's Purchase Order in accordance with the terms and conditions therein.

- (i) Original and two (2) copies of the Supplier's invoice showing Goods description, quantity, unit price, total amount;
- (ii) First and Second Original of negotiable, clean, on-board bill of lading marked freight prepaid and one (1) copy of non-negotiable bill of lading;
- (iii) Original and two (2) copies of the packing list identifying contents of each package;
- (iv) Original and two (2) copies of the Insurance certificate;
- (v) Original and two (2) copies of the Manufacturer's/supplier's warranty certificate;
- (vi) Inspection certificate, issued by the nominated inspection agency and the Supplier's factory inspection report; and

The above documents shall be received by the Purchaser at least one week before arrival of Goods at the port and, if not received, the Supplier will be responsible for any consequent expenses.

**SC.11 Insurance (Clause GC.11)**

Notwithstanding GC 10.2 The marine insurance shall be in an amount equal to 110% of the CIF value of the goods from "warehouse to warehouse" on "All Risks" basis including War Risks and Strike clauses. Warehouse to warehouse shall mean from the warehouse of the supplier to the warehouse of the Purchaser.

**SC.12 "THIS SECTION WAS INTENTIONALLY LEFT BLANK"**

**SC.13            Incidental Services (Clause GC.13)**

All required incidental services have been included in the Technical Specifications. The cost shall be included in the Contract price.

**SC.14            Spare Parts (Clause GC.14)**

Supplier shall carry sufficient inventories to assure ex-stock supply of consumable spares such as gaskets, washers, etc. Other spare parts and components shall be supplied as promptly as possible but in any case within six months of placement of order and establishment of Letter of Credit.

**SC.15            Warranty (Clause GC.15)**

In partial modification of the provisions, the warranty period shall be twelve (12) months from the date of commissioning.

**SC.16            Payment (Clause GC.16)**

(a) Payment for Imported Goods.

On Shipment: 100% of the Contract Price of the Goods shipped shall be paid through irrevocable confirmed Letter of Credit established in favor of the Supplier in a bank in his country, on submission of documents specified in Clause GC.10

**SC.17 - 27**            "THESE SECTIONS WERE INTENTIONALLY LEFT BLANK"

**SC.28            Resolution of Disputes (Clause GC.28)**

The dispute resolution mechanism to be applied pursuant to Clause GC.28 of the General Conditions shall be as follows:

(a) in the case of a dispute between the Purchaser and a Supplier which is a national of the Purchaser's country, the dispute shall be referred to adjudication/arbitration in accordance with the laws of the Purchaser's country; and

(b.i) in the case of a dispute between the Purchaser and a foreign Supplier, the dispute shall be settled by arbitration in accordance with the provisions of the UNCITRAL Arbitration Rules.



(b.ii) The Appointing Authority shall be the President for the time being of the Jamaica Institute of Engineers (J.I.E.).

(b.iii) There shall be one Arbitrator.

**SC.29 - 30**

"THESE SECTIONS WERE INTENTIONALLY LEFT BLANK"

**SC.31**

**Notices (Clause GC.31)**

For the purpose of all notices, the following shall be the address of the Purchaser and the Supplier.

***Purchaser:***

**Purchasing Manager  
Jamaica Public Service Co. Ltd.  
P.O. Box 54  
Kingston, Jamaica.**

**Supplier:**

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**PART 4**  
**EXHIBITS**

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# Exhibit 1

## FORM OF BID BOND

KNOW ALL MEN \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

as Principal, and \_\_\_\_\_

\_\_\_\_\_

as Surety, are held and firmly bound unto Jamaica Public Service Company Limited with Head Office at 6 Knutsford Boulevard, Kingston 5, Jamaica W.I. (hereinafter called the Purchaser) in the sum of \_\_\_\_\_

\_\_\_\_\_ Dollars (\$.....), as hereinafter set forth and for the payment on demand of which sum well and truly to be made we bind ourselves, our Executors, our Administrators, Successors and Assigns, jointly and severally, by these present.

WHEREAS, the Principal has submitted a Bid dated \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_ for the supply of Medium Voltage Capacitor Banks under the **JPS – North East Coast Voltage Security Improvement Project**

NOW THEREFORE, the conditions of the obligation are that if the Purchaser receives the Bid of the Principal and:

- (a) If the Bidder does not withdraw the Bid during the bid validity specified by the Bid in the Tender Document, and/ or
- (b) If the Purchaser accepts the Bid of the principal, and the principal executes such Contract Documents, if any as may be required by the terms of the bid and give such Supplier's Bond or Bonds for the performance of the contract and for the prompt payment of material furnished or works executed for the project as may be specified in the bid, then this obligation shall be null and void otherwise shall remain in full force and effect

(c) In the event of withdrawal of the bid during the bid validity period or in the event of failure of the Principal to execute such document, if any, and give such Supplier's Bond or Bonds if the Principal shall pay to the Purchaser the difference, not to exceed the sum hereof, between the amount specified in the Bid and such larger sum for which the Purchaser may in good faith Contract with another party to furnish materials for the project, then this obligation shall be avoided to here wise remain in full force and effect, and shall be payable forthwith as damages on demand made by the Purchaser. It being expressly agreed that such a demand shall be conclusive evidence as between the Purchaser and the Surety that the sum demanded is properly due and payable.

**IN WITNESS WHEREOF**, the undersigned have caused this instrument to be executed and their respective corporate seals to be affixed and attested by \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_.

\_\_\_\_\_  
**PRINCIPAL (SEAL)**

**Attest:** BY \_\_\_\_\_

\_\_\_\_\_  
**SECRETARY**

\_\_\_\_\_  
**TITLE**

\_\_\_\_\_  
**SURETY**

**Attest:** BY \_\_\_\_\_

\_\_\_\_\_  
**SECRETARY**

\_\_\_\_\_  
**TITLE**

## Exhibit 2

### FORM OF PERFORMANCE BOND

To: Jamaica Public Service Company Limited

WHEREAS \_\_\_\_\_ hereinafter called "the Supplier" has undertaken to supply 30 MVARs of Open-Rack and Metal-Enclosed Capacitor Banks hereinafter called "the Contract".

AND WHEREAS it has been stipulated by you in the said Contract that the Supplier shall furnish you with a Bank Guarantee by a recognized bank for the specified therein as security for compliance with the Supplier's performance obligations in accordance with the Contract. AND WHEREAS we have agreed to give the Supplier a Guarantee:

THEREFORE, WE hereby affirm that we are Guarantors and responsible to you, on behalf of the Supplier, up to a total of (\_\_\_\_\_ Dollars \$\_\_\_\_\_) and we undertake to pay you, upon your first written demand declaring the Supplier to be in default under the Contract and without cavil or argument, any sum or sums within the limits of  
(\_\_\_\_\_

\_\_\_\_\_ Dollars  
\$ \_\_\_\_\_) as aforesaid, without your needing to prove or to show grounds or reasons for your demand of the sum specified therein.

This guarantee is valid until the \_\_\_\_\_ day of \_\_\_\_\_ 20 \_\_\_\_

Signature and Seal of the Guarantors

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Date:** \_\_\_\_\_

**Address:** \_\_\_\_\_

*Exhibit 3***FORM OF AGREEMENT**

This Agreement made the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_ for the supply of 30 MVARs of Open-Rack and Metal-Enclosed Capacitor Banks under the JPS North East Coast Voltage Security Improvement Project. Substation Document # 940747

**BY AND BETWEEN**

**JAMAICA PUBLIC SERVICE COMPANY LIMITED**, a Company incorporated under the laws of Jamaica with Head Office at No. 6 Knutsford Boulevard in the Parish of St. Andrew, Jamaica; hereinafter called the "Purchaser".

**AND**

with registered office at \_\_\_\_\_ hereinafter called the "Supplier".

**WITNESSETH** that the Purchaser and the Supplier agree as follows:

1. The following documents shall be deemed to form and be read and construed as part of this Agreement which shall constitute a binding Contract between the Purchaser and the Supplier:
  - (a) The Addenda (if any)
  - (b) The letter of award/acceptance
  - (c) The Technical Specifications
  - (d) Drawings referred to in the Specification
  - (e) The Special Conditions of Contract
  - (f) The General Conditions of Contract
  - (g) The Bidders Proposal
  - (h) The Instructions to Bidders

The aforesaid documents shall be taken as complimentary and mutually explanatory of one another but in the case of ambiguities or discrepancies shall take precedence in the order set out above.

2. In consideration of the payments to be made by the Purchaser to the Supplier as hereinafter mentioned, the Supplier agrees to furnish the materials and equipment complete in every respect in conformity with the provisions of this Contract and to the satisfaction of the Purchaser and the delivery of such materials and equipment shall be made on or before \_\_\_\_\_

3. In consideration of the Execution of the Works in accordance with the Provisions of this Contract and to the satisfaction of the Purchaser, the Purchaser agrees to pay the Contract Price to the Supplier at the time and in the manner prescribed herein. The Contract Price shall consist of unit prices and lump sums named in the attached Schedule of Prices having a total (based on estimated quantities in the case of unit price items) of

\_\_\_\_\_ \$ \_\_\_\_\_

**The Supplier has furnished and the Purchaser accepts:**

**A Performance Bond that is:**

**Issued by the** \_\_\_\_\_

**In the amount of** \_\_\_\_\_

**Dated the** \_\_\_\_\_

**Having Serial No.**

\_\_\_\_\_

With respect to the execution of the Works by the Supplier which bond shall operate according to its tenure.

This Agreement bears the formal date aforementioned and shall be for all purposes retroactive to such date even though signed and acknowledged on the dates mentioned below.

The Supplier and the Purchaser for themselves, their successors, and assigns hereby agree to the full performance of the covenants herein contained in witness whereof they have executed this Agreement as of the day and year first written above.

**SIGNED SEALED AND DELIVERED** ) \_\_\_\_\_



**by the said SUPPLIER in the  
presence of**

)  
)

\_\_\_\_\_

\_\_\_\_\_  
**WITNESS**

**SIGNED SEALED AND DELIVERED  
by the said PURCHASER in the  
the presence of**

)  
)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
**WITNESS**

**PART 5**  
**BID FORM**

**Bid for**  
**THE JAMAICA PUBLIC SERVICE COMPANY LIMITED**  
**NORTH EAST COAST VOLTAGE SECURITY**  
**IMPROVEMENT PROJECT**

**FOR THE SUPPLY OF**  
**30 MVARs OF OPEN AIR RACK AND METAL ENCLOSED**  
**SUBSTATION CAPACITOR BANKS**

**BID DOCUMENT # 940747**

Proposed by

\_\_\_\_\_ of \_\_\_\_\_  
a Company duly incorporated under the laws of \_\_\_\_\_  
and licensed to carry on business in the Country of \_\_\_\_\_  
and having its head office at \_\_\_\_\_  
hereinafter called the Bidder.

**TO: THE JAMAICA PUBLIC SERVICE CO. LTD.**  
**6 KNUTSFORD BOULEVARD**  
**P. O. BOX 54**  
**KINGSTON 5, JAMAICA W.I.**

Having examined the Bid Documents including Instructions to Bidders, General Conditions of Contract, Special Conditions of Contract, Exhibits, Technical Specification and Attachments to the above named documents the undersigned Bidder hereby proposes and offers to supply 30 MVARs of Open-Rack and Metal-Enclosed Capacitor Banks in conformity with the Specification for and at the prices set out in the annexed Schedule of Prices and by the date specified in the Schedule of Requirements.

The total amount of this Bid calculated according to the said Schedule of Prices is

\_\_\_\_\_  
United States Dollars (US\$ \_\_\_\_\_). The Bidder undertakes to enter into a Contract incorporating Bid Documents and this Bid and the Bidder hereby agrees that until such a Contract is executed, the said documents and the Notification of Acceptance of Bid by the Purchaser to the successful Bidder shall constitute a binding Contract.

The Bidder agrees that his Bid shall continue open to acceptance and irrevocable until the formal Contract is executed by the successful Bidder for the said work and the Purchaser may at any time within ninety (90) days of the closing date for Bids, accept this Bid without notice, whether any other Bid has previously been accepted or not.

**BID BOND**

Accompanying this bid is a bid bond that is:

Issued by \_\_\_\_\_  
In the amount of \_\_\_\_\_  
Dated the \_\_\_\_\_  
Having a Serial No. \_\_\_\_\_

The following Schedules are attached to and form part of this Bid:

- Schedule of Information
- Schedule of Prices
- Schedule of Deliveries
- Schedule of Technical Data

**IN WITNESS WHEREOF** \_\_\_\_\_ has executed these presents this \_\_\_\_\_ day  
of \_\_\_\_\_ 20\_\_

**SEALED WITH the corporate seal of**

\_\_\_\_\_  
\_\_\_\_\_  
and attested by its proper \_\_\_\_\_  
officers in that behalf \_\_\_\_\_  
\_\_\_\_\_

**PART 6**

**TECHNICAL SPECIFICATIONS**

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**TS.01 Summary of Work**

**TS.01.1 Description of Project**

This project involves the design, manufacture and installation of Capacitor Banks and Capacitor Bank Control Equipment at the following substations. Each bank is expected to have a total approximate capacity of 10.0 MVAR equipped with 2 stages each carrying 5.0 MVAR:

SUBSTATION	TOTAL MVARs	SWITCHING INCREMENT MVARs	STATION VOLTAGE	OPTION A	OPTION B	OPTION C	PARISH
Ocho Rios (T1)	10.0	2 x 5.0	24 kV Wye	Open Air Type	Metal Enclosed Type with Roll-Out Type Circuit Breaker	Hybrid Type Outdoor Circuit Breaker separate from the enclosed capacitor bank components	St. Ann
Roaring River (T1)							
Cardiff Hall (T1)							

**TS.01.2 Locations**

Substation sites are detailed in Section TS.01.1. The Supplier is to provide 3 options as part of the bid which are designed to meet the space requirements as indicated below:

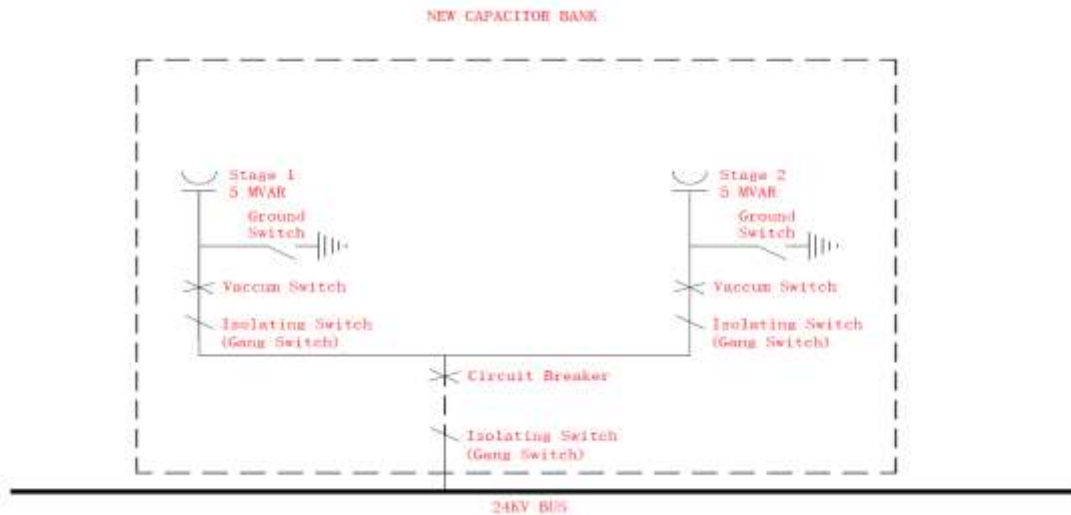
**Option A:** Open air type capacitor bank (All outdoor open air type capacitor bank with equipment listed under section TS 03.1)

**Option B:** Metal enclosed type capacitor bank (All metal enclosed type capacitor bank as listed under section TS 03.2)

**Option C:** Hybrid type capacitor bank (1 x 38 kV outdoor circuit breaker as per section TS.014; all other capacitor bank components housed in a metal enclosed container)



Single Line Diagram of Connection: The single line diagram below shows the proposed single line for the capacitor banks.



Ocho Rios Substation: Total space 34ft (north to south) x 17ft (east to west) as shown



Figure 1: Ocho Rios Substation

**Roaring River Substation:** Total space 22ft (north to south) x 27ft (east to west) with an option to extend north to south by an additional 10ft.



**Figure 2: Roaring River Substation**

**Cardiff Hall Substation:** Option A (open air) is to install a new third capacitor bank structure to house an additional 12 capacitors rated at 300 kVAR each (Reference Appendix for layout drawing of structure foundation). The 24 existing capacitors housed in the 2 structures are to be replaced with 300 kVAR units to get a total of 36 x 300 kVAR = 10.8 MVAR. Option B (metal enclosed) and Option C (hybrid options) would be to totally demolish the existing infrastructure and install a metal enclosed or hybrid solution.

Total space is 17ft (north to south) x 35ft (east to west)



**Figure 3: Cardiff Hall Substation**

**TS.01.3 Scope of Work**

The Supplier shall design, supply, factory test, guarantee and deliver to Kingston, Jamaica, W.I. all material and equipment for the above substations in accordance with these specifications and Section 3 "Schedule of Requirements".

**TS.01.4 Specification Drawings**

The drawings that accompany and form part of this specification are included in Section 8 of these bid documents.

The general arrangement and typical electrical drawings that accompany this specification are intended to indicate the type of capacitor installation envisioned by the Purchaser. However, the Supplier is free to use designs and arrangements that best suit the equipment proposed. Detailed design, location of equipment on structures and provision of proper electrical working clearances, phase to phase and phase to ground shall be the responsibility of the Supplier.

**TS.01.5 Work Not Included**

The following work shall not form part of this contract:

- detailed design of concrete foundations for steel structures and equipment pads
- assembly and erection of steel work and bus-work
- assembly, installation, adjustment and commissioning of equipment on site unless separately and specifically requested by Purchaser.

**TS.01.6 Supplier's Drawings and Schedules**

The Supplier shall submit, for review, within the time specified in the agreed Work Schedule, four copies of all general assembly drawings, together with such additional detailed drawings as are required or specifically requested, to fully demonstrate that all parts of the equipment to be furnished will conform with the provisions and intent of this specification. Any drawing of a preliminary nature must be so indicated.

In addition to the requirements specified in Section TS.02.2 "General Requirements" for drawings related to the equipment being supplied, the Supplier shall also be responsible for preparing all electrical drawings related to the overall substation including the equipment being supplied in the other Packages.

These drawings shall include:

- AC single line diagrams
- Tripping Logic Diagrams

- AC three line diagrams
- AC / DC schematic diagrams for control and protection
- Panel wiring diagrams
- Anchor bolt layout, equipment layout plan, elevations & section details
- Grounding Layout

Cable lists and equipment interconnection diagrams will be prepared by others.

## **TS.02           General Requirements**

### **TS.02.1        Work Schedule**

To suit the execution of the project and the required commissioning date, it is anticipated that commencement and completion dates for the project will be in accordance with the Tentative Work Program attached.

The Supplier shall submit **within 10 working days** of acceptance of the tender a general Work Schedule in the form of a bar chart. The Work Program shall show the order in which he proposes to carry out the work and the time schedule he guarantees to follow, for design and approvals, manufacture, factory test, transport, etc. based on the Purchaser's Tentative Work Program enclosed herein and drawing approvals so that the specified delivery date(s) shall be met.

The schedule shall indicate commencement and completion dates for the principal features of the Works including, but not limited to, engineering design and submittal of drawings for review.

### **TS.02.2        Information to be submitted by the Supplier**

The Supplier shall submit to the Purchaser, drawings, design data, operation and maintenance manuals, as may be called for herein, or as the Purchaser may reasonably require. The Supplier's drawings and design data shall bear the Supplier's official verification that the information shown thereon has been checked by the Supplier and is correct for use in construction, except for drawings of a preliminary nature furnished for information only, which shall be clearly identified as such.

The following essential drawings and information are to be submitted for approval before manufacture/fabrication commences.

- equipment arrangement - plan and elevations
- dimensioned outline drawings, details and weights of all equipment
- structural steel drawings and calculations
- equipment foundation drawings including loads and reactions
- equipment type test reports
- electrical drawings

All drawings are to be produced using AUTOCAD format, at no stage of the approval process will hand drawn drawings be accepted.

In addition, the following data shall be provided for review and comment:

- nameplate diagram
- equipment wiring diagrams
- schematic control diagrams
- manuals for installation, operation and maintenance of the equipment
- testing and commissioning procedures.

For equipment which uses oil as the insulating medium, a certification from an independent testing laboratory, attesting to the level of PCBs in the oil must be provided. PCB level should NOT exceed 2ppm (two parts per million).

### **TS.02.3 Submission and Approval of Drawings**

The Supplier shall submit four (4) copies of all drawings, and data to the Purchaser for review.

One copy of each drawing submitted for review will be returned with any necessary changes or comments noted on the drawing. The drawings will be reviewed only for general design, overall dimensions and materials. Review by the Purchaser will not relieve the Supplier of responsibility for conformity to the specification, correct details and fit of parts when erected. Drawings which have been reviewed "as noted" will not have to be re-submitted for acceptance unless so indicated. No major revision affecting the design shall be made after a drawing has been accepted, without re-submitting the drawing for review. Every revision shall be shown by number, date and subject in a revision block. The symbology to be used shall be in accordance with ANSI Standards.

All applicable requirements in the preceding paragraphs, with reference to drawings, shall apply to catalog cuts, illustrations, printed specifications or any other data submitted.

The Supplier shall submit for final acceptance revised copies within one (1) month of the receipt of the marked-up drawings. Any manufacturing done before approval of the drawings will be at the Supplier's own risk. The Purchaser will have the right to require the Supplier to make any changes in design which are necessary, in the opinion of the Purchaser, to make the equipment conform to the requirements and intent of the Specifications without additional cost.

After accepted drawings have been received, the Supplier shall without delay complete all necessary corrections or additions and furnish the Purchaser with one (1) reproducible (Mylar or Dylar) copy of each drawing as a "Final" copy.

If minor revisions are made subsequently following testing, then one (1) reproducible (Mylar or Dylar) copy of the revised drawing shall be forwarded to the Purchaser.

In addition, Purchaser requires that Supplier provide a copy of each Final drawing in AUTOCAD 14 format on compact disks (CD).

The Bill of Materials shall be treated as a drawing and one (1) reproducible (Mylar or Dylar) copy shall be furnished.

All drawings or documents submitted to the Purchaser shall bear the Supplier's stamp "For Approval", the date of submission and the Supplier's signature.

Acceptance by the Purchaser of the Supplier's drawings shall not relieve the Supplier of his responsibility for the correctness of his drawings.

Drawings and data shall be submitted within the agreed time after the date on which an order or letter of intent is received by the Supplier.

**TS.02.4 Drawing Format**

Each Drawing shall have a title block provided at the lower right-hand corner. At least the following information shall be included in the title block:

- the Supplier's name
- the Purchaser's name (Jamaica Public Service Company Limited)
- the Substation name
- drawing title (brief description of drawing)
- drawing and revision number
- first date and revision dates
- scale and scale bar (where applicable).

The north arrow shall be shown on all layout drawings.

Letters and figures shall be clear, uniform and evenly spaced.

The graphical symbols on electrical drawings, diagrams, and other documents shall be in accordance with ANSI standards.

Dimensions of Drawing frames without folding margin shall be as follows

<b>Drawing Size</b>	<b>Dimension of Drawing Frame</b>
	(mm)
A1	566 x 801
A2	400 x 566
A3	283 x 394

Outline drawings of major electrical equipment, panels, schematics and substation steel details shall be A1 format.

Units of measure and weights shall be expressed in the metric (SI) system of measurements with Imperial equivalent in parenthesis

## **TS.02.5 Installation, Operation and Maintenance Manual**

Seven (7) copies of the installation, operation and maintenance manual shall be furnished by the Supplier not later than twenty-three (23) days before shipment of equipment and materials. If this schedule is not met, the supplier shall send the O&M manuals by air freight to arrive Kingston, Jamaica before the equipment.

The manual shall contain the following minimum information:

- General descriptive information
- Assembly and/or erection details
- Operating and Maintenance instructions
- Instructions for testing and adjustments
- One copy of each approved drawing including catalog cuts and other pertinent data.
- Test Certificate(s)
- List of recommended spares
- Equipment insulation curves
- Parts identification list for each item of equipment furnished
- Manufacturer's descriptive information and instructions for all accessory equipment

Two (2) Preliminary copies of the operating and maintenance manuals shall be submitted for review in sufficient time to allow for issue of the final copies 23 days prior to shipping the equipment from the factory.

## **TS.02.6 Inspection, Testing and Training**

All equipment and materials supplied under this Contract shall be subject to inspection and testing by the Purchaser or his appointed representative. Satisfactory completion of such inspection and testing shall not prejudice the right of the Purchaser to reject the equipment if it fails to comply with the Specifications or fulfill the function for which it was intended.

The Supplier shall perform factory tests on all materials, equipment, parts, assemblies and sub-assemblies in accordance with the latest revisions of the applicable standards. The Supplier shall comply in every respect with the provisions of Section GC.07 of the General Conditions of Contract concerning Inspection and Tests of material and equipment.

At least 3 weeks' notice of the date, time and place of all tests shall be given to the Purchaser so that arrangements can be made to witness the tests. The Supplier shall conduct the tests and provide all necessary labor and equipment to carry out the tests.

Arrangements shall be put in place for training in the operation, maintenance, testing and commissioning of capacitor banks.

**TS.02.7 Standards**

All equipment and materials shall conform to the latest editions of all relevant ANSI standards. Where equipment, components or materials are not covered by appropriate ANSI standards, relevant IEEE, NEMA, ASTM, AISC and AWS shall apply. If equipment or materials conforming to other recognized national standards are offered, the bidder shall submit a copy, in English, of the standard offered and shall itemize the pertinent areas where the standard differs from the requirements of the relevant ANSI standard.

The foregoing referenced standards and their abbreviations are as follows:

Name	Abbreviations
American National Standards Inc.	ANSI
American Society for Testing and Materials	ASTM
National Electrical Manufacturers Ass.	NEMA
Institute of Electrical and Electronic Engineers, Inc.	IEEE
Insulated Cable Engineers Association	ICEA
American Welding Society	AWS
American Institute of Steel Construction	AISC

**TS.02.8 System Characteristics**

(i)	System Phase to phase voltage	24 kV
	Nominal system voltage	24 kV
	Maximum operating voltage	25.8 kV



(ii)	System BIL	150 kV
(iii)	Number of phases	3
(iv)	Frequency	50 Hz
(v)	System connection	Wye
(vi)	Method of Grounding	Effectively grounded
(vii)	Fault level (symmetrical), MVA	300
(viii)	Auxiliary power supply	120 V, 1 phase, 50Hz 240 V, 3 phase, 50Hz 125 V dc +10%, -15%

**TS.02.9 Environmental Conditions**

(i)	Altitude	Less than 1,000 meters above sea level.
(ii)	Ambient Temperatures	Maximum 40°C Average 30°C over 24hrs Minimum 15°C
(iii)	Atmospheric Conditions	Tropical climate subject to direct sunlight, 200 km/hr wind.  The distance of the substations from the sea range from 13 km to 25 km.
(iv)	Seismic Coefficient	0.2g
(v)	Relative Humidity	maximum - 100% average - 50%

**TS.02.10 Preparation for Shipment**

The Supplier shall prepare all equipment and their components in such a manner as to facilitate handling and to adequately protect them from contamination, corrosion or damage in-transit and shall be responsible for and make good any or all damages due to improper preparation or loading.

Small or fragile pieces shall be carefully boxed or otherwise protected against loss or damage during shipment. Delicate electrical and other parts shall be boxed in weather-proof containers.

Detachable items shall be removed for shipment and shall be crated in such a way as to prevent weight from being directly placed on the equipment during transportation.

Bare and insulated conductors shall be transported on non-returnable steel or wooden reels.

It shall be the responsibility of the Supplier to take any other precautions required to ensure the arrival of the equipment in an undamaged and satisfactory working condition.

All crates, wooden reels, sacks and bundles shall be clearly marked to facilitate field identification as follows:

Name of Substation

Order No. \_\_\_\_\_

Jamaica Public Service Co. Ltd.

Kingston

Jamaica, W.I.

and any other relevant identification marks.

All external markings shall be legible and durably printed or stenciled on two sides and both ends (where applicable) of containers in letters at least 50 mm high.

In order to facilitate field identification, shipping documents shall include lists with type and quantities of materials contained in each crate.

### **TS.02.11 Shipping Documents**

The following should be adhered to when issuing shipping documents

- (a) Original invoice must be signed and state whether prices are FOB or CIF.
- (b) No lot value should appear on the invoice, each item should have a unit price and total value.
- (c) A proper description or generic description with part number or catalogue number is required and not part number or catalogue number only.
- (d) In the case of NO CHARGE ITEMS state "Value for customs purposes only".

### **TS.02.12 Tropicalization of Equipment**

In the selection of materials and equipment, due regard shall be given to the hot and humid conditions to which they will be subjected. Untreated organic materials, such as cotton, paper or wood, shall not be used. Operating coils of relays and meters shall be impregnated with a fungus-

inhibiting varnish. Marking strips and nameplates shall be of plastic laminate or anodized aluminum. Paper label shall not be used even if protected in a plastic envelope.

Panels, enclosures and cubicles shall totally enclose the equipment. Doors of panels shall be close-fitting and ventilated openings shall be suitably screened to prevent entrance of insects and rodents. All cable entrances to equipment shall be tightly sealed with gland plates.

All enclosures containing motors, instruments, control and switching equipment shall be equipped with anti-condensation heaters. The construction of the enclosures and placement of heaters shall be such as to ensure effective air circulation while avoiding local overheating.

Internal wiring shall be dual insulated thermoplastic or rubber and teflon or halogen based non-flammable insulation suitable for a minimum continuous operating temperature of 105°C. All live and exposed conductors and connections shall be suitably insulated to prevent short-circuiting by vermin.

Prior to shipment, surfaces of wiring and all other parts susceptible to moisture absorption or fungus attack shall receive treatment with fungicidal varnish.

### **TS.02.13 Packing and Delivery**

All material and equipment for each particular substation shall be packed separately to facilitate direct delivery to the substation.

The Supplier shall ensure that all shipments are packed properly for shipment and protected from the harsh environment in which it may be subjected over a long period.

No delivery of equipment or materials shall be initiated without the written approval of the Purchaser. Deliveries should be made in accordance with the Schedule of Deliveries.

All equipment and materials shall be delivered to

Jamaica Public Service Company Ltd.  
Kingston, Jamaica

### **TS.02.14 Design and Workmanship**

The design of the equipment and materials shall be such as to give long and continuous service with minimum maintenance under all operating conditions. Equipment shall be of the best quality and most suitable for the function intended, and shall withstand all normal working conditions without deterioration. All equipment shall operate without excessive vibration and noise. Equipment and accessories shall be of well-proven design and provide ease of inspection and maintenance.

The Specification layout drawings showing structures are intended to show only governing dimensions, unless otherwise indicated, and are not intended to define exact details to be furnished.

The Supplier should utilize designs and arrangements to suit his particular equipment and the design loads specified.

### **TS.02.15 Spare Parts**

The Supplier shall supply spare parts required for 2 years' normal operation. All spare parts shall be identical to the original parts and shall be properly treated and packed for prolonged storage in the prevailing ambient conditions. Each part shall be clearly identified with its description and function on the outside of the package.

All spare parts shall be shipped with the main equipment and shall be appropriately labeled as spares.

### **TS.03 List of Components**

#### **TS.03.1 Open Air**

##### **TS.03.1.1 Description**

Outdoor substation, externally fused, shunt capacitor bank. The bank is rated 10 MVAR (2 stages of 5.0 MVAR per stage) at 24 kV LL, 150 kV BIL, 50Hz, three phase, connected **ungrounded single wye**.

##### **TS.03.1.2 Components**

1 – Key Interlock Scheme

Supplier to Provide Qty – Capacitor block frame (rack), welded marine grade aluminum, with aluminum fuse bus, and fuse bus insulators.

Supplier to Provide Qty – Capacitor bank elevating structure, marine grade aluminum.

Supplier to Provide Qty – Preferred are Capacitor units, 200 kVAR, 13,800 Volts, 150 kV BIL, 2 bushing, 50 Hz, Edisol VI non-PCB dielectric fluid, externally fused, Heavy Duty (HD) type.

Supplier to Provide Qty - Current limiting/expulsion assembly fuses TBD by manufacturer.

2 – Three Phase Capacitor switches, vacuum, 25 kV, 150 kV BIL, 200A, 120VAC solenoid operated, manual trip lever with mounting.

3 – Outdoor Group Operated (Gang) Air Switches, 27 kV, 150 kV BIL, 600A, 50 Hz

6 – Current-limiting reactors TBD by manufacturer with mounting.

- 6 – Single phase surge arresters, rated 18kV, MCOV 15.3 kV with mounting.
- 3 – Line Voltage Transformers, 13.8kV rated, one primary bushing, two 120V secondary windings, 1.0 kVA, 150kV BIL, 50Hz, C/W with mounting
- 2 – Neutral voltage transformers for unbalance protection, 150kVBIL, 50Hz ratio 200:1 with mounting.
- 2– 4 pole gang-operated ground switch
- 3 – Junction boxes for terminating cables for line PTs secondary wiring and neutral PT secondary winding
- 1 – Lot of hardware, bus work, bus insulators, and intra-connection material.
- 1 – 38kV capacitor circuit breaker

## **TS.03.2 Metal Enclosed Capacitor Bank**

### **TS.03.2.1 Description**

Outdoor substation, externally fused, shunt capacitor bank. The bank is rated 10.0 MVAR (2 stages of 5.0 MVAR per stage) at 24 kV LL, 150 kV BIL, 50Hz, three phase, connected **ungrounded single wye**.

### **TS.03.2.2 Components**

- 1 – Key Interlock Scheme
- Supplier to Provide Qty – 13.8kV, 50 Hz Power Capacitors
- Supplier to Provide Qty – Individual HV Fuses
- 2 – Three Phase 25kV, 200A Vacuum Switches
- 6 – Reactors
- 3 – 18kV, 15.3 kV MCOV MOV Surge Arresters
- 3 – 13.8kV/120V Voltage Transformers
- 3 – Line Current Transformers, 600:5A Multi-Ratio
- 2 – Neutral Voltage Transformer
- 2 – 38kV, 600A Continuous Ground Switch

1 – 38kV Capacitor Bank Roll-Out Circuit Breaker

1 – Lot Protection & Control hardware, wiring and interface to include facility to house SEL 487V relay

1 – Outdoor Group Operated (Gang) Air Switch, 27 kV, 150 kV BIL, 600A, 50 Hz

## **TS.04 Technical Specifications - Open Air Type**

### **TS.04.1 General**

These specifications cover the design, manufacture, testing and delivery of 24 kV LL three phase, open-rack air type, capacitor banks for installation at various substations.

The drawings accompanying this specification are intended to show the general location of the banks relative to the 24 kV and 13.8 kV bus to which the bank is to be connected. The bidder shall provide general arrangement drawings showing the capacitor bank and capacitor switching equipment.

### **TS.04.2 Capacitor Block Frame**

This section of the Specification covers the design, supply, fabrication and delivery of support structures for the capacitor banks and associated equipment including base plates, anchor bolts and all other materials necessary for the complete and effective erection of the structures as shown on the drawings and as specified herein.

Supplier shall be responsible for preparation of anchor bolt plans for each capacitor bank installation, these plans shall be submitted for JPSCo.'s approval, before the steelwork details for approval and finalized in the shortest possible time in order to facilitate the early preparation of civil designs for structure foundation bases.

### **TS.04.3 Standards**

Design, detailing and fabrication shall comply with the recommendations contained in American Society of Civil Engineers (ASCE) manuals and reports on engineering practice, No. 52 "Guide for Design of Steel Transmission Towers", second edition, latest revision, and all relevant American Institute of Steel Construction (AISC) standards.

Materials shall be new and shall comply with the latest provision of ASTM A36 and BS-4360, (BSEN10113, 10155, ADM 6825, 6884), or equivalent. All parts shall be hot-dipped galvanized after fabrication according to specification clause TS.04.1.7.

## TS.04.4 Details of Design

The drawings included with these specifications are intended to show the general arrangement and clearances only. The supplier may vary dimensions and make structural adjustments as required to suit the proposed equipment, but in general the overall dimensions shown on the layout drawings should be maintained.

### LOADING FOR STEEL COMPONENTS

#### SEISMIC QUALIFICATION:

Steel structures shall be designed to stay elastic with a load of 0.2g static, which is less than 1/5 of the peak of the UBC response spectrum. Using this criteria, the performance curve for steel components should greatly exceed the performance curve for porcelain. Seismic withstand capability shall be demonstrated by either static analysis or dynamic analysis. Circuit breakers and interrupters can be qualified by static analysis using static loads of 0.5g in the two horizontal directions and shall be combined with 0.4g in the vertical direction.

The stresses in the two horizontal directions and the vertical direction shall be combined using the Square Root of the Sum of the Squares (SRSS) method. The maximum importance factor should be used, as well as zone 4 as the design area.

The Earthquake code to be used for design is the most recent edition of the Uniform Building Code (UBC) or the equivalent Structural Engineering Association of California (SEAOC) code.

#### WIND QUALIFICATION

The basic wind speed for design is 56m/s. This speed should be factored using the greatest importance factor for substation steel structures. The wind code for design is the most recent edition of Caribbean Uniform Building Code or the Barbados Association of Professional Engineers Code of Practice for Wind Loads for Structural Design.

#### GENERAL LOADING QUALIFICATION:

The codes to be used for the overall design of the steel components while checking the allowable stresses, combined stress, shear, deflection, torsion, slenderness, strength, stability against overturning and sway, fracture due to fatigue, brittle fracture, vibration, corrosion and durability, etc. are B.S. 5950 part 1, B.S. 449 part 2, or the ASCE or AISC equivalent.

The steel structures shall be designed to withstand forces resulting from the following combinations of loading.

- 1.4 (Dead load + Live load + Earthquake load)
- 0.9 Dead load  $\pm$  1.4 Earthquake load
- 1.2 (Dead load + Live load + Wind load)
- 1.2 (Imposed load + Wind load)
- 1.4 (Dead load + Wind load)

- 1.4 Dead load + 1.6 Live load
- 1.4 (Dead load + 50% Wind load + Short Circuit Forces)

(a) Vertical (dead) Loading

The weight of the conductors, ground wire, insulator strings, workers, the structural steel and equipment to be supported shall be considered.

(b) Wind Pressure  
(Not Including Factor of Safety)

- On conductors and earth wires:
  - 180 kg/m<sup>2</sup> on projected area
- On insulators and all other circular section:
  - 180 kg/m<sup>2</sup> on projected area
- On lattice structures or beam structure, and column structure:
  - 290 kg/m<sup>2</sup> on projected area.

(c) Tensions of Conductor and Wire  
(Not Including Factor of Safety)

**24 kV**

Conductors                      750 kg

(d) Factor of Safety

The structures shall be designed so that no failure or permanent distortion shall occur when a load equivalent to 1.4 times the maximum simultaneous working load is applied or as otherwise dictated in B.S. 5950.

(e) Acceptance criteria for member stresses:

Member stresses shall not exceed the following values:

- The total stresses in the porcelain bushings including dead, pressure, normal operating, and seismic shall not exceed 40 per cent of the ultimate strength.
- The total stresses in steel and ductile aluminum components shall not exceed the allowable stresses specified in the latest revision of the Uniform Building Code with a 1/3 increase for seismic forces where allowed.



- The total stresses in cast aluminum components shall not exceed 40 percent of ultimate strength.

(f) Ratio of Slenderness

The value of slenderness shall not exceed the following:

- (a) for members resisting loads other than wind loads 180
- (b) for members resisting self-weight and wind loads only 250
- (c) for any member normally acting as a tie but subject to reversal of stress resulting from wind or seismic action 350

Members whose slenderness exceeds 180 should be checked for self-weight deflection. If this exceeds length/ 1000 the effect of bending should be taken into account in the design.

All designs inclusive of fabrication, erection, calculations and drawings shall become the property of the Purchaser.

The design should include the following: -

- i) all lattice columns should be square
- ii) maximum of one splice per column leg, no splices in beams
- iii) where practical, anchor bolts should be J type
- iv) structure base plates and anchor bolt configurations should be square
- v) anchor bolts should be provided with two nuts, one of which will be used for levelling the structure
- vi) anchor bolts should have at least 100mm of thread
- vii) an alphanumeric grid should be used on all arrangement drawings associated with the substations
- viii) template to be provided for alignment of the anchor bolts

The bus shall be rated for a maximum temperature rise of 30<sup>0</sup>C in an ambient of 40<sup>0</sup>C at 135% rated current.

**TS.04.5 Fabrication**

Each field piece shall be plainly marked in a conspicuous place with an identification mark as indicated on the supplier's erection drawings. These marks shall be unique for each or similar members and peculiar to each substation.

Marks shall be stamped into the material with a metal dye before galvanizing and characters shall be at least 12.7 mm (1/2 in.) high.

Additionally, duplicate marks in block characters 25.4 mm (1 in.) high shall be printed on each field piece after galvanizing. These marks shall be located adjacent to the dye marks and shall be made with black indelible marker.

Each rack shall be equipped with a warning sign on all four sides reading "CAUTION! FRAME ENERGIZED" or similar wording.

The structure shall be provided with a capacitor bank nameplate mounted at eye level in a convenient location. The nameplate shall include bank rated voltage, bank kVAR and bank connection

**TS.04.6 Materials**

All steel used for the structures shall have a high yield point of at least 2500 kg/cm<sup>2</sup> and a tensile strength of not less than 3500 kg/cm<sup>2</sup> and shall be subject to the approval of the Purchaser. No member shall be thinner than 3/16 in (4.76 mm).

**TS.04.7 Galvanizing**

All structural steel shall be hot-dipped galvanized after fabrication in accordance with the latest revision of ASTM Specification A123, A143 and A383, with 600g/m<sup>2</sup> coating of zinc.

Bolts, nuts, washers and similar parts shall be galvanized with 400g/m<sup>2</sup> coating of zinc as per ASTM A153.

If any galvanized part is found to be imperfect, such part must be replaced. The entire expense involved in the replacement of the imperfect part shall be borne by the Contractor.

In order to avoid the formation of white rust on the galvanized surface of iron and steel articles, the galvanized surface shall be treated with an approved dichromate solution process immediately following galvanizing. The coating of dichromate shall be sufficient to meet a 48-hour salt spray test performed in accordance with ASTM B201.

**TS.04.8 Workmanship**

The cutting, drilling, punching and bending of all fabricated steelwork shall be in accordance with the best practice for the materials being used and subject to the approval of the Purchaser. Diameter of bolt holes shall not be more than 1.5 mm larger than the diameter of the bolts.

All structures shall have 16-mm diameter holes in two convenient opposite locations above the base to accommodate an approved bolted ground connector. Support structures for capacitor banks, surge arresters, reactors, shall have 14 mm diameter holes at 1 meter intervals along the structure length to accommodate bolted cable clamps supporting ground cable connection to the equipment.

**TS.04.9 Tests**

Samples of all materials used in the fabrication of the substation structures including nuts, bolts, washers and brackets, shall be tested in accordance with ASTM standards as appropriate. The Supplier shall submit test results from a recognized independent testing laboratory.

**TS.04.10 Foundation Design**

The design of foundations should be in accordance with B.S. 8004, B.S. 8081 and B.S. 8110 and should accommodate all the forces imposed on them. Attention should be given to the method of connecting the steel structure to the foundations and the anchorage of any holding down bolts.

Holding down bolts should be designed to resist the effect of factored loads in tension due to uplift forces and bending moments and shear where appropriate.

Holding down bolts should be able to transmit tension and should be anchored into the foundation by a washer plate or other load distributing member embedded in the concrete; this plate or member should be designed to span any grout tubes or adjustment tubes provided for the holding down bolts.

The embedment length of the holding down bolts and the arrangement of the load distributing assembly should be such that in transmitting the loads from the anchorage to the foundation the load capacity of the foundation is not exceeded.

The bolt arrangement should be the best that can be engineered safely, of a square arrangement rather than a rectangular arrangement for foundations for similar types of equipment, to reduce confusion in the field during construction of the bases, as well as installation of structures and equipment.

Two ground pads, each with two holes drilled to NEMA spacing, shall be provided on diagonally opposite sides of the elevating structure for grounding.

The structure shall include appropriate means for mounting and connecting capacitor units. They should also include a terminal pad for the incoming cable phase connections.

#### **TS.04.11 Packaging for Shipment**

Structural steel bundles shall be marked with the following: -

- a) gross, tare and net weights in kilograms
- b) Piece mark, quantity and item no.
- c) Supplier and specification no. and project name
- d) Bolts and small fittings shall be double stacked, boxed or supplied in kegs
- e) All structures and equipment stands shall be shipped unassembled
- f) Banding of galvanized bundles shall be of rust proof material to prevent staining
- g) All bolts, nuts and other miscellaneous items shall be segregated according to size and material and packed in separate boxes or kegs and clearly labelled for identification
- h) Material shall be properly packed on pallets with spacers between members to prevent injury to galvanizing and painting, to prevent distortion of members during transit, and to facilitate unloading
- i) All small pieces and light materials shall be carefully boxed, crated or otherwise protected for shipment
- j) All parts for any structures shall be included in the same shipment
- k) All bundles shall include parts for one structure only

**TS.05**            **Capacitors**  
**TS.05.1**        **Description**

Capacitor, Power, Single Phase, Double Bushing, 200 kVAR, 13.8kV, 150 kV BIL, 50Hz

Capacitor, Power, Single Phase, Double Bushing, 200 kVAR, 13.8kV, 150 kV BIL, to be installed on substation bus for improving power factor, reducing voltage drop and reducing line losses on the transmission grid.

Capacitors shall be suitable for single installation in substation switched or unswitched banks. Capacitor dielectric loss shall not exceed 0.07 watt/kVAR. Capacitor shall be capable of withstanding a 10,000 Amp fault current and shall operate safely at 135% of kVAR rating.

The capacitor tank shall be manufactured from stainless steel, shall be light gray in colour and shall be resistant to severe corrosion. Capacitor bushings shall be wet-process-porcelain type, light gray and hermetically sealed to capacitor tank. Bushing creepage distance – 559mm.

Parallel-groove, tin plated terminals suitable for connecting 3.31 – 63.8 mm sq. (#12 – #1 AWG) copper or aluminum conductors shall be supplied on all capacitors. Capacitors shall be manufactured with internal discharge resistors for reducing terminal voltage to 50 volts or less after the capacitor has been disconnected. Nameplate shall be stainless steel and shall contain data as required by NEMA and ANSI/IEEE. Capacitor insulating oil shall contain less than 2 PPM PCB and a decal shall be attached to capacitor indicating such. Capacitor dimension and weight shall be kept to minimum.

Capacitors shall be manufactured in accordance with applicable NEMA and ANSI/IEEE standards.

Each capacitor shall have a permanent weather resistant name plate. The name plate shall clearly state the following information:

- A) Name of Manufacturer
- B) Unique serial number
- C) Manufacturers type, model, style, or catalog number
- D) Year manufactured
- E) Rated reactive power
- F) Rated voltage RMS
- G) Rated frequency
- H) BIL
- I) Flammability classification and volume of insulating fluid
- J) Statement that capacitor contains an internal discharge device
- K) Nominal or measured capacitance,  $\mu\text{F}$

**TS.06**            **Individual Capacitor Fusing**

To improve bank reliability and protect against case rupture, each capacitor is to be individually fused with current limiting or expulsion type fuse assemblies. Fuses to be equipped with blown fuse indicators.

**TS.06.1 Blown Fuse Detection System**

Blown Fuse detection system to be provided for each stage. The relays to be equipped with alarm and trip set point. The alarm set-point warns personnel of a blown fuse. The trip set-point takes the capacitor bank off line for any condition that may cause damage to the remaining capacitors

**TS.07 Vacuum Capacitor Switch**

**TS.07.1 Description**

Single-phase, electrically operated vacuum switch with close and latch capability. Switch shall be Rated 25 kV/150 kV BIL per rating table below:

Voltage Class	25 kV
Minimum ANSI/IEEE C37 Switching Class	C1 (Low Probability of Restrike)
Rated Maximum Voltage, 50 Hz	
Ungrounded capacitor banks, L-L (kV)	25
Solidly grounded capacitor banks, L-L (kV)	38
<b>Impulse Withstand Voltage</b>	
Line to ground (kV BIL)	150
Open Contact kV (BIL)	125
Power Frequency Dry Withstand (kV)	70
Power Frequency Wet Withstand (kV)	60
<b>Withstand Voltage, 50 Hz</b>	
Power Frequency Dry Withstand (kV)	70
Power Frequency Wet Withstand (kV)	60
Continuous current 50 Hz (A)	200
Capacitive switching current 50 Hz (A)	200

**TS.07.2 Vacuum Switch Features**

- The switch shall be maintenance free. No routine maintenance is required.
- The switch shall be operable in any mounting orientation.

- The switch shall withstand a minimum of 50,000 mechanical operations (one operation equals one open operation plus one close operation).
- Nominal terminal to ground creepage shall be 32 inches.
- Switch is designed for optional type A, B, or C auxiliary contacts.
- Load side termination ring designed for 360 degree terminations (no need to break seals to rotate head for directional connections). Design also allows for termination of multiple loads.
- Bushing constructed of low viscosity cycloaliphatic epoxy resin. Designed to IEC 60815 SPS class E.
- Switch shall be Vacuum operated only.
- Tank made from fiberglass reinforced polyester (non-corrosive). Tank bears no structural loading; it is an environmental shield only. Tank contains integrated rain shield and hot stick guide over the manual operating handle.
- Permanent Magnetic Solenoid design for robust mechanical operation (no cams, linkages, struts, or pins). No relays or switching electronics allowed in the body of the switch.
- Optional accessories include bird guards for all terminals, auxiliary contacts, and additional load terminals
- Open/Closed indication integrated into manual operating handle
- Mounting bracket made from type 304 stainless steel.

## **TS.08 Reactors**

### **TS.08.1 General**

This Specification covers the design, manufacture, testing and delivery of 24-kV reactors.

All equipment furnished shall be suitable for operation under all possible local conditions.

### **TS.08.2 Standards and Codes**

The reactors shall comply with the requirements of the latest revisions of all relevant ANSI/IEEE standards.

If this Specification conflicts in any way with ANSI requirements, this Specification shall have precedence and shall govern. However, the Bidder shall point out these conflicts in its Bid.

**TS.08.3 Ratings**

The 24-kV reactors shall have the following electrical characteristics and ratings:

Nominal system voltage	24 kV
Continuous Current Rating	To be determined
Inductance	To be determined
Frequency	50 Hz
BIL	150 kV

**TS.08.4 Construction**

The 24-kV reactors shall be of the outdoor type, single-phase, porcelain-clad, oil-filled, hermetically sealed units. The porcelain used shall have long creepage path to ensure approved characteristics at 50 Hz, and the glaze shall be grey in colour.

**TS.08.5 Terminals**

Tin plated, clamp type terminals for primary connection shall be provided on the transformer bushings suitable for the size of stranded copper cable.

Ground studs and clamp type terminal connectors suitable for 7 #5 (0.428" dia), stranded copper weld cable shall be fitted near the base of each equipment support structure. The ground studs shall be bronze and brazed to the metal unit.

**TS.08.6 Painting**

All painted surfaces shall be shop painted with a compatible primer which shall have a dry film thickness of not less than 75  $\mu\text{m}$ .

Two finish coats of light gray epoxy paint shall be applied over the primer.

**TS.08.7 Nameplates**

Nameplate shall be of stainless steel and shall contain, but shall not be limited to

- name and address of manufacturer
- type and designation or serial number
- rated voltage
- rated frequency
- BIL



- year of manufacture

All nameplate data shall be legible to an observer at ground level. All equipment shall be identified, and all nameplate wording shall be subject to Owner's approval.

## **TS.08.8 Factory Tests**

The equipment will be assembled at the factory and subjected to tests. Factory tests shall include all routine electrical and mechanical tests in accordance with all relevant ANSI standards. Purchaser reserves the right to witness these tests and shall be notified at least 3 weeks prior to the commencement of the tests.

One complete equipment of each type and rating shall be subject to type tests as specified in the relevant ANSI standard. If the Contractor can supply certified copies of type test certificates covering equipment of similar design, rating and construction, the Purchaser may waive such-tests entirely. Contractor shall furnish six certified copies of all test reports within 2 weeks after completion of any tests.

## **TS.09 Surge Arresters**

### **TS.09.1 Description**

**Arrester, 18kV, 15.3 kV MCOV Surge, Station Class, Metal Oxide Varistor (MOV), Polymer, Heavy Duty**

### **TS.09.2 Specifications**

Station Class Arrestor shall incorporate the latest in metal oxide varistor (MOV) technology. Arrester shall be designed and manufactured without series or parallel gaps and shall have its disks stacked in a single column. The arrester shall be housed in direct molded silicone and shall be grey in colour. The arrester shall be supplied with four hole NEMA terminals and clamp. The arrester shall also be supplied with a tripod-mounting base with a bolt circle range of 225mm-250mm (8.75''-10'').

### **TS.09.3 Ratings**

The arrester shall be rated as follows:

Rated Voltage - 18kV, Frequency - 50Hz, MCOV - 15.3kV, Front of Wave (FOW) protective level for 10kA crest (maximum value) - 54.7 kV. Maximum Discharge Voltage using 8/20 $\mu$ s Current impulse shall be; 10 kA crest - 46kV, 20 kA Crest - 52kV, 40 kA Crest - 60 kV.

**TS.010 Line Voltage Transformers**

**TS.010.1 General**

This Specification covers the design, manufacture, testing and delivery of 24 kV voltage transformers and associated equipment.

All equipment furnished shall be suitable for operation under all possible local conditions.

**TS.010.2 Standards and Codes**

The voltage transformers shall comply with the requirements of the latest revisions of ANSI/IEEE C57.13 and all other relevant ANSI standards.

If this Specification conflicts in any way with ANSI requirements, this Specification shall have precedence and shall govern. However, the Bidder shall point out these conflicts in its Bid.

**TS.010.3 Ratings**

The 24 kV voltage transformers shall have the following electrical characteristics and ratings:

Nominal system voltage	24 kV Wye
Rated primary voltage	13800V
Rated secondary voltage	120V
Ratio	115:1
Number of secondary windings	2
No. of primary bushings	1
Thermal rating	500 VA
Accuracy class	0.3 wxyz
BIL	150 kV
Transformer connection	Phase-Grd.
Frequency	50Hz

**TS.010.4 Construction**

The 24 kV voltage transformers shall be of the dry type, suitable for outdoor use. Voltage transformer shall be hermetic sealed such that the interior of the unit is protected from air and moisture, and dielectric strength is preserved while allowing for thermal expansion.

**TS.010.5 Terminals**

Clamp type terminals for primary connection shall be provided on the transformer bushings. Terminals shall be tin plated, suitable for the size of stranded aluminum or copper cable shown on the drawings.

Ground studs and clamp type terminal connectors suitable for 7 #5 (0.428" dia), stranded copper weld cable shall be fitted near the base of each equipment support structure. The ground studs shall be bronze and brazed to the metal unit.

**TS.010.6 Marshalling Box**

An outdoor, weatherproof stainless steel marshalling box shall be provided for the secondary terminations of each voltage transformer. The box shall contain incoming and outgoing terminals.

**TS.010.7 Painting**

All painted surfaces shall be shop painted with a compatible primer which shall have a dry film thickness of not less than 75  $\mu\text{m}$ .

Two finish coats of light gray epoxy paint shall be applied over the primer.

**TS.010.8 Nameplates**

Nameplate shall be of stainless steel and shall contain, but shall not be limited to

- name and address of manufacturer
- type and designation or serial number
- Ratios
- rated primary voltage
- rated frequency
- BIL
- number and rating of secondary windings
- Thermal Burden rating
- accuracy classifications
- year of manufacture

All nameplate data shall be legible to an observer at ground level. All equipment shall be identified, and all nameplate wording shall be subject to Owner's approval.

**TS.010.9 Factory Tests**

The equipment will be assembled at the factory and subjected to tests. Factory tests shall include all routine electrical and mechanical tests in accordance with all relevant ANSI standards.

Purchaser reserves the right to witness these tests and shall be notified at least 3 weeks prior to the commencement of the tests.

One complete equipment of each type and rating shall be subject to type tests as specified in the relevant ANSI standard. If the Contractor can supply certified copies of type test certificates covering equipment of similar design, rating and construction, the Purchaser may waive such tests entirely. Contractor shall furnish six certified copies of all test reports within 2 weeks after completion of any tests.

**TS.011 Neutral Voltage Transformers**

**TS.011.1 General**

This specification covers the design, manufacture, testing and delivery of 25 kV class neutral current transformer and associated equipment.

All equipment furnished shall be suitable for operation under all possible local conditions.

**TS.011.2 Standards and Codes**

The neutral current transformers shall comply with the requirements of the latest revisions of ANSI/IEEE C57.13 and all other relevant ANSI standards.

If this Specification conflicts in any way with ANSI requirements, this Specification shall have precedence and shall govern. However, the Bidder shall point out these conflicts in its Bid.

**TS.011.3 Ratings**

The 25 kV neutral voltage transformers shall have the following electrical characteristics and ratings:

Voltage Class	25 kV
Frequency	50 Hz
Rated primary voltage	24,000/24000Y
Rated secondary voltage	120V
Ratio	200:1
No. of primary bushings	2
Rated Burden	1200 VA
ANSI relaying accuracy class	0.3Y
BIL	150 kV

#### **TS.011.4 Terminals**

Clamp type terminals for primary connection shall be provided on the transformer primary suitable for copper conductor.

A weatherproof secondary terminal box, with provision for one 25mm dia conduits from below, shall be provided complete with terminal blocks and connectors suitable for terminating incoming 4 sq. mm copper cables.

Ground studs and clamp type terminal connectors suitable for 7 #5 (0.428" dia), stranded copper weld cable shall be fitted near the base of each equipment support structure. The ground studs shall be bronze and brazed to the metal unit.

#### **TS.011.5 Painting**

All painted surfaces shall be shop painted with a compatible primer which shall have a dry film thickness of not less than 75  $\mu\text{m}$ .

Two finish coats of light grey epoxy paint shall be applied over the primer.

#### **TS.011.6 Nameplates**

Nameplate shall be of stainless steel and shall contain, but shall not be limited to

- name and address of manufacturer
- type and designation or serial number
- Ratios
- rated primary and secondary current
- nominal system voltage
- rated frequency
- lightning impulse withstand level
- number and rating of secondary windings
- continuous thermal current rating
- accuracy classifications
- year of manufacture.

All nameplate data shall be legible to an observer at ground level. All equipment shall be identified, and all nameplate wording shall be subject to Purchaser's approval.

#### **TS.011.7 Factory Tests**

The equipment will be assembled at the factory and subjected to tests. Factory tests shall include all routine electrical and mechanical tests in accordance with all relevant ANSI standards.

Purchaser reserves the right to witness these tests and shall be notified at least 3 weeks prior to the commencement of the tests.

One complete equipment of each type and rating shall be subject to type tests as specified in the relevant ANSI standard. If the Supplier can supply certified copies of type test certificates covering equipment of similar design, rating and construction, the Purchaser will waive such tests entirely.

Supplier shall furnish six certified copies of all test reports within 2 weeks after completion of any tests.

## **TS.012      *Ground Switch***

*Grounding switch is required for the capacitor bank assembly rated at 600A continuous. Grounding switches shall be 4 pole gang operated when wye connected capacitors are used and 3 pole gang operated when delta connected capacitors are used. Ground switch handles shall be located on the outside of the enclosure.*

*An interlock shall prevent operating the grounding switches when the disconnecting means for the capacitor bank is closed. Key locks are to be provided by the vendor and keyed to the disconnect key lock.*

### **TS.012.1      *Ground and Phase Bus***

A minimum 1/4" X 2" Silver plated Copper ground bus to be provided through the width of the enclosure to assist in grounding during maintenance. All phase bus is Silver plated and rated at a minimum of 135% of the bank nominal current rating.

## **TS.013      *Bus Work and Insulators***

### **TS.013.1      *General***

This Specification covers the design, manufacture, testing, and delivery of 24-kV switchyard bus work including

- 24-kV disconnect switches
- strain and tubular bus
- equipment connections and jumpers
- post and strain insulators
- strain assemblies
- connectors and hardware.

All equipment furnished shall be suitable for operation under all possible local conditions.

**TS.013.2 Standards and Codes**

The equipment and materials shall comply with the requirements of all applicable ANSI and ASTM standards.

If this Specification conflicts in any way with any of the above standards or codes, this Specification shall have precedence and shall govern. However, the Bidder shall point out these conflicts in its Bid.

**TS.013.3 Design Criteria**

(a) Layout

The layout of the switchyard shall conform generally with the arrangement drawings and to the single-line diagrams which form part of this Specification.

(b) Clearances

Minimum electrical clearances shall be as follows:

	<b>24 kV</b>
Phase to ground between rigid metal parts	310 mm
Phase to phase between rigid metal parts	380 mm
Between overhead live parts and grade	3000 mm
Between live parts and roadways	6700 mm

(c) Conductors

Conductors shall conform to the following.

- Strain bus shall be hard drawn, bare, stranded copper conductor sized as designed by the Supplier.
- Rigid tubular bus shall be copper. Tubular copper bus shall conform to ASTM "Specification for Copper Bar for Electrical Purposes".

(d) Loading

Buses, connections and bus supports shall be designed to withstand the forces resulting from short circuits and wind without exceeding the stress and deflection limits specified below.

- Short-circuit forces shall be those resulting from the symmetrical fault currents listed in Section TS.02.8 "General Requirements" of this specification.

- Wind pressure shall be:
  - 180 kg/m<sup>2</sup> for curved surfaces
  - 290 kg/m<sup>2</sup> for flat surfaces.
- seismic coefficient = 0.2g

(e) Rigid Bus

Rigid bus shall be sized to limit sag or deflection under dead load conditions to not more than

- 1/150 of the unsupported length for a single span
- 1/200 of the unsupported length for continuous spans.

Provision shall be made for expansion and contraction of elements due to temperature variations as well as relative displacements of support structures. Expansion fitting shall be located as required.

Taps to rigid bus or connection of rigid bus to equipment terminals shall be made using four-bolt terminals (or equivalent) bolted to tube with expansion connector if required.

End caps or corona bells shall be installed in rigid bus to prevent the intrusion of moisture and shall be of the drive fit type.

Rigid bus shall be arranged in a manner such that it can be extended without difficulty.

Rigid bus to rigid bus connections shall be made by bolting. Rigid bus section shall be continuous between supports. Welded splices between supports will not be permitted.

Precautions shall be taken as required to limit vibration in tubular buses, either through installation of a damping cable or insertion type torsional dampers within tube. In general, damping will be required when ratio of span length to bus diameter exceeds 80.

(f) Stresses

Maximum stresses shall not exceed the following limits:

- 50% of ultimate tensile or 67% of yield stress, whichever is the least, under conditions of maximum design load as given in Clause TS.14.3(d) above.
- 20% of ultimate tensile stress under condition of self-weight.

(g) Corona

Conductors, buses, taps, joints and energized portions of bus supports, strain and suspension assemblies shall be free of audible and visible corona when subjected to 1.15 times equivalent



line to ground voltage of maximum rated voltage. The corona-free requirement shall be applicable under the following environmental conditions: standard temperature and atmospheric pressure, free of industrial contamination and free of precipitation, but at 90% relative humidity.

Strain and rigid buses shall be designed so that voltage stress shall not exceed an equivalent value of 16.5 kV/cm at sea level and at rated line-to-ground voltage.

(h) Temperature Rise

Conductors shall be designed to the following temperature rise limitations.

- Continuous Current

All buses shall be designed to limit the temperature rise, with full sunshine and 0.61 m/s crosswind, to a maximum conductor temperature of 150°C when carrying the currents specified on the drawings.

- Short-Circuit Currents

All buses and connections shall be able to withstand the short-circuit current specified in section TS.2 "General Requirements" of these specifications for 1 second without exceeding a final temperature of 200°C. Initial temperature shall be the maximum temperature specified above for continuous current carrying capacity.

(i) Connectors

All connectors shall be of the **bolted** type, welded connectors are not acceptable.

The current carrying capacity of each connector shall not be less than the conductor to which it is to be applied. Connectors shall be compatible with the 150°C maximum conductor temperature.

The bores of all bolted connectors for aluminum stranded or tubular conductor shall be the correct diameter to fit the contour of the conductor to which it is to be applied.

The clamping elements of bolted type connectors shall have a minimum contact length along conductor of 100 mm.

(j) Tap

Connectors to existing bus shall be of the bolted type

(k) Dead Ends

Strain bus terminations shall be of bolted type. Fittings for tension strings shall have a minimum ultimate strength of 95% of conductor ultimate strength. Provision shall be made for adjusting strain bus tensions through the use of turnbuckles.

#### TS.013.4 Outdoor Group Operated (Gang) Air Switches

- a) In accordance with the specific requirements contained in this section the Supplier shall furnish including the design, manufacture, testing and delivery, of all 24 kV LL disconnect and capacitor switches as specified below and shall include switches for interfacing capacitor banks to the existing 13.8/24 kV bus-bar.

All equipment furnished shall be suitable for operation under all possible local conditions.

The switches shall comply with the requirements and the latest revisions of all relevant ANSI standards, in particular the C37 series.

If this Specification conflicts in any way with any of the above standards, this specification shall have precedence and shall govern. However, the Bidder shall point out these conflicts in its Bid.

- b) Ratings

The rating and electrical characteristics of all disconnect switches shall be as follows:

- normal operating voltage	24 kV
- rated maximum voltage	27 kV
- frequency	50 Hz
- continuous & interrupting current, min.	600 A
- short time (momentary) current	61 kA
- 3 sec. withstand current	25 kA
- lightning impulse withstand	150 kV
- 1-min power frequency withstand	75 kV

- c) Design and Performance

All disconnect switches shall be outdoor, copper, 3-pole, manually group-operated type. Insulators should be station class insulators for 150 kV BIL preferably composite type.

All current-carrying contact parts shall be silver-plated. The disconnect switch contact arms shall have a rotating motion, and current transfer to the terminals shall be braid-less.

- e) Manual Operating Mechanism

A manual group operating mechanism shall be provided for all three pole switches. The operating mechanism shall be capable of being padlocked in either the open or closed

positions. The mechanism shall be provided with flexible braided grounding straps and clamps.

The operating mechanism shall be so designed that the switch cannot open or close independently of the operator.

The operating mechanism shall be rigid to the extent that the switch position indicator does not indicate that the closed position has been attained unless the blades are fully engaged with the jaw contacts.

One set of six (6) auxiliary contacts shall be provided on all circuit breaker isolating disconnect switches. The auxiliary contacts, three "a" and three "b" contacts shall be mounted in a NEMA 4 waterproof and dustproof housing with removable or hinged cover.

Kirk key interlocks shall be provided on all capacitor isolating and grounding switches to prevent operation with the circuit breaker and circuit interrupter closed and to prevent closing of the circuit breaker and/or circuit interrupter with the capacitor grounding switch closed. Interlocks are to be coordinated with the circuit breaker and circuit interrupter supplier.

f) Galvanizing

All structural material and fittings shall be hot-dipped galvanized after fabrication. The weight of zinc coating per square meter of actual metal surface shall not be less than 0.6 kg.

In order to avoid the formation of white rust on the galvanized surface of iron and steel articles, the galvanized surfaces shall be treated with an approved dichromate solution process immediately following galvanizing. The coating of dichromate shall be sufficient to meet a 48-hour salt spray test performed in accordance with ASTM B201.

All galvanized members shall be free from burrs, sharp edges and lumps and shall be smooth so that interconnecting parts will fit properly and parts may be assembled and disassembled readily. No machine or shop work, die work, punching, welding, etc., will be allowed after galvanizing, except the tapping of threads and clearing of holes.

The preparation for galvanizing and galvanizing itself shall not adversely affect the mechanical properties of the coated material.

Tubular members shall be provided with drainage holes.

g) Painting

All painted surfaces shall be shop painted with a compatible primer which shall have a dry film thickness of not less than 75  $\mu\text{m}$ .

Two finish coats of light grey epoxy paint shall be applied over the primer.

## h) Nameplates

Nameplates shall be of stainless steel and shall contain, but shall not be limited to

- name and address of manufacturer
- type and designation or serial number
- rated voltage
- rated frequency
- lightning impulse withstand voltage
- continuous current rating
- year of manufacture.

All nameplate data shall be legible to an observer at ground level. All equipment shall be identified and all nameplate wording shall be subject to the Purchaser's approval.

## i) Terminals

Switches shall be equipped with ANSI standard, tin plated copper, 4-hole terminal pads with connectors suitable for stranded cable or tubular bus as shown on the drawings. Each terminal of the switch shall be rated at a minimum of 600A.

Ground studs and clamp type terminal connectors suitable for 7 # 5 stranded bare copper weld cable shall be fitted near the base of the disconnect switches. The ground studs shall be of bronze, and brazed to the metal unit. If the disconnect switches are comprised of more than one separate metal unit, grounding studs and clamps shall be fitted to each unit.

## j) Factory Tests

The switches will be assembled at the factory, and subjected to tests. Factory tests shall include all routine electrical and mechanical tests in accordance with relevant standards.

The complete equipment shall be subjected to type tests as specified in ANSI standards. If the Contractor can supply certified copies of type test certificates covering equipment of similar design, rating and construction, the Purchaser may waive such tests entirely.

The Purchaser reserves the right to witness these tests and shall be notified at least 3 weeks prior to commencement of these tests.

The Contractor shall furnish six certified copies of all test reports, curves and oscillograms within 2 weeks after completion of any tests.

**TS.014 Design and Workmanship – 38 kV Vacuum Medium Voltage Circuit Breaker**

**TS.014.1 General**

The 38kV vacuum circuit breakers will be used for switching and fault current interruption. All equipment furnished shall be suitable for operation under all possible load conditions.

**TS.014.2 Standards and Codes**

All equipment and materials shall conform to the latest editions of all relevant ANSI/IEEE C37 series and ANSI standards. Where equipment, components or materials are not covered by appropriate ANSI standards, relevant IEEE, NEMA, ASTM, AISC and AWS shall apply. If equipment or materials conforming to other recognized national standards are offered, the bidder shall submit a copy, in English, of the standard offered and shall itemize the pertinent areas where the standard differs from the requirements of the relevant ANSI standard.

The foregoing referenced standards and their abbreviations are as follows:

<b>Name</b>	<b>Abbreviations</b>
American National Standards, Inc.	ANSI
American Society for Testing and	ASTM
National Electrical Manufacturers Ass.	NEMA
Institute of Electrical and Electronic	IEEE
Insulated Cable Engineers Association	ICEA
American Society for Welding	ASW
American Institute of Steel	AISC

**TS.014.3 Ratings**

The circuit breakers shall have the following ratings.

<b>Circuit Breaker Characteristics</b>	
Rated Voltage	38kV
Type of circuit breaker	Vacuum
Lightning Impulse Withstand Level	200kV
Rated Continuous Current	1200A
Minimum Interrupting Capability	25,000A Symmetrical
Maximum interrupting time	5 cycles
Number of Phases	3
Rated Control Voltage	125V dc

Frequency	50 Hz
Minimum ANSI/IEEE C37 Switching Class	C1 (Low Probability of Restrike)

#### TS.014.4 Design and Performance

The circuit breaker will be installed in harsh, corrosive, salt spray environment therefore special consideration must be given to this condition during the design exercise.

The circuit breaker shall be of the outdoor, dead tank, vacuum type. The circuit breaker shall be single tank, with three phases and supplied complete with operating mechanism and other accessories necessary for installation and operation.

The circuit breakers shall be re-strike free, trip free and suitable for remote and local electrical tripping and closing, or local emergency mechanical tripping and closing.

The circuit breakers shall have proven ability for full out-of-phase switching of its rated interrupting capacity, and for handling short-line fault conditions with short-circuit capacity of all current-carrying parts equal to the circuit breakers' rated interrupting capacity.

Supplier shall provide appropriate test data, curves and oscillograms to establish the ability of all equipment proposed to meet the conditions specified.

#### TS.014.5 Operating Mechanism

The circuit breaker operating mechanism shall be a magnetic actuator with electronic controller and capacitors. The operating mechanism of the circuit breaker can be operable low voltage DC supply provided with the unit (125Vdc/48Vdc).

The circuit breaker shall be provided with the following:

- Manual operating facility.
- Mechanical position status indicator, which clearly indicates the closed or open position of the circuit breaker. The indicator shall be visible from the ground.
- The operating mechanism should be provided with at least three "a" and three "b" contacts for the Purchaser's use.

The circuit breaker shall be equipped with trip and close coils suitable for local and remote operation from the station battery supply. It shall also incorporate a manually operated, independent, local tripping device for use in emergency or during maintenance. The necessary terminals and wiring for trip circuit supervision in both open and closed positions shall be provided.

Kirk type key interlocks shall be provided to prevent the local manual operation of the associated disconnect switches when the breaker and interrupters are closed and closing of the circuit breaker and/or interrupters when the capacitor ground switch is closed. Each circuit breaker shall have a facility for mechanical and electrical timing of the main interrupting contacts.

Each circuit breaker pole shall be equipped with an enclosed type mechanical position indicator clearly visible from the ground.

#### **TS.014.6 Bushing Current Transformers**

All circuit breakers shall be equipped with bushing type, multi-ratio current transformers on each bushing. The quantity on each bushing and ratings of current transformers shall be as follows:

Voltage Class:	38 kV standard creepage
Quantity per bushing:	2
Ratio:	1200:5 multi-ratio
Accuracy:	C400
Thermal Rating:	TR 2.00

The polarity should be towards external bushing terminals. Current transformers shall be mounted such that the bushing can be removed without disturbing the transformers. The Supplier shall provide ratio and phase angle correction factor curves, excitation curves and resistance values of the secondary winding and connecting leads together with the approval drawings.

#### **TS.014.7 Control and Auxiliary Power**

The following power supplies will be provided in the substation and the equipment shall be suitable for operation from these supplies, as applicable:

- DC supply voltage      125 V nominal, range 105 - 140 V
- AC supply                120 V, single-phase, 50 Hz  
                                  240 V, 1-phase, 50Hz

#### **TS.014.8 Grounding Terminals**

Two ground studs and clamp type terminal connectors suitable for 4/0 copper (120 sq.mm) stranded copper-weld cable shall be fitted near the base of the circuit breakers. The ground studs shall be of bronze, brazed to the metal unit. Each pole unit (interrupting chamber) shall be electrically bonded to the frame of the circuit breaker.

## TS.014.9 Operating Requirements

Operating Requirements	
Phase Overcurrent	Pickup range up to 1200 Amps
Ground Overcurrent	Pickup range up to 600 Amps
Over Voltage	Provided
Under Voltage	Provided
Phase-Trip Curve	Definite –time and inverse-time curves
Ground-Trip Curve	Definite –time and inverse-time curves
Ground Trip Blocking	Facility Required
Control Voltage	125 Vdc/48Vdc stand-alone charging facility similar to Cooper Power System type ME Control Power Supply
Rated interrupting time	3 cycles
Metering	Power, Voltage, Current, Maximum Current Demand

- (1) Metering Power, voltage, current, maximum current Demand. **Circuit Breaker should be equipped with DNP3 for metering purposes.**
- (2) Over-current Protection: Microprocessor-based, phase/ground, instantaneous/time, high/low set, wide choice of time-current characteristic curves
- (3) Metering and Event  
Recording Function: Microprocessor-based
- (4) Breaker Control Switch with red and green indicating lights
- (5) Local/Remote Switch
- (6) Fuses and Switch for DC control panel
- (10) Cut Off Switch for AC power
- (11) Breaker open/closed Indicator



- (12) Provision shall be made for tripping the circuit breaker by means of external protective relaying
  
- (13) Facilities for remote trip/close

### **TS.014.10 Nameplates**

Nameplates shall be of stainless steel and contain, but shall not be limited to the following:

- name and address of manufacturer
- type and designation or serial number
- rated voltage
- rated frequency
- lightning impulse withstand voltage
- rated short-circuit breaking current
- year of manufacture
- operating pressure range
- control voltage range

All nameplate data shall be legible to an observer at ground level. All equipment shall be identified, and all nameplate wording shall be subject to Purchaser's approval.

### **TS.014.11 Control Cabinet**

The circuit breakers shall be provided with a rigidly framed, weatherproof, sheet steel control cabinet, minimum 3 mm thick, mounted on the breaker supporting structure and positioned such that all controls may be operated from grade level. The cabinet shall be fitted with a hinged door complete with a 3-point latch with padlocking facility and shall be equipped with a detachable bottom entry conduit plate suitable for drilling in the field.

The control cabinets shall contain, but shall not be limited to:

- one knockout to facilitate SEL 487V capacitor bank control relay
  
- one set of control components, as required, to operate the 3-pole breakers
  
- one circuit breaker trip-close control switch, rotary, panel-mounted type, enclosed contact mechanism with removable cover
  
- two indicating lamps, one red and one green, for circuit breaker position indication

- one moulded case 2-pole circuit breaker for dc control supply with minimum of 10,000 A interrupting capability
- operation counter
- one two-position selector switch marked 'remote-local'
- one mechanically driven circuit breaker auxiliary switch with necessary contacts for proper circuit breaker operation, remote indication, supervisory control and indication, and six "a" and six "b" spare contacts. All contacts shall be rated 20 A continuous and 2.5 A break of inductive load at 125-V dc ungrounded circuit. Each contact shall be electrically independent and adjustable for late or early opening or closing. All 'a' and 'b' contacts shall be readily interchangeable
- one 15-A moulded case circuit breaker having a 10,000-A rms symmetrical interrupting capacity controlling the 240-V ac supply
- one incandescent lamp with door activated switch
- one duplex convenience outlet, 15 A, 120 V, 2-pole, 3-wire, polarized, grounded
- one control cabinet dual element anti-condensation heater with thermostat.
- one approved mechanical emergency hand trip device with mechanically interlocked contacts to disconnect circuits from remote closing devices, easily accessible and clearly marked 'emergency trip'
- copper ground bus, minimum 6 mm x 25 mm
- all necessary terminal blocks for all remote control, indication and trip circuit supervision circuits
- all pressure gauges, density meters, and breaker position indicators shall be readily visible without opening door covers
- alarm devices with independent NO and NC contacts for remote indication of breaker abnormal conditions, including low SF<sub>6</sub> gas pressure, low closing mechanism pressure, etc.
- one set of auxiliary contacts for monitoring spring charge status
- the charging motor shall be dual voltage operated ie: 120VAC and 125VDC for emergency operation

## TS.014.12 Wiring and Terminations

### (a) High Voltage Bushings

Bushings for circuit breakers shall be of the porcelain type, and shall be located so as to provide adequate electrical clearance between bushings of any phase and between phases. Bushings of like voltages shall be inter-changeable. Bushings shall be so designed that there will be no undue stress on any part due to temperature changes, and adequate means shall be provided to accommodate conductor expansion. The bushings shall be as free as possible from radio disturbances when operating at normal rated voltage. The design of the circuit breakers shall be such that under impulse voltage, flashover will occur outside of the tank before flashover occurs within the breaker. Polymer type bushings shall be quoted as an option.

The bushing shall be constructed with standard 4-hole, NEMA, Tin Plated terminal pad and each circuit breaker shall be supplied with connectors suitable for accommodating stranded cable 4/0(120 sq. mm) – 500 MCM (240 sq. mm) Copper/Aluminium conductors.

All connectors shall be of the bolted type, welded connectors are not acceptable. The current carrying capacity of each connector shall not be less than the conductor to which it is to be applied. Connectors shall be compatible with the 150 deg. C maximum conductor temperature.

### (b) Control Wiring

All control wiring shall be 600-V, 90degC, flame- and oil-resistant insulated, stranded copper wire. Wire sizes shall be appropriate for the function, but not be less than 2.5 mm<sup>2</sup> for control circuits. All power and control wiring shall be shielded from metering conductors. All wiring connections shall be readily accessible and removable for test or other purposes. Wiring between terminals of the various devices shall be point to point. Splices or tee connections are not acceptable. Wire runs shall be neatly trunked inside the panels or in wiring troughs. All wires shall be identified at both ends with sleeve type markers.

Terminal blocks with removable marking strips shall be provided for all circuits and 20% of the total number of spare terminals shall be supplied. Terminal blocks for the current transformer leads shall be of the short-circuiting type. Buchanan type 3B or approved equal.

## TS.014.13 Painting

All painted surfaces shall be shop painted with a compatible primer which shall have a dry film thickness of not less than 75 µm. Final paint finish shall be light grey (ANSI 70/ASA 61)

Two finish coats of light grey epoxy paint shall be applied over the primer. The paint should be weatherproof and specially treated for use in a tropical environment.

#### **TS.014.14 Bases and Structures**

The support structures shall be supplied complete with adequately sized anchor bolts.

The equipment and its supporting structures shall be designed such as to prevent any distortion under a suddenly applied load which would adversely affect the operation of the equipment.

#### **TS.014.15 Spare Parts**

All spare parts shall be interchangeable and of the same material and workmanship and shall meet the same requirements as the corresponding original parts furnished with the breaker.

The Supplier shall supply spare parts for the circuit breakers. These spare parts shall include, but not be limited to the following:

- (i) Porcelain bushings;
- (ii) Complete sets of contacts;
- (iii) Vacuum bottles;
- (iv) Tripping and closing coils;
- (v) Set interrupter unit;
- (vi) Two (2) complete set of gaskets.
- (vii) One (1) microprocessor-based protection/control unit for 24 kV circuit breaker;

Based on the proposed scope of work the Tenderer shall specify any other type of device and quantities for which spare are recommended for an operation period of 5 years. Each item shall be adequately described and separately priced as set out in the Schedule of Spare Parts and Tools.

The Tenderer shall also propose additional spare parts necessary for 10 years' operation.

#### **TS.014.16 Selector**

Selector switches shall be of the two-position type (i.e. on, off and Control Switches neutral position) with provision for locking in both the local and remote positions. Control switches shall be arranged to return automatically to the neutral position when the handle is released after being turned to either the "close" or "trip" position. Sequence devices shall not be fitted.

**TS.014.17 Position Indicators**

The following are the minimum position indicators that shall be provided on the switchgear for each circuit breaker.

- a. "Spring charged"
- b. "Spring free"
- c. Circuit breaker "CLOSED"
- d. Circuit breaker "OPEN"
- e. Isolator "CLOSED"
- f. Isolator "GROUNDED"
- g. Trip circuit healthy

All above indicators shall be operated through mechanical means. Additional electrical indicator lamps (LED type) showing the status (e.g. circuit breaker " CLOSED " or " OPEN") shall be provided on the front of the switch panel. Supply of these electrical indicators shall be fed from the battery charger.

Any two switching devices which are inter-locked together shall be secured by a double operation inhibit system in such a way that if an operation command is issued simultaneously to both devices or if they are both operated manually, their interlocks cannot block both the switches in an undefined, intermediate position. This means that while one device is being operated by hand or by a motorized mechanism, operation of the device interlocked with the former is blocked (with the exception of the closing operation of tee-off circuit breaker).

**TS.014.18 Factory Tests**

The circuit breaker shall be completely assembled at the factory, and shall be subjected to all routine and type tests in accordance with ANSI Standards. If the Supplier can supply certified copies of type tests on identical equipment, the Purchaser may waive such tests entirely. Purchaser reserves the right to witness all tests and shall be notified at least 3 weeks prior to the commencement of the tests.

The total cost (all expenses paid) for witnessing the final shop and functions tests by two (2) of the Purchaser's Engineers, shall be included in the quoted CIF cost of supply of 38kV Circuit Breaker, but itemized separately.

Supplier shall furnish six certified copies of all test reports, curves and oscillograms within 2 weeks after completion of any tests.

### TS.014.19 Operation & Maintenance Instruction Manual

One operation and instruction manual shall accompany each circuit breaker.

The manual shall include but not be limited to the following:

- a) General information;
- b) Manufacturer's descriptive literature including commissioning, testing and maintenance procedures;
- c) List of replacement parts and corresponding catalogue numbers;
- d) Complete set of final as-built drawings.

### TS.14.20 Loading

Structural and apparatus wind loadings shall conform to the Standard Publication. All constructions shall withstand a wind speed of 55 m/s.

Structures shall be capable of withstanding forces resulting from the following combinations:

- (a) Dead load + normal erection and maintenance loads
- (b) Dead load + wind load
- (c) Dead load + 50% wind load + short circuit forces
- (d) Dead load + earthquake load.

Equipment loads are to be weight of equipment, wind on equipment and any other loads.

Earthquake loads are to be taken as loads resulting from an acceleration of 0.25g.

Short circuit forces shall be taken as resulting from an electrical fault (symmetrical) of 1,000 MVA for 24 kV at the substation being applied to the conductors and current carrying parts of equipment being supplied.

### TS.014.21 Connections

In general, all connections shall be designed for field bolting. Exceptions are for small frames or sub-assemblies which can be factory welded and shipped without being distorted in transit. All bolts shall be furnished with lock washers and locknuts. Five percent (5%) of the number of field bolts and nuts shall be furnished in excess of the number actually required.

### TS.014.22 Finish

All ferrous parts including bolts, nuts and washers shall be hot dip galvanised as in accordance with the Standard Publication ISO or equivalent. Nuts may be threaded after galvanising to ensure clean threads but bolts shall not be threaded after galvanising.

### **TS.014.23 Open holes**

All structures shall be provided with clear 1/2 inch diameter holes in two convenient opposite places 6 inches above the base to accommodate an approved bolted type ground connectors.

### **TS.014.24 Markings**

Each field piece shall be plainly marked in a conspicuous place with an identification mark as indicated on the manufacturer's erection drawings. These marks shall be unique for each or similar members.

The marks shall be stamped into the material with a metal dye before galvanising and characters shall be at least 1/2" high.

Additional duplicate marks in block characters 1-inch-high shall be printed in each field piece after galvanising. These marks shall be adjacent to the dye marks.

### **TS.014.25 Welding**

Use of weld should be kept to a minimum, when necessary welding of steel shall be carried out before galvanizing. All welds shall be continuous and sealed.

### **TS.014.26 Galvanizing**

All steel used shall be galvanized after all manufacturing.

Galvanising shall be in accordance to the relevant standard ISO or equivalent. The zinc coating shall be smooth, clean, of uniform thickness and free from defects.

After galvanizing all members shall be protected from the formation of wet rust storage stain (white rust). The protection shall consist of chromate coating sufficient to meet a 48 hours salt spray test performed in accordance with ASTM B201.

## TS.015 Control and Auxiliary Power

The following power supplies will be provided in the substation and the equipment shall be suitable for operation from these supplies, as applicable:

- dc supply voltage      125V, nominal, range 105 - 140 V
- ac supply                120V, single-phase, 50 Hz
- 240V, 3-phase, 50Hz

### (b) Control Wiring

All control wiring shall be 600-V, 90degC, flame- and oil-resistant insulated, stranded copper wire. Wire sizes shall be appropriate for the function, but not be less than 2.5 mm<sup>2</sup> for control circuits. All power and control wiring shall be shielded from metering conductors.

All wiring connections shall be readily accessible and removable for test or other purposes. Wiring between terminals of the various devices shall be point to point. Splices or tee connections are not acceptable. Wire runs shall be neatly trunked inside the panels or in wiring troughs. All wires shall be identified at both ends with sleeve type markers.

Terminal blocks with removable marking strips shall be provided for all circuits and 20% of the total number of spare terminals shall be supplied. Terminal blocks for the current transformer leads shall be of the short-circuiting type. Buchanan type 3B or approved equal.

## TS.015.1 Nameplates

Nameplates shall be of stainless steel and contain, but shall not be limited to the following: -

- name and address of manufacturer
- type and designation or serial number
- rated voltage
- rated frequency
- lightning impulse withstand voltage
- rated short-circuit breaking current
- year of manufacture
- operating pressure range
- control voltage range.

All nameplate data shall be legible to an observer at ground level. All equipment shall be identified, and all nameplate wording shall be subject to Purchaser's approval. Structure and positioned such that all controls may be operated from grade level. The cabinet shall be fitted with a hinged door complete with a 3-point latch with padlocking facility and shall be equipped with a detachable bottom entry conduit plate suitable for drilling in the field.



**TS.015.2      Painting**

All painted surfaces shall be shop painted with a compatible primer which shall have a dry film thickness of not less than 75 µm.

Two finish coats of light grey epoxy paint shall be applied over the primer. The paint should be weatherproof and specially treated for use in a tropical environment.

**TS.015.3      Bases and Structures**

The support structures shall be designed and fabricated in accordance with Section TS.04.1.2 "Capacitor Bank Frame" of this specification and shall be supplied complete with adequately sized anchor bolts.

The equipment and its supporting structures shall be designed such as to prevent any distortion under a suddenly applied load which would adversely affect the operation of the equipment.

**TS.015.4      Spare Parts**

The Supplier shall provide a separate price for his recommended spare parts for the circuit breakers.

**TS.015.5      Tools and Accessories**

The Supplier shall furnish a complete set of any special tools or equipment that may be necessary or convenient for assembly, filling or maintenance of the units. Manual operating levers and any other devices necessary for satisfactory operation shall also be furnished.

## **TS.016 Control and Relaying Equipment**

### **TS.016.1 Scope of Work**

The Scope of Work includes the design, manufacture, testing, packaging for shipment, and delivery of Capacitor Protection Panels all in accordance with the requirements of this Specification and as shown on the drawings.

The Scope of Work also includes the preparation of all the ac and dc elementary and wiring diagrams for the capacitor installations as they apply to the protective relaying and control of the capacitor banks, as well as the calculation and presentation of recommended relay settings.

It is the intent of this Specification that the Work enumerated be fully complete in every detail for the functions designated and the Supplier shall furnish all materials, equipment and cubicles. Only proven equipment shall be provided, and evidence of service experience is required.

### **TS.016.2 Standards**

All equipment shall conform to the latest revision of ANSI standard C37.90, C37.90.1 and all other relevant ANSI and IEC Standards. If this specification conflicts in any way with any ANSI standard, this specification shall have precedence and shall govern. However, the bidder shall point out these conflicts in his bid.

### **TS.016.3 General Protection Requirements**

In describing operating locations, the following definitions shall apply

- **local** at the location of the subject circuit breaker, and circuit interrupters
- **standby** at the location of the control or relay panel in the station control building
- **remote** at a control point remote from the **local** or **standby** positions and usually supervisory control from System Control via SCADA

Every protective relay shall be fully equipped with either target relays or LEDs to indicate its operation.

Every relay which has a target or which requires manual resetting shall be mounted on the front of the relay panel.

All protective relays shall be of the solid state microprocessor type and, except for certain auxiliary relays, shall be withdrawable from their case without opening current transformer secondary circuits, disturbing external circuits or requiring disconnection of wiring. Relay cases shall be

semi-flush, back connected, dust tight, switchboard type with removable transparent covers. Covers shall have means for sealing against unauthorized tampering.

All relays shall be suitably marked with the following data in a location such that it is easily legible, without removing the cover, when the relay is mounted on the panel.

- Manufacturer's name
- Type designation and serial number
- Rated value (and range) of the operating quantity
- Rated frequency or symbol for dc
- Rated value or range of time delay if applicable
- Data to permit identification of the operating coil(s).

Protective relays shall be designed for maximum accuracy and shall be free from errors caused by normal variations of frequency, wave-form, power factor and ambient temperatures between 0°C and 40°C. The operating limits of all relays shall be 80% and 110% of the rated values. All current coils shall be able to withstand 35 times coil rating for 0.5 seconds.

Each protective relay shall be provided with at least two independent circuit closing contacts, one for tripping and the other for signaling suitable for operation on a 125 V dc ungrounded system. If two electrically separate contacts are not available, suitable auxiliary relays shall be provided.

All equipment shall operate satisfactorily and shall not be subject to deterioration in the range of 80 to 120% of nominal battery voltage.

All current transformer and voltage transformer wiring, on entering the control and relay panel, shall after termination run directly to test switches. Test switches shall be ABB type FT-1 flexi-test, or approved equal.

All outgoing trip contacts shall be provided with an isolating switch. Where an integral isolating switch is not available with the relay, a separate ABB type FT-1 Flexi-test switch or approved equivalent shall be provided for this purpose.

All protective relay operating supplies shall be obtained from the station dc system. The use of small rechargeable cells within the relay unit or system is not acceptable.

All equipment shall be suitably shielded and protected so that any surges on the current transformer, voltage transformer, or dc systems do not cause damage or relay malfunction.

In order to make provision for future supervisory alarm requirements, all relays, which initiate alarms, shall be supplied with two annunciation contacts, one for station annunciation and one for supervisory annunciation.

Each protection circuit shall be monitored by means of an under voltage relay connected at the end of the daisy chained positive and negative buses, the relay shall have at least two output

contacts suitable for operating an indicator light located on the panel and remote SCADA annunciation signal.

### **TS.017.1 Other Accessories**

The following accessories shall be provided on the control and relay panels:

- (a) Test and Isolating Switches and Fuse Links
- (b) Nameplates
- (c) Red pistol grip handle switches with three signaling lamps for circuit breaker control
- (d) Auxiliary relays

All instrument and control switches shall be of the rotary type with operating handles on the front and the contact mechanism on the rear of the panel. The switches shall be GE Type SBM, ELECTROSWITCH type 24 or equivalent.

Each switch shall be provided with a rectangular escutcheon plate etched or engraved to show each operating position and the equipment device no. All switches shall have fixed handles fastened to the switch shaft by a screw through the front of the handle.

Circuit breaker control switches shall be furnished with mechanical operation indicators to show the last manual operation of the switch and shall be equipped with one red, one green and one white indicating lamp. The indicating lamps, complete with caps, shall be General Electric type ET-16 or equivalent.

Test and Isolating switches shall be ABB type FT-1 or equivalent, each having the requisite number of shorting type current and potential switches.

Fuses and fuse links shall be provided as shown on typical drawings. Fuses and fuse holders shall be GEC type C1A HRC type and C30H respectively. Links and link holders shall be GEC type SS and HRC type SS-P respectively.

### **TS.017.2 Interfaces for Remote Control**

The Supplier shall supply all the equipment (such as bridged jumper terminals, auxiliary relays, shielded wires, local/remote switches) necessary to interface the SCADA system to the equipment to be controlled and measuring devices to be monitored at SCC in Kingston.

The following functions are to be monitored and controlled at the System Control Center (SCC) in Kingston:

Status of circuit breakers (one contact open when C.B. is closed)

Status of Vacuum Interrupters (one contact open when interrupter is closed)

Alarms as shown on the drawings (two contacts for each alarm, open in normal condition)

From SCC in Kingston the following equipment shall be controlled

- 38-kV circuit breakers
- 24-kV interrupters.

The Supplier shall provide complete remote control interface facilities (auxiliary trip and close relays included) for the substations.

**(b) Auxiliary Wiring**

All panel interior wiring shall be stranded copper 1.5 sq.mm minimum unless approved by the Purchaser in writing. Current transformer secondary wiring shall be 2.5 sq.mm minimum. Insulation shall be of moisture and flame-retardant 90°C cross linked polyethylene (XLPE) or of fluoridated polycarbon material.

All wiring shall be neatly run and securely fixed in such a manner that, wherever practical, wiring can be easily checked against diagrams.

Wiring shall be so arranged that access to panel-mounted equipment terminals is not impeded. Where provision is made for future equipment to be mounted on a panel, suitable means of supporting and terminating the wiring shall be used. Wires shall not be jointed or teed between terminals. No more than two wires shall be connected to one side of any terminal.

All wiring shall be fitted with numbered marker ferrules. The ferrules shall be black on white, of heat shrink or ring type, made of noncombustible insulating material and with a glossy finish to prevent the adhesion of dirt. C type ferrules are not acceptable.

The ferrules shall not be affected by moisture or oil and shall be clearly and permanently marked; temporary marking shall not be used. The same ferrule marking shall not be used on wires forming connections not directly in series or parallel in the same panel.

Wherever practicable, all power circuits shall be kept physically separated from the control wiring and low-level signal wiring. Separated raceways shall be provided for the above systems. The working voltage of each circuit shall be marked on the associated terminal boards.

**(c) Terminals**

Panels shall be equipped with a minimum of two vertical columns of DIN rail mounted, pressure clamp type terminals, one on each side and each vertical column set obliquely toward the rear of the panel to give easy access to terminations and to permit reading of ferrule numbers. If more than one terminal column per side is required, they shall be spaced at least 10 cm apart. The bottom termination shall not be less than 30 cm above the removable gland plate.

Terminals shall be insulated for 600v minimum and shall be suitable for terminating up to 6 sq. mm stranded wire or 2- 4 sq. mm wires.

Terminals for SCADA analog, status and alarm wiring shall be of the disconnecting type, Wieland type WK4 or accepted equal. Shield wires shall use Wieland type WK2.5 terminals or accepted equal.

Panel wiring shall be connected to one side of the terminal leaving the other side clear for the connection of external cables. Insulating barriers shall be installed between terminals of different voltages or from different sources of supply. Transparent insulating covers shall be fitted to terminals connected to voltage higher than 125 V.

Terminals shall be provided for all external connections plus 15% spare terminals for each column. Adequate space shall be provided on both sides of the terminals, for connection of wiring.

Terminations shall be grouped according to function and labels shall be provided on the fixed portion of the terminal racks showing the function of each group.

Supplier shall submit details of the types of terminals it proposes to use for acceptance of Purchaser.

**(d) Grounding**

Each row of panels shall have a continuous copper ground bus, 25 x 3 mm minimum area, run at the bottom of each panel. A clamp type connector, suitable for #4/0 equivalent copper weld cable shall be provided at each end of this bus for connection to the main station grounding system.

Metal cases of instruments, relay cases, switches, etc., shall have individual connections made to the ground bus by 2.5 sq. mm conductor.

**(e) Labels**

The Supplier shall supply and install identifying labels for each item of equipment on, or in, each panel. Equipment mounted on the panel front shall have one label mounted on the front of the panel and an identical label mounted inside the panel, adjacent to the equipment and readily visible. Labels shall be of laminated plastic, **WHITE** lettering on **BLACK** background.

All wire labels shall be in accordance with the Purchaser's standard of labelling wires.

Size and inscriptions on nameplates shall be Approved by Purchaser prior to fabrication.

(f) **Lighting and Power**

Each panel shall be equipped with an interior light controlled by a door-operated switch as well as a metal-clad, 125V, 15A, 2 pin and ungrounded duplex outlet to North American standards. The power supply available on site is from a single-phase, 120-V, 50-Hz, system.

**TS.018 Metal Enclosed Capacitor Banks**

**TS.018.1 General**

These specifications cover the design, manufacture, testing and delivery of 24 kV L-L three phase, metal enclosed, capacitor banks for installation at various substations.

The drawings accompanying this specification are intended to show the general location of the banks relative to the 24 kV bus which the bank is to be connected. The bidder shall provide general arrangement drawings showing the capacitor bank and capacitor switching equipment.

**TS.018.2 Standards and Codes**

The capacitors shall comply with the requirements of all applicable ANSI and NEMA standards.

If this Specification conflicts in any way with any of the above standards or codes, this Specification shall have precedence and shall govern. However, the Bidder shall point out these conflicts in its Bid.

**TS.018.3 Detailed Requirements**

The MVAR ratings of the capacitor banks required are listed in Section V1 "Schedule of Requirements".

**TS.019 Design and Construction**

**TS.019.1 Enclosure**

Free standing, compartmentalized, all welded, 11 gauge galvanized steel construction with 3 point pad-lockable latching handles and stainless steel hinges. The enclosure should to be painted with corrosion resistant ANSI enamel paint. NEMA 3R construction or its equivalent should be standard.

**TS.020      Key Interlock System**

Key Interlock System that dictates a safe sequence of operation and entry into the capacitor bank.

**TS.021      *Capacitors***

Refer to Section TS.05

**TS.022      *Individual Capacitor Fusing***

Refer to Section TS.06

**TS.022.1    *Blown Fuse Detection System***

Refer to Section TS.06.1

**TS.023      *Vacuum Switches***

Refer to Section TS.07

**TS.024      *Reactors***

Refer to Section TS.08

**TS.025      *Surge Arresters***

Refer to Section TS.09

**TS.026      *Voltage Transformer***

Refer to Section TS.10



**TS.027 Line Current Transformer**

**TS.027.1 General**

This specification covers the design, manufacture, testing and delivery of multi-ratio 600V class window type line current transformer and associated equipment.

All equipment furnished shall be suitable for operation under all possible local conditions.

**TS.027.2 Standards and Codes**

The line current transformers shall comply with the requirements of the latest revisions of ANSI/IEEE C57.13 and all other relevant ANSI standards.

If this Specification conflicts in any way with ANSI requirements, this Specification shall have precedence and shall govern. However, the Bidder shall point out these conflicts in its Bid.

**TS.027.3 Ratings**

The 600V line current transformers shall have the following electrical characteristics and ratings:

Type	Window
Voltage Class	600 V
Rated Primary current	1200A (Multi-ratio)
Rated secondary current	5A
ANSI relaying accuracy class	C400
ANSI metering accuracy	0.3-B0.1 through B0.9/ 0.6 – B1.8
BIL	10 kV

**TS.027.4 Terminals**

Clamp type terminals for primary connection shall be provided on the transformer primary suitable for copper conductor.

A weatherproof secondary terminal box, with provision for one 25mm dia conduits from below, shall be provided complete with terminal blocks and connectors suitable for terminating incoming 4 sq. mm copper cables.

Ground studs and clamp type terminal connectors suitable for 7 #5 (0.428" dia), stranded copper weld cable shall be fitted near the base of each equipment support structure. The ground studs shall be bronze and brazed to the metal unit.

**TS.027.5 Painting**

All painted surfaces shall be shop painted with a compatible primer which shall have a dry film thickness of not less than 75 µm.

Two finish coats of light grey epoxy paint shall be applied over the primer.

**TS.027.6 Nameplates**

Nameplate shall be of stainless steel and shall contain, but shall not be limited to

- name and address of manufacturer
- type and designation or serial number
- Ratios
- rated primary and secondary current
- nominal system voltage
- rated frequency
- lightning impulse withstand level
- number and rating of secondary windings
- continuous thermal current rating
- accuracy classifications
- year of manufacture.

All nameplate data shall be legible to an observer at ground level. All equipment shall be identified, and all nameplate wording shall be subject to Purchaser's approval.

**TS.027.7 Factory Tests**

The equipment will be assembled at the factory and subjected to tests. Factory tests shall include all routine electrical and mechanical tests in accordance with all relevant ANSI standards.

Purchaser reserves the right to witness these tests and shall be notified at least 3 weeks prior to the commencement of the tests.

One complete equipment of each type and rating shall be subject to type tests as specified in the relevant ANSI standard. If the Supplier can supply certified copies of type test certificates covering equipment of similar design, rating and construction, the Purchaser will waive such tests entirely.

Supplier shall furnish six certified copies of all test reports within 2 weeks after completion of any tests.

**TS.028      *Neutral Voltage Transformer***

Refer to Section TS.11

**TS.029      *Ground Switch***

An interlocked ground switch should be provided to ground the load-side terminals of the incoming air-disconnect switch and/or capacitors for safety during maintenance.

**TS.030      *Ground and Phase Bus***

A minimum 1/4" X 2" Silver plated Copper ground bus to be provided through the width of the enclosure to assist in grounding during maintenance. All phase bus is Silver plated and rated at a minimum of 135% of the bank nominal current rating.

**TS.031      *Ancillary Controls***

On/Off Switches are standard with stage on and off indicators. Enclosure lights are to be provided in the control, main-incoming fuse, and capacitor compartments. Convenient outlet to be provided in the control compartment.

**TS.032      *Power Termination***

Designed to accept NEMA standard two hole lugs compression lugs.

**TS.033      *NEMA 12/4X Construction***

*NEMA 12 or 4X (stainless steel) construction to be provided.*

**TS.034      *Bus Work, Insulators and Group Operated (Gang) Air Switches***

Refer to Section TS.013

**TS.035            38 kV Vacuum Roll-Out Circuit Breaker**

An integral 38 kV roll out vacuum circuit breaker to be supplied for disconnecting the capacitor bank from the power system. The circuit breaker shall meet or exceed the specifications outlined in Section TS.014.

**TS.035.1        Design and Workmanship - Vacuum Circuit Breaker**

Circuit breakers shall be vacuum type, designed to withstand impact and vibrations under rated and short circuit current conditions. The vacuum bottles shall be made from a metal alloy that will withstand high switching duties. Vacuum bottles and circuit breakers should be manufactured and assembled by the switchgear supplier. The glass ceramic bottle shall be securely fused to the end fittings. The moving contact activating rod shall be carried on bellows protected from the sputtering of molten metal during switching operation by a shield. The breaker contacts shall be mounted in epoxy cast resin bushings.

Each circuit breaker shall be provided with a suitable mechanically operated indicating device, marked "OPEN" and "CLOSED". The indicating device shall be visible at all times from the front panel as well as from the circuit breaker compartment. Suitable well-lit lighting and transparent cover shall be provided to visually inspect the indicator from the circuit breaker compartment.

Circuit breaker operating mechanisms shall be motorized, and equipped with a spring charged indicating device. Circuit breaker mechanisms shall be trip free and designed for operation at 125 VDC, however meter shall be powered by the AC auxiliary panel provided.

A suitable form of arc control shall be incorporated in the design and the contacts shall be renewable and self-aligning to ensure full contact without undue maintenance.

Vents shall be provided in the top plate of each circuit breaker for the safe escape of gas. The vents shall have an efficient oil tap where applicable. Cast iron shall not be used for the circuit breaker or top plates. The Circuit breakers shall be rated in accordance with the relevant ANSI standard, and compatible with the switchgear system ratings specified the switchgear specifications. The rated operating sequence (Duty Cycle) shall be 0 - 3 min - CO - 3 min - CO for the rated current.

Circuit breakers which require rapid auto-reclosing shall have a rated operating sequence of 0-0.3 s - CO - 3 min - CO.

The circuit breakers shall be designed to accommodate the TRV peak which occur during the breaking of small inductive currents normally encountered in high voltage systems.

Vacuum circuit breakers shall not produce excessive over voltage as a result of current chopping. Special design is to be incorporated to reduce the effect of chopping to less than 5 Amps during any interruption action.

The circuit breaker operating mechanism shall be located in the low voltage compartment allowing access while the primary equipment is in service.

The operating mechanism shall be designed for high speed opening and closing of the circuit breaker under all operating conditions. All mechanical parts shall be adequately sized to ensure consistent operation of the mechanism when subjected to forces due to heavy short circuit currents. The maximum difference in opening time between the three phases shall not be more than 1/10 of one cycle of the rated frequency. It shall be possible to lubricate and service the moving parts of the mechanism without dismantling major components.

The operating mechanism for the circuit breaker shall be "trip free" type.

Closing operation shall be accomplished by means of a spring operated, stored energy-type mechanism, with electrical release. The mechanism shall be designed such that:

- it shall not be possible for the circuit breaker to close while the closing spring is being charged.
- it shall be necessary for the spring to be fully charged before it can be released to close the circuit breaker.
- it shall be possible to charge the spring with the circuit breaker in the closed position. if the spring is released during charging, the circuit breaker shall not open.

A visual, mechanical indicating device shall be provided to indicate the position of the spring. The position indicator shall say " SPRING CHARGED " when the mechanism is fully-charged, and ready to close the circuit breaker, and " SPRING FREE " when it is in any other condition.

Tripping Operation - of the circuit breaker shall be by means of a charged spring. Each mechanism shall be provided with a shunt release, and the necessary auxiliary switches. An operation counter shall be fitted to the mechanism, designed to total all "opening" operations of the interrupter.

Provisions for locking-out the manual tripping of the circuit breaker shall be made. It shall not be possible to defeat locking of the manual tripping.

Each operating mechanism shall be provided with the following control features:

- Remote electrical closing & tripping, with provisions for connection to a supervisory control system.
- Local electrical closing and trip with selection switch at the circuit breaker.
- Local manual closing and trip, preferably by push-buttons shrouded to prevent inadvertent operation.
- Local and remote electrical operation of the disconnect switch with automatic cutoff, when switch has reached the full open/closed position.
- Manual operation of isolator.

The operating mechanism shall automatically recharge the spring after the completion of a closing operation, with a control switch on each panel to cut off the DC supply to disconnect this facility. When a disconnect or grounding switch is operated by hand, operation of the motorized mechanism is blocked. An auxiliary switch as shall be, provided to give remote indication of "spring charged" status & trip/close status.

### **TS.035.2 Testing - Vacuum Circuit Breaker**

The roll-out breaker shall be designed to be easily extracted from the circuit breaker compartment for replacement or testing by field personnel. The circuit breaker shall be able to 'open' and 'close' outside the compartment to facilitate testing by field personnel.

In addition, the entire circuit breaker contact system as designed in the system, to include circuit breaker in 'closed' position inside the compartment and connections to the circuit breaker, must be able to accessed to perform contact resistance testing by JPS field personnel. The contact resistance of the entire circuit breaker contact system as designed by the manufacturer shall be less than 100  $\mu\Omega$  when contact resistance testing of 100A for 30 seconds is performed.

### **TS.036 Selector**

Selector switches shall be of the two-position type (i.e. on, off and Control Switches neutral position) with provision for locking in both the local and remote positions. Control switches shall be arranged to return automatically to the neutral position when the handle is released after being turned to either the "close" or "trip" position. Sequence devices shall not be fitted.

### **TS.037 Position Indicators**

The following are the minimum position indicators that shall be provided on the switchgear for each circuit breaker.

- a. "Spring charged"
- b. "spring free"
- c. Circuit breaker "CLOSED"
- d. Circuit breaker "OPEN"
- e. Isolator "CLOSED"
- f. Isolator "GROUNDED"
- g. Trip circuit healthy

All above indicators shall be operated through mechanical means. Additional electrical indicator lamps (LED type) showing the status (e.g. circuit breaker " CLOSED " or " OPEN") shall be provided on the front of the switch panel. Supply of these electrical indicators shall be fed from the battery charger.

Any two switching devices which are inter-locked together shall be secured by a double operation inhibit system in such a way that if an operation command is issued simultaneously to both devices or if they are both operated manually, their interlocks cannot block both the switches in an undefined, intermediate position. This means that while one device is being operated by hand or by a motorized mechanism, operation of the device interlocked with the former is blocked (with the exception of the closing operation of tee-off circuit breaker).

**TS.038**      ***Exhaust Fan***

Exhaust fan to be supplied for forced ventilation of the enclosure.

**TS.039**      **Control and Auxiliary Power**

Refer to Section TS.015

**TS.040**      **Control and Relaying Equipment**

Refer to section TS.016

**PART 7**  
**SCHEDULES**



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## SCH.01 Schedule of Requirements

The design and supply of 30 MVARs of open air rack and metal enclosed capacitor banks **complete** with associated equipment, circuit breakers, vacuum switches, grounding switches, protection panels, etc. as follows, all as specified herein:

Item	Substation Location	System Voltage Rating (kV)	Bank Size (MVARs)	Number of Banks	Frequency (Hz)
1	Ocho Rios	24	2 x 5.0	1	50
2	Roaring River	24	2 x 5.0	1	50
3	Cardiff Hall	24	2 x 5.0	1	50
	<b>Total</b>		<b>30.0</b>	<b>3</b>	

The capacitor banks will be connected to the 24kV bus at the three (3) substations. All equipment shall be appropriately rated.

The design and supply of the open air rack and metal enclosed capacitor banks shall include requirements for interfacing with the existing substations at which the bank is to be installed.

### 1. Supply of Spare Parts

The Supplier shall supply all spare parts which the Supplier considers necessary for the proper functioning of the capacitor bank installations.

### 2. Commissioning and On-Site Equipment Demonstration

The provision of technical assistance for the commissioning of the capacitor bank. This will include all expense paid travel arrangements for the Supplier's Commissioning Engineer to visit Jamaica once to give on-site technical assistance in the commissioning of the capacitor bank into service and assist in the familiarization of JPS's Engineers and Technicians with the new equipment.

**SCH.02 Schedules of Information**

**SCH.02.1 Financial Data**

The Bidder attaches the following information concerning his financial resources and previous experience in order to fully demonstrate his ability to undertake the Works:

**SCH.02.2 Addenda to Bid Documents**

The Bidder has received the following Addenda to the Bid Documents prior to submission of this Bid.

ADDENDA NO.

DATED

**SCH.02.3 Deviations from Specification**

The deviations from the Specification are as follows:

**SCH.02.4 Appendices to Bid**

The appendices which form an integral part of the Bid are as follows:

Appendix A - Tender Drawings

**SCH.02.5 Sub-Contracted Work**

Sub-suppliers may be used to supply the following materials and services:

**SCH.02.6 Change in Quantities**

The maximum percent (%) change in quantities allowable within quoted rates is .....

For and on behalf of

\_\_\_\_\_  
(Supplier's name)

\_\_\_\_\_

\_\_\_\_\_  
Title

**SCH.03 SCHEDULE OF PRICES**

**SCH.03.1 30 MVARs of Open Air Rack and Metal Enclosed Capacitor Banks**

**Option A – Open Air Capacitor Bank System**

All outdoor capacitor bank equipment as listed under section TS 03.1

**Option B – Metal Enclosed Capacitor Bank System**

All metal enclosed capacitor bank equipment as listed under section TS 03.2

**Option C – Hybrid Capacitor Bank System**

1 x 38 kV outdoor circuit breaker as per section TS.014; all other capacitor bank components housed in a metal enclosed container

**Ocho Rios Option A – Open Air**

<b>Component</b>	<b>JPS Expected Quantity</b>	<b>Manufacturer Recommended Qty</b>	<b>Unit Cost (US\$)</b>	<b>Total Cost (US\$)</b>
38 kV Outdoor Vacuum Circuit Breaker	1			
Capacitor Block Frame & Elevating Structure (Set)	2			
Capacitor Units	48			
Current Limiting Fuses	48			
Vacuum Capacitor Switches	2			
Outdoor Gang Air Switches	3			
Reactors	6			
Surge Arresters	6			
Line Voltage Transformers	3			
Neutral Voltage Transformers	2			
4 Pole Gang Ground Switch	2			
Junction Boxes	3			
Key Interlock Scheme (Set)	1			
Hardware, Bus Work, Insulators, Connectors (Lot)	LOT			
<b>TOTAL</b>				

### Ocho Rios Option B – Metal Enclosed

<b>Component</b>	<b>JPS Expected Quantity</b>	<b>Manufacturer Recommended Qty</b>	<b>Unit Cost (US\$)</b>	<b>Total Cost (US\$)</b>
38 kV Vacuum Roll-Out Circuit Breaker	1			
Metal Enclosure	1			
Capacitor Units	24			
Current Limiting Fuses	24			
Vacuum Capacitor Switches	2			
Outdoor Gang Air Switches	1			
Reactors	6			
Surge Arresters	6			
Line Current Transformers	3			
Line Voltage Transformers	3			
Neutral Voltage Transformers	2			
4 Pole Gang Ground Switch	2			
Junction Boxes	3			
Key Interlock Scheme (Set)	1			
Hardware, Bus Work, Insulators, Connectors (Lot)	LOT			
<b>TOTAL</b>				

## Ocho Rios Option C – Hybrid

<b>Component</b>	<b>JPS Expected Quantity</b>	<b>Manufacturer Recommended Qty</b>	<b>Unit Cost (US\$)</b>	<b>Total Cost (US\$)</b>
38 kV Outdoor Vacuum Circuit Breaker	1			
Metal Enclosure	1			
Capacitor Units	24			
Current Limiting Fuses	24			
Vacuum Capacitor Switches	2			
Outdoor Gang Air Switches	1			
Reactors	6			
Surge Arresters	6			
Line Voltage Transformers	3			
Neutral Voltage Transformers	2			
4 Pole Gang Ground Switch	2			
Junction Boxes	3			
Key Interlock Scheme (Set)	1			
Hardware, Bus Work, Insulators, Connectors (Lot)	LOT			
<b>TOTAL</b>				



### Roaring River Option A – Open Air

<b>Component</b>	<b>JPS Expected Quantity</b>	<b>Manufacturer Recommended Qty</b>	<b>Unit Cost (US\$)</b>	<b>Total Cost (US\$)</b>
38 kV Outdoor Vacuum Circuit Breaker	1			
Capacitor Block Frame & Elevating Structure (Set)	2			
Capacitor Units	48			
Current Limiting Fuses	48			
Vacuum Capacitor Switches	2			
Outdoor Gang Air Switches	3			
Reactors	6			
Surge Arresters	6			
Line Voltage Transformers	3			
Neutral Voltage Transformers	2			
4 Pole Gang Ground Switch	2			
Junction Boxes	3			
Key Interlock Scheme (Set)	1			
Hardware, Bus Work, Insulators, Connectors (Lot)	LOT			
<b>TOTAL</b>				

### Roaring River Option B – Metal Enclosed

<b>Component</b>	<b>JPS Expected Quantity</b>	<b>Manufacturer Recommended Qty</b>	<b>Unit Cost (US\$)</b>	<b>Total Cost (US\$)</b>
38 kV Vacuum Roll-Out Circuit Breaker	1			
Metal Enclosure	1			
Capacitor Units	24			
Current Limiting Fuses	24			
Vacuum Capacitor Switches	2			
Outdoor Gang Air Switches	1			
Reactors	6			
Surge Arresters	6			
Line Current Transformers	3			
Line Voltage Transformers	3			
Neutral Voltage Transformers	2			
4 Pole Gang Ground Switch	2			
Junction Boxes	3			
Key Interlock Scheme (Set)	1			
Hardware, Bus Work, Insulators, Connectors (Lot)	LOT			
<b>TOTAL</b>				

### Roaring River Option C – Hybrid

<b>Component</b>	<b>JPS Expected Quantity</b>	<b>Manufacturer Recommended Qty</b>	<b>Unit Cost (US\$)</b>	<b>Total Cost (US\$)</b>
38 kV Outdoor Vacuum Circuit Breaker	1			
Metal Enclosure	1			
Capacitor Units	24			
Current Limiting Fuses	24			
Vacuum Capacitor Switches	2			
Outdoor Gang Air Switches	1			
Reactors	6			
Surge Arresters	6			
Line Voltage Transformers	3			
Neutral Voltage Transformers	2			
4 Pole Gang Ground Switch	2			
Junction Boxes	3			
Key Interlock Scheme (Set)	1			
Hardware, Bus Work, Insulators, Connectors (Lot)	LOT			
<b>TOTAL</b>				

Cardiff Hall Option A – Open Air<sup>1</sup>

Component	JPS Expected Quantity	Manufacturer Recommended Qty	Unit Cost (US\$)	Total Cost (US\$)
38 kV Outdoor Vacuum Circuit Breaker	-			
Capacitor Block Frame & Elevating Structure (Set)	1			
Capacitor Units	36			
Current Limiting Fuses	36			
Vacuum Capacitor Switches	3			
Outdoor Gang Air Switches	-			
Reactors	9			
Surge Arresters	9			
Line Voltage Transformers	3			
Neutral Voltage Transformers	2			
4 Pole Gang Ground Switch	-			
Junction Boxes	3			
Key Interlock Scheme (Set)	-			
Hardware, Bus Work, Insulators, Connectors (Lot)	-			
<b>TOTAL</b>				

<sup>1</sup> Option A (open air) is to install a new third capacitor bank structure to house an additional 12 capacitors rated at 300 kVAR each (Reference Appendix for layout drawing of structure foundation). The 24 existing capacitors supported on the 2 existing structures are to be replaced with 300 kVAR units to get a total of 36 x 300 kVAR = 10.8 MVAR.

### Cardiff Hall Option B – Metal Enclosed<sup>2</sup>

Component	JPS Expected Quantity	Manufacturer Recommended Qty	Unit Cost (US\$)	Total Cost (US\$)
38 kV Vacuum Roll-Out Circuit Breaker	1			
Metal Enclosure	1			
Capacitor Units	24			
Current Limiting Fuses	24			
Vacuum Capacitor Switches	2			
Outdoor Gang Air Switches	1			
Reactors	6			
Surge Arresters	6			
Line Current Transformers	3			
Line Voltage Transformers	3			
Neutral Voltage Transformers	2			
4 Pole Gang Ground Switch	2			
Junction Boxes	3			
Key Interlock Scheme (Set)	1			
Hardware, Bus Work, Insulators, Connectors (Lot)	LOT			
<b>TOTAL</b>				

<sup>2</sup> Option B (metal enclosed) would be to totally demolish the existing infrastructure and install a metal enclosed solution.

Cardiff Hall Option C – Hybrid<sup>3</sup>

<b>Component</b>	<b>JPS Expected Quantity</b>	<b>Manufacturer Recommended Qty</b>	<b>Unit Cost (US\$)</b>	<b>Total Cost (US\$)</b>
38 kV Outdoor Vacuum Circuit Breaker	1			
Metal Enclosure	1			
Capacitor Units	24			
Current Limiting Fuses	24			
Vacuum Capacitor Switches	2			
Outdoor Gang Air Switches	1			
Reactors	6			
Surge Arresters	6			
Line Voltage Transformers	3			
Neutral Voltage Transformers	2			
4 Pole Gang Ground Switch	2			
Junction Boxes	3			
Key Interlock Scheme (Set)	1			
Hardware, Bus Work, Insulators, Connectors (Lot)	LOT			
<b>TOTAL</b>				

<sup>3</sup> Option C (hybrid) would be to totally demolish the existing infrastructure and install a hybrid solution.

Item	Substation Location	Bank Size (MVAR)	Number of Banks	Option A – Open Air Total Cost CIF (US\$)	Option B – Metal Enclosed Total Cost CIF (US\$)	Option C – Hybrid Total Cost CIF (US\$)
1.1	Ocho Rios	10.0	1			
1.2	Roaring River	10.0	1			
1.3	Cardiff Hall <sup>4</sup>	10.0	1			
2	Sub-Total					
3	Witness Testing					
4	On-Site Equipment Demonstration & Commissioning					
5	<b>Total</b>	<b>30.0</b>				

<sup>4</sup> Option A (open air) is to install a new third capacitor bank structure to house an additional 12 capacitors rated at 300 kVAR each (Reference Appendix for layout drawing of structure foundation). The 24 existing capacitors supported on the 2 existing structures are to be replaced with 300 kVAR units to get a total of 36 x 300 kVAR = 10.8 MVAR. Option B (metal enclosed) and Option C (hybrid option) would be to totally demolish the existing infrastructure and install a metal enclosed or hybrid solution.

Bidder shall provide the price for the equipment specified in SCH.01 Schedule of Requirements.

\_\_\_\_\_ ex-works/CIF Currency of  
Bid \_\_\_\_\_

Inland Transportation \_\_\_\_\_  
Port Costs, Insurance

Name of Bidder \_\_\_\_\_  
\_\_\_\_\_

Signature of Bidder \_\_\_\_\_



**SCH.03.2 Spare Parts**

Bidder shall provide separate prices for the spare parts listed in section TS.02.20 of these specifications, which shall be supplied as part of this contract.

Item	Parts	Unit	Price
No.	Description	Quantity	

Total CIF Cost of Required Spare Parts \_\_\_\_\_

**Recommended Spare Parts**

Bidder shall list here with unit prices, any additional spare parts and special tools it recommends for continuous operation of the plant for a period of 5 years.

**SCH.03.3 Commissioning and On-Site Equipment Demonstration**

Bidder shall provide separate price for providing technical assistance for the commissioning of the Capacitor banks at all four substation sites as detailed in SCH.01 Schedule of Requirements.

Total CIF Cost for provision of technical assistance for the commissioning of the capacitor banks into service \_\_\_\_\_

Name of Bidder \_\_\_\_\_

Signature of Bidder \_\_\_\_\_

**SCH.04 SCHEDULE OF DELIVERIES**

**Open Air Rack and Metal Enclosed Capacitor Banks: Total of 30 MVARs**

Purchaser's Required Delivery: Six (6) months A.R.O

Supplier's Proposed Delivery: \_\_\_\_\_

Name of Bidder: \_\_\_\_\_

Signature of Bidder: \_\_\_\_\_

**SCH.05      Schedule of Technical Data**

**SCH.05.1      Materials and Workmanship**

The Supplier guarantees that the equipment/material furnished hereunder will be entirely suitable for the service specified, will conform to all conditions of performance and design, be free from manufacturing and material defects.

The Supplier also guarantees that he will at the convenience of and without charge to the Purchaser replace, repair and install any of the Works or part thereof which prove defective as a result of faulty design, materials or workmanship within a period of twelve months after acceptance of the Works.

**SCH.05.2 Open Air Rack Capacitor Banks****SCH.05.2.1 CAPACITORS**

Manufacturer	
Nominal System Voltage (kV)	
Frequency (Hz)	
Rated Reactive Power (kVAR)	
BIL (kV)	
No. of Bushings	
Bushing Creepage Length (mm)	
Rated Capacitance ( $\mu$ F)	

**SCH.05.2.2 FUSES**

Manufacturer	
Type (Expulsion/Current Limiting)	
Nominal System Voltage (kV)	
Nominal RMS Current (A)	
Symmetrical Interrupting Rating (kA)	

**SCH.05.2.3 REACTORS**

Manufacturer	
Nominal System Voltage (kV)	
Continuous Current Rating RMS (A)	
Inductance ( $\mu$ H)	
Frequency (Hz)	
BIL (kV)	

**SCH.05.2.4 SURGE ARRESTERS**

Manufacturer	
Nominal System Voltage (kV)	
Rated Voltage (kV)	
Frequency (Hz)	

Maximum Continuous Operating Voltage, MCOV (kV)	
Front of Wave (FOW) protective level for 10kA crest (maximum value) (kV)	
Maximum Discharge voltage using 8/20 $\mu$ s	
10 kA crest (kV)	
20 kA crest (kV)	
40 kA crest (kV)	

### SCH.05.2.5 LINE VOLTAGE TRANSFORMER

Manufacturer	
Nominal System Voltage (kV)	
Rated kVA	
Rated primary voltage (kV)	
Rated secondary voltage (V)	
Number of secondary windings	
Thermal Rating (VA)	
Accuracy Class (wxyz)	
BIL (kV)	
Transformer Connection	

**SCH.05.2.6 NEUTRAL VOLTAGE TRANSFORMER**

Manufacturer	
Nominal System Voltage (kV)	
Rated kVA	
Rated primary voltage (kV)	
Rated secondary voltage (V)	
Number of secondary windings	
Thermal Rating (VA)	
Accuracy Class (wxyz)	
BIL (kV)	
Transformer Connection	

**SCH.05.2.7 GROUND SWITCH**

Manufacturer	
No. of Poles	
Nominal System Voltage (kV)	
Rated Continuous Current RMS (A)	
BIL (kV)	

**SCH.05.2.8 VACUUM CAPACITOR SWITCH**

Voltage Class	
Minimum ANSI/IEEE C37 Switching Class	
Rated Voltage (kV)	
Ungrounded Capacitor Banks L-L (kV)	
Solidly grounded Capacitor Banks L-L (kV)	
Impulse Withstand Voltage	
Line to Ground (kV BIL)	
Open Contact kV (BIL)	
Power Frequency Dry Withstand (kV)	
Power Frequency Wet Withstand (kV)	
Withstand Voltage, 50 Hz	
Power Frequency Dry Withstand (kV)	

Power Frequency Wet Withstand (kV)	
Continuous Current 50 Hz (A)	
Capacitive Switching Current 50 Hz (A)	

### SCH.05.2.9 OUTDOOR VACUUM CIRCUIT BREAKER

Manufacturer	
Nominal System Voltage (kV)	
Rated Voltage (kV)	
Type of Circuit breaker	
Lightning impulse withstand level (kV)	
Rated Continuous current (kA)	
Minimum interrupting capability (A)	
Maximum interrupting time	
Number of Phases	
Rated Control Voltage (V dc)	
Frequency (Hz)	
ANSI/IEEE C37 Switching Class	



**SCH.05.3 Metal Enclosed Capacitor Banks****SCH.05.3.1 CAPACITORS**

Manufacturer	
Nominal System Voltage (kV)	
Frequency (Hz)	
Rated Reactive Power (kVAR)	
BIL (kV)	
No. of Bushings	
Bushing Creepage Length (mm)	
Rated Capacitance ( $\mu$ F)	

**SCH.05.3.2 FUSES**

Manufacturer	
Type (Expulsion/Current Limiting)	
Nominal System Voltage (kV)	
Nominal RMS Current (A)	
Symmetrical Interrupting Rating (kA)	

**SCH.05.3.3 REACTORS**

Manufacturer	
Nominal System Voltage (kV)	
Continuous Current Rating RMS (A)	
Inductance ( $\mu$ H)	
Frequency (Hz)	
BIL (kV)	

**SCH.05.3.4 SURGE ARRESTERS**

Manufacturer	
Nominal System Voltage (kV)	
Rated Voltage (kV)	
Frequency (Hz)	
Maximum Continuous Operating Voltage, MCOV (kV)	
Front of Wave (FOW) protective level for 10kA crest (maximum value) (kV)	
Maximum Discharge voltage using 8/20 $\mu$ s	
10 kA crest (kV)	
20 kA crest (kV)	
40 kA crest (kV)	

**SCH.05.3.5 LINE VOLTAGE TRANSFORMERS**

Manufacturer	
Nominal System Voltage (kV)	
Rated kVA	
Rated primary voltage (kV)	
Rated secondary voltage (V)	
Number of secondary windings	
Thermal Rating (VA)	
Accuracy Class (wxyz)	
BIL (kV)	
Transformer Connection	

**SCH.05.3.6 LINE CURRENT TRANSFORMERS**

Manufacturer	
Type	
Voltage Class (V)	
Rated Primary Current (A)	
Rated Secondary Current (A)	
ANSI Relay Accuracy Class	

ANSI Metering Accuracy	
BIL (kV)	
List of Multi-Ratios Available	

### SCH.05.3.7 NEUTRAL VOLTAGE TRANSFORMER

Manufacturer	
Nominal System Voltage (kV)	
Rated kVA	
Rated primary voltage (kV)	
Rated secondary voltage (V)	
Number of secondary windings	
Thermal Rating (VA)	
Accuracy Class (wxyz)	
BIL (kV)	
Transformer Connection	

### SCH.05.3.8 GROUND SWITCH

Manufacturer	
No. of Poles	
Nominal System Voltage (kV)	
Rated Continuous Current RMS (A)	
BIL (kV)	

### SCH.05.3.9 VACUUM CAPACITOR SWITCH

Voltage Class	
Minimum ANSI/IEEE C37 Switching Class	
Rated Voltage (kV)	
Ungrounded Capacitor Banks L-L (kV)	
Solidly grounded Capacitor Banks L-L (kV)	
Impulse Withstand Voltage	
Line to Ground (kV BIL)	

Open Contact kV (BIL)	
Power Frequency Dry Withstand (kV)	
Power Frequency Wet Withstand (kV)	
Withstand Voltage, 50 Hz	
Power Frequency Dry Withstand (kV)	
Power Frequency Wet Withstand (kV)	
Continuous Current 50 Hz (A)	
Capacitive Switching Current 50 Hz (A)	

### SCH.05.3.10 ROLL-OUT VACUUM CIRCUIT BREAKER

Manufacturer	
Nominal System Voltage (kV)	
Rated Voltage (kV)	
Type of Circuit breaker	
Lightning impulse withstand level (kV)	
Rated Continuous current (kA)	
Minimum interrupting capability (A)	
Maximum interrupting time	
Number of Phases	
Rated Control Voltage (V dc)	
Frequency (Hz)	
ANSI/IEEE C37 Switching Class	
Facility to View Open/Close Indicator on Circuit Breaker within Circuit Breaker Compartment (Yes/No)	
Provision to Allow Contact Resistance Test of Entire Circuit Breaker Contact System (Yes/No)	