

# **FIJI ELECTRICITY AUTHORITY**

**Tender No. MR 124/2016**

**Vuda Power Station**

**Upgrade of the Vuda G1 and G2**

**MCC 415V Switchboards and Amot Control Panels**

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## **GENERAL CONDITIONS OF CONTRACT**

### **1.0 DEFINITIONS**

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

- 1.1 "Authority" or "Purchaser" means the Fiji Electricity Authority.
- 1.2 "Contract" means the agreement entered between the Authority and the Contractor as recorded in the Contract Form signed by the parties, including all attachments and appendices thereto and all documents incorporated by reference therein.
- 1.3 "Contract Price" means the price payable to the Contractor under the Contract for the full and proper performance of its contractual obligations.
- 1.4 "Goods" means all the equipment, which the Contractor is required to supply to the Authority under the Contract.
- 1.5 "Contractor" means the individual or firm carrying out works as defined under Scope of Works.
- 1.6 "Site" means the place where the equipment will be installed, as stated in the Schedules.
- 1.7 "Engineer" means the General Manager Generation of the Authority or his representative authorised in writing by him.

### **2.0 APPLICATION**

These General Conditions shall have effect, subject to any express stipulation or condition at variance with these conditions that may be contained in the specification or may otherwise be incorporated in the contract.

### **3.0 STANDARDS**

The Goods supplied under this Contract shall conform to international ISO / DIN standards for mechanical and IEC standards for electrical work.

### **4.0 CONTRACT AGREEMENT**

Notwithstanding the formation of the contract by the Authority's acceptance of the Contractor's tender in writing, the Contractor and the Authority shall, within 30 days of such acceptance, enter into and execute a Contract Agreement.

### **5.0 PERFORMANCE BOND**

- 5.1 Within 21 days after the Contractor's receipt of notification of award of the contract or upon contract signing and down payment, the Contractor shall furnish a performance bond to the Authority in the amount of 10% of the tendered price.
- 5.2 The proceeds of the performance bond shall be payable to the Authority as compensation for any loss resulting from the Contractor's failure to complete its performance obligations under the Contract.
- 5.3 The performance bond shall be denominated in the currency of the Contract or in another freely convertible currency acceptable to the Authority, and shall be in one of the following forms:
  - a) A performance bond issued by a surety acceptable to the Authority, and in the form provided in the Tender Documents.

- b) A Bank Guarantee issued by a bank located in the Authority's country or abroad acceptable to the Authority, and in the form provided in the Tender Documents.
  - c) A cashier's cheque, certified cheque, irrevocable letter of Credit or Cash.
- 5.4 The Performance Bond will be discharged by the Authority not later than 90 days following the date of completion of the Contractor's performance obligations, including any warranty obligations under the Contract.

## **6.0 PROGRAMME TO BE FURNISHED**

Within 20 days of the acceptance of his tender the Contractor shall submit to the Authority, for approval, a programme showing the order in which he proposes to carry out the works, including design, manufacture and delivery.

## **7.0 INSPECTION AND TESTS**

The Authority's Engineer or his representative shall have the right to inspect and/or to witness test the Goods at the factory or place of manufacture, for their conformity to the Contract Specifications. The Authority shall notify the Contractor in writing of the identity of its Engineer(s) or representative(s) retained for these purposes. The contractor shall provide the authority with a detailed program for the inspections and/or witness tests and notice of at least 3 weeks of notice when the materials, equipment, system shall be ready for inspection & testing. Nothing in this clause shall in any way release the Contractor from any warranty or other obligations under this Contract in delivering a fully functional plant as specified elsewhere in this document or the contractors' design and specifications.

## **8.0 PACKING**

- 8.1 The Contractor shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to Fiji. Each component or item shall be suitably packaged & sealed to withstand tropical weather conditions. The packing shall be sufficient to withstand, rough handling during transit and exposure to extreme temperatures, salt, high humidity and precipitation during transit and open storage.
- 8.2 The packing, labeling and documentation within and outside the package shall comply strictly with such special requirements as shall be expressly provided for in the Contract and, in any subsequent instructions ordered by the Authority.
- 8.3 Nothing in this clause and the contract documents shall in any way release the Contractor from any warranty or other obligations under this Contract in case of deterioration or damage until the entire plant and facility has been certified as complete by the Authority.

## **9.0 INSURANCE**

The contractor shall provide for 100% insurance cover for the equipment supply, transport and contractor's personnel, including third-party liabilities and Contractors All Risk (CAR) insurance for the equipment scope and consequential damage insurance to existing facilities due to contractor activity/negligence. They shall include the Authority and their representatives as co-insured and hold them harmless from all liabilities and claims.

## **10.0 DELIVERY**

Delivery for the complete Scope of Supply (Goods) shall be to Delivered Duty Unpaid (DDU) to Suva Port complete with all required auxiliary and ancillary equipment.

## **11.0 TRANSPORTATION**

The Contractor is required under the Contract to deliver the Goods (complete equipment scope) Delivered Duty Unpaid (DDU), per Incoterms 2000, to the Suva Dock , Suva, Fiji Islands. Costs associated with carriage and risk thereof shall be included in the Contract Price. Normal Port of Entry shall be Suva.

## **12.0 PAYMENT**

Payment shall be on a percentage of completion basis up to 90% of contract sum till initial commissioning date, 5% retention till successful completion of site tests and final 5% retention after warranty period expires. Payment will be net 10 working days after receipt of invoice-milestone of completion against a mutually agreeable irrevocable Letter of Credit.

12.1 The Contractor's request for payment shall be made to the Authority in writing, accompanied by invoice(s) describing as appropriate, the Goods delivered and services performed together with shipping and other documents as may be required by the Authority. Payments shall be made promptly within ten (10) days, but no later than thirty (30) days of submission of an invoice/claim made by the Contractor, upon approval of the invoice.

12.2 In case there is any dispute on the percentage completion or the amount of work accomplished, the authority shall inform the contractor within 10 days for revision of the invoice.

## **13.0 PRICES**

Prices charged by the Contractor for Goods delivered under the Contract shall not, with the exception of any price adjustments authorised under Clause 14, vary from the prices quoted by the Contractor in his bid. Contractor shall note that no price variation shall be effective unless and until it has been approved by the Authority in writing.

## **14.0 CHANGE ORDERS**

14.1 The Authority may at any time, by written order given to the Contractor, make changes within the general scope of the Contract any one or more of the following :

- a) Drawings, Designs or Specifications.
- b) Where the goods that are to be furnished under the Contract needs to be modified by the Authority.
- c) The method of shipment or packing.
- d) The place of delivery.

14.2 If any such change causes an increase or decrease in the cost of, or the time required for the Contractor's performance of any part of the work under the Contract Price or Delivery Schedule, or both, the Contract shall accordingly be amended. Any claim by the Contractor for adjustment under

this Clause must be issued to the Authority within thirty days from the date of the Contractor's receipt of the Authority's change order.

## **15.0 DELAYS IN THE SUPPLIER'S PERFORMANCE**

15.1 Delivery of the Goods, installation & commissioning shall be made by the Contractor in accordance with time schedule specified by the Contractor in his tender. The preliminary schedule provided in the tender shall form the basis of the detailed program as indicated in item # 6.

15.2 An unexecuted prolonged delay by the Contractor in the performance of his delivery obligations shall render the Contractor liable for any or all of the following sanctions, damages, forfeiture of its performance security, and/or termination of the Contract for default.

15.3 If at any time during the performance of the Contract, the Contractor should encounter conditions impacting timely performance of the work. The Contractor shall immediately notify the Authority in writing of any delays, its likely duration and its cause(s). As soon as practicable after receipt of the Contractor's notice, the Authority shall evaluate the Contractor's case and determine if an extension in time for performance of the contract is justifiable. Any extension granted shall be ratified by both parties by an amendment to the Contract. Unless the extension and changes in performance has been duly authorized by the Authority in writing, the delay shall be at the Contractor's risk.

## **16.0 TERMINATION FOR DEFAULT**

16.1 The Authority may, without prejudice to any other remedy for breach of Contract, by written notice of default sent to the Contractor, terminate this Contract on the following grounds :

- a) If the Contractor 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 Authority.
- b) Fails to perform any other obligation(s) under the Contract.
- c) If the Contractor fails to comply within a period of ten days (or any such period as the Authority may authorise in writing) after receipt of default notice from the Authority.

## **17.0 FORCE MAJEURE**

Notwithstanding the provisions of Clause 15 & 16 the Contractor 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

In this Clause *Force Majeure* means any event or circumstance (whether arising from natural causes, human agency or otherwise) beyond the control of the Contractor including (in so far as beyond such control but without prejudice to the generality of the foregoing expression) strikes, lockouts or other labour disputes, riot, civil commotion, aircraft fire, flood, drought loss, delay at sea, breakdown or war.

## **18.0 LANGUAGE**

The Contract shall be written in the English language. Subject to Clause 19, the language version of the Contract shall govern its interpretation. All literature, corresponding and other documents pertaining to the Contract which are exchanged by the parties shall be written in that same language.

## **19.0 APPLICABLE LAW**

The Contract shall be interpreted in accordance with the laws of Fiji.

## **20.0 ARBITRATION**

All questions or differences what so ever which may at any time hereafter arise between the parties hereto or their respective representatives attached to this agreement or the subject matter or construction hereof or the rights and duties of the parties hereunder, shall be referred to a single arbitrator if the parties agree or otherwise, to four arbitrators, one to be appointed by each party and in either case, in accordance with and subject to the provisions of the Arbitration Act Cap. 38 of the Laws of Fiji or of any statutory modification or re-enactment thereof for the time being in force. Such person to be an arbitrator will be nominated by the Fiji Institute of Engineers.

## **21.0 NOTICES**

21.1 Any notice given by one party to the other, pursuant to this Contract shall be sent in writing or facsimile to the address specified for that purpose in the Contract.

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

## **22.0 ACCEPTANCE OR REJECTION OF TENDER**

The Authority shall not be bound to accept the lowest or any tender nor assign any reason for the rejection of a tender and reserves the right to waive any formality in the tender.

## **23.0 WARRANTY**

23.1 The Contractor warrants that all Goods supplied, installed and commissioned under this Contract shall have no defect arising from material used, workmanship or from any act or omission of the Contractor, that may develop under normal use of the supplied Goods in the conditions prevailing in the country of final destination.

23.2 The Contractor shall clearly specify the Warranty period of the installed and commissioned Goods supplied under this contract and such period shall be referred to as the Warranty and shall not be any period less than 12 months from the date of commissioning (Formal or Official acceptance of the completed installation by the Authority). The contractor shall ensure that the equipment supplied under this Contract shall operate within specified guaranteed performance levels during the warranty period.

23.3 The Authority shall promptly notify the Contractor in writing of any claims arising under this Warranty. Upon receipt of such notice, the Contractor shall, with all reasonable speed, repair or replace the defective Goods or parts thereof, including transport, duty, and local Fiji charges, without any cost to the Authority.

## **24 GENERAL CONDITIONS`**

General conditions of this contract shall be governed by the Built & Turnkey of the Federation Internationale Des Ingenieurs Conseil (FIDIC), Green Book. (Copies can be obtained from FIDIC PO Box 86 CH 1000 Lausanne, 12 Switzerland. Fax 41-21-653 5432)

## **PART 1 INFORMATION TO TENDERERS**

### **1. NAME AND ADDRESS OF PURCHASER**

Fiji Electricity Authority  
Private Mail Bag  
Suva  
**FIJI**

### **2. SCOPE OF WORKS**

Refer to part section 2 in part 4 - technical specifications.

### **3. CONDITIONS OF CONTRACT**

The conditions of Contract included with this tender document in conjunction with General Conditions of Contract apply to this contract.

### **4. TENDER DOCUMENTS**

I) Tender documents comprises of :

- a) General Conditions of Contract
- b) Information to tenderers
- c) Condition of Tendering
- d) Specifications
- e) Schedules
- f) Form of Tender
- g) Price Schedule

### **5. CLOSING DATE OF TENDERS**

The tender closes at Noon on Wednesday, 23<sup>rd</sup> November 2016.

### **6. ADDRESSEE AND ADDRESS FOR POSTED TENDERS**

The Secretary - Tender Committee  
Fiji Electricity Authority  
Private Mail Bag  
Suva  
**FIJI**

### **7. ADDRESS AND PLACE OF DELIVERY FOR TENDERS**

The Secretary - Tender Committee  
Fiji Electricity Authority  
Head Office  
Suva, FIJI

**DRAFT FORM OF AGREEMENT**  
(Not to be completed with the Tender)

THIS AGREEMENT made the.....day of.....2015... BETWEEN the FIJI ELECTRICITY AUTHORITY of Private Mail Bag, Suva, FIJI (hereunder called "the Authority") of the one part, AND..... of..... (hereunder called "the Contractor") of the other part.

WHEREAS the Authority is desirous that certain work should be provided and executed, viz. Design, supply delivery, installation, site testing and commissioning of 1 (one) only Main 415V Switch board for Wailoa Power Station and has accepted a Tender by the Contractor for the provision execution and supply of such works.

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement, words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of the Contract.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement, namely :
  - a) The said Tender
  - b) The letter of Acceptance of Tender
  - c) The Conditions of Contract
  - d) The Specifications, Schedules and Drawings including any amendments, clarifications issued until the close of the tender.
  - e) The Form of Tender
  - f) Any variations to any of the above that has been agreed by the Authority and the Contractor.
3. In consideration of the payments to be made by the Authority to the Contractor, the Contractor hereby covenants with the Authority to provide, execute, complete and maintain the works in conformity in all respects with the provisions of the Contract.
4. The Authority hereby covenants to pay the Contractor in consideration of the provision, execution, completion and maintenance of the Works at the Contract Price at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have cause their respective Common Seals to be hereunto affixed (or have hereunto set their respective hands and seals) the day and year first above written.

The Common Seal of  
was hereunto affixed in the presence of :  
or  
Signed Sealed and Delivered by the said  
in the presence of :

**FIJI ELECTRICITY AUTHORITY**  
**Main 415V Switchboard for Wailoa Power Station**  
(Note: Tenderers are not required to fill in this form)

**FORM OF PERFORMANCE BOND**

BY THIS BOND We,.....  
whose principal place of business (registered office) is at .....  
(hereinafter called "the Contractor") and .....whose principal place of  
business (registered office) is at .....  
(hereafter called "the Sureties") are held and firmly bound unto the FIJI ELECTRICITY AUTHORITY a statutory  
body established under the provisions of the Electricity Act Cap 180 (hereinafter called "The Authority") in the sum  
of.....  
(.....) for payment of which sum the Contractor and the Sureties bind themselves and their assigns  
jointly and severally by these presents.

Sealed with our respective seals and dated this ..... day of .....2015..

WHEREAS the Contractor by an Agreement made between the Authority of the one part and the Contractor of the  
other part has entered into a Contract (hereinafter called "the said Contract") to design, supply deliver, install, site  
test and commissioning of 1 (one) only Main 415V Switchboard for Wailoa Power Station, has accepted a Tender  
by the Contractor for the provision execution and supply of such works.

NOW THE CONDITION of the above written Bond is such that if the Contractor shall duly perform and observe all  
the terms, provision, conditions stipulated in the said Contract on the Contractor's part to be performed and observed  
according to the true purport intent and meaning thereof or if on default by the Contractor the Sureties shall satisfy  
and discharge the damages sustained by the Authority thereby up to the amount of the above written Bond, then this  
obligation shall be null and void but otherwise shall be and remain in full force and effect but no alteration in terms  
of the said Contract or in the extent or nature of the Works thereunder or in respect of the obligations to correct  
defects thereunder and no allowance of time by the Authority under the said Contract nor any forbearance or  
forgiveness in or in respect of any matter or thing concerning the said Contract on the part of the Authority shall in  
any way release the Sureties from any liability under the above written Bond.  
Provided always that the above obligation of the Sureties to satisfy and discharge the damages sustained by the  
Authority shall arise only under one or both of the following :

- a) on written notice from both the Authority and the Contractor that the Authority and the Contractor have  
mutually agreed that the amount of damages concerned is payable to the Authority and such damages shall  
have been paid to the Authority.
- b) on receipt of the Sureties of a legally certified copy of an award issued in arbitration proceedings carried  
out in conformity with the terms of the said Contract that the amount of the damages is payable to the  
Authority, and such damages awarded shall have been paid to the Authority.

The Common Seal of .....  
.....

was hereunto affixed in the presence of :

Signature : .....  
Position : .....  
Address : .....  
.....

The Common Seal of .....  
.....

was hereunto affixed in the presence of :

Signature : .....  
Position : .....  
Address : .....  
.....

## PART 2

## CONDITIONS OF TENDERING

For the Design, supply, delivery, commissioning and provide the necessary warranties and guarantees for a safe and long-term reliable operation of one(1) x 415V Switchboard complete with associated required accessories as per specification, for Fiji Electricity Authority.

### 1. TENDER DOCUMENTS

- I) One set of the Tender is provided electronically to prospective tenderers and further copies of the documents will be provided by the Authority on request in writing from Tenderers.
- ii) Tenders are to be submitted in the standard form of Tender provided and are to be accompanied by the full Tender documents with all Schedules duly completed together with all additional information and drawings required by the Specification. In addition to all information which the specification requires to be included with the Tender, Tenderers may also include any additional information which they consider necessary to explain and support their tender.
- iii) Where a Tenderer wishes to submit a Tender which significantly deviates from this specification, he shall submit one tender which conforms with the Tender documents marked "Original Tender", together with other tenders as the Tenderer may wish to submit marked "Alternative Tender No.....". Each alternative Tender shall describe clearly the manner and extent to which it departs from the conforming Tender.
- iv) ***A site visit is compulsory for all Bidders and is scheduled for Friday 11<sup>th</sup> of November 2016 at 10am at Vuda Power Station.***
- v) All Tenders are to remain open for acceptance for a period of 90 days from the date on closing of tender.

### 2. LODGEMENT OF TENDERS

- 2.1 Tender submitted shall be complete in every respect including Tenderer's drawings and any technical literature the Tenderer may wish to submit to explain his proposal. Where a Tenderer wishes to submit a conforming tender and an alternate tender(s), the conforming tender shall be clearly marked "Original" and the non conforming, "Alternate Tender".
- 2.2 All tender documents are to be sent to the Secretary Tender Committee through the website:

**[www.evalua.com.au/fea](http://www.evalua.com.au/fea)**

- 2.3 Any tender received after the stipulated bid closing date and time will be returned unopened to the Tenderer.

### 3. TENDER PRICES

For the purpose of comparison, the tender prices shall be converted into Fijian Currency at the exchange rates prevailing as of the date of opening of Tenders.

4. All tenders will be opened at the Head Office of the Fiji Electricity Authority, 2 Marlow Street, Suva at **1400 hours 24/11/2016** by the Secretary, Fiji Electricity Authority Tender Committee in the presence of three other responsible officers.

5. **ACCEPTANCE OF TENDERS**

The Purchaser shall not be bound to accept the lowest or any tender. A Tender shall not be deemed to be accepted unless and until notice in writing is handed by the Purchaser to the Tenderer or is posted by the Purchaser to the Tenderer at the address appearing on his Tender.

6. **ACCURACY**

No alterations to the tenderer shall be made after the date for lodging tenders. The Purchaser accepts no responsibility for the accuracy of any tender.

7. **EXPLANATIONS**

If the Tender needs any clarifications, he should make his inquiry in writing to :

Mr Tuvitu Delairewa  
The Supply Chain Manager  
Fiji Electricity Authority  
Private Mail Bag  
Suva

**FIJI**

Telephone : (679) 3311 133

Fax : (679) 3311882

e-mail: TDelairewa@fea.com.fj

All explanations to the clarifications shall be answered in writing.

# **Vuda Power Station**

## **MCC 415V Switchboard and Engine Control Panel Replacement for G1 and G2**

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and New Control Panel**

## **Annex C**

**Technical requirements to AS/NZS 3439.1**

## **1 General Requirements**

### **1.1 Location**

The new MCC switchboard and the new. Control Panels are to be installed at the Vuda Power Station owned by Fiji Electricity Authority (FEA) and operated by Contractor Penix Fiji. Vuda Power Station is situated South and about 10 km from Lautoka City.

Vuda Power Station is located beside the Fiji Electricity Authority Control Center and houses four diesel driven Engine, 2 x 6MW Wartsila Engine and 2 x 5MW Mirrless Engine.

## 1.2 Scope

The scope of the works shall comprise the design, manufacture, factory testing (witnessed by the Purchaser, or its representatives), delivery to site, installation and commissioning of the following equipment to replace the existing G1 and G2 Motor Control Center (MCC) switchboard and 2 x New Control Panels that is to control G1 and G2 Mirlees Generator in accordance with the Contract and manufacturing requirements of AS, NZS and IEC standards.

- 2x new MCC Panel to supply all the auxiliaries for the two Mirrlees Blackstone Generator
- 2x new Control Panel similar to existing, and used to control the two Mirrlees Generators G1 and G2
- 2x DC Supply system to supply both new Control Panel and New MCC. One for each Mirrlees Blackstone Generator

Scope includes the supply of;

- One set of spare parts;
- Four sets of installation, operation and maintenance manuals, as well as all relevant drawings, plus one electronic copy of the manual and drawings;

The requirements for the installation and commissioning are covered under Section 3 of this technical specification.

The new MCC switchboard and new Control Panel shall be located in the same location as the existing boards/panels.

The Contractor/Bidder is to upgrade or change all the outgoing existing motor cables as these may be short to be connected to the new MCC.

The new MCC 415V switchboards should be manufactured into two or three sections to ease the logistic of removing the old and installing the new board.

The Contractor shall be responsible for the following requirements:

### **Motor Control Center ( MCC) Panels x 2**

1. The redesign and providing calculations for the busbar rating and short circuit current ratings using the existing ratings as shown on the annexed schematic drawing No. 1OE 31004 (FEA Drg No. 10-E31-004)
2. Existing Motor Starters are DOL but Bidders should consider Soft Starters for the high ampere motor circuit.
3. The determination of current rating and protection for all outgoing circuit from the MCC should use existing as reference.

4. Provide provision for remote start and stop of all Motors Starters should be also provided.
5. Provision of a more advance control system will be an advantage.
6. The Bidder shall provide details for the Supply of;
  - a) Two complete 415V MCC switchgear indoor metalclad switchboard equipped with withdrawable main circuit breakers for isolation during maintenance.
7. Provide a work schedule for this project which includes the installation and commissioning.
8. Existing MCC Panel Dimension is W-500mm, L-3550mm, H-2300.
9. Provide
  - Power, control and instrumentation cables and cable support system;
  - Provide replacement of existing cables for all auxiliary motors
  - All necessary accessories.

### **New Control Panels x 2**

1. Redesign of the Engine controls, indications, instrumentation of these two Blackstone Mirrlees Engines.
2. The redesign will include the replacement of field switches/devices on the engine such as Pressure switches, Temperature switches, Level switches, flow switches, Speed monitoring, thermocouples and any other device that is required to be displayed on this panel. This includes associated device cables.
3. A PLC control design is required and this should include local Display on the Panel and a Remote Scada system that displays both Blackstone Mirrlees Engines parameters and controls. The Scada will be placed in the Control Station Booth.
4. The PLC should be of Modicon or Schneider PLCs with Scada.
5. The new Controls should be able to control the auxiliary motors on the MCC on Manual/Automatic modes and also start the Generator on Remote Auto Start/Stop Mode in a sequence listed in the attached Annex document (Description of Remote Automatic Start/Stop Circuit Operation).
- 6.

### **1.3 Delivery**

The new 415V MCC switchboards and new Control Panels shall be delivered to Vuda power station, installed and commissioned according to Standard mentioned in this document.

### **1.4 Existing Drawings Supply Characteristics**

The information on the existing MCC and AMOT Panels , instrument electrical diagram, is included in Annex A of this document.

#### MCC Panel Drawings;

1. Layout Panel Drg No. 10E31004 (FEA Drg No. 10-E31-004)
2. Sample for the Motor Control Cct Drg No. 10E13036 (FEA Drg No. 10-E13-036)
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#### Control Panel Drawings

1. 10E31040 (FEA Drg No. 10-E13-040)
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3. 10E31041 (FEA Drg No. 10-E13-041)

4. 10E31042 (FEA Drg No. 10-E13-042)
5. 10E31043 (FEA Drg No. 10-E13-043)
6. 10E31044 (FEA Drg No. 10-E13-044)
- 7.

## 1.5 Climate

The following service conditions will apply

- Ambient temperature 10°C to + 40°C;
- 100 % humidity with rapid temperature drop can occur;
- The altitude is less than 100m asl;
- Earthquakes can be expected.
- Rainy season is over the October-March period.

## 1.6 Standards

The equipment shall comply with the requirement of the latest revisions of the following standards, as applicable and the equivalent AS/NZS where available. In case of deviation between the IEC, ANSI and IEEE standards and the AS/NZS standards, the latter will take precedence.

IEC 60044	Instrument transformers;
IEC 60144	Degrees of protection of enclosures for low voltage switchgear and control gear;
IEC 60185	Current Transformers;
IEC 60664	Insulation co-ordination
AS/NZS 3439	LV Switchgear and control gear assemblies, including metal-enclosed bus;

## 1.7 Drawings

### Specification drawings

The contract drawings shall be of the attached specimen in Annex B

### Contract drawings

Contract drawings shall be provided by the Contractor to the Engineer to the Contract not later than four weeks after the contract award and shall include:

- a. Fully dimensioned outline and layout drawings of the equipment.
- b. Construction and assembly drawings showing details of the equipment including complete panel mounting details, electrical wiring, terminal blocks, electrical power connections and instrumentation.
- c. Diagrams of all electronic and electrical circuits contained in the equipment.
- d. Design calculations.

All the drawings prepared by the Contractor must comply with the FEA Drafting Specification for New Plant (see Annex B).

All drawings shall be A2, A3 and A4 standard sizes and in addition to the drawing title an information block shall be shown near the lower right hand corner to contain the following entries:

- Specification No.
- Contract No.

- Drawing approved
- Drawing approved subject to statutory approval
- Approval not required
- Provisional approval as noted. Design/Manufacture may proceed
- Not approved
- Date
- Space for Project Manager signature

### **1.8 Design Suitability**

It shall be the Contractor's responsibility to implement the design requirements and objectives of the specification. Where the specification does not cover an aspect of the equipment design, the Contractor, in consultation with FEA, shall use a design that ensures correct and reliable operation.

The contractor shall assume full responsibility for the correct operation of the equipment.

Design work shall include, but is not limited to:

- a) Provision of an overall programme.
- b) A detailed Commissioning Plan to coordinate all required tests and inspections with the commissioning programme.
- c) Layout drawings for the cubicles, cables routes, etc
- d) Cable schedules
- e) I/O list
- f) Updating FEA drawing files and as built station drawings
- g) Liaison with FEA representative for protection, control, and instrumentation.

Upon completing the draft design the Contractor shall submit the relevant documentation to the Engineer to the Contract who will convene a design review and Hazop meeting to verify that the design meets the objectives of the upgrading project. The Contractor shall address any deviation, or requirement identified through the design review meeting.

### **1.9 Manufacturing Programme and Progress Reporting**

The Contractor shall supply to the FEA, not later than two weeks after contract award date, a manufacturing programme showing the proposed progress of drawings, manufacture, delivery of equipment and installation/commissioning.

The contractor shall submit two copies of a brief and concise monthly progress report covering:

- (i) The state of progress in manufacture and installation as measured against the approved Manufacturing and Installation Programme.
- (ii) A statement of any delays and reasons why they have occurred.
- (iii) An assessment of the effect of such delays on the attainment of the approved Manufacturing and Installation Programme (not necessarily solely contractual key dates).
- (iv) A statement of the measure, which has been taken or is proposed to eliminate or at least minimize the effect of the delay.

### **1.10 Inspection and Test Plan**

The Contractor shall submit for approval not later than 2 weeks from acceptance date of the tender, two copies of an inspection and test plan (and every subsequent changes).

If at any time during the execution of the Contract, it is found necessary to modify the inspections and test plan, then the Contractor shall submit a revised plan to FEA representative for approval.

### **1.11 Instruction Manuals**

The contractor shall supply four copies of an installation, operation and maintenance manual at, or prior to, the time of the delivery. These manuals shall contain all the information necessary for the erection, installation, commissioning, operation and maintenance of the equipment and shall include copies of the technical descriptions of all other manufacture's items used.

The manuals shall be as simple and as clear as possible, fully illustrated with drawings and diagrams as necessary and detailed with part numbers for ordering replacements.

The manuals shall be submitted as an electronic copy as well.

In addition the manual shall contain the data sheets of all the parts used, suitable for identification and ordering purposes.

## **2. New MCC Board and New Control Panel** **Technical Requirements**

### **2.1 General Requirements – Motor Control Center (MCC)**

#### **2.1.1 Scope of Contract**

The equipment required to be supplied under this part of the contract consists of:

- a) 2 x Motor Control Center (MCC) 415V switchboard
- b) Recommended spare parts.
- c) Special erection and maintenance tools.
- d) Installation, operation and maintenance manuals.

#### **2.1.2 Service**

The switchboard is to be located inside the Vuda powerhouse will provide power supply to all auxiliary motors for G1 and G2. These two generators are Mirrlees Blackstone Generators.

The following are the listed auxiliaries connected to one MCC;

<b>Motor Description</b>	<b>Rating in HP</b>	<b>Rating in KW</b>	<b>Amps</b>
Main Incomer Circuit Breaker			800
Jacket Water Pump	30	22.37	74.69
Air Compressor	7.5	5.6	18.70
LuB Oil Purifier	5.5	4.1	13.69

L.F.Pressure Pump	1.5	1.12	3.74
Line Heaters		18	60.10
Valve Cage Pump	10	7.46	24.91
Lub Oil Priming Pump	15	11.185	37.34
Anti Condensation Heaters			30
Crankase Fan	2	1.5	5.01
Lub Oil Radiator - Fan No6	20	14.912	49.79
Lub Oil Radiator - Fan No5	20	14.912	49.79
Air/Air Radiator - Fan No4	15	11.185	37.34
Air/Air Radiator - Fan No3	15	11.185	37.34
Air/Air Radiator - Fan No2	15	11.185	37.34
Air/Air Radiator - Fan No1	15	11.185	37.34
Jacket Water Radiator Fan No7	40	29.83	99.60
Jacket Water Radiator Fan No8	40	29.83	99.60
Feeder TP&N			30
Feeder TP&N			30
Barring Gear	3	2.24	7.48
		Total	783.80

The exact single drawings for the existing MCC is not available because this Power Station has been in operation for the last 30+ years and documentation of some equipment cannot be located. The design of the new MCC panel should be of standard mentioned in this document.

The Auxiliaries are programmed to start one at a time if the control mode is in Automatic. Remote modes of control should be also provided. Manual modes of starting and stopping are also to be provided on each aux panel. Any over current trip should lockout the controls and can only be restarted once the trip lockout is manually reset.

The control for each Auxiliary Motor should have their respective protection as per ASNZ or IEEC standard mentioned in this document.

## **2.1.1.0 General Requirements – New Generator Control Panel**

### **2.1.1.1 Scope of Contract**

The equipment required to be supplied under this part of the contract consists of:

- a) 2 x new Control Panel Design.
- b) Replacement of Field devices such as Pressure switches, Temperature switches, Level switches, Flow switches and thermocouples.
- c) Replacement of all aux motor supply cables from the MCC to each motor.
- d) 2 x new DC Control System for the new Control Panel and new MCC panel
- b) Recommended spare parts.
- c) Special erection and maintenance tools.
- d) Installation, operation and maintenance manuals.

### **2.1.1.2 Service**

The switchboard is to be located inside the Vuda powerhouse will provide power supply to all auxiliary motors for G1 and G2. These two generators are Mirrlees Blackstone Generators.

### **2.1.1.3 Seismic Strength**

The equipment will be installed in an area subject to earthquakes and shall withstand without damage or malfunction the most adverse combination of the following forces:

- Forced produced by the equipment own weight.
- Earthquake induced forces giving rise to horizontal and vertical accelerations of 0.75g acting through the centre of mass of the equipment. Both horizontal and vertical motions shall be combined to provide the most adverse effect unless it can be shown that there is insignificant interaction between the horizontal and the vertical motions of the equipment response.
- Electromagnetic and mechanical forces produced over the full range of the equipment operating capability.

Individual vibration sensitive components forming part of the equipment must be able to withstand induced loads resulting from periodic vibration having an acceleration of 0.75g over the frequency range of 1Hz to 15Hz.

All components shall be securely fastened into place. Provision shall be made to mechanically restraining all plug-in, or withdrawable devices and modular elements.

### **2.1.4 Drawings**

#### Specification drawings

The drawings listed under Section 1.7 and 2.1.2 above are relevant to this part of the specification and are in Annex A.

#### Contract drawings

Contract drawings shall be provided by the Contractor to the Engineer to the Contract not later than four weeks from the contract award and shall include:

- a. Fully dimensioned outline and layout drawings of the equipment
- b. Busbar general arrangement, Layout and footprint drawings
- c. Construction and assembly drawings showing details of the equipment including complete panel mounting details, electrical wiring, terminal blocks, power connections and instrumentation
- d. Diagrams of all electric and electronic circuits contained in the equipment.
- e. Design calculations (fault calculations, cable sizing, load list, load analysis, etc)
- f. Protective device coordination and protection relay settings.

All the drawings prepared by the Contractor must comply with the FEA Drafting Specification for New Plant (see Annex B).

All drawings shall be A2, A3 and A4 standard sizes and in addition to the drawing title an information block shall be shown near the lower right hand corner to contain the following entries:

- Specification No.
- Contract No.
- Drawing approved

- Drawing approved subject to statutory approval
- Approval not required
- Provisional approval as noted. Design/Manufacture may proceed
- Not approved
- Date
- Space for Project Manager signature

### **2.1.5 Design Suitability**

It shall be the Contractor's responsibility to implement the design requirements and objectives of the specification. Where the specification does not cover an aspect of the equipment design, the Contractor shall use a design that ensures correct and reliable operation.

The contractor shall assume full responsibility for the reliable operation of the equipment.

### **2.1.6 Manufacturing Programme**

The Contractor shall supply to the Engineer to the Contract, not later than two weeks from contract award date, a manufacturing programme showing the proposed progress of drawings, manufacture and delivery of equipment.

### **2.1.7 Instruction Manuals**

The contractor shall supply four copies of an installation, operation and maintenance manual at, or prior to, the time of the delivery. These manuals shall contain all the information necessary for the erection, installation, commissioning, operation and maintenance of the equipment supplied by the Contractor and shall include copies of the technical descriptions of all other manufacture's items used.

In addition the manual shall contain the data sheets of all the parts used, suitable for identification and ordering purposes

### **2.1.8 Training**

The Contractor is required to provide training to 10 FEA personnel on;

1. the operation of the switchboard with related interlocks
2. switchgear operation
3. PLC reloading of software and work file
- 4.

### **2.1.9 Spares**

The following should be included in the scope of equipment supply;

1. All ratings of thermal Protection and contactor used
2. All types of indications used
3. All types of switches used

## **2.2 Technical Requirements**

### **2.2.1 Standards**

The equipment supplied shall meet the following standards.

AS/NZS 3439 – Low voltage switchgear and control gear assemblies

AS/NZS 3497 – Low voltage switchgear and control gear

AS 1939 – Classification of degree of enclosure protection  
IEC 6044-1, 2 – Instrument transformers

All electrical apparatus, materials and wiring shall comply with the AS/NZS 3439.1 Electrical Wiring Regulations as applicable. Equipment built to other standards will be accepted providing that in the opinion of the Engineer to the Contract they meet or surpass the above standards. Full details of the standard used shall be provided in the tender submitted.

## 2.2.2

### 2.2.3 MCC Switchboard

The location of the MCC 415V station switchboard is on the main generator floor corridor beside each Mirrlees Blackstone Generators.

The switchboard shall have a neat and uniform appearance and the layout of the equipment mounted on the panel fronts shall follow the logical pattern for ease of identification and maintenance.

The available space dimensions of the existing 415V main switchboard are: 2.3m(H)x3.55 m(L)x0.5m(D) if it is shifted preassembled into place.

The switchboard shall be equipped with explosion vents through the top and shall be capable of preventing any internal arcing fault being propagated beyond the compartment in which it occurs. The switchboard shall be designed to ensure the safety of personnel standing in front of the switchboards during an internal arcing fault. The incomer to the MCC 415V Board shall be a Circuit Breaker rated to replace as per existing isolating switch.

The switchboard shall be manufactured to a design successfully tested to the standard requirement of internal arcing fault test to AS/NZS 3439.1.

The switchboard shall have a form of segregation Form 3b, or Form 4 to AS/NZS 3439.1 Annex ZD. The switchgear shall conform to Type 2 coordination as per AS/NZS 3947.

The Switchboard shall be mounted on Anti Vibration devices

The switchboard and equipment must be fully type tested in accordance with the relevant standards.

The existing MCC switchboard is rated for 415V, 3-phase, 4 wire, 50Hz and 1200A continuous, with a short-time withstand capability of 51kA for 1 seconds. However the Contractor shall submit, as a part of the design, the calculation for determining the 415V busbar maximum short circuit current under the worst case scenario. Existing rating is listed on Drg No. 10E31004 (FEA Drg No. 10-E31-004) in Annexed A

Provisions shall be made for connecting temporary earthing leads to the incoming cable terminations.

The Contractor shall design the switchboard for maximum continuity of supply so as to ensure that it is capable of a very high level of availability and reliability, given its vital function for the operation and safety of the power station.

Specific technical requirements in accordance with AS/NZS 3439.1 are included in Annex C.

***The contractor shall include in his proposal an optional arcing detector in the busbar compartment.***

### **2.2.3.1 New Control Panel**

The drawing for the existing AMOT generator Control Panel is listed in the drawings Annexed A, Drg No. 10E31008 (Blackstone Drg No. 153546).

The new Control Panel shall be mounted on Anti Vibration devices

All instrumentation requirement are listed in this drawings with the existing panel dimensions.

Below are Pressure switches, Temperature switches, Flow switches and Level switches for the Generator Controls to be upgrade/replaced. There are also pressure gauges listed in the attached drawings that will be also required for upgrading or by use of other

<b>Description</b>	<b>Settings</b>		
<b>Pressure Switches</b>			
Lub Oil Inlet pressure	Low	Alarm	Shutdown
Lub Oil Filter Differential Press	High	Alarm	
Pedestal Bearing Lub Oil Press Low	Low	Alarm	Shutdown
Starting Air Pressure	Low	Alarm	
Air Filter Diff Pressure	High	Alarm	
<b>Temperature Switches</b>			
Lub Oil Inlet Temperature	High	Alarm	Shutdown
Lub Oil Inlet Temperature	High	Alarm	Shutdown
Valve Cage Water Inlet Temp	High	Alarm	Shutdown
Valve Cage Water Outlet Temp	High	Alarm	Shutdown
Jacket Water Outlet Temp	High	Alarm	
Heavy Fuel Temp	Low	Alarm	
<b>Level Switches</b>			
Jacket Water Flow Low	Low	Alarm	
Valve Cage Water Head Tank Level	Low	Alarm	
Lub Oil Sump Level Low	Low	Alarm	
Light Fuel Service Tank Level	Low	Alarm	
<b>Flow Switches</b>			
Charge Air Radiator Cooling Air Flow	Low	Alarm	
Valve Cage Water Outlet Flow	Low	Alarm	

The Generator control philosophy/mode for these two Generators are described on attached PDF file "Gencont" and also attached drawing No. 10E13040 (FEA No. 10-E31-040).

### **2.2.4 New MCC and Control Panel Maintainability**

It shall be possible to fully service, remove and replace existing functional units safely while the switchboard is in service and energized.

It shall also be possible to install additional functional units in spare positions on the switchboard and their associated cabling while the switchboard is in service and energized.

Visual inspection of the following equipment shall also be possible while the switchboard is in service and energized:

- Switching devices
- Conductor connections and markings
- Relay settings and indicators
- Fuse links

All circuit breakers, isolators, etc shall have provision for padlocking in the open (Off) position.

### **2.2.5 Auxiliary Power Supply**

A new dc power supply system shall be part of this contract to supply control voltage to both the New MCC and the New Control Panel.

The equipment supplied by the Contractor shall have standard protection for any DC Control System.

The dc supply at the switchboard incomers shall be monitored and alarmed for undervoltage/loss of supply conditions. Auxiliary contact shall be provided for remote alarming.

The existing DC Supply is a very old and the Contractor is required to review the existing supply. FEA is looking at having a separate DC Supply system (24 – 48V) and the Contractor is required to design this option.

### **2.2.6 415V Switchboard Components**

#### **MCC Busbars**

The busbar assembly shall be a Type Tested assembly rated 1200A.

The preferred material is hard-drawn rectangular section copper, which shall be rigidly supported and fully insulated (Rated insulation voltage 1,500V; Rated impulse insulation voltage 12kV) throughout their length with heat-shrinking material appropriately coloured for identification purposes. Tee-offs and bolted joints shall be provided with removable boots to allow inspection and Ductor testing. The neutral busbar shall be sized as the phase busbars.

The busbar system shall be completely enclosed in earthed metal chambers with removable panel fitted to give access to them. The removal of these panels shall not give access to other incoming or outgoing circuits which may be energized from their remote ends. The bus sections shall be fully segregated from each other.

Circuit phase busbars and connections shall be rated at not less than the associated switchgear.

As-built drawings showing details of the busbar general arrangement, joints, take-off points and other connections on the busbars shall be provided. All torque settings for the bolted connections shall be clearly indicated on the drawings.

Neutral and earth busbars shall be completely isolated from each other. The current carrying capacity of the neutral bars shall not be less than the current carrying capacity of the associated phase busbars. The main earth bar shall be copper with a minimum cross section of 25mmx6mm and shall run the full length of the switchboard. The main earth bar shall be capable of carrying the short time withstand current specified for a period of one seconds. Full height earth bars in cable compartments shall be provided. The earth bars shall be drilled at regular spacing for

the connection of external cabling earth conductors. Likewise full height neutral busbars in cable compartments shall be provided.

All busbar assemblies, including main horizontal and vertical runs and connections to incomer and bus tie ACBs shall be fully accessible for inspection and available with the necessary safeguards for thermal imaging. Thermal imaging is preferred to be conducted via inspection windows mounted at strategic locations on the switchboard enclosure. The inspection windows shall be type tested for arc faults within the switchboards.

#### Anti-condensation Heaters

Thermostatically controlled anti-condensation heaters shall be provided in all cable wireways, incoming feeder compartments and busbar chambers. The heaters shall be supplied from a power supply external to the switchboard. MCBs shall be used to feed the heater circuits, which shall be protected against earth leakage. Heater status indication LEDs shall be provided.

#### Factory Testing Requirements

Routine test in accordance with AS/NZS 3439 shall be carried out at the switchboard manufacturer's premises. These tests shall include the following as a minimum:

- All type test
- Ductor (micro ohm meter) test of all busbar joints, tee-offs and connections. The tests shall be complete with a detailed busbar general arrangement diagram showing all joints/connections.
- Dielectric tests
- Insulation resistance test (power and control circuits)
- Contact resistance on circuit breakers
- Functional tests on all circuit breakers
- Ratio and impedance test on all current transformers
- Earth continuity
- Functional sequence, interlocking and primary injection testing of all protective relays and devices
- Phase sequence/orientation for all busbars and feeders.

Prior to commencement of tests at the manufacturer's works the Contractor shall submit for approval of the Engineer to the contract an inspection and test plan

#### Withdrawable air circuit breakers

Each incoming feeder shall be equipped with withdrawable air circuit breaker of the triple pole unit, apart from the circuit breaker for the diesel generator, which shall be of the four pole type. Each incoming feeder circuit breaker shall be housed in a separate metal compartment.

The circuit breakers shall have the following current ratings:

Rated voltage	415Vac
Rated current	Incomers 1200A,
Rated frequency	50Hz
Short circuit breaking capacity	30kA
Short circuit making capacity	60kA
Short time withstand current	31kA for 1sec

The withdrawable circuit breakers shall have the following features:

- a) Automatic safety shutters to cover the busbar circuit connections when the circuit breaker is withdrawn. The shutters shall be provided with facility to be locked for isolation purposes. Integral earthing facilities shall be provided to effectively earth the circuit breaker frame when it is in the service position.
- b) A stored energy operation mechanism capable of being electrically and manually charged with both remote and electrical and manual control. The circuit breaker auxiliary power shall be from the 110Vdc system referred to in Section 2.2.5 of this specification. The status of the stored energy shall be indicated.
- c) Interlocks to inhibit circuit breaker closing operation until the stored energy system is sufficiently charged to close and trip the circuit breaker.
- d) Anti-pumping device to prevent re-closing of the circuit breaker after it tripped subsequent to closing and tripping on fault.
- e) Mechanical interlock to prevent disconnection of the circuit breaker from the busbars unless the circuit breaker is in the open position.
- f) Mechanical interlocks to prevent connection of the circuit breaker to the busbar unless the circuit breaker is in the open position.
- g) A clearly visible mechanical indicator to show the circuit breaker closed or open position.
- h) A circuit breaker operation counter.
- i) Auxiliary contacts as follows:
  - Four contacts that close when the circuit breaker is open
  - Four contacts that close when the circuit breaker is closed
  - Two contacts that close when the circuit breaker is in service position
  - Two contacts that open when the circuit breaker is in service position
  - Two contacts that close when the circuit breaker trip operates.

The status of the first two sets of contacts above shall remain unchanged when the circuit breaker is withdrawn. The last set of contacts above shall be provided with a reset facility. The spare circuit breaker auxiliary contacts shall be pre-wired to terminals for future use.
- j) Be interchangeable for units of the same rating.
- k) Service, test and isolated position with relevant position indicators.
- l) Lockable covers on the local manual controls
- m) Manual resetting of the circuit breaker before it can be manually re-closed.
- n) For the unit transformer circuit breakers only, an undervoltage trip and re-close inhibit on all local manual and remote electrical operation, when the supply voltage falls below 90% of the rated voltage. This relay shall be self resetting.
- o) Overcurrent and earth fault protection devices. All protection relays shall be provided with test terminal blocks to facilitate secondary injection tests. The same tests terminal blocks are also required for the Energy Meters.
- p) Switchgear local/remote control selector switch.

#### Instrument and metering

Instruments supplied with the switchboard shall comply with the requirements of IEC 60051-2. The instrument frames shall be dimensioned 96mmx96mm and have non-reflective glass and stud terminals.

Voltmeters for the incoming circuit and busbars shall be equipped with switches to be used for selecting the voltage between any two phases for indication on

the voltmeter. Each voltmeter shall be of class 1.5 accuracy and shall be scaled 0 to 500V, with the 415V value marked in red.

The ammeters shall be supplied for each incoming circuit and shall have accuracy class 1.5 and suitably scaled to match the nominal maximum current from the relevant circuit. Ammeter phase test links shall be provided in a readily accessible location.

#### Voltage failure relays

The Contractor shall supply voltage failure relays which shall operate if the voltage of one or more phases falls below 70% of the nominal phase to earth voltage of 240V for more than 0.5sec.

Each voltage failure relay is to be equipped with two normally open and two normally closed auxiliary contacts.

The voltage failure relays shall have adjustable voltage and time delay settings.

#### Current transformers

The current transformers shall comply with the requirements of BS 3938. They may be of either the bar primary, or wound primary type. All current transformers are required for operation at the rated frequency and shall have an insulation level of 2.5kV. All the old CTs in circuit shall be replaced with new ones, this including the ones for the transformer protection.

All current transformer secondary windings shall be terminated into separate terminal blocks with means of shorting the secondary windings at the terminal blocks. All current transformers shall be Class I, Class SP10, 5/10/15VA or according to Design requirement and shall have a rated secondary current of 1A.

#### Overcurrent, Under Voltage and Earth Fault protection

All incomer main circuit breakers shall be supplied with new separately mounted current transformers and overcurrent, under voltage and earth fault protection relays to provide adequate protection for the switchgear and the supply transformers.

These units shall be adjustable and sufficiently accurate to provide discrimination with each other and any branch circuit for overcurrent. The contractor shall select appropriate protection characteristics for the load types and shall be graded so that a short circuit or overload occurring in any branch is cleared by the relevant switching device without affecting the other outgoing branch circuits.

The Contractor is required to include any additional/proposed protection schemes that will add more safety to the switchboard and equipment. The Circuit Breaker in built Protection shall be used as a backup protection unit.

#### Power Energy meters

The incomers to the switchboard shall each be metered by a **Nemo HD+** capable of giving out remote metering on the switchboard. The meters shall comply with IEC 62053-11 and shall be of accuracy class 0.1 or better.

#### Terminal blocks

Terminal blocks shall comply with ESI 12-1. The preferred terminal blocks are:

Type	Application
Klippon SAK2.5	Remote control and remote indication
Klippon SAK4	General
Klippon SAK 6N	General and 240Vac circuits
Klippon SAK10	General (high current)

Klippon SAKA10      VT and CT earth links  
 Klippon EG32/1      Mounting of diodes in circuit breaker controls/protection  
 Klippon DK4          Mounting of diodes in alarm circuits.  
 The minimum thickness of terminal blocks shall be 6.5mm.  
 The trip connection shall be shielded at their terminal block by means of insulated covers.  
 Cabinets shall have at least 10 spare terminals and enough extra space on mounting bars for 20% more terminals.

## 2.2.7 MCC Switchboard and Control Panel Construction

### Cabinets

The equipment shall be constructed in free standing sheet metal cabinets suitable for top cable entry. The cabinet sheet metal work shall not be less than 2mm thick and gland mounting plates shall not be less than 3.5mm thick. Gland mounting plates shall be undrilled unpainted galvanized steel or brass for 3-phase cables, and brass or aluminum for single core cables.

The cabinets shall be provided with a base plinth being 100mm high as a minimum height.

The cabinets shall be suitable for mounting on Unistrut framework.

The switchboard panels shall be accessible on the front and on rear.

The cabinets shall comply with AS 1939. The degree of protections with the doors or covers of functional units or ducts open or removed shall not be less than IP21.

### Panel wiring, ferrules and cableways

All panel wires shall be multi-stranded copper of at least seven strands and shall have radial thickness of PVC insulation to IEC 60502-1 standard.

The minimum conductor cross sectional area shall be 1.5mm<sup>2</sup>

The wiring insulation shall be coloured in accordance with the following table.

Colour of wire	Circuit Particular
Red White Blue	AC Phase connections in current and voltage transformer circuits
Green with yellow stripes	Connections to earth.
Black	AC neutral connections, earthed or unearthed, connected to the secondary circuits of current and voltage transformers and all the other neutral points.
Light grey	Connections in dc circuits

Inter panel connections shall be made in such a way that does not reduce the ability of the switchgear to contain an arcing fault.

The wiring shall be executed in a neat and orderly manner and the arrangement of wiring and the positioning of any cableways within each cabinet shall not obstruct access to equipment terminals and mounting devices.

Vertical cabling ducts extending the full height of each tier shall be provided for cabling access to each module. Vertical ducts shall be provided with internal full-length perforated metal supports for fixing cables by means of cable ties and shall be no less than 400mm in clear width. Each cable compartment shall be fitted with a lift-off hinged door.

Extra low voltage equipment, control wiring and busbars shall be grouped and separated from low voltage equipment.

### Labels and engravings

All controls, instruments and indications shall be labeled with appropriate inscriptions describing their function. All switchboard equipment shall be numbered from left to right when viewed from the front of the switchboard unless noted otherwise.

All labels shall be submitted to the Engineer to the Contract for approval.

Labels shall have black background with white letters and shall be made of engraveable phenolic material engraved with suitably sized vertical characters. The label shall be fixed in place with suitable adhesive.

Nameplates reading "DANGER – LIVE BUSBARS" shall be affixed on each removable cover of busbar chambers of incoming supply connections. Each shroud over terminals of normally live bare metal shall be labeled "DANGER – LIVE TERMINALS" warning label shall have white lettering on red background.

### Anticorrosion treatment

Equipment offered shall be constructed of materials and be finished in such a way that corrosion is minimized. Materials and combination of materials used in the construction of the equipment shall be selected and arranged to prevent bimetallic corrosion.

Ferrous parts shall be either:

Hot dip galvanized

Zinc-plated and passivated

Painted over zinc coating, or phosphate treated

Surfaces to be hot dip galvanized shall be sound, clean and free from harmful scale, rust, moisture or any foreign matter. Inspection of the completed surface preparation may be required by the Engineer to the Contract before galvanizing or painting begins.

### Painting

If steel parts are not zinc coated, a suitable phosphate treatment or approved equivalent shall be applied. Where blast cleaning is necessary to remove rust or scales, it shall be prepared by the dry method of sandblasting.

The application of the first coat of paint shall follow immediately after inspection of the cleaned surfaces and in the case a surface becoming contaminated between cleaning and applying the protective coating, then it shall re-cleaned.

Primer (of the rust-inhibiting type) and undercoat paint shall be applied as soon as possible thereafter, each to a minimum thickness of 0.05mm. Finishing coats of baking enamel shall then be applied so that the complete paint system shall have a minimum thickness of 0.13mm with no porosity.

The colour of finishing coats of the internal surfaces shall be grey, whereas the colour of the external surfaces shall be advised by the Engineer to the Contract on contract award. All internal gear trays shall be painted white.

### Quality control

The Contractor shall ensure that effective quality control procedures are instituted at his works and details of any quality assurance standards adhered to should be provided in the tender.

It will be expected that the quality control procedures will include at least the following:

- a) Ensuring that materials/parts used in the manufacture of the specified work are free from defects and meet their specification. This must include checking against tolerances, and obtaining manufacturer's test and, where applicable, analysis certificates.
- b) Inspection at the critical stages of all phases of the specified works

- c) Verifying the accuracies of gauges and test instruments used for checking and commissioning the specified works.
- d) Ensuring that the components, materials and processes are fitted, used and applied in accordance with their manufacturer's instructions.
- e) Ensuring that the qualification and training of personnel used in the design, production, testing, erection and inspection processes are adequate for their respective functions.

The Purchaser may appoint an independent inspecting authority to certify that the Contractor's design, production, testing and quality assurance resources, procedures and facilities are appropriate to the specified work.

## **2.2.8 Power, Control, Signal Cabling and Earthing**

### **2.2.8.1 Power cables**

#### Single core power cables

Single core power cables shall be fixed at intervals not exceeding 2,400mm for vertical runs and horizontal runs on cable ladders, and 600mm horizontal runs on Unistrut channel, and at either side of bends, or risers and before terminations.

Single cores forming part of a 3-phase circuit shall, unless otherwise specified, be held in trefoil touching formation by cable clamps with band of neoprene lining between clamps and cable surface at interval not exceeding 600mm for straight runs and not exceeding 300mm in curves.

Cable clamps for single core in trefoil formation shall be fixed directly to supporting steelwork. All the other cables shall be installed on Aluminium cable ladders; alternatively the existing cable support can be used subject to Engineer's approval. The distance between the wall and the surface of the nearest cable shall not be less than 20mm. The supports shall be capable of withstanding the extreme forces when the cables are carrying the maximum possible short-circuit current. Cable ladders shall not form part of the supporting steelwork or the purpose of fixing cleats.

#### Multicore power cables

Multicore power cables shall be installed in one basic layer, spaced at least one cable diameter apart and fixed as follows:

- a. On horizontal ladders at intervals not exceeding 2400mm
- b. On vertical ladders or clamped to Unistrut channels at intervals not exceeding 600mm, or 20 times the outside diameter of the cable, whichever is the least.

### **2.2.8.2 Control Cables**

In this specification the term 'control cables' shall mean any cables or cabling used for control, indication, protection and alarm purposes.

Control cable shall have copper conductors with PVC insulation rated for 600V and PVC overall jacket unless otherwise specified.

Control, indication, protection and alarm cables shall be installed as follows:

- On horizontal ladders, fixing is required for take off points and elsewhere as necessary to ensure a neat secure formation;
- On vertical cable ladders, cables may be bunched in groups and fixed to the Unistrut channel with clamps at intervals not exceeding 300mm. The overall height of the bunch shall not exceed 75mm.
- Where clamped to Unistrut channels, cables may be bunched in groups and fixed to the Unistrut channel with clamps at intervals not exceeding 300mm. The overall height of the bunch shall not exceed 75mm.

### **2.2.8.3 Cable Installation**

A combination of cable ladder systems, ducts and conduits shall be provided to the cabling, taking into account aesthetics, maintenance access to other equipment, and environmental considerations. Where possible, existing cable ladder systems, ducts and conduits shall be used.

In locations where available space restricts the installation of cable ladders, cables may be clamped to perforated cable trays or to horizontal Unistrut channels, fixed directly to the wall. For vertical runs three methods shall be employed for the principal cable routes as follows:

1. Open cable ladders with cable strapped to the ladder with ties;
2. Cables clamped to Unistrut channels with Unistrut cable clamps or trefoil cable clamps;
3. Perforated cable trays. This method is limited to short, complicated runs with many directional changes and tee offs.

Power cables shall be spaced at least 20mm from the walls.

Cables may be supported by running in aluminum or PVC conduits or pipes fixed directly to the surface. These conduits or pipes shall be purely for the provision of mechanical support to the cable; sheath shall not be removed from cables within such conduits. Conduits shall be fixed in position with saddles at spacing of not more than 1,200mm.

Cable installation facilities shall be fixed to concrete with expanding type masonry anchors. Explosion driven fasteners shall not be used.

#### Control and power cables on one ladder

Where the number of power and control cables installed in the area does not warrant the installation of separate cable ladders, both types of cables may be installed on the one cable ladder side by side on the one set of Unistrut channels. In such cases control indication and alarm cables may be bunched as above, but power cables shall be spaced at least 300mm away from the control, indication, protection and alarm cables and from other power cables and be installed in one basic layer only.

#### Support of cables

All cables shall be provided with supports located as close as possible to the point of termination of the cables. Cables run on perforated cable trays shall be fixed with profile shaped saddles at spacing between 150mm and 300mm as required to ensure a neat installation without sagging between saddles. Cables leaving cable ladders over the side rail shall be fixed to the ladder at the point from where they start to lift. Where cables drop over the ladder rung, the sharp edge shall be fitted with a smooth radius drop-out fitting.

#### Cable protection

In all locations within 200mm of the floor and in any other locations where cables may be exposed to mechanical damage, the Contractor shall provide and install guards to protect the cables, or alternatively shall enclose the cables in aluminium, or PVC pipes or conduits. Where cables on ladders pass under or adjacent to pipes containing fluids they shall be provided with covers to divert any leaking fluid.

#### Conductors of different systems in raceway

Cables of different usage, voltage and classification shall as far as possible be physically separated in accordance with IEEE 422, however the following requirements must be complied with unless otherwise approved by the Engineer to the Contract.

Where cableway consists of two or more levels of cable ladder, power cables are to run on the higher level and control and instrumentation cables on the lower levels. Control and instrumentation cables are to be physically segregated into two groups as follows:

- Control cables used for intermittent operation of devices, indication and alarms.
- Low level analogue signal typically 4-20mA and low level digital signals.

A minimum distance of 300mm shall be kept between all sound or telephone cables and any other cables except when cables paths cross at right angles, and where run with low level analogue or digital control cables.

Earthing cables shall be segregated from all other cables such that should an earth conductor be damaged by a high earth fault current, no damage will result to other cables.

Control and instrumentation cables are not to be run in the same cable ladder with high voltage cables under any circumstances.

Control cables may be run with power cables over short distances, such as entrances to motor control centres, provided that:

- The control wiring is insulated for the full power circuit voltage and is used to control only the equipment supplied by the adjacent power cables.
- Cables are installed in an order which will prevent any cable being damaged by the weight of the others.

#### Conductors of different systems in the same cables

Conductor used for ac and dc circuits shall not be carried in the same multi conductor cable. Low level process signal conductors shall not be carried with other signal conductors in the same multi conductor cable.

Separate cables shall be provided for control and instrumentation and power circuit.

#### **2.2.8.4 Cable Ladders**

Cable ladders shall be made of aluminium in all areas. The ladders shall not have deflections of more than 3.5cm when simply supported over a 6m span and carrying an evenly distributed load of 40kg per metre, noting however that the ladder shall be supported at  $\leq 3$ m intervals. The cable ladders shall be complete with all necessary non-combustible, corrosion resistant supports, hanger rods and brackets and the like.

Aluminium cable ladders shall not be placed in direct contact with unpainted or uncoated dissimilar metals other than zinc, tin or cadmium except when making conductive connections by an approved method.

#### **2.2.8.5 Cable Identification**

The Contractor shall identify the ends of all power, control, and instrument circuits in accordance to IEC 391 and/or FEA practice.

#### **2.2.8.6 Termination and Ferrules**

The end of every wire and every cable core shall be fitted with an appropriate crimp or cable lug and shall be fitted with a ferrule to provide a permanent method of identifying the wire or cable core.

Wire ends terminated in screw terminals must be crimped in boot lace ferrules.

The identification system used to mark each cable, core, or wire shall be manufactured from moisture and oil resistant insulating material and offer long life in

the environment, which they are installed without fading or deterioration. The marker shall be of the interlocking type and shall grip the insulation firmly.

Where possible, phase identification of multicore power cables shall be self-coloured cores. For cables where the cables cores are not self-coloured, the phase identification shall be provided by insulated, non flammable, heat-shrinkable tubing, coloured appropriately.

Unless otherwise specified, the screens of screened cables shall be earthed at one end only. This shall generally be the end at which the signal originates.

Earthing of copper screens shall be by means of wrapping three or more turns of 1.0mm<sup>2</sup> stranded tinned copper earthing conductors over the exposed screen and making an effective soldered joint with the screen. The earth conductor shall be terminated at the equipment by means of crimp-on terminal lugs. All earthing conductor must be insulated.

#### **2.2.8.7 Trefoil Cable Cleats**

Trefoil cleats shall be of non magnetic material, fitting the contours of the single core cables and securely anchoring the cable into position. The cleats shall be capable of withstanding bursting forces of 4kN due to fault current in the cable.

#### **2.2.8.8 Conduits**

Conduit and conduit fittings shall comply with the requirements of, and be installed in accordance with the NZ Electricity Regulations Act.

Metallic conduits and fittings shall be aluminium. PVC conduit shall be of the heavy duty grade.

Where wiring is to be concealed from view, the conduit shall be installed above suspended ceilings, embedded in concrete, or chased in masonry walls. The chasing of concrete walls and floors is not acceptable.

Conduit shall be installed to allow easy and safe drawing of cables. Where conduits are bent, the inside radius of the bend shall be not less than six times the nominal size of the conduit. No more than two consecutive 90degrees bends or multiple number of bends adding up to a total of 180degrees shall be installed between two conduit ends. Where more than the above number of bends is required an intermediate flush draw-in box shall be provided. Conduit runs in excess of 10m shall also be provided with draw-in boxes.

Conduits exposed to view shall run parallel to the structural lines.

Where surface mounted conduit crosses an expansion joint, then expansion fittings must be provided.

All joint in PVC conduits shall be made waterproof by using suitable adhesive compounds. Suitable moulded threaded attachments shall be used for entry into equipment.

All surface mounted conduits shall be fixed in position with stand-off saddles and screws, spacing the conduits approximately 5mm off the surface, at spacings no more than 1.2m, for metallic conduits and 0.8m for PVC conduits.

#### **2.2.8.9 Earthing**

Cable ladders shall be bonded together to form a continuous electrical circuit and shall be provided with an electrical connection to the main station earthing busbar comprising of an aluminium conductor of not less than 70mm<sup>2</sup> in cross sectional area at each end and at the intermediate positions spaced not more than 10 metres apart.

All the electrical equipment must be earthed. The contractor shall ensure that all metal work encasing electrical items is bonded to earth.

Busbars and grounding conductors shall be rated to carry currents equal in magnitude and duration to that associated with the short circuit rating of the equipment.

The earthing terminals on the frames of control cubicles and other such enclosures shall be a M8 stud. The metal cases of all the instruments, relays and the like mounted within such enclosures shall be connected to this earthing stud by conductors of not less than 6mm<sup>2</sup>.

Earthing connections between this stud and the existing station earth grid shall be via an aluminium strap not less than 90mm<sup>2</sup>.

### **2.2.9 Tests**

The equipment shall be thoroughly tested at the manufacturer's works. Should failure to comply with the guaranteed or specified standards occur, the Purchaser reserves the right to reject the item of equipment concerned.

#### Routine tests

Works tests shall include electrical and mechanical routine tests as appropriate as specified in the relevant standards.

#### Test Certificates

Certificates recording the test results shall be supplied in the form of separate documents for:

- Type tests
- Routine tests
- Performance tests

### **2.2.10 Spares and Accessories**

All special lifting and handling devices and tools required for the installation and maintenance of the equipment offered shall be supplied with the equipment.

The Contractor shall as a minimum supply spares as detailed in the relevant schedule. The Contractor shall also offer any spare parts considered necessary. The Purchaser reserves the right to vary the number of spares ordered when the contract is awarded.

Spares shall be supplied preserved against deterioration in storage. Packages shall be clearly marked so that the contents may be identified without opening.

## **2.3 Civil Work Requirements**

### **2.3.1 Mounting of new switchboard**

The new switchboard shall be mounted on the same position as the old board.

All new cubicles shall be bolted down to the floor with chem.-set bolts all around the base. The cubicle/panel design should be done to allow cable entry from the existing cable trench or overhead cable ladders/trays as if required. The Contractor shall be responsible for resealing the floor or any similar requirement after the new switchboard is installed and any other Civil Works required if their switchboard design layout differs from existing cable trenching layout.

After completing the design, the Contractor shall provide the drawings showing the dimensions and location for bolting the switchboard base to the concrete floor with the calculation of their seismic strength. Note the panels will be installed beside the Diesel Mirrlees Balckstone Engines and will encounter a lot of vibration.

### **2.3.2 Ducts**

Where ducts or trenches are required through existing walls or floors the Contractor shall submit a methodology for the duct installation to the Engineer to the Contract for approval.

## **3. New MCC and New Control Panel Installation and Commissioning**

### **3.1 General Requirements**

This installation specification stipulates the requirements for the upgrading of the existing MCC 415Vac switchboard that supplies the generator auxiliaries and the Amot Control panel for the Mirrlees Blackstone Generator G1 and G2 of Vuda power station.

The contractor is required to notify the FEA Project Manager and the Engineer to the Contract at least two weeks prior to the commencement of work.

*The Bidder/Contractor shall be responsible for the installation and commissioning of the new 415V Board and shall bid accordingly. FEA shall provide manpower to assist as part of on the job training.*

To ensure a good communication and a full understanding of the responsibilities of the parties, the Contractor is responsible for ensuring that Contractor's personnel is appraised of these requirements.

The following requirements for work at site shall be met by the Contractor:

- Site induction – All Contractor staff shall have current First Aid/CPR and PHC certificates, and shall undergo site induction before commencing any work at Vuda power station. The Contractor must ensure that any addition to the work team undergo this induction on their first arrival to site. Induction is to be arranged by the Contractor through the FEA Project Manager.
- A Contractor AHC holder must be present all times work is performed on site.
- The tendering company must hold and maintain an Employer License, applicable to all staff who are proposed to be used on this contract.

### **Standards and Regulations**

The installation of the 415V switchboard, shall comply with the following standards.

Safety Rules, Fiji, or NZ Electricity Industry  
 General Safety Handbook, Fiji, or NZ Electricity Industry  
 AS/NZS 3000:2007 Australian/New Zealand wiring rules  
 AS/NZS 4325 Power cables  
 AS/NZS 2650 PVC-insulated cables for switchgear/control gear wiring  
 AS/NZS 5000.3 Multicore control cables  
 AS/NZS 4417 Cable markings  
 IEC 60702-2 Cable termination

### 3.2 Scope of Work

The contract works include providing supervision, administration and management, and supplying all construction equipment, materials supplies and services necessary for the installation, testing and commissioning of the new MCC 415V switchboard, and new Control Panel as specified under Section 2 of this specification.

The Contractor shall manage the disconnection and removal of existing cable circuits and removal of the old 415V Board and how to shift the new switchboard to site and how to effect the installation of and the connection of the various feeders and outgoing circuits to the new switchboard. The Contractor shall provide, a works program schedule with the minimum interruption to the Vuda Power Station power generation capability for FEA approval.

### 3.3 General Installation Requirements

**To make easement of installation FEA will prefer one Contract for this two requirement and also a Contractor who have experience on the Control of Diesel Generators like the Mirrlees Blackstone.**

Access and work shall be governed by the Safety Rules, Electricity Industry, April 1995. The Contractor is responsible for meeting all safety requirements as directed by the Engineer to the contract.

Standards of workmanship and materials referred to under Section 2 and 4 must be adhered to.

All work of the Contractor shall comply with the following regulations and standards:

General safety Handbook of the Electricity Industry SM-EI Parts 1, 2 and 3.  
Electricity regulations and Electricity Safety book  
AS/NZS 2017 Electrical installations – testing and inspection guidelines

Any work that the Engineer/FEA to the Contract will deem unsatisfactory in terms of compliance with the above standards shall be reworked at the Contractor's expense to the satisfaction and approval of the Engineer to the Contract.

The technical requirements regarding cabling, terminations and wiring are those specified under Section 2 of this specification.

### 3.4 Installation Procedures

The succession of work stages shall be such that, for minimizing the duration of the relevant outages of the main machines, it will be necessary to complete beforehand all the installation work that can be effected with the main units in service.

The principal areas of work associated with the installation and commissioning of the new MCC 415V switchboard and the new Control Panel are:

- Setting in place the new 415V station switchboard and test it prior to connecting to it incoming circuit, by using the local 415V supply;
- Connecting and testing progressively the incoming and outgoing cables to the new switchboard, endeavoring to have only one generator outage at any time;
- Testing the new cables to all the aux motors and load test of the MCC panel.
- Test of the new Control panels with associated new replaced field devices
- Interfacing with the unit and station PLC if available at the time.

Before commencing any such work the Contractor shall ensure that the following prerequisite have been met:

- Inform the Engineer to the contract and complete the site induction procedures
- Electrical, mechanical and hydraulic isolation of equipment as applicable
- Receive authorization documentation.

### Cabling

The contractor shall supply all the following cable requirements:

- Replace the existing power cable from the MCC 415V terminals to all the Aux Motors.
- Replace the existing cables to the new field devices
- Provide new cables for the to the new Scada in the Station Control room.
- Any other accessories required for termination of cables to the new MCC switchboard or new Control Panel.

The Contractor shall submit a detailed procedure for effecting the progressive connections of feeders and loads to the new switchboard with minimal impact on the availability of the unit still in service and with reliable power supply for the station essential services.

## **3.5 Equipment and Materials**

The Contractor shall procure and supply the materials and equipment necessary to complete the installation of the 415V switchboard and its connections to the controls and auxiliary services. The equipment and materials to be supplied shall include, but not limited to, the following items:

- Power and control cables
- Cable accessories, racks, termination kits
- Holding down bolts
- Terminals for I/O connection
- All consumables

## **3.6 Testing and Commissioning**

The Contractor shall be responsible for ensuring that all equipment and systems covered and altered by this contract are tested and commissioned successfully in accordance with manufacturer requirements and relevant standards.

The Contractor shall provide all equipment necessary for testing and commissioning and shall also submit to the Engineer to the contract a programme of the commissioning tests, with relevant estimated duration.

The pre-commissioning tests shall include but not limited to the following:

- a) inspection of all the equipment for correct installation, functioning, labeling and wiring;
- b) insulation resistance tests of all circuits to earth and between phases.

In particular the following tests shall be performed as a minimum:

- LV switchboard: IR, Phase rotation and functional tests
- Cables: IR and loop tests
- Protection relays: Secondary injection, calibration, continuity, polarity tests.

All control, protection, alarm and indication circuits shall be tested to ensure correct operation and shall include, but not limited to the following:

- a) local and remote opening and closing of the main circuit breakers (feeder and bus couplers);
- b) circuit breaker open/closed and racked-in indication
- c) point of control switch operation
- d) remote alarms and indications.

Any defect or inadequacy identified through the tests shall immediately fixed, or listed in a Commissioning Defect sheet if it cannot be fixed immediately.

Two weeks after commissioning, the Contractor shall carry out post commissioning checks on the equipment. All items noted on the Commissioning Defect sheet must have been fixed at this time and written confirmation of their completion produced during these checks.

Following the completion of the commissioning tests, the Contractor shall check spares against list and put them into stores.

At this time the Contractor shall deliver all outstanding documentation including compliance certificates, as-built drawings, O&M manual, commissioning test report as well as the close out report to the satisfaction of the Engineer to the Contract.

#### **4. Post Award Documentation Requirements**

In addition to the supply of the equipment called upon in this Specification, the Contractor shall comply with the requirements set out in the following clauses.

##### **4.1 Information to be Supplied by the Contractor**

In addition to the supplied of the plant called for in this specification the Contractor shall comply with the requirements set out in the following clauses.

All drawings and other information, including technical manuals, instructions and plant and equipment markings and labels shall be submitted in English.

##### **4.2 Manufacturing Programme**

The Contractor shall submit for approval, not later than two weeks from acceptance of the tender, two copies of the Manufacturing Programme of the 415V switchboard, which shall contain:

- (i) The list of activities and sub-activities with relevant time durations
- (ii) The order in which the Contractor proposes to carry out completion of supply of the plant, including design, manufacture, factory test and delivery
- (iii) The times when submission and approval of all the Contractor drawings and documentation are required.

If at any time during the execution of the Contract it is found necessary to modify the Manufacturing Programme, the Contractor shall submit for approval a revised Manufacturing Programme. No alteration to the Manufacturing Programme shall be made without written approval of the Engineer to the Contract.

##### **4.3 Progress Reports**

The supplier shall submit two copies of a brief and concise monthly progress report indicating:

- (i) The state of progress in manufacture as measured against the approved Manufacturing Programme
- (ii) A statement of any delays and reasons
- (iii) An assessment of the effect of such delay on the attainment of the approved Manufacturing Programme
- (iv) A statement of the measures that have been taken, or are proposed to eliminate or at least minimize the effect of the delay.

#### **4.4 Inspection and Test Plan**

The Contractor shall submit, not later than 3 weeks from acceptance of the tender, two copies of an inspection and test plan for approval of the Engineer to the contract. If at any time during the execution of the Contract it is found necessary to modify the inspection and test plan, the Contractor shall submit for approval a revised plan.

#### **4.5 Contract Drawings**

The Contractor shall submit for approval not later than 3 weeks from acceptance date of the tender a list of proposed drawings required under this contract. The list shall include a brief drawing title.

#### **4.6 Instruction Manual**

The Contractor shall supply installation, commissioning, operation and maintenance manuals. The manuals shall contain all the information necessary for erection, installation, commissioning, operation and maintenance of the 415V switchboard and shall include technical descriptions of all other sub-supplier's item used.

The manuals shall be as simple and clear as possible, fully illustrated with drawings and diagrams and detailed with data sheets and part numbers for ordering replacement.

Two draft copies of the manuals (marked as draft) shall be submitted for approval not later than 16 weeks from acceptance of tender.

No later than two weeks after final approval, four copies of the approved manual shall be supplied for use during the installation work.

Four copies of any subsequent approved revisions shall be supplied for inclusion in the manuals.

The Contractor shall supply all final copies of the manuals in durable A4 size, four hole, D-ring binders. The binders shall be inscribed on the front cover and the spine with:

Fiji Electricity Authority  
Vuda Power Station  
MCC 415V Switchboards  
Contract No.....  
Installation, O&M Manual

Fiji Electricity Authority  
Vuda Power Station  
Mirreles Blackstone Control Panel  
Contract No.....  
Installation, O&M Manual

The contents of the manual shall be written specifically for the plant being supplied, shall be fully indexed and shall generally follow the format and include the information as outlined in the following clauses.

## General Information

The following general information shall be included in the manuals:

- (i) Title page containing the following information:
  - a. Base data,
  - b. Type and model.
  - c. Name of station it is to be installed in.
  - d. Contract number.
  - e. Serial numbers.
  - f. Standards the MCC 415V switchboards and New Control Panels were built to.
  - g. Manufacturer's address.
- (ii) A general description (including any special features) referring to photographs and figures where appropriate.
- (iii) A technical schedule giving the following information:
  - a. All the information required by the Specification's technical schedule.
  - b. A full schedule of weights and dimensions.
  - c. Current and voltage rating of all components, i.e. maximum continuous, emergency, overload capability, and fault current withstand capability.
- (iv) The serial numbers and manufacturer's address for all items supplied by other manufacturers.
- (v) Details and drawings of any special tools required for installation, operation or maintenance.
- (vi) Colour photographs showing external views and views inside the cabinets.

## Description of the equipment

The detailed description of the equipment covering the technical characteristics shall be followed by the headings that specifically illustrate the installation, commissioning, operation and maintenance procedures, as well as the spares requirements.

### • Installation Instructions

Detailed instructions shall be included for the handling, installation and storage of the equipment including the following:

- (i) A brief description on the method of dispatch (including precautions taken on shipping specifications if applicable) shall be supplied.
- (ii) A detailed list of the checks required on arrival at site shall be given in the manual.
- (iii) Detailed instructions on precautions and maintenance requirements to be taken for both long-term (greater than 3 months) and short-term (up to 3 months) storage.
- (iv) Detailed instruction procedures.
- (v) All drawings used in manufacture or assembly of the equipment shall be listed and referred to on the installation drawings. Where components are proprietary manufactured items they shall be identified on the drawings and manufacturer's name, model number and size stated.

### • Commissioning

Detailed instructions for pre-commissioning and commissioning tests (procedure and expected results) and checks shall be supplied. Results of factory acceptance tests shall be included for comparison with acceptance tests.

- **Operating Guide**

A detailed operating guide shall be supplied.

- **Maintenance**

Detailed inspection, maintenance and test procedures shall be included and shall comprise:

- (i) Instructions for routine tests
- (ii) All necessary information for the correct setting, or other adjustment and testing of all items including proprietary manufactured items.
- (iii) Lists and details of recommended inspection, assessment repair and test procedures. Areas subject to high stress or corrosion during operation shall be identified.

- **Spares**

A complete list of spares shall be provided in the manual. The spare parts list shall contain the following information:

- (i) Part description and identification number to sufficient detail to facilitate Purchaser's orders.
- (ii) Quantities of like parts on each piece of equipment.

#### **4.7 Test Report and Calculations**

The Supplier shall supply reports detailing test methods and recording test results in the form of separate documents for:

- (i) Routine tests.
- (ii) Special tests.
- (iii) Commissioning tests.
- (iv) Performance tests.
- (v) PLC/Software configuration and parameter settings.

The Supplier shall supply four copies of all test reports within two weeks of completion of the FAT. Prints and oscillograph photographs of such quality that all lines and inscriptions are clearly legible shall be included in each test report.

The test reports and calculations supplied by the Supplier shall include:

- (i) Contract number and name.
- (ii) Equipment description and serial numbers.
- (iii) Report number and date.

#### **4.8 Shipping Documents**

The Supplier shall forward shipping documents to the Purchaser prior to the time of delivery of the Plant in accordance with the General Conditions of Purchase.

### **5. Summary of Information Required after Contract Award**

The number of prints/copies of the following data and drawings as indicated below shall be forwarded to the Engineer to the Contract for approval by the required dates.

Item No.	Description	No. Copies	Date required by
1.1	Confirmed Manufacturing Programme	2	3 weeks after award
1.2	Progress Reports	2	Monthly
1.3	Inspection and Test Plan	3	3 weeks after award
1.5	Drawing List	1	3 weeks after award
1.6	All Contract Drawings	3	4 weeks after award
1.7	Instruction Manuals	5	16 weeks after award

## **6. Information Required after Contract Award as Final Versions**

The final versions of prints/copies of the following data and drawings as indicated below shall be forwarded to the Engineer to the Contract by the required dates.

Item No.	Description	No. Copies	Date required by
1.9	Updated Manufacturing Programme	2	3 week after approval
1.10	Inspection and Test Plan	3	3 week after approval
1.11	Drawing List	1	16 weeks after award
1.12	Contract Drawings	3	18 weeks after award
1.13	Instruction Manuals	5	3 weeks after approval
1.14	Test Reports	4	2 weeks after FAT
1.15	Shipping Documents	1	Prior to shipment
1.16	Software licenses (registered in the name of FEA)	2	16 weeks after award

## **B. Schedules**

### **Schedule 1 Price schedule**

The Bidder shall provide price schedule for

- one MCC 415V Switchboard requirement for one Generator
- two MCC 415V Switchboard requirement for the two Generators
- one Control Panel requirement for one Generator
- one for both MCC and Control Panel Requirement for one Generator
- Both MCC and Control Panel requirement for the two Generators.

FEA will make decisions on how to approach this Project depending on the cost involved. All Bidders are required to submit price schedule as above or they will not be considered if FEA decides to go with one of the option above and price not submitted.

Below are formats of price schedules that Bidders may use or may submit similar formats.

**Schedule 1A – Prices**

Item	Quantity	Description	Unit price	Total price
1	1	415V main switchboard		
2	1	Set of contractual spares		
3	1	Set of special tools		
4	1	Installation/commissioning of 415V switchboard		

**Schedule 1B – Packing and Shipping**

Item	Quantity	Description	Unit price	Total price
1	1	415V main switchboard		
2	1	Set of contractual spares		
3	1	Set of special tools		

**Schedule 1C – Schedule of Essential Spare Parts**

Item	Quantity	Description	Unit price	Total price
1	1	Air circuit breaker spring charging motor		
2	1	Air circuit breaker trip and closing coil set		

**Schedule 1D – Labour, plant and materials for variation work**

Item	Description	Unit	Rate	
1	<b>Labour (*)</b>			
	a. Supervisor	Hr		
	b. Test Technician	Hr		
	c. Electrical Fitter	Hr		
	d. Welder	Hr		
	e. Labourer	Hr		
2	<b>Plant</b>		<b>With Op.</b>	<b>Without Op.</b>
	a. Mileage (state vehicle)	km		
	b. Mileage (state vehicle)	km		
	c. Compressor (state data)	hr		
3	<b>Material</b>			
	a. 11kV cable (state data)	m		
	b. 415V cable (state data)	m		

	<b>c. Control cable (state data)</b>	<b>m</b>	
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(\*) The hourly rate shall be inclusive of any on/off site overhead

## Schedule 2 Manufacturing Programme

The Tenderer shall submit with the tender a proposed manufacturing Programme in the form of Gantt chart using Microsoft Project or similar project management software.

The Gantt chart shall incorporate the key dates and show the activities necessary throughout the contract period to indicate the Tenderer's programme for manufacturing and delivery of the goods. The programme shall include as minimum:

1. The scheduled start and finish date for each activity
2. The float associated with the scheduled dates
3. The duration of each activity
4. The identification of all milestone dates
5. The critical clearly shown.
6. The key dates, as follows:
  - Commencement of design
  - Completion of design
  - Award of sub-supplier purchase orders
  - Shipment of critical materials/items
  - Receipt of critical materials/items
  - Commencement of fabrication of major items
  - Completion of fabrication of major items
  - Commencement of assembly
  - Completion of assembly
  - Commencement of testing
  - Completion of testing
  - Packing
  - Shipping
  - Arrival at Vuda power station

## Schedule 3 Tenderer's Experience

The Tenderer shall supply the following information with the tender:

1. A statement setting out the experience, resources and facilities at the Tenderer's disposal, and that of their sub-contractors, in the supply, maintenance, testing, delivery of items to be supplied under the contract.
2. Details of the Tenderer's previous experience in the supply of similar type of goods and equipment to that offered. The information to be supplied shall include:
  - Model/type number
  - General description
  - Number installed
  - Date installed
  - Country
  - Customer name and address

## Schedule 4 Information on goods offered

The Tenderer shall supply a full description of the goods offered showing suitability for its intended application.

If equipment is offered complying with a standard equivalent to any standard mentioned in this specification, then the Tenderer shall state the name of the standard, issuing authority, number, issue and full title of such standards and include an English language copy of the standard or relevant part thereof with the tender.

### Schedule 5 Shipping Plan

The Tenderer shall provide with the tender, the details of how it proposes to ship of the completed goods to the delivery point, to include, but not limited to:

- Details and contents of the shipment
  - type of packaging, e.g. containerized, or crated
  - type of container
  - number of crates
  - weight and dimensions of each container or crate
  - storage, e.g. below deck or on deck
  - any proposed above deck cargo, or soft top containers, hazardous cargo information, special requirements, handling methods
- Value of shipment
- Name and location of factory
- Expected time of departure (ex factory)
- Name of port
- Expected time of departure ex port
- Expected time of arrival NZ port
- Road transport details
- Expected time of arrival at the delivery point, i.e. power station

### Schedule 6 Quality Assurance Programme

The Tenderer shall submit a draft Quality Assurance manual in accordance with the NZ Standard NZS 9901:2000. Where the Tenderer is already working to an equivalent or higher category of any internationally recognized Quality Assurance Standard then the standard may be proposed for the Work.

If a standard is offered as equivalent to or exceeding the specified NX Standard NZS9002:1990 category, the Tenderer shall state the issuing authority, number issue and full title of the Standard.

The tenderer shall provide evidence of Certification to NZS 9002: 1990 or equivalent or higher standard by a recognized authority.

The tenderer shall provide full details of the methods of traceability. Tenderers may propose any part or component of the goods for which it considers traceability inappropriate.

If the Tenderer is not certified to an internationally recognized Quality System the Purchaser may, during evaluation of tenders, call for further information and may require to audit the supplier quality system.

### Schedule 7 Proposed Subcontractors and Sub-suppliers

Tenderers shall submit with the tender a list of Sub-Contractors and Sub-Suppliers that they propose to employ together with a brief description of the Plant or Work they propose to sublet.

Description of Sub-suppliers/contractors	Name/address of Sub-supplier/contract


### Schedule 8 Deviation from / Exceptions to Tender Documents

The Tenderer shall specify below, in detail, all deviation from, exception to and alternatives offered to the tender document, including reference to the appropriate clauses or sub-clauses. Any entry shall be referenced to the Tender Document Clause No. to which they refer. A complete copy of this schedule should be supplied with the tender.

The Tender shall be deemed to be compliant with the content and intent of the tender document except in respect of deviation or exceptions listed in this schedule. If no deviations or alternatives are proposed by the Tenderer, enter “**None**” below. No deviations from or exception to or alternative to the Tender Document shall be made subsequently to the contract without the written approval of the Purchaser.

Clause No.	Details of Deviation/Exception	Reason for Deviation/Exception

### Schedule 9 Technical Data Schedules

The Tenderer shall complete the following schedules and shall guarantee the particulars and performance set out therein. The Tenderer shall supply a copy of the completed schedule with the tender.

#### **Schedule 9.1 Recommended Additional Spare Parts**

The Tenderer shall complete the following table with the spare parts they recommend for:

- The duration of the warranty period
- 15years of operation

Such spare parts shall be in addition to the mandatory spare parts already listed in the tender document. The price for these recommended additional spare parts shall not be included into the bid price.

It shall be understood that:

- The Purchaser may at their sole discretion choose to purchase any one or combination and any quantity of these spare parts
- The price of such a purchase will be added to the contract price
- The delivery of such additional spare parts shall be subject to same terms and conditions as those applicable to the mandatory spare parts.

Description	Qty for DLP duration	Qty for 15yrs	Unit price NZ\$

### Schedule 9.2 Special Tools

Item	Description	Use	Number	Weight

### Schedule 9.3 Consumables

Item	Unit quantity	Quantity for 1yr	Supplier 1	Supplier 2

### Schedule 9.4 Technical Support

Description of Technical Support	Details of Personnel and Support Centres

## Annex A – Drawings

- Remote Automatic Start/Stop Circuit Operation Procedure
- Remote Automatic Start/Stop Circuit Operation Drg 1OE31004 (FEA Drg No. 10-E31-004)
- Drawings
  - a) 10E13040 (FEA Drg No. 10-13-040)
  - b) 10E13040A (FEA Drg No. 10-13-040A)
  - c) 10E13041 (FEA Drg No. 10-13-041)
  - d) 10E13042 (FEA Drg No. 10-13-042)
  - e) 10E13043 (FEA Drg No. 10-13-043)
  - f) 10E13044 (FEA Drg No. 10-13-044)

## **Annex B**

### **FEA DRAUGHTING SPECIFICATION FOR NEW PLANT**

Below is a sample

## Technical requirements to AS/NZS 3439.1

Item	Detail/Value	Notes
Service Condition	Indoors where the switchboard is in a well ventilated area	
Cable Entry (Incoming supply cables)	Top and Bottom Entry	
Cable Entry (Outgoing cables)	Top and Bottom Entry	
Access	Front access. Rear access for busbar inspection	
Supply Voltage (V)	415V, 3 phase, 4 wire	Classification in AS/NZS3439.1
Supply Frequency (Hz)	50Hz	Classification in AS/NZS3439.1
Connected Load (A)	Refer Single Line Diagrams	Classification in AS/NZS3439.1
Fault Level (kA)	30kA	Classification in AS/NZS3439.1
Fault duration (sec)	1 second	Classification in AS/NZS3439.1
Diversity	0.9	Classification in AS/NZS3439.1
Ambient Temperature (°C)	10-40°C	
Relative Humidity (%)	Up to 90%	Damp conditions
Chemical Present	Nil	
Pollution Degree	Degree 3	Classification in AS/NZS3439.1
Segregation	Form 3b or 4	1. Separation of busbars from the

		functional units and separation of all functional units from one another. 2. Separation of terminals for external conductors from the functional units, but not from each other. Terminals to be shrouded with removable boots. 3. Terminals for external conductors separated from busbars
Degree of Protection	IP43 or better	Live parts, ingress of foreign bodies and liquid
Spare Space	10% minimum	
Module Style	Fully withdrawable	
Main Circuit Breaker	Withdrawable ACB	
Bus Coupler	Withdrawable ACB of same size as incomer	
Power Monitors	Separate unit or integral with circuit breaker	
Motor Starters		
Motor Starter Communication		
Soft-starters		
Soft-starter Communication		

## **Tender Submission - Instruction to bidders**

It is mandatory for Bidders to upload a copy of their bid in the **TENDER LINK** Electronic Tender Box no later than **4:00pm, on Wednesday 23<sup>rd</sup> November, 2016.**

To register your interest and tender a response, view 'Current Tenders' at:

<https://www.tenderlink.com/fea>

For further information contact The Secretary Tender Committee, by e-mail

[TDelairewa@fea.com.fj](mailto:TDelairewa@fea.com.fj)

In additional, hard copies of the tender, one original and one copy must be deposited in the tender box located at the FEA Head Office, 2 Marlow Street, Suva, Fiji no later than **4:00pm, on Wednesday 23<sup>rd</sup> November, 2016**- Addressed as

**Tender – TENDER No. MR 124/2016**

**Vuda Power Station G1 and G2 MCC and Control Panel Upgrade  
The Secretary Tender Committee  
Fiji Electricity Authority  
Head Office  
Suva  
Fiji**

- **Hard copies of the Tender bid will also be accepted after the closing date and time provided a soft copy is uploaded in the e-Tender Box and it is dispatched before the closing date and time.**

Tenders received after **4:00pm** on the closing date of **Wednesday 23<sup>rd</sup> November, 2016.**

- will not be considered.
- Lowest bid will not necessarily be accepted as successful bid.
- **It is the responsibility of the bidder to pay courier chargers and all other cost associated with the delivery of the hard copy of the Tender submission.**