FIJI ELECTRICITY AUTHORITY

SPECIFICATION FOR THE DESIGN, SUPPLY, DELIVERY AND COMMISSIONING OF ONE (1) ONLY 350KW STANDBY RATING (CANOPY) DIESEL GENERATING SET

TENDER DOCUMENT

TENDER MR 67/2015

FIJI ELECTRICITY AUTHORITY

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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 15 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 144 hours of notice when the materials, equipment, system is 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 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 Contractors 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, it’s 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 or 8,000 machine operating hours, whichever comes first 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) first edition 1995. (Copies can be obtained from FIDIC PO Box 86 CH 1000 Lausenne, 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 as per advertised date.

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.....201... 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 one only … KW (e) Diesel Generating Plant, complete with associated pipe work, auxiliary drives, excitation system, associated switchgear 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
..... KW(e) DIESEL GENERATING SETS
(**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 .....201..

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 one(1) only ..... KW (e) Diesel Generating Plant, complete with associated pipe work, auxiliary drives, excitation system, 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) only 350 $KW_{(e)}$, **Standby Rating** complete with associated pipe work, auxiliary equipment, excitation control etc, 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) 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 as per tender instructions

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 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.

PART 3 **SPECIFICATIONS: GENERAL**

1.1 SCOPE OF SUPPLY

The contract includes for the design, manufacture, works testing and freight to Suva Port, Fiji one(1) only 350 $KW_{(e)}$, **Standby Rating (Canopied)** complete with associated pipe work, auxiliary equipment, excitation control etc, for Fiji Electricity Authority.

The contract also includes:

i) Three copies of Operating, Servicing and Maintenance Instructions and Spare Parts Manuals.

ii) Any necessary erection materials including a complete set of special tools and equipment necessary to erect, operate, service and maintain the genset.

iii) A list and price of spare parts for operating and maintaining the Plant up to 5,000 hrs, to include but not limited to the following:

Normal maintenance spares for engines and all other auxiliaries
Emergency and safety spares for engine and all other auxiliaries
General and special tools for engine and all other auxiliaries
Test and calibration tools for engine and all other controls and auxiliaries
Cleaning/reconditioning/remanufacturing tools for engine components and auxiliaries
Machine shop tools

iv) Detailed design calculations, specifications and drawings used in the contract.

1.2 INFORMATION WITH TENDER

Tenders must fill in all Schedules and give all particulars pertaining to the Diesel Generating Plant offered.

In particular they shall supply the following in their tender:

a) Preliminary performance schedule, which shall form the basis of the contract performance program.

b) Drawings showing all dimensions of the complete Diesel Generating Plant.

c) Drawings or Schedules showing the shipping dimensions and weights.

d) One copy in the English Language of the Design Codes to which the tenderer elects to design the Diesel Generating Plant and its ancillaries.

e) A list of recommended maintenance, safety, and emergency spares for engines and auxiliary equipment for a service period of 5,000 hrs with all prices quoted. Other parts, tools and equipment specified in 1.1 iii) above.

f) A maintenance programme in terms of machine operating hours, indicating when minor and major servicing, such as oil change periods, filter changes, protection tests, top overhauls and major overhauls are to be carried out. The programme should also include the spare parts anticipated to be changed and the time and manpower required to carry out the work.

1.3 DRAWING AND INFORMATION TO BE SUPPLIED BY CONTRACTOR

a) The following must be submitted with the tender :

i) General arrangements for the plant, giving dimensions, weights and basic specifications of diesel engine and generator and other equipment.

ii) Illustrations and printed matter showing constructional details and details of instrumentation, protection and accessories.

iii) Life cycle cost calculations

iv) Preliminary Project Schedule.

v) List of spare parts, tools, diagnostic & calibration tools instruments and other equipment necessary to carry out maintenance, overhauls, inspections, and repairs expeditiously.

b) The following drawings are to be submitted with the contract, in printed **and** electronic/AutoCAD formats:

i) Certified general arrangement drawings showing all fittings and accessories provided and including dimensions and weights and the specifications for diesel engines, generator and accessories.

ii) Electrical and instrument diagrams showing the local/auto start, stop and output control circuit and the protection, instrument systems, auto voltage and governor controls.

iii) Excitation System and AVR detailed drawings.

iv) Combined Instrumentation and piping diagram with operational parameters.

v) Certification of all the final design calculations, drawings and evidence of compliance to such design parameters.

c) SUBMISSION OF DRAWING

All drawings submitted pursuant to this clause, shall form part of the contract, after approval by the Engineer. The sequence of submission of all drawings shall be such that all information is available for checking each drawing when it is received.

Notation on drawings shall be in the English language.

1.4 PROGRAMME OF WORKS

The programme proposed for this Contract is outlined below; however the Contractor may forward his own programme of works acceptable to FEA.

Completion Periods

NOTE: All the periods given below are to be measured from the date appearing on the Purchaser's Contract Acceptance Letter.

a)	Period of receipt by the Engineer of final and sufficient information relating to the contract and enabling the design of the system.	1 Calendar Week
b)	Manufacture Completed	4 Calendar Week

c)	Factory Tests Completed	1 Calendar Week or as advised by the Engineer.
d)	Delivered DDU, Suva Port, Fiji	3 Calendar Week
e)	Installation Completed	1 Calendar Week
f)	Commissioning Completed	1 Calendar Week
g)	Training of staff – operation & maintenance	1 Calendar Week

Liquidated damages shall apply to the period given in sub-paragraphs (b) of 1.5.

1.5 LIQUIDATED DAMAGES

a) General

Liquidated damages will be payable by the Contractor to the Purchaser if the Contractor has failed to provide deliveries of information and plant within the programme set out in sub-paragraph 1.5 (b).

b) Amounts of Liquidated Damages

The amount of Liquidated damages shall be as follows:

i) Delay to supply Information.

Should the Contractor fail to supply to the Engineer within the stipulated period from the date of the Purchaser's Contract Acceptance Letter all the information required to be supplied by the Contractor, under sub-paragraphs (b) and (c) of 1.3 and as more fully described in 1.4, liquidated damages shall be determined and charged at the rate of F$1,000.00 per calendar week of delay or part thereof during which all the aforementioned information is supplied, as stipulated in 1.3 and 1.4.

ii) Delay to Complete and Deliver, installation and commission

Should the Contractor fail to complete the Commissioning (item (e) in 1.4) within the period set out in 1.4 (or price schedules 9A), liquidated damages for such late execution shall be charged at a rate of F$1,000.00 per generating set per calendar day of delay or portion thereof.

1.6 DESIGN AND STANDARDISATION

The generating plants together with its auxiliaries shall be designed and manufactured to ensure:

i) Satisfactory continuous operation under prevailing atmospheric conditions at the site.

ii) Safety of operation and maintenance personnel.

iii) Facilitate economical, easy and simple inspection, maintenance and operations.

iv) To operate satisfactorily under such variations of load as may be met with under working conditions in the system including those due to short circuit.

1.7 TOOLS AND INSTRUMENTS

The Contractor shall supply all special tools and instruments which may be necessary to carry out the installation, commissioning, operation maintenance, overhauls, inspections and repairs expeditiously, for all the equipments supplied through this contract. These tools and instruments should cover:

i) Normal maintenance, emergency , and insurance spares for engines and auxiliary equipment
ii) General and special tools for engine, auxiliary mechanical & electrical equipment.
iii) Testing and calibration tools for control & instrumentation on engine, mechanical and electrical equipment.
iv) Computer programs (Software/hardware) used in the operation, monitoring, setting and /or maintenance of all the equipments supplied through this contract

Exceptions and items required but not supplied must be highlighted along with the current market rate for each of such items. Unless the authority has granted any relief or exemption, the contractor is expected to include all such tools and instruments in the bid price. List of such tools and instruments should be provided with the Tender with their unit prices. The tools and instruments provided shall facilitate simultaneous maintenance and servicing.

1.8 PROVISION FOR HANDLING THE PLANT

All heavy parts of the plant supplied under the contract shall have provisions for lifting, slinging and handling during delivery, erection, maintenance and overhauls. A legible name plate indicating the safe limits shall be prominently displayed where possible.

1.9 PACKING

The successful Tenderer is to ensure that the following shipping marks appear on each case shipped.

a) The Authority's official order number, which shall be "FEA, *followed by a number*".

b) The words "Suva", FIJI".

All material and equipment are to be packed to be transported to the site so that they are protected against climatic conditions and handling to which they may be subjected to in transit and storage at the site.

Spare parts or components supplied shall be individually and suitably preserved, packed and 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 or prolonged storage. Preservation chemicals/agents may be employed to ensure that goods delivered are received in good shape and that they can be stored for long durations without fear of corrosion or contamination.

All markings within the inside and on the outside of casings or packaging are to be either of a water proof ink, material or protected by Shellac or varnish to protect obliteration in transit, handling and storage.
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2.0 INSURANCE

The Tenderer shall deliver the complete equipment supply, Delivered Duty Unpaid to the transfer point identified in the Tender specifications.

2.1 TAXES

The Authority shall pay all customs, duties, excise taxes and other related fees associated with the importation of the off-shore equipment scope.

The Tenderer shall be responsible for paying any and all Fiji Government taxes, VAT, income taxes, normal business permit, fees, or taxes related to the on-shore "Fiji" related installation work including but not limited to Fiji purchases, all Fiji related construction, consultancy, sub-contracting, transportation, commissioning, training, warranty or other work or activities while in Fiji.

PART 4 SPECIFICATIONS: TECHNICAL

1. SCOPE OF WORK

The scope of work to be carried out under the terms of this specification comprises the design, supply, delivery to Suva Port one(1) only 350 $KW_{(e)}$, **Standby Rating** at 0.8 PF, 50HZ, 415V lagging, complete with all necessary mechanical and electrical auxiliaries including but not limited to, excitation equipment, cooling system, engine alarm control panel - both local and provisions for remote control, metering and instrumentation, to connect with the provisions provided on the existing 415V switch gear, generator alternator and engine protection, auto synchronizing, engine auxiliary drives, associated pipe work and associated controls.

1.1 The following should be included as part of the contract:

i) Three (3) copies of operating, servicing and maintenance instructions and spare parts manuals, for the complete scope of supply, including the maintenance programs (soft ware/hardware) developed by the contractor.

ii) Any necessary erection material including special tools and equipment necessary to erect, operate and maintain the genset.

iii) Duplicates of softwares/programs, licenses, software keys, passwords, etc. supplied in this contract shall be hand over and shall form part of the completed installation.

iv) A list and price of consumables & spare parts for operating and maintaining the genset up to 5,000 operating hours

2. DESIGN REQUIREMENTS

The work performed and equipment offered to this specification shall have a proven track record of satisfactory service in similar applications under site conditions, similar or more severe than those specified herein. The contractor shall provide a detailed schedule of each of the equipment having met the required design criteria and standards and include deviations from the current standards used in the design. The decision of the Authority in certifying and acceptance of the result shall be one of the main factors in evaluation and certifying completion of the contractor's performance and settling the payments due to the contractor for the performance.

The specification provided in the tender document is for guidance, however the contractor is allowed to improve on such conditions and indicate in the tender documents if the intent of such deviations establishes that the products provided are equal to or better than what is mentioned in the tender document.

3. REFERENCE CONDITIONS

The following environmental conditions are applicable to this site.

I) Elevation above mean sea level 5 metres

ii) Average barometric pressure 1012 mBar

iii) Ambient air temperature
Design Temperature 40 Deg C
Minimum 20 Deg C

iv) Relative Humidity
Maximum relative humidity 95%
Minimum relative humidity 70%

v) Seismic Condition
All equipment shall be capable of withstanding an acceleration of 3.3 m/sec² in any direction without sustaining any damage.

The temperature of the fresh water supply is always less than 30 ^{o} C at the site. The following is an analysis of the supply water available :

pH	8.3
Alkalinity	mg $CaCO_3$/Ltr68.2
Chloride	mg/Ltr7.3
Sulphate	mg SO_4/Ltr8.4
Free CO_2	mg/Ltr0.62
Temporary Hardness	mg/Ltr3.6
Permanent Hardness	mg/Ltr64.0
Total Hardness	mg $CaCO_3$/Ltr68.2
Total suspension solids	mg/Ltr<1
Total dissolved solids	mg/ltr126

4. CAPACITY AND RATING

4.1 Genset Capacity

The net maximum continuous site rated capacity of the generating plant shall not be less than 350KW$_{(e)}$ at the specified reference conditions and 0.8 power factor lagging. The output shall be 3 phase and 415 volts at 50 hertz.

The net maximum continuous site rated capacity of the diesel generating gensets shall be defined as the electrical output available at the alternator output terminals LESS the sum of rated full load electrical power requirements of all auxiliaries.

The diesel generating units shall be designed to operate at 80% continuous base load operation for +5,000 hours per year, Utility operation. Gensets will operate in parallel with other plants and Utility system, or may be operated independently in Island mode. Gensets will be factory tested to demonstrate the ability to carry an overload of 10% of the maximum continuous site rated capacity for one hour of continuous operation without overheating or tripping alarms.

The engine shall be commissioned and put into commercial operation at 80% base load. It shall be able to absorb and sustain 10% overload swings for a minimum of five (5) minutes & maximum thirty (30) minutes without activating any alarms or shutdowns.

4.2 Rating

The maximum continuous and short time rating of the alternator at the specified site conditions shall comply to AS1359 and shall be sufficient to enable the maximum continuous site rated capacity and overload capacity of the genset to be obtained at the specified reference conditions.

The continuous and overload rating of the diesel engine shall be in accordance with ISO 3046 Part I and shall be sufficient to enable specified maximum continuous rated capacity and overload capacity of the genset to be obtained at the specified reference conditions in accordance with the adjustment provisions of ISO 3046 Part I.

In determining the ratings of individual items of the equipment, reference shall be taken of the conditions at the Power Station as specified in clause 3.

5. PLANT LAYOUT REQUIREMENTS

5.1 General Arrangement

The existing plant layout shall be provided upon request to show the proposed location of the installation.

5.2 Safety Aspects

All items of the equipment shall inherently be designed for safe operation and the plant shall be designed such that, the plant may be operated in compliance with the Health and Safety Act Work Act 1996 of the Republic of Fiji, and/or existing OHS regulations in Australia/New Zealand.

6. CONTROL

6.1 All panels, cubicles, mountings, instruments, protective devices, control equipment and connections necessary for the safe, convenient and reliable operation of the generating plant and for effective fault indication shall be provided and installed. Effective dissipation of heat generated by components shall be provided.

6.2 Where appropriate, solid state electrical circuitry is preferred. Relays shall be of the plug-in type, fitted with retaining clips and provided with adequate dust covers. Relays shall have a reliability of operation appropriate to the application.

6..3 All control components shall be clearly identified and labelled in accordance with a scheme. Cable identification shall be of the slip on type sized to fit neatly over the cables.

6..4 Indication of the status of the control system shall be displayed on the diesel generator control board (and duplicated as specified at the remote control panel).

6.5 The control system shall disable operation of the generating units under fault conditions.

6.2 Control System

6.2.1 A control system shall be provided to enable control of the diesel generating unit, through start, run, synchronise, load, unload and stop, to be exercised from engine room or control room and this control mode shall be defined as local control. Provision for remote operation/control of this control system shall be provided.

6.2.2 The control system should provide for parallel operation either with Droop, VAR or Power Factor

control. Provision for Dead Bus Operation must also be provided.

Note: A Control System which integrate all the functions in (6) above into one Control System is preferred for enhanced Reliability & Performance

7. DIESEL ENGINE AND AUXILIARY EQUIPMENT

7.1 The diesel engine shall operate satisfactorily on the fuel oil as specified in 7.4 of this section and generally in accordance to ISO 3046, unless specified otherwise. The diesel engine shall be equipped with all ancillary equipment required to satisfactorily achieve the required performance under the specified site conditions.

7.2 Engine Governing

The engine shall be provided with an electro-hydraulic controlled actuator/governor having programmable provisions/adjustment of droop, speed synchronizing, load limiting and synchronizing indications.

For engine speed control, it shall be set up for direct-acting operation whereby a loss or interruption of electrical/electronic signal to the actuator will move the fuel rack to minimum fuel and cause engine shutdown.

The governor shall be capable of parallel operation with other gensets within the power plant, or other gensets in the national grid.

The governing requirements must comply to ISO 3046, class M2, the genset to comply with ISO 8528-5, class G2.

7.3 Engine combustion air System

Exhaust gas driven turbochargers are to be provided. The turbocharger rotor shall be statically and dynamically balanced to ensure a smooth and vibration free operation.

7.4 Engine Fuel Oil System

8.4.1 Specification of Industrial Diesel Fuel available for use is as follows :

Characteristic	Clear and Bright at Ambient Temp	Test Method	Average of last 12 months
Colour	4.0 max	D1500	2.0
Density @ 15° C (Kg / m^3)	920 max	D1298/D4052	851.0
Ash (% by mass)	0.01 max	D482	< 0.01

Carbon residue	0.2 max	D189/D4530	< 0.20
Cetane number	35 min	D613	-
Cetane index	35 min	D4737	54
Cold filter plugging point (^{o}C)	11 max	IP309	9
Flash point (^{o}C)	65 min	D93	80
Sulphur (% by mass)	1.0 max	IP336	0.45
Water (% by volume)	0.1 max	D95	0.07
Sediment (% by mass)	0.02 max	D473	< 0.02
Viscosity @ 40° C (mm^2 / s)	1.8 - 5.8	D445	3.1
Neutralisation Value (Strong Acid #) (MgKoH/g)	nil	D664/D974	nil
Conductivity @ 23° C (Ex refinery) (pS / m)	100 - 450	D2624	200
Conductivity @ 23°C (Within terminal) (pS / m)	70 - 450		-

7.4.2 The standby generator must have a day tank. Available runtime must be provided for 100% load condition with a full day tank.

7.4.4 The fuel filters shall be capable of removing all foreign matter above a particle size of 5 microns and shall have a capacity sufficient to ensure 500 hours full load operation between servicing.

7.5 Engine Lubricating Oil System

7.5.1 The engine shall be equipped with a positive pressure forced-feed lubrication system to all moving parts of the engine. There shall be no moving part which requires manual lubrication whilst in operation. The engine lubricating oil system pressurising pump shall be attached to and driven from the engine. It shall be of the positive displacement type and shall be equipped with a pressure relief valve (with provisions to adjust the pressure) to regulate oil pressure at the engine bearings and to prevent a build up of excessive pressure within the system

7.5.3 Provisions to check the oil level with a graduated dipstick while engine is running should be provided.

7.5.4 If the engine sump is wet type a sump drain facility shall be provided with positive locking against accidental opening. A high and low oil level shall be provided on the oil sump to allow shutting down of generating set in case of very low oil level and very high oil level due to fuel or water leakage into oil sump.

7.5.5 The engine shall be fitted with full flow type lubricating oil filters. The Tenderer is required to specify the type of lubricating oil filter recommended with its economic justification. Mobil, TOTAL, or Pacific Energy presently provides lubrication oil in Fiji. Tenderer is asked to specify at least one type of recommended lubrication oil from each lube oil supplier.

7.6 Instruments & Protection

All engine sensors, gauges; automation/instrumentation shall be mounted/located in a manner allowing ease of access for service, testing, maintenance, troubleshooting and replacement of faulty components. Mounting of control panels and terminal boxes on the engine shall be extremely minimal and where it cannot be avoided, they shall be fitted with vibration mounts. Instrumentation and Control wires/cables as well as connection plugs and terminations to be used shall be double insulated and additional measures taken to avoid damage caused by excessive heat and vibration. Sufficient spare plugs, terminal lugs, and/or jackets shall be provided.

7.6.1 Local engine instrumentation should include at a minimum:

a) Lubricating oil temperature
b) Lubricating oil pressure
c) Water temperature after radiator
d) Water temperature before radiator
e) Water outlet pressure
f) Engine inlet charge air temperature & pressure
g) Control air pressure
h) Cylinder exhaust temperature.

In addition, provisions must be provided for a remote engine alarm as per above list. All alarm indications are to be mounted on an annunciation panel with facility for **TEST**, **MUTE** and **RESET**.

7.6.2 Engine shutdowns shall be required for :

a) Water outlet temperature high
b) Alternator bearing temperature high.
c) Engine lubricating oil pressure low.
d) Engine lubricating oil temperature high.
f) Radiator water level low
g) High oil sump level
h) Low oil sump level
i) Overspeed trip (Electrical, which shall be set lower than mechanical overspeed).
j) Electrical fault which is a group alarm for differential fault on the generator.
k) Emergency stop both local and remote.
l) Control supply failed.
m) Over Cranking

On the operation of any one of the above :

a) The engine should shutdown completely.
b) The generator circuit breaker should trip and display C/B open remote alarm.
c) Data logging with time sequence of all alarms.

To avoid the engine restarting when the trip is reset, the engine override shutdown timer should be locked out to the desired stop down time.

In addition a provision must be available for remote engine shutdown as per above list.

7.6.3 Engine Protection (Electrical)

The engine shall be fitted with all protection devices necessary to ensure safe operation of the engine under the specified operating conditions. Such devices shall, where applicable, be integrated with other protection devices specified.

The following protection equipment is a minimum requirement. However, the tenderer shall also include any additional items deemed necessary to satisfy the requirements of this section.

a) Overspeed Trip

The engine shall be provided with an over-speed trip which shall operate independently of the normal speed governor and shall act directly upon the supply fuel to the engine. Operation of the over-speed trip shall also operate auxiliary contacts for the initiation of all alarms and for switchgear tripping.

b) Low lubricating oil pressure shutdown

The engine shall be provided with a mechanically operated device which shall operate independently of normal speed governor and shall act directly upon the engine fuel supply. Operation of this trip shall also operate auxiliary contacts for the initiation of all alarms and for switchgear tripping. The setting pressure of the device shall be much lower than the electrically operated device but above the safe operational requirements.

7.7 Engine Crankcase Ventilation

The engines shall be equipped with an engine crankcase breather or condensation trap, together with associated electrics, valves and pipe work to effectively condense lubricating oil fumes so that no lubricating oil is discharged outside the power station.

7.8 Engine Exhaust System

7.8.1 The engine shall be provided with a residential exhaust system comprising steel exhaust piping, expansion bellows, exhaust silencers and all necessary hangers and supports for a horizontal mounted arrangement. The exhaust piping shall be of thick walled steel sized in accordance with the engine manufacturer's requirements.

7.8.2 Critical grade (35 db) Exhaust silencer(s) residential grade shall be provided and shall be located horizontally on support stand and shall be supported on adequately designed anti-vibration devices to prevent transmission of noise and vibration to the building structure. Where piping penetrates the wall of the power station or the ceiling, approved pipe sleeves shall be provided.

7.8.3 The noise level outside the power station due to the complete equipment scope offered shall be less than 75 dB(A) at a distance of 7 metres from building walls or externally mounted equipment.

7.9 Engine Cooling System

7.9.1 The engine shall be water cooled. The radiators shall be engine mounted and cooling fan engine driven. The radiators shall be of the heavy duty and pressurised type protected for humid and salt air conditions and shall be designed with adequate core cooling capacity. The radiators shall have a cooling capacity under the specified site conditions of 40 deg C, sufficient to adequately satisfy the cooling requirements of the diesel engine operating at 100% of continuous site rating. In the design of the radiator, an allowance of not less than 20% shall be made for reduction in heat transfer capacity by fouling. Sizing calculations are to be provided with engineering submittals. Coolant water conditioning system shall be provide to adequately maintain cool water chemistry.

7.9.2 A thermostatically controlled diverting device shall be installed in the cooling water circuit to maintain the temperature of the water entering the engine jacket at the required level and to facilitate rapid warming up of the engine during start up.

7.9.3 All rigid piping shall have provisions to absorb shock and vibration caused by the engine while running.

8.0 Automatic Voltage Regulator Panel

A separate free standing panel or a panel incorporate within the control panel with anti-vibration mountings to house a Thyristor divert Automatic Voltage Regulator (or manufacturers standard), with a field circuit breaker (if required) and associated instruments and indications as listed below are required :

a) Generator volts
b) Field volts
c) Divert current
d) Field current
e) Field circuit breaker trip indicator

Note: A separate field suppression switch will be required if an alternative Automatic Voltage Regulator is used. The Contractor will have to supply information on the type and make of the automatic voltage regulator and provide the installation details.

9.0 ALTERNATOR & EXCITATION

9.1 Alternator

9.1.1 The alternator shall be flexibly connected to the prime mover. The alternator cover and vent openings shall have screens to protect any foreign objects from entry. The main rotor shall be of a rotating field type fitted with damper windings and should be self ventilated.

9.1.2 The alternator offered shall be suitable for parallel operation with other generators in the National grid. The phase rotation of the existing plant is Red, Yellow, Blue or A, B, C.

9.1.3 Windings shall be star connected with both ends of each winding brought out to separate terminals for external star connection for appropriate neutral earthing resistor and isolator. Suitably sized switchgear and resistor shall be provided. The Neutral earthing system supplied shall be designed in manner that overheating of the resistor or associated connection accessories due to harmonics or load unbalance is minimized.

9.1.4 Each phase winding shall incorporate positive temperature coefficient thermistor for over temperature detection and Partial discharge detection coils (ROGOWSKI). The later is optional and should be quoted separately if it is not a standard fitting. A complete spare set of thermistors shall be incorporated and terminated adjacent to the terminals of its corresponding element and a temperature monitoring device shall be provided in the remote engine control panel.

9.1.5 A terminal box shall be fitted to the stator frame to enclose the winding and thermistor terminals. The terminal box shall be suitable for right angle termination of main cables in the alternator on either side of the stator.

9.1.6 The alternator frame earthing shall be external to the terminal box or to a suitable location within stator frame.

9.1.7 The Stator and Rotor windings shall be insulated to Class F standard or higher.

9.1.8 The wave form of the output voltage shall be sinusoidal for the full range of loads and power factors and should comply to AS1359.The zero sequence reactance of the alternator shall not exceed 30%.

9.1.9 Winding temperature rise above reference conditions shall remain within the limits stated in AS1359 under specified load and a 1 hour overload condition. The rotor shall be statically balanced and remain in dynamic balance up to 125% of rated speed.

9.2 Excitation

If the alternator is provided with a direct coupled shunt wound exciter, adequate access to the brush gear for inspection and maintenance shall be provided.

A Brushless type Excitation is preferred that is fitted with protection for the diodes. Diode failure indication shall be provided and the machine shall continue to operate in the event of a single diode failure. Excitation transformer shall be protected by fuse and located in the alternator pit. It may be oil or air insulated.

Preference will be given to a dynamic excitation system.

Windings shall be insulated to Class F standard or higher.

Provisions for the connection of automatic field suppression shall be provided.

9.3 Voltage Regulation

(a) The regulated voltage shall remain within ± 1.5% of the set value under all specified steady load conditions for frequencies between 46 and 54 hertz. The engine-generator shall be able to operate on-load without limitation on the above-specified frequencies as per condition specified in (d) below.

(b) The output voltage shall be adjustable within ± 10% of nominal.

(c) The regulated voltage shall be taken as the average of phase to neutral RMS voltages of the three windings excluding cases where the current ratio between highest and lowest phases exceeds 2:1.

(d) Under the condition of sudden application of (Specify Maximum Allowed) xx% rated load or the removal of full load, the voltage shall remain within a minimum of ± 7% and a maximum of ± 10% of the set value with 99% recovery effected within 0.5 seconds and full recovery within 1 second for frequencies between 46 and 54 Hertz. Tenderer shall provide performance test results of proposed equipment impact loading/load rejection capability.

(e) The Contractor could provide, if possible, a value better than the above voltage regulation.

(f) The maximum deviation in voltage shall conform to the requirements of IEC34.

(g) Additional manual field regulation shall be provided with the selector and controls mounted on the front of the AVR panel (if available).

(h) Voltage regulation equipment shall be suitable for parallel operation of alternators in the Fiji National Grid.

(i) Equivalent characteristics for voltage regulation must be provided with a clear statement describing

the type of voltage regulation offered so that reactive power loading can be shared equally or as desired between the existing generators and the one offered.

(j) Control, Protection and Monitoring requirements are specified elsewhere. Alternator output shall collapse on short circuiting the output terminals in a manner which operates the protection relays.

(k) Set voltage shall be re-established within 2 seconds of removing the short circuit. The differences in phase to neutral voltages for an out of balance loading between any two phases should not exceed ± 2 1.5% of nominal voltage.

(l) On start-up, with automatic voltage control on and with a resistive load of 30% rated capacity applied to the output voltage, regulation shall be achieved within 3 seconds of the genset reaching a shaft speed corresponding to 46 Hz.

10.0 OTHER ELECTRICAL COMPONENTS

10.1 Design Standards for Electrical Plant

All electrical components shall be designed for continuous operation when the plant is operating at full rated output under the conditions specified. Design standard for electrical works shall be IEC

Except for the Alternator and Exciter, the electrical components and cables shall be selected such that, under full rated plant output, the current and voltage conditions for the components do not exceed 80% of the manufacturer's safe working rating.

The temperature rise of the air within the enclosed cubicles shall not exceed 30°C at the full rated output at the specified reference conditions. The IEC Wiring Regulations shall apply to all electrical works. All capacitors used, shall be designed to withstand 2.5 times the test voltage for 1 minute at its rated values. Electrolytic capacitors could only be used in printed circuit boards according to the design.

Synchronising facilities for parallel operation of the generating plant should be provided.

All circuit components shall have provisions for testing, fault tracing and shall have Test/Disconnect terminal blocks with relevant drawings.

11.0 WIRING, CABLES AND CONNECTIONS

All wiring work shall be carried out neatly to the satisfaction of the Authority and in accordance with the SAA regulations or better.

Insulation shall be non-flammable, non-hygroscopic, fungus resistant and shall not be affected by normal plant operating temperatures or by oils and lubricants.

Insulation resistance shall not be less than 100 Megohm at a voltage which is the greater than 500 V dc or equivalent to a DC voltage equal to twice the peak working voltage.

Wiring for control and monitoring system shall be colour coded PVC insulated complete with wire numbers inserted and enclosed in "galvanised screwed conduits" terminating in terminal boxes. The connections should also be water tight.

11.1 Cable size

The minimum cable size shall be:

a) Control Wiring, 1.5 mm^2

b) Power Wiring, 2.5 mm^2

A copper Busbar or multi strand soft drawn copper cable shall be used where the cross sectional area of conductor exceeds 95 mm^2.

Wiring terminations shall be identified according to the wiring diagrams and the conductors shall be securely clamped in approved terminal blocks by means of self-locking screwed clamps.

High voltage cables shall be XLPE and armoured with steel wire.

The contractor shall provide on-site training for up to 4 persons nominated by the Authority in the correct operation of plant installed for a period of one week prior to preliminary site testing of the gensets is completed. The tenderer shall include this training cost in their proposal.

Operating and Maintenance Manuals as specified shall be made available by the contractor before such training is commenced.

13.0 TESTING AND COMMISSIONING

13.1 General Requirements

The Contractor shall be responsible for performing all required tests, including the provision of materials, test equipment, measuring equipment and any specific arrangements that may be deemed necessary by the Authority to achieve the testing required with the exception of the supply and cost of fuel, electricity and water required for site preliminary and acceptance tests. The required tests are specified in the following sections of this specification.

13.2 The testing programme shall generally consist of :

a) Tests prior to delivery to the site. Such tests are intended to ensure no faulty or unsuitable items are delivered to site.

b) Preliminary tests at site for individual and assembled components. Such tests shall demonstrate the ability of components to perform their designed function in accordance with the Specification and performance.

c) Commissioning tests on the completed installation. Such tests shall demonstrate that the performance of the installation that meets the Specification and guaranteed performances.

The sequence of tests shall be subject to the prior approval of the Authority. The proposed programme of tests shall be submitted to the Authority at least 4 weeks before the commencement of the commissioning tests.

The Contractor shall perform any additional tests that the Authority may deem necessary to satisfy that the plant complies with the Specification.

All tests shall be performed in the presence of and to the satisfaction of the Authority or nominated representative. The limits of accuracy shall be as specified in ISO 3046/111.

The results of all tests shall be recorded and certified by the Contractor and copies of the certified results delivered to the Authority within 2 weeks of the completion of the tests.

Defects revealed during testing shall be rectified at the Contractor's expense and the tests subsequently repeated until all defects are eliminated.

Live load shall be available at the site to provide suitable loading conditions at the time of testing.

The frequency of measurements proposed during the tests shall be subject to an agreement by the Authority in advance.

A regulatory certificate and approval required for the installation and equipment shall be obtained by the Contractor on the Authority's behalf and supplied to the Authority prior to operation of that equipment.

13.3. The TEST for the generating plant shall comprise:

a) A general inspection of the equipment to check its compliance with the specified requirements.
b) Measurement of the cold resistance of the electrical windings.
c) Determination of the alternator open circuit and short circuit characteristics.
d) Pre-starting and start-up procedures, alarm and shutdown tests, synchronising tests and engine compression tests.
e) A continuous trial sequence of :

0.5 hour at 20% rated load
0.5 hour at 30% rated load
0.5 hour at 40% rated load
0.5 hour at 50% rated load
0.5 hour at 60% rated load
2.5 hour at 70% rated load
2.5 hour at 80% rated load
2.5 hour at 90% rated load
8 hours at 100% rated load

At the above mentioned loads, all the parameters listed in the local instrumentation and those in remote engine control panel shall be monitored. The accuracy of the measurements shall be as in ISO 3046. In addition, the specific fuel consumption and the specific lubricating oil consumption shall be calculated and provided with the tender document.

13.3.1 The continuous test run shall comprise of:

a) After completion of the continuous trial runs, the genset shall be returned to 100% rated load for a length of time sufficient for the alternator and exciter temperatures to stabilise. The genset shall then be shut down and measurements and readings taken immediately of the alternator and exciter winding temperatures and hot winding resistances.

b) Determination of frequency and voltage transient and permanent changes and response times under the following instantaneous load changes :

i)No load to 50% of rated load (or maximum allowed by manufacturer)
ii) 100% rated load to no load (rejection test)
iii) No load to 100% rated load in steps of 25% of rated load.

c) Operation of all protective circuits and devices together with verification of the settings of the associated sensors.

d) Insulation resistances and high voltage checks.

The parameters to be measured on the engine shall be in accordance with Table 2, List A of ISO3046/II appropriate to the engine group number as defined in Table 1 of ISO3046/II. Where no provision exists on the engine for the measurement of any particular parameter, this shall be stated in the tender. The accuracy of measurement of all engine parameters shall be in accordance with ISO3046/III.

For any witness tests by the client, the Contractor shall arrange at no extra cost, the removal of all necessary covers to permit adequate visual inspection of components of the equipment to facilitate these tests.

The Contractor will also be required to arrange for the inspection of valve faces and combustion components using a baroscope. In addition, the Authority may nominate one cylinder head, piston and connecting rod assembly to be removed for inspection. Furthermore a pair of main bearings shall also be opened and inspected.

If the condition of components inspected is considered satisfactory, the generating plant shall be re-assembled.

If the condition of components removed is considered unsatisfactory by the Authority, a complete strip down of such engine or generating unit may be required to determine the cause of failure of components. The necessary remedial action shall be taken by the Contractor and the appropriate test repeated until satisfactory results are obtained. Such work shall be at the expense of the Contractor.

The Contractor shall repair or replace any equipment that fails in service. Penalties for late delivery of the each genset shall apply until the repaired/replaced equipment becomes fully operational.

14.0 COMMISSIONING TESTS

14.1 The Tests shall consist of:

a) Inspection and verification of the complete plant to determine the overall compliance, correctness of all adjustments and settings, operational suitability of the installation against the specified requirements and shall include checking the tightness of all connections and fastening devices.

b) Verification of the correctness of operation of all protection devices and systems, including the related relative sensors settings. Induced faults imposed to simulate the responses shall be as close as possible to the actual fault conditions.

c) During the continuous trial the following parameters shall be measured at intervals not exceeding 30 minutes.
   i) Alternator output, kW or kVA.
   ii) Alternator output voltage
   iii) Alternator output current and Temperatures
   iv) Alternator output frequency
   v) Power factor
   vi) Exciter voltage
   vii) Exciter current
   viii) Engine parameters as specified
   ix) Electrical power requirements of all continuously running electric motor driven ancillaries and auxiliaries.

d) Determination of frequency and voltage transient and permanent changes and response times under the following instantaneous load changes for the generating unit :
   i) No load to 100% of rated load (or maximum manufacturer allowed step load)
   ii) 100% of rated load to no load (rejection test)
   iii) No load to 100% rated load in increments of 25% of the rated load.

e) Verification of the correctness of operation of all starting, synchronising, parallelling, and stopping control systems, both automatic and manual.

f) Verification of compliance with the total harmonic distortions as specified.

g) Verification of specific fuel and specific lubricating oil consumption.

The Contractor shall carry out such further tests as the Authority may require to satisfy the Contractor's installation meets all the specified requirements.

At the completion of the above commissioning tests, the Contractor shall be required to arrange, at no extra cost, for the removal of all covers to permit adequate visual inspection of the equipment.

The Contractor will be required to arrange for the inspection of valve faces and combustion components using a baroscope. In addition, based on the inspection results, operational performance and crankshaft deflection readings; the Authority will nominate one cylinder head, piston and connecting rod assembly to be removed and inspected. Furthermore a pair of main bearings shall also be opened and inspected.

If the condition of components inspected is considered satisfactory by the Authority, the generating unit shall be reassembled.

If the condition of components inspected is considered unsatisfactory by the Authority, a complete strip down of such engine or generating plant may be required to determine the cause of failure. The necessary remedial action shall be taken by the Contractor and the appropriate test repeated until satisfactory results are obtained. All such work shall be at the expense of the Contractor.

15.0 SERVICE

The tenderer shall nominate the type and extent of the servicing facilities, the availability of spare parts, and numbers of field service engineers trained and certified to supervise service work on the engines offered.

The tenderer shall indicate the anticipated long term availability of spare parts.

The Tenderer shall offer an extended 3,000 engine hour warranty or 12 months whichever occurs first for the engine and all auxiliary systems supplied.

16.0 SPARE PARTS

The tenderer shall provide a guarantee from the Manufacturers that all spare parts, materials and components used in all the equipment supplied in this tender shall be available for procurement for a period of 10 years after the equipment has been successfully commissioned and accepted by the Authority.

PART 5 **DELIVERABLES**

SCHEDULE 1 of 7 Schedules: Technical Particulars
(Note: Failure to submit all required technical information would make the tender bid **non-compliant)**

1. Tender's Name: _____

2.0.0 Diesel Generator Plants

2.0.1 Make of Engine/s _____
Type of Engine/s _____
Year of Manufacture _____
Make of Alternator _____
Type of Alternator _____
Rated Speed (rpm) _____

2.0.2 Engine/s manufactured by and Country _____
Alternator/s manufacture and Country _____

2.0.3 Continuous rated output at Alternator terminals:

i) ISO 3046/1 Conditions _____
ii) At specified site conditions _____

3.0.4 Fuel Consumption Guarantee

i) Based on fuel oil having a net calorific value of 42,700 kJ/kg and specific gravity of 0.84 at ISO 3046/1 conditions in kJ/kWhe, net plant :

% of Full Load	**Specific Fuel Consumption in Kg/kwh electrical Output for fuel type specified**	
	Net kg/kWh measured at alternator terminals	Net Plant KG/kWh measured at 11 KV bus
75		
85		
100		

ii) 0% Tolerance in above consumption at rated load per ISO 3046/1

3.0.5 Lubricating Oil Consumption Guarantee

i) Lubricating oil consumption

% of Full Load	**Specific Lubricating Oil Consumption Litres/kWh**
100	

ii) 0% Tolerance in above lube oil consumption at 100% load

3.0.6 Ancillary Power

The continuous net site rating should be measured with all the electrical driven engine ancillaries and auxiliaries when the diesel generating plant is operating at maximum continuous rating.

3.0.7 Engine governor

a) Manufacturer _____
b) Model _____
c) Type _____
d) Conforms to Class A Regulations [Yes / No]
If no, please specify _____
e) Is the load control motor
24V dc, 3 wire system [Yes / No]
If no, please specify _____

Load Acceptance characteristics

% of Full Rated Load Accepted	Governor Recovery Period in seconds	Minimum Speed Reached (rpm)
50		
75		
100		

Load Rejection characteristics

% of Full Rated Load Rejected	Governor Recovery Period in seconds	Maximum Speed Reached (rpm)
50		
75		
100		

3.0.8 Installation Data

I) Overall Dimensions of the plant
Length _____ mm
Width _____ mm
Height _____ mm

ii) Total weight of engine and alternator _____ kg

iii) Minimum turning radius for the assembled plant _____ mm

iv) Weight of heaviest part to be lifted for :
installation _____ kg
maintenance _____ kg

v) Minimum recommended clear access space for operation and/or maintenance at :
free end of engine _____ mm
sides of plant _____ mm
excitor end of plant _____ mm

x) Type of installation selected i.e. solidly mounted or with a combined under base :_____
_____

xi) Justification for type of design chosen : _____
_____

xii) Detail modifications required to adapt the plant in the existing foundation : _____
_____

3.0.9 Vibration Characteristics

a) Anti-Vibration Mounting (if applicable)
I) Make and type _____
ii) Number per genset _____
iii) Isolation efficiency over a range of frequencies (%) _____

4.0.0 DIESEL ENGINE

a) Number of cylinders _____
b) Bore, Stroke _____, _____ mm
c) Speed _____ rpm
d) Type of aspiration _____
e) I.S.O. Standard Power at ISO 3046/1 conditions (MW) _____
f) Recommended lubricating oil _____
g) Method of starting _____

5.0.0 ALTERNATOR

5.0.1 Type _____ Make _____
5.0.2 Maximum continuous rating _____ MW at U.PF
_____ MW at 0.8 PF
5.0.3 Rated Voltage _____ kV
5.0.4 Rated Frequency _____ Hz
5.0.5 Full rated load current _____ Amps
5.0.6 State compliance to what Standard to which the alternator is made and tested _____
5.0.7 Insulation class of Rotor_____ and Stator _____
5.0.8 Temperature rise at max continuous rating _____°C
Temperature rise after 10% overload for one hour _____°C
5.0.9 Efficiencies

% of Maximum Continuous Rating	Efficiency at Unity pf	Efficiency at 0.8 pf

Signature of the Tenderer

Date:

100		
90		
80		
70		
60		
50		

5.0.10 Voltage wave form on open circuit (Ph - Ph) _____ Volts
(Ph - N) _____ Volts

Amplitude of 3rd Harmonics _____
Amplitude of 5th Harmonics _____
Amplitude of 7th Harmonics _____
Amplitude of 9th Harmonics _____
Amplitude of 11th Harmonics _____
Amplitude of 13th Harmonics _____

5.0.11 Inherent Regulation at rated voltage at unity pf _____
at 0.8 pf _____

5.0.12 Reactance

a) Reactance at full rated voltage _____
b) Leakage reactance XL _____
c) Direct axis synchronous reactance Xd _____
d) Quadrature axis synchronous reactance Xq _____
e) Direct axis transient reactance X'd _____
f) Direct axis sub-transient reactance X"d _____
g) Quadrature axis sub-transient reactance X"q _____
h) Negative phase sequence reactance X_2 _____
I) Zero phase sequence reactance X_0 _____

5.0.13 Time Constants

a) Direct axis transient open circuit T'do _____
b) Direct axis transient short circuit T'd _____
c) Direct axis transient sub transient short circuit T"d _____

5.0.14 Characteristic Curves

Tenderer to enclose following:

1) Manufacturer's Generator Characteristic Curves showing :
   i) Open Circuit Saturation
   ii) Short Circuit Saturation
   iii) Air Gap Line
   iv) Rated Current Saturation at 0.8 pf

2) V-Curves at rated voltage

3) Capability Curves at rated voltage.

5.0.15 Excitation voltage at max continuous generator output volts

5.0.16 Excitation current at max continuous generator output amps

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Date:

5.0.17 Type and make of stator winding temperature monitoring device
Range°C to °C _____ to_____
Accuracy ± °C _____

6.0.0 EXCITOR

6.0.1 Make and type _____

6.0.2 Type of Enclosure _____

6.0.3 Rated output _____ Amps _____ Volts

6.0.4 Maximum voltage _____

6.0.5 Class of Insulation _____

6.0.6 Alternator Noise

Frequency Hz	163	125	250	500	1000	2000	4000	8000	**Total**
Sound dB(A)									

6.0.7 Excitor winding Temperature rise at maximum continuous rating _____°C

7.0 AUTOMATIC VOLTAGE REGULATOR

a) Make and type _____

b) Regulated voltage range under all specified steady load conditions for frequencies between 46 and 54 hertz. _____ to _____ volts

c) Does the voltage remain within a minimum of ± 7% and a maximum of ± 10% of the set value with 99% recovery effected within 0.5 seconds and full recovery within 1 second with a sudden application of 60% of full load. [Yes / No]

If No, please specify _____

d) Does the voltage remain within a minimum of ± 7% and a maximum of ± 10% of the set value with 99% recovery effected within 0.5 seconds and full recovery within 1 second with a sudden removal of 100% load. [Yes / No]

If No, please specify _____

e) Does the maximum deviation in voltage conform to the requirements of AS1359. [Yes / No]

If No, please specify _____

f) Is a manual field regulation provided with the selector and controls mounted on the front of the AVR panel. [Yes / No]

If No, please specify _____

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Date:

g) Is voltage regulation equipment suitable for parallel operation of alternators. [Yes / No]

If No, please specify _____

h) Does the regulation equipment have the following :

I) Droop adjustment [Yes / No]
ii) Voltage level adjustment [Yes / No]
iii) Gain setting control [Yes / No]
iv) Stabilising quality control [Yes / No]

i) Does the alternator output collapse on short circuiting the output terminals in a manner which operates the over current, differential, reverse power and earth fault protection relays. [Yes / No]

j) Can the Set voltage be re-established within 2 seconds of removing the short circuit (as in 7.0 I above). [Yes / No]

k) What is the percentage difference in phase to neutral voltage for an out of balance loading between any two phases : ± _____ % of nominal voltage.

l) Can voltage regulation be achieved within 3 seconds of the genset reaching a shaft speed corresponding to 46 Hz upon starting with a resistive load of 30%? [Yes / No]

If No, please specify _____

8.0 ENGINE PROTECTION DEVICES

8.01 Are there any provisions for the termination of remote alarms for :

a) Low lubricating oil pressure [Yes / No]
b) Low fuel pressure [Yes / No]
c) High Cooling water temperature [Yes / No]
d) High Lubricating oil temperature [Yes / No]
e) Engine overspeed [Yes / No]
f) Cooling water flow fail [Yes / No]
g) Tank level abnormal (Jacket water, fuel, lube oil etc) [Yes / No]
h) High & low sump level [Yes/No]

9.0 INSTRUMENTATION

9.01 Are the following Engine monitoring provided at the engine control and alarm panel :

a) Jacket water pressure inlet/outlet [Yes / No]
b) Jacket water temperature inlet/out [Yes / No]
c) Lube oil pressure [Yes / No]
d) Lube oil temperature inlet/outlet [Yes / No]
e) Engine speed indicator [Yes / No]
f) Alternator Winding temperature with switch [Yes / No]
g) Alternator hot air temperature [Yes / No]
h) Cylinder Exhaust temperature [Yes / No]

9.02 Are the following Alternator monitoring parameters provided at the engine common control desk and for remote metering:

a) Generator MW [Yes / No]

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Date:

b) Generator MVar [Yes / No]
c) Generator Field current [Yes / No]
d) Generator Output Volts [Yes / No]
e) Generator Output Amps [Yes / No]
f) Generator Output Power Factor [Yes / No]
g) Generator Output Frequency [Yes / No]

10.0 ENGINE STARTING SYSTEM

10.01 Type of engine starting system together with any technical advantages.
_____
_____

11.0 TURBOCHARGER

11.01 Make _____
11.02 Type_____
11.03 Maximum speed _____ rpm
11.04 Maximum operating temperature _____ °C
11.05 Boost pressure ratio _____
11.06 Type of vibration level monitoring device provided _____
_____

12.0 AIR INTAKE SYSTEM

12.0.1 Air Intake Filter
a) Make and type _____
b) Smallest particle allowed to pass through the filter _____ microns
c) Pressure loss across filter _____ kPa
d) Is a Service Indicator provided [Yes / No]

13.0 FUEL SYSTEM

13.0.1 Fuel Water/Separator
a) Make and model_____
b) Efficiency _____ %

13.0.2 Fuel Flow Meter
a) Make and model _____
b) Flow rate range _____ to _____ m/s
c) Pressure drop across the flow meter at engine full rated load _____ kPa
d) Accuracy of flow meter ± _____ %

13.0.3 Engine Fuel Supply Filter
a) Make and Type _____
b) Pressure drop across filter at engine full rated load _____ kPa
c) Degree filtration _____ microns
d) Are service indicators provided [Yes / No]

14.0 LUBRICATING OIL SYSTEM

14.0.1 Type of Engine Lubricating Oil _____

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Date:

14.0.2 Are Full flow Lubricating Oil Filters provided [Yes / No]

a) Degree of filtration _____ microns

14.0.3 Are Bypass Lubricating Oil Filters provided [Yes / No]

a) Degree of filtration _____ microns

b) Are differential pressure gauges provided [Yes / No]

c) Is there any provision to extend the differential pressure set points to the engine common alarm panel [Yes / No]

15.0 ENGINE EXHAUST SYSTEM

15.0.1 Silencers attenuation rating _____dBa

a) Temperature Monitoring Unit_____

b) Make and Type _____

c) Range _____ to _____ °C

d) Accuracy ± _____%

16.0 ENGINE CRANKCASE EXTRACTION

16.0.1 Are there any local Crankcase pressure indicators [Yes / No]

16.0.2 What are the safety devices for preventing a build up of excessive crankcase pressure

_____

_____

17.0 ENGINE COOLING SYSTEM

17.0.1 Engine Cooling Radiator

a) Type _____

b) System pressure _____ kPa

Schedule 2 of 7 Schedules

Price List of recommended spares

The tenderer shall list below the spare parts which he would recommend should be stored at the facility to ensure 5 years of operation and servicing, at 8,000 hours per year at 90% load for the gensets and auxiliary equipment offered for mechanical, electrical and electronic systems in the tender.

Description of Item	Unit	Recommended Qty	Rate Ex-Works	Total Cost

Signature of the Tenderer

Date:

Schedule 3 of 7 Schedules

Special Tools

The tenderer shall list below full details of all special tools, fixtures, appliances or test equipment required to operate, service and maintain the gensets and auxiliary equipment offered (mechanical, electrical and electronic systems in the tender) over the 8,000hour service life listed above.

Schedule 4 of 7 Schedules

Deviations

The tenderer shall list below all deviations from the specifications and tender document.
Where no such deviation from specification is listed, full compliance with specification will be required.

Specification Clause #	Deviation	Justification

SCHEDULE 5 OF 7 Schedules

OVERHAUL AND EXPECTED LIFE TIME OF COMPONENTS

Signature of the Tenderer

Date:

Component	Time Between Overhauls Hours	Expected Life Time Hours
Piston		
Cylinder Liner		
Cylinder Head		
Inlet Valve		
Exhaust Valve		
Injector Nozzle		
Injector Pump		
Main Bearing		
Large End Bearing		
Turbocharger		

SCHEDULE 6 OF 7 Schedules

MAINTENANCE SCHEDULE IN TERMS OF MACHINE HOUR

Provide a detailed maintenance program in terms of machine operating hours, indicating when servicing and replacing of parts is required along with expected labour hours for each task. The schedule should include the spare parts that are anticipated to be replaced, time required to carry out the task and the manpower requirements. Assume 90% loading, 8,000 hours per year operation over a 5-year time period. All spare parts prices should be for new parts, delivered EX Works. If a remanufactured parts program is available, separate alternative life cycle costs schedules should be provided along with clear conditions/terms/warranty for remanufactured components.

SCHEDULE 7 OF 7 Schedules

1 x 350KW(e) DIESEL GENERATING SETS FOR FEA HEAD OFFICE

PRICE SCHEDULE

Description		* $ Amount
1	1 x 350KW generating set with auxiliaries and canopy	
2	Freight, transportation cost, Insurance, Delivered Duty Unpaid, Suva Port	
3	Three sets of Spare parts manuals, Operation & Maintenance manuals, drawings, design & technical information required for site installation, software, and other documentation as per tender	
5	Installation	
6	Commissioning & Training	

Signature of the Tenderer

Date:

	Sub-Total	
	Engine Spares(5000hrs)	
7	Other (Please specify)	
8	Total, Off-Shore Equipment Supply – exclusive of Fiji Import Custom Duty, taxes or other Fiji Government related charges	

Notes:

* All local labour will be subject to 15% Non-Resident Withholding Tax for any local service works provided by an overseas contractor.

*Ensure all required technical specifications are provided

Signature of the Tenderer

Date:

Form of Tender

FIJI ELECTRICITY AUTHORITY

DIESEL GENERATING SETS ..... KW_e each

TO : FIJI ELECTRICITY AUTHORITY, SUVA, **FIJI**

Gentlemen,

1. We.....do hereby tender for the supply of Diesel Generating Set/s ..... KW(e) for Fiji Electricity Authority in accordance with the Conditions of Contract, Specification and Schedules for the sum specified in the Schedule of Prices, annexed hereto and to complete the same in accordance with the programme of works

2. The total fixed price of this Tender, (in words)
(…….)

3. If our Tender is accepted we will, if required, obtain the guarantee of an Insurance Company or Bank or other sureties (to be approved by you) to be jointly and severally bound with us in a sum not exceeding 20 per cent of the above named tender amount for the due performance of the Contract under the terms of a bond to be approved by you.

4. We agree abide by this Tender for the period of ninety days from the date fixed for receiving the same and it shall remain binding on us and may be accepted at any time before the expiry of the said 90 days.

5. Unless and until a formal Agreement is prepared and executed this Tender, together with your written acceptance thereof, shall constitute a binding Contract between us.

6. We understand that you are not bound to accept the lowest or any Tender you may receive.

Dated this ..... day of ..... 201 .....

Signature ..... in the capacity of .....

duly authorised to sign tenders for and on behalf of (Company title in Block Capitals).

Address .....
.....
.....
.....

Witness .....

Address .....
.....
.....

Occupation .....
…….....

Signature of the Tenderer

Date: