



MR 142/2025

# Supply of 11kV/0.415kV Auxiliary Earthing Transformer for Korovou Power Station

# **TABLE OF CONTENTS**

<b>1.0 INVITATION FOR TENDER .....</b>	<b>6</b>
<b>2.0 INSTRUCTIONS TO TENDERERS.....</b>	<b>7</b>
2.1 Eligible Tenderers .....	7
2.2 Eligible Materials, Equipment and Services .....	7
2.3 One Bid per Tenderer .....	7
2.4 Cost of Bidding .....	7
2.5 Site Visits .....	7
2.6 Contents of Bidding Documents .....	7
2.7 Clarification of Bidding Documents .....	7
2.8 Amendment of Bidding Document .....	8
2.9 Language of Bid.....	8
2.10 Bid Prices.....	8
2.11 Bid Currencies .....	8
2.12 Bid Validity .....	8
2.13 Format and Signing of Bids.....	8
2.14 Sealing and Marking of Bids .....	8
2.15 Deadline for Submission of Bids .....	8
2.16 Late Bids.....	9
2.17 Modification and Withdrawal of Bids .....	9
2.18 Rejection of One or All Bids .....	9
2.19 Process to be Confidential .....	9
2.20 Clarification of Bids .....	9
2.21 Compliance with Specifications .....	9
2.22 Signature of Tenderer.....	9
<b>3.0 GENERAL CONDITIONS OF CONTRACT .....</b>	<b>10</b>
<b>CONDITIONS OF PARTICULAR APPLICATION .....</b>	<b>10</b>
<b>4.0 REFERENCES .....</b>	<b>14</b>
4.1 Applicable Standards .....	14
4.2 Applicable Laws .....	15
<b>5.0 SERVICE CONDITIONS .....</b>	<b>16</b>
5.1 Environmental Conditions and Mounting .....	16
5.2 System Conditions .....	16
5.3 Seismic Disturbances.....	16
<b>6.0 DESIGN AND MANUFACTURING CRITERIA .....</b>	<b>17</b>
6.1 General.....	17
6.2 Electrical and Short Circuit Characteristics .....	17
6.2.1 <i>Terminals and Connections</i> .....	18
6.3 Oil Preservation System – Type .....	18
6.4 Tanks and Ancillary Equipment .....	18
6.4.1 <i>Transformer Tanks</i> .....	18
6.4.2 <i>Construction</i> .....	19
6.4.3 <i>Cover</i> .....	19
6.4.4 <i>Thermometer Pockets</i> .....	20
6.4.5 <i>Access Openings</i> .....	20
6.4.6 <i>Lifting, Jacking and Haulage</i> .....	20
6.4.7 <i>Pressure and Vacuum Withstand</i> .....	20
6.4.8 <i>Mounting of Bushings</i> .....	20
6.4.9 <i>Bushing Turret Bleeds</i> .....	20
6.4.10 <i>Gun Studs</i> .....	20
6.4.11 <i>Valves and Location</i> .....	20
6.4.12 <i>Pressure Relief Device</i> .....	21
6.4.13 <i>Earthing Terminals</i> .....	21
6.5 Magnetic Circuit and Windings .....	22
6.5.1 <i>Magnetic Circuit</i> .....	22

6.5.2	<i>Flux Density</i> .....	22
6.5.3	<i>Windings</i> .....	22
6.5.4	<i>Internal Earthing</i> .....	23
6.6	Impedance Voltage.....	23
6.7	Cooling .....	23
6.8	Insulating Oil .....	23
6.9	Bushings and Terminals .....	24
6.9.1	<i>General</i> .....	24
6.9.2	<i>LV Bushings</i> .....	24
6.9.3	<i>Marking of Terminals</i> .....	24
6.10	Cables and Terminations .....	24
6.10.1	<i>Cable End Boxes</i> .....	24
6.10.2	<i>Cables</i> .....	25
6.11	Sound Level.....	25
6.12	Radio and Television interference .....	25
6.13	Galvanizing .....	25
6.13.1	<i>General</i> .....	25
6.13.2	<i>Castings</i> .....	26
6.13.3	<i>Iron Castings</i> .....	26
6.13.4	<i>Steel Castings</i> .....	26
6.13.5	<i>Non-ferrous Castings</i> .....	26
6.13.6	<i>Welding</i> .....	26
6.14	Anti-Corrosion Design.....	26
6.14.1	<i>Finishes</i> .....	27
6.14.2	<i>Tanks, Accessories, Pipe-work</i> .....	27
6.14.3	<i>Zinc Spraying of Main Tank Base</i> .....	27
6.14.4	<i>External Surface Preparation</i> .....	27
6.14.5	<i>Interior Surfaces</i> .....	28
6.14.6	<i>Internal Fastings</i> .....	28
6.15	Corona Inception Fields.....	28
6.16	Harmonic Suppression .....	28
6.17	Transformer Losses.....	28
6.17.1	<i>Guaranteed Losses</i> .....	28
6.18	Minimum Power Efficiency.....	29
6.19	Shipment and Drying Out.....	29
<b>7.0</b>	<b>INSPECTION AND TESTING</b> .....	<b>29</b>
7.1	Type Tests and Special Tests.....	29
7.2	Routine Tests on Transformers .....	29
7.3	Witnessing of Tests.....	31
7.4	Test Certificates .....	31
<b>8.0</b>	<b>RELIABILITY</b> .....	<b>31</b>
8.1	Service Life .....	31
8.2	Evidence in Support of Reliability .....	31
<b>9.0</b>	<b>ENVIRONMENTAL CONSIDERATIONS</b> .....	<b>31</b>
<b>10.0</b>	<b>PACKAGING AND MARKING</b> .....	<b>31</b>
<b>11.0</b>	<b>QUALITY REQUIREMENTS</b> .....	<b>32</b>
<b>12.0</b>	<b>PRODUCT WARRANTY PERIOD</b> .....	<b>32</b>
<b>13.0</b>	<b>INFORMATION TO BE SUPPLIED BY THE SUPPLIER</b> .....	<b>32</b>
13.1	Documentation to be supplied with the Tender.....	32
13.2	Training.....	32
<b>14.0</b>	<b>SCHEDULE A: LIST OF EXPERIENCE, PERSONNEL &amp; FINANCIAL STATEMENTS</b> .....	<b>34</b>
<b>15.0</b>	<b>SCHEDULE B: PRICE AND PAYMENT SCHEDULE</b> .....	<b>35</b>
<b>16.0</b>	<b>SCHEDULE C: AS 4911 ANNEX A (TO BE SUBMITTED BY TENDERER)</b> .....	<b>36</b>

<b>17.0 SCHEDULE D: SPECIFICATION REQUIREMENTS.....</b>	<b>38</b>
<b>18.0 SCHEDULE E: PROGRAMME OF WORK.....</b>	<b>43</b>
<b>19.0 SCHEDULE F: DEPARTURE FROM SPECIFICATIONS.....</b>	<b>44</b>

## 1.0 INVITATION FOR TENDER

Energy Fiji Limited ("EFL") is responsible for generation, transmission and distribution of electricity in Viti Levu, Vanua Levu, Ovalau and Tavuani in Fiji. It owns over twenty (20) power stations and forty (40) substations and switching stations on the islands of Viti Levu, Vanua Levu, Taveuni and Ovalau. EFL owns, operates and maintains 147km of 132kV transmission lines, 524km of 33kV lines and over 9,200km of 11kV and 415V distribution lines.

EFL is seeking tender bids from reputable manufacturers and suppliers for **Design, Manufacture, Testing and Supply of 11kV/0.415kV Auxiliary-Earthing Transformers** for its Korovou Power Station.

All tenders for the contract shall be submitted on the appropriate forms provided and shall include the completed price schedule, technical schedule and schedules of experience etc. The bid shall be on the basis of a lump sum contract based on firm prices.

During evaluation of tenders EFL may invite a tenderer or tenderers for discussions, presentations and any necessary clarification before awarding of the contract.

The tender submissions close at **1600hrs on 23<sup>rd</sup> April, 2025, Fiji Time.**

Further information for this tender may be acquired from:

**Jitendra Reddy**  
**Manager Procurement, Inventories & Supply Chain**  
**2 Marlow Street, Suva, FIJI.**  
**Phone: 679 3224 320**  
**Facsimile: 679 331 6773**  
**Email: [JReddy@efl.com.fj](mailto:JReddy@efl.com.fj)**

## **2.0 INSTRUCTIONS TO TENDERERS**

### **2.1 Eligible Tenderers**

This invitation is open to all Tenderers who have sound Financial Background, and have previous experience in design, manufacture and supply of such auxiliary-earthing transformers.

Tenderers shall provide such evidence of their continued eligibility satisfactory to EFL as EFL shall reasonably request. Tenderers who are not manufacturer of such Auxiliary Earthing Transformers shall provide evidence of agency.

Tenderers shall not be under a declaration of ineligibility for corrupt or fraudulent practice.

### **2.2 Eligible Materials, Equipment and Services**

The materials, equipment, and services to be supplied under the Contract shall have their origin from reputable companies as specified by EFL and from various countries and all expenditures made under the Contract will be limited to such materials, equipment, and services. Upon request, Tenderers may be required to provide evidence of the origin of materials, equipment, and services.

For purposes of this Contract, "services" means the works and all project-related services including design services.

For purposes of this Contract, "origin" means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing or substantial or major assembling of components, a commercial recognized product results that is substantially different in basic characteristics or in purpose or utility from its components.

The materials, equipment and services to be supplied under the Contract shall not infringe or violate any industrial property or intellectual property rights or claim of any third party.

### **2.3 One Bid per Tenderer**

Each Tenderer shall submit only one bid. A Tenderer who submits or participates in more than one bid will cause all those bids to be rejected.

### **2.4 Cost of Bidding**

The Tenderer shall bear all costs associated with the preparation and submission of its bid and EFL will in no case be responsible or liable for those costs.

### **2.5 Site Visits**

Site visit is not mandatory. However, if any bidder wishes to identify and familiarize themselves with the site than they can notify EFL's Supply Chain office on the address/email given above to book a timeframe or appointment.

### **2.6 Contents of Bidding Documents**

The Tenderer is expected to examine carefully the contents of this Bidding document. Failure to comply with the requirements of bid submission will be at the Tenderer's own risk. Bids which are not substantially responsive to the requirements of the bidding documents will be rejected.

### **2.7 Clarification of Bidding Documents**

A prospective Tenderer requiring any clarification of the bidding documents may notify EFL in writing via email addressed to:

**Jitendra Reddy**  
**Manager Procurement, Inventories & Supply Chain**  
**2 Marlow Street, Suva, FIJI.**  
**Phone: 679 3224 320**  
**Facsimile: 679 331 6773**

Email: [JReddy@efl.com.fj](mailto:JReddy@efl.com.fj)

EFL will respond to any request for clarification which it receives earlier than three (3) days prior to the deadline for submission of bids.

## 2.8 Amendment of Bidding Document

At any time prior to the deadline for submission of bids, EFL may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Tenderer, modify the bidding documents by issuing addenda.

## 2.9 Language of Bid

The bid, and all correspondence and documents related to the bid, exchanged between the Tenderer and the EFL shall be written in the English language.

## 2.10 Bid Prices

Unless specified otherwise, Tenderers shall quote for the entire facilities on a "single responsibility" basis such that the total bid price covers all the Supplier's obligations mentioned in or to be reasonably inferred from the bidding documents in respect of the design, manufacture, including procurement and subcontracting (if any), testing and delivery.

Tenderers shall give a breakdown of the prices in the manner and detail called for in this bidding document, or any issued addenda.

Bids shall be given on a **CFR or DDU** basis. The point of delivery shall be Suva Port. The term CFR and DDU shall be governed by the rules prescribed in the current edition of Incoterms, published by the International Chamber of Commerce, Paris.

Tenderers shall be responsible for all costs associated with procurement of any equipment required for the project.

## 2.11 Bid Currencies

Prices shall be quoted in either local currency (Fijian dollars), or in local currency (Fijian dollars) and one foreign currency.

## 2.12 Bid Validity

Bids shall remain valid for a period of **120 days** from the date of Deadline for Submission of Bids specified in Sub-Clause 2.15.

## 2.13 Format and Signing of Bids

The Tenderer shall upload electronic copy of the Technical and Financial proposals on EFL's electronic tender hosting website, <https://www.tenderlink.com/efl>. **No hardcopy bid submission will be accepted.**

The bid shall contain no alterations, omissions or additions, except those to comply with instructions issued by EFL, or as necessary to correct errors made by the Tenderer, in which case such corrections shall be initialed by the person or persons signing the bid.

## 2.14 Sealing and Marking of Bids

Bidders are requested to upload electronic copies via Tender Link by registering their interest at: <https://www.tenderlink.com/efl>.

## 2.15 Deadline for Submission of Bids

Bids must be received by EFL at the address specified above no later than 1600 hours (Fiji Time) **23<sup>rd</sup> April 2025.**

EFL may, at its discretion, extend the deadline for submission of bids by issuing an addendum, in which case all rights and obligations of EFL and the Tenderers previously subject to the original deadline will thereafter be subject to the deadlines extended.

## **2.16 Late Bids**

Any bid received by EFL after the deadline for submission of bids prescribed above will be rejected and returned unopened to the Tenderer.

## **2.17 Modification and Withdrawal of Bids**

The bidder may modify or withdraw its bid after bid submission on the Tenderlink by editing submission. No bid may be modified by the bidder after the deadline for submission of bids.

## **2.18 Rejection of One or All Bids**

EFL reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids, at any time prior to award of Contract, without thereby incurring any liability to the affected Tenderer or Tenderers or any obligation to inform the affected Tenderer or Tenderers of the grounds for the rejection.

## **2.19 Process to be Confidential**

Information relating to the examination, clarification, evaluation and comparison of bids and recommendations for the award of a contract shall not be disclosed to Tenderers or any other persons not officially concerned with such process. Any effort by a Tenderer to influence EFL's processing of bids or award decisions may result in the rejection of the Tenderer's bid.

## **2.20 Clarification of Bids**

To assist in the examination, evaluation and comparison of bids, EFL may, at its discretion, ask any Tenderer for clarification of its bid. The request for clarification and the response shall be in writing via email, but no change in the price or substance of the bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by EFL in the evaluation of the bids.

## **2.21 Compliance with Specifications**

The tender shall be based on the equipment and work specified and shall be in accordance with the Technical Specification. It should be noted that unless departures from specifications are detailed in Schedule G of the Technical Specification, the tender would be taken as conforming to the Specification in its entirety. The Tenderer shall tender for the whole of the Works included in the Specification.

## **2.22 Signature of Tenderer**

A tender submitted by a Partnership shall be signed by one of the members of the Partnership and shall be accompanied by a certified authorization of all the partners authorizing the individual partner to sign on behalf of the Partnership. A tender submitted by a Corporation to the Contract and shall be accompanied by a certified resolution of the Board of Directors authorizing the individual to sign on behalf of the Corporation.



### 3.0 GENERAL CONDITIONS OF CONTRACT

The General Conditions of Contract shall be based upon AS 4911 – 2003 General conditions of contract for the supply of equipment without installation.

The Conditions of Contract comprises two parts:

1. Part 1 – General Conditions; and
2. Part 2 – Conditions of Particular Application

### CONDITIONS OF PARTICULAR APPLICATION

#### 1. Interpretation and Construction of Contract

Add the following:

*“Bid has the same meaning as tender.”*

Replace

*“qualifying cause of delay means*

- a) *any act, default or omission of the Purchaser, its consultants, agents or other contractors (not being employed by the Supplier); or*
- b) *other than*
  - i) *a breach or omission by the Supplier;*
  - ii) *industrial conditions or inclement weather occurring after the due for delivery; and*
  - iii) *stated in item 22”*

With

*“qualifying cause of delay means a cause of delay other than that caused by*

- a) *a breach or omission by Supplier;*
- b) *industrial conditions or inclement weather occurring after the due for delivery; and*
- c) *a cause stated in item 22 “*

#### 5. Service of notices

Replace

*“ii) confirmation of correct transmission of fax”*

With

*“ ii) confirmation of correct electronic transmission”*

#### 6. Contract Documents

Under 6 Contract Documents, make the following change:

Replace “6.1 Discrepancies” and contents in subclause 6.1 Discrepancies with the following,

##### *“6.1 Discrepancies and Priority of Documents*

*The following priority of documents applies if there is any ambiguity, discrepancy or inconsistency in the documents comprising the Contract:*

- a) *Letter of Acceptance from Supplier*
- b) *Conditional Award Letter from Purchaser*
- c) *EFL Tender Addenda (if any issued, if not, remove this item from list)*
- d) *EFL Tender Specifications, including drawings*
- e) *Conditions of Particular Application to AS 4911-2003*
- f) *General Conditions of Contract AS 4911-2003*
- g) *Supplier’s Tender Clarifications (if any provided by Supplier during tender evaluation, if not, remove this item from list)*
- h) *Supplier’s Bid Document*

*If either party discovers any inconsistency, ambiguity or discrepancy in any document prepared for the purpose of performing the Contract that party shall give the other party written notice of it. The Purchaser, thereupon, and upon otherwise becoming aware, shall direct the Supplier as to the interpretation and construction to be followed, with the priority order of documents above.*

*If compliance with any such direction under this subclause causes the Supplier to incur more or less cost than otherwise would have been incurred had the direction not been given, the difference shall be assessed by the Purchaser and added to deducted from the contract sum.”*

## **9. Warranties**

Replace "9. Designated Items" and its contents with the following "

### **9. Warranties**

#### **9.1 Ownership**

The Supplier represents and warrants that:

- a) It is the legal and beneficial owner of the goods; and
- b) that upon payment of the contract sum no person other than the Purchaser will be entitled to hold any interests in, or hold any encumbrance over, the goods.

#### **9.2 Supplier's Warranty**

The Supplier represents and warrants that the goods will upon delivery:

- a) comply in all respects with the Contract;
- b) be suitable for the purpose stated in Item 5;
- c) be of merchantable quality;
- d) conform to any sample provided by the Supplier and approved by the Purchaser.
- e) in the absence of any specific provision of the Contract, meet any relevant Australian Standard and industry best practice;
- f) be free of design defects;
- g) be, unless otherwise agreed, new.

If the Supplier is in breach of any of the warranties in this clause 9, the Purchaser may, in addition to the Purchaser's other rights and remedies, at any time give 7 days' written notice to the Supplier to rectify such breach, and if the Supplier fails to comply with such notice, the Purchaser may employ others to carry out works required to satisfy the warranty. The cost thereby incurred shall be moneys due and payable to the Purchaser.

The representation and warranties in this clause survive the completion or earlier termination of the Contract and each warranty in this clause is independent of, and is not limited by, reference to any other warranty.

The Supplier shall obtain all warranties relevant to the goods from manufacturer or suppliers or as otherwise specified in the Contract, including any warranties that are provided by any sub-contract and ensure that the Purchaser has the benefit of those warranties. "

## **14. Directions**

Add the following to 14 Directions, at the end,

"The Purchaser may appoint the individual stated in Item 1A to exercise delegated Purchaser's functions. The Purchaser may, from time to time, by notice in writing to the Supplier, substitute or appoint more than one such Purchaser's representative, provided that no aspect of any function shall at any time be the subject of delegation to more than one Purchaser's representative.

Every reference in the Contract to the Purchaser's representative shall include the Purchaser and vice versa."

## **17. Time**

Under 17.2 Claim, make the following change

Replace

"a) delivery is or will be delayed by a qualifying cause of delay; and "

With

"a) delivery is or will be delayed by a qualifying cause of delay that includes but is not limited to any act, default or omission of the Purchaser, its consultants, agents or other contractors (not being employed by the Supplier; and "

## **19. Delivery**

Add the following to 19.1 Mode of and Date and Place for Delivery, at the end,

"The Supplier must ensure that all goods are properly, safely and securely packaged and labeled for identification and safety as follows:

- a) the goods must be individually packaged for transport so that they are protected from all reasonably foreseeable condition which might cause corrosion, deterioration or physical or bearing damage during handlings and transport. All packaging and preservation materials must be supplied by the Supplier; and
- b) each package must be clearly and indelibly inscribed with the Purchaser's name, the address of the delivery place, the Purchaser's contract number and any safety warnings for the contents."

## **21. Acceptance or Rejection of Equipment**

Add the following to 21.1 Notification, at the end,

*"The Purchaser shall be under no obligation to give written notice to the Supplier that the Equipment is acceptable unless:*

- a) the Purchaser is satisfied that the Equipment is satisfactory and complies with the "as manufactured" drawings approved by the Purchaser; and*
- b) all drawings and manuals required to be supplied by the Supplier, have been duly supplied by the Supplier.*

#### **24. Payment**

Replace "24.1 Invoices and time for payment" With "24.1 Claim for Payment and time for payment"

Under 24.1 Claim for Payment and Time for Payment, make the following change.

Replace all occurrences of "an invoice" with "written claim for payment".

#### **26. Termination by frustration**

Under 26 Termination by frustration, make the following change.

Replace all occurrences of

*"an invoice"*

with

*"written claim for payment".*

#### **27. Notification of claims**

Under 27.1 Communication of claims, make the following change

Replace

*"As soon as practicable after a party becomes aware of any claim in connection with the subject matter of the Contract, that party shall give to the other party the prescribed notice of a notice of dispute under subclause 28.1."*

With

*"As soon as practicable and in any event not later than seven (7) consecutive days after a party becomes aware of any claim in connection with the subject matter of the Contract, that party shall give to the other party the prescribed notice of a notice of dispute under subclause 28.1."*

#### **28. Dispute Resolution**

Replace "28.2 Conference" and contents with the following:

*"28.2 Conference*

*Within 14 days after receiving a notice of dispute, the parties shall confer at least once to resolve the dispute or to agree on methods of doing so, including, but not limited to, mediation, conciliation, binding expert determination and arbitration, of the whole or any part of the dispute. Where arbitration is agreed method of resolution, the arbitration shall be conducted in accordance with the rules of Item 38(b) and the arbitrator, unless otherwise agreed, shall be nominated by the President of the Fiji Institute of Engineers.*

*At every such conference, each part shall be represented by a person having authority to agree to such resolution or methods. All aspects of every such conference except the fact of occurrence shall be privileged.*

*If the dispute has not been resolved nor a method of resolution agreed within 56 days of service of the notice of dispute, that dispute shall be dealt with in accordance with subclause 28.3."*

Replace "28.3 Arbitration" and contents with the following

*"28.3 Elevation of Disputes*

*If the parties are unable to resolve the dispute or agree a method of resolution in accordance with sub clause 28.2:*

- a) the dispute shall be referred to the Chief Executive Officer, or a duly authorized representative, of the Purchaser and the Chief Executive Officer/Managing Director, or a duly authorized representative, of the Supplier to resolve the dispute or agree on a method of resolution;*
- b) the individuals referred to in sub clause 28.3 (a) shall meet within 14 days after referral of the dispute in an effort to resolve the dispute or agree a method of resolution;*
- c) if the individuals referred to in sub clause 28.3 (b) are unable to resolve the dispute but agree at that meeting on a method of resolution, they shall also nominate a timeframe for the commencement and conclusion of the method of resolution; and*
- d) if the individuals so referred to in sub clause 28.3(b) are unable to resolve the dispute or agree a method of resolution, each within 14 days of the dispute being referred, either parts may give written notice to the other stating that the parties have been unable to resolve the dispute or agree a method of resolution.*

*Where arbitration is the agreed method of resolution, the arbitration shall be conducted in accordance with the Rules stated in Item 38(b) and the arbitrator, unless otherwise agreed, shall be nominated by the President of the Fiji Institute of Engineers."*

Replace "28.4 Summary Relief" and the contents with the following:

*"28.4 Instituting Proceedings*

*Neither party shall proceed to resolve a dispute by instituting court proceedings until issuing to, or receiving from, the other party, a notice in accordance with sub clause 28.3(d)."*

Add the following after 28.4 Institutional Proceedings

*"28.5 Summary Relief*

*Nothing herein shall prejudice the right of a party to institute proceedings to enforce payment due under the Contract or to seek injunctive or urgent declaratory relief."*

**Annexure A**

Replace Annexure A - Part A with the form provided in Schedule C.

## 4.0 REFERENCES

### 4.1 Applicable Standards

Transformers shall be designed, manufactured and tested in accordance with the following international Standards and all amendments issued prior to the date of closing of tenders except where varied by this Specifications.

AS 1100	Drawing Practice Scales – Part 7	AS 1194	Winding Wires Parts 1 – 4
AS 1265	Bushings for Alternating Voltages Above 1 000 V		
AS 1319	Safety Signs for the Occupational Environment		
AS/NZS 1580	Paints and Related Materials — Methods of Test		
AS 1627	Metal Finishing – Preparation and Pretreatment of Surfaces		
AS 1650	Galvanized Coatings		
AS 1767	Insulating Oil for Transformer and Switchgear		
AS 1824	Insulation Co-Ordination		
AS 1931	High Voltage Testing Techniques – Part 1		
AS 2067	Substations and High Voltage Installations Exceeding 1kV AC		
AS 2129	Flanges for Pipes, Valves and Fittings		
AS 2312	Guide to Protection of Iron and Steel Against Exterior Atmospheric Corrosion		
AS 2374	Power Transformers — Part 1 to 3, 5, 6 and 7		
AS 2700	Colour Standards for General Purpose		
AS 2768	Electrical Insulating Materials		
AS 3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)		
AS/NZS 3750	Paints for Steel Structures		
AS 4398	Insulators – Ceramic or Glass – Station Post for Indoor and Outdoor Use – Voltages greater than 1000V a.c.		
AS 4436	Guide for the selection of insulators in respect of polluted conditions		
AS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles		
AS 60076	Power transformers (including all parts and normative references as current)		
AS/NZS 60137	Insulated bushings for alternating voltages above 1000 V		
AS 60214	Tap-changers (including all parts and normative references as current)		
AS 60270	High voltage testing techniques — Partial discharge measurements		
AS 62271.200	High-voltage switchgear and controlgear - A.C. metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV		

AS 62271.301	High voltage switchgear and controlgear – Dimensional standardization of terminals
AS/NZS 9001	Quality Systems Model for Quality Assurance in Design, Development, Production, Installation and Servicing
IEC 61619	Insulating liquids - Contamination by polychlorinated biphenyls (PCBs) - Method of determination by capillary column gas chromatography

Should inconsistencies be defined between Standards and this Specifications, this Specification will take precedence. However, significant inconsistencies shall be referred to EFL for resolution.

## 4.2 Applicable Laws

The Supplier warrants (without limiting any other warranties or conditions implied by law) that all Goods have been produced, sold and delivered to EFL in compliance with all applicable laws (including all workplace health and safety and electrical safety legislations and codes of conduct).

## 5.0 SERVICE CONDITIONS

### 5.1 Environmental Conditions and Mounting

The transformers shall be designed to withstand the following service conditions of:

Atmosphere	:	Saliferous, corrosive and dusty
Ambient temperature	:	Peak : 40°C
	:	24 Hour Average: 30°C
	:	Annual Average: 22°C
	:	Minimum: 10°C
Relative Humidity (Average)	:	85%
Annual Average Rainfall	:	1900 mm
Wind Speed	:	Sustained : 55 m/s
	:	Gusts : 70 – 110 m/s

Isokeraunic Level : 60 Thunder days per year

Seismic: To a maximum of 7 on the open-ended Richter Scale

**Note:** Fiji is situated in a region where cyclones are experienced frequently. All plant and equipment shall be designed and constructed to withstand these extreme conditions. All plant and equipment shall be rust proof, vermin proof and weather proof and designed to be suitable for a damp, tropical climate, which may be experienced simultaneously.

### 5.2 System Conditions

The rated frequency of EFL's power system is 50 Hz. Each unit shall be suitable for use on its respective system position.

Particulars:	System Voltages	
	240V/415V	6.35kV/11kV
Nominal System Voltage:	240V (p-n), 415V (p-p)	6.35/11kV
Highest (Equivalent) System Voltage:	254.4V (p-n), 439.9V (p-p)	6.92kV/12kV
Number of phases:	1 or 3	3
Impulse Withstand voltage (peak):	AC 10kV rms	70kV
Power frequency withstand voltage:		28kV

### 5.3 Seismic Disturbances

The equipment shall be designed to withstand the most onerous seismic events over its operating life. The design shall meet the requirements as shown in table below and shall be in accordance with AS 1170.4 and the Building Code of Fiji.

Seismic requirements	Particular Detail
Earthquake structural design criteria (AS 1170.4, 2007)	Structure Importance Level 4 Probability factor $k_p = 1.5$ Hazard Factor $Z = 0.12$ Structural Ductility Factor

## 6.0 DESIGN AND MANUFACTURING CRITERIA

### 6.1 General

The Auxiliary/Earthing transformers shall comply with IEC 60076, IEC 60137, 60214 & 60289 and shall be of the oil immersed ONAN type suitable for outdoor installation and are to have a main zigzag winding which will be connected to the 11kV busbar.

The neutral point of the zigzag winding shall be brought out of the tank through a bushing insulator. This point will be connected to earth directly in order to provide an earthing point for the neutral of the system.

When operating at CMR of the secondary winding, the HV winding shall be capable of withstanding, simultaneously, the rated short-time current and, for 3 seconds, the current obtained with a short-circuit applied between one HV line terminal and the HV neutral terminal with full line voltage maintained at the HV line terminals. The auxiliary/earthing transformers shall generally comply with the following key technical requirements:

<b>Rating</b>	300 kVA
<b>High voltage winding</b>	11kV + 2*2.5% kV, - 2*2.5%kV
<b>Low voltage winding</b>	0.415kV
<b>Frequency</b>	50 Hz
<b>Vector group</b>	ZNyn1
<b>Cooling</b>	ONAN
<b>Impedance (%)</b>	~3.50%
<b>Zero sequence impedance (equivalent.)</b>	~17.25 Z / phase
<b>Maximum HV Neutral Fault Current (Amp)</b>	~1,270Amps @ 10 secs
<b>HV bushings</b>	Enclosed in cable end box with breathers and doors for accessibility
<b>LV bushings (Auxillary)</b>	Enclosed in cable end box with fused switch, breathers and doors for accessibility
<b>Neutral bushing</b>	Enclosed in cable end box with isolators, breathers and SBEF current transformers
<b>Quantity Required</b>	1

The zero sequence impedance of the HV winding shall have the minimum value specified above. The guaranteed value shall be stated by the Tenderer in the Technical Schedule and shall be within the range plus 20% and minus zero of the guaranteed value.

The lower voltage windings shall be provided to give a 415/240 Volts, 3 Phase, and 4 Wire Supply.

Note: HV and LV windings should be copper and Oil level indicator, Pressure Relief Device, Oil Temperature indicator shall be of either Messko or MR branded.

### 6.2 Electrical and Short Circuit Characteristics

The maximum fault current for a solid earth fault on the earthing transformer terminals shall not exceed the value given in Section 6 above.

Under the condition of a solid earth fault in the transformer terminals, limited only by the earthing transformer zero sequence impedance, the earthing transformer shall be capable of withstanding this condition, both thermally and dynamically without



damage. Additionally, earthing transformers shall, when operating continuously at any load up to CMR, be capable of withstanding for minimum three seconds the current obtained when a short circuit is applied between any or all of the lower voltage terminals with full line voltage maintained at the higher voltage terminals.

The foregoing conditions shall assume an initial winding temperature which is the sum of the maximum ambient temperature stated in these specifications and the temperature rise obtained by continuous operation at CMR.

### 6.2.1 Terminals and Connections

The three-phase, four-wire connections from the transformer windings shall be terminated at a three- pole combined switch-fuse unit with bolted neutral link and gland entry for a four-core solid dielectric cable. This shall be accommodated in a lockable, fully weatherproof compartment together with a neutral earthing link. The purpose of the neutral earthing link is to connect the 415V system neutral to earth. It shall be connected between the transformer winding end of the neutral link and a suitably located earthing terminal to which the system earth can be connected. An earthing terminal shall be provided on the transformer core frame with a cross bonding connection to the main earthing terminal which shall be provided at the base of the cubicle. Three spare fuses shall be supplied with each transformer.

Generally, all design and construction of the items and their components and parts must be Fit for Purpose and Fit for Duty, including for Normal Cyclic and Emergency Cyclic Duty as described in this specification and applicable documents to prevent distortion or damage under service conditions and during handling and transport.

The transformers will be suitably stiffened and braced to prevent distortion or damage under service conditions or during handling and transport.

All bolts nuts and washers (fasteners, studs, lifting lugs etc.) will be to Australian Metric Standards and be stainless steel Grade 316. Compatibility, with regard to corrosion prevention, between the fasteners will be observed. To prevent binding, different grade stainless steel nuts and bolts will be used together with anti-seizing lubricant on all bolt threads.

## 6.3 Oil Preservation System – Type

Sealed tank type construction will be used; however, the transformers will not be pressurized or incorporate gases other than air.

## 6.4 Tanks and Ancillary Equipment

### 6.4.1 Transformer Tanks

Each transformer shall be enclosed in a suitable stiffened welded steel tanks such that the transformer can be lifted and transported without permanent deformation or oil leakage. The construction shall employ weldable mild steel and shall be of sufficient strength and rigidity to withstand moving, shipping and handling without deformation.

Lifting lugs shall be provided, suitable for the weight of the transformer, including core and windings, fittings, and with the tank filled with oil. Each tank shall be provided with jacking lugs suitably positioned for transport. The transformer tank shall be capable of withstanding full vacuum without deflection exceeding the value stated in the Schedule of Tests. Where the design of the tank is such that the bottom plate will be in direct contact with the surface of the foundations, the plates shall have the following minimum thickness: -

<u>Length of Transformer</u>	<u>Minimum Thickness</u>	
	<u>Side Plates</u>	<u>Bottom Plates</u>
Less than 2500 mm	6 mm	19 mm
Greater than 2500 mm	12 mm	25 mm
Greater than 7500 mm	32 mm	40 mm

Where skid type bases are provided, the plates shall have the following minimum thickness: -

<u>Length of Transformer</u>	<u>Minimum Thickness</u>	
	<u>Side Plates</u>	<u>Bottom Plates</u>
Less than 2500 mm	6 mm	9 mm
Greater than 2500 mm	9 mm	12 mm

In case of a self-supporting tank bottom of the power transformer without steel cross beams, the bottom plate shall have a minimum thickness of 20 mm. The base of each tank shall be so designed that it is possible to move the complete transformer unit in any direction without injury when using rollers, plates, or rails. Transformers may have flat, skid or wheel bases subject to the approval of EFL, but, detachable under bases must not be used unless specifically approved by EFL. All joints other than those, which may have to be opened, shall be welded. Caulking of defective welded joints may be re-welded subject to the written approval of EFL. The tank and cover shall be designed in such a manner as to leave no external pockets in which water can lodge, no internal pockets in which oil can remain when draining the tank or in which air can be trapped when filling the tank, and to provide easy access to all external surfaces for painting.

When built-on radiators are used, each radiator bank shall be connected to the main tank through flanged valves mounted on the tank at top and bottom and each bank shall be fitted with drain valve and air release plug.

Each tank cover shall be of adequate strength, must not distort when lifted and shall be provided with suitable flanges having sufficient and properly spaced bolts. Inspection openings shall be provided to give access to the internal connections of bushings, winding connections and earthing links. Each opening shall be correctly located and must be of ample size for the purpose of which it is intended. All inspection covers shall be provided with lifting handles. Tank covers with low level welded flanged joints are preferred, but Suppliers may offer alternative designs with high level covers. It must be possible to remove any bushing without removing the tank cover. Pockets shall be provided for a stem type thermometer and for the bulbs of temperature indicators where specified. These pockets shall be located in the position of maximum oil temperature and it must be possible to remove any bulb without lowering the oil level in the tank. Captive screwed caps shall be provided to prevent the ingress of water to the thermometer pockets when they are not in use.

#### 6.4.2 Construction

Weldable structural steel of an approved grade to BS 7668, BS EN 10029, BS EN 10025 and BS EN 10210 or equivalent shall be used in construction. Each transformer shall be enclosed in a suitably stiffened welded steel tank suitable for outdoor service and designed so the transformer can be transported. When fully oil filled, the transformer shall be able to be jacked, lifted, and hauled into place without permanent deformation or leakage.

Tank wall stiffeners shall be of the vertical type to minimise corrosion of the surfaces and to allow for the option of sand filling inside the stiffeners for noise control. Sand filling inside the tank wall stiffeners for additional noise control shall be agreed during the Design Review at the manufacturers' works.

The design of the tank and cover shall not have any external pockets or dips in which water can lodge or pond, or internal pockets in which oil can remain when draining the tank or in which air can be trapped when filling the tank. The same applies to spaces under access covers.

The tank design shall provide for easy access to all external surfaces for painting. Joints around access openings, bushings and any other removable accessories shall be bolted, and an electrical bond provided across the bolted joint.

All external edges shall have a minimum 3 mm radius to ensure adequate paint thickness.

#### 6.4.3 Cover

Each tank cover shall be of adequate strength, must not distort when lifted and shall be provided with suitable flanges having sufficient and properly spaced bolts. Inspection openings shall be provided to give access to the internal connections of bushings, winding connections and earthing links. Each opening shall be correctly located and must be of ample size for the purpose of which it is intended. All inspection covers shall be provided with lifting handles. Tank covers with low level welded flanged joints are preferred, but Suppliers may offer alternative designs with high level covers. It must be possible to remove any bushing without removing the tank cover and adequate access chambers shall be provided for this purpose.

A bolted or welded cover may be used for the main tank cover. If a welded cover is used 'MIG' welding shall be used to weld the cover to the main tank. The core and windings shall not be suspended from the main tank cover.

#### **6.4.4 Thermometer Pockets**

A thermometer pocket shall be provided and it shall comply with the requirements of BS 2765 and be located according to IEC 60076-2.

#### **6.4.5 Access Openings**

Openings shall be provided in the main tank to give access for in-situ tightening of the core and windings without removing the main tank or the main tank cover. Openings shall be provided in the tank to give access to the internal connections of all bushings, earthing connections, CT secondaries, and tap- changers. The opening shall give unimpeded internal access and shall be of ample size for the purpose intended.

All access openings shall have flanges welded to them by means of continuous welds both on the inside and the outside of the flange. To make it easy to fit covers to the openings, the flanges shall have drilled and tapped blind holes to accommodate the studs.

All access covers shall be provided with lifting handles.

#### **6.4.6 Lifting, Jacking and Haulage**

The transformer tank shall be provided with attachments (front, rear, and both sides) for lifting and haulage. Lifting lugs shall be strong enough to lift, without distortion, the complete transformer when full of oil.

Haulage eyes shall be provided on each side and each end of the transformer tank. They shall be located symmetrically about the tank center line, 200 mm to 300 mm above the base of the tank and perpendicular to the tank. A hole, at least 50 mm in diameter, shall be provided for the eye, and at least 100 mm of free working space shall be provided above and below each haulage eye.

#### **6.4.7 Pressure and Vacuum Withstand**

The complete tank with all fittings and pipework shall withstand full vacuum (-1014 millibars gauge), and an internal pressure of 50 kPa without permanent deformation or leaks. The Supplier shall test the tank in accordance with Clauses 6.5.7 and 6.5.8 to prove compliance with the above.

#### **6.4.8 Mounting of Bushings**

Each bushing shall be mounted on an annular steel ring equipped with studs and designed to the following specifications:

- Outside diameter = flange diameter of the bushing.
- Inside diameter = lower portion bushing diameter plus 12 mm
- Minimum thickness = 1.5 x diameter of fixing studs

Each ring shall be fixed to the outside surface of the cover or tank by means of continuous welding around both the internal and external circumferences. Stainless steel studs shall be fitted to the mounting ring.

#### **6.4.9 Bushing Turret Bleeds**

Air bleed pipework for trapped air and combustible gases shall be provided for all bushing turrets. The air bleed and trapped gas pipework shall be connected to the main tank Buchholz relay.

#### **6.4.10 Gun Studs**

Stainless steel gun studs shall be used for all stud fittings on the external surfaces of the main tank. Subject to the approval of the Employer, the following alternative method of stud installation may be used: Stainless steel threaded rods inserted into tapped blind holes - provided a suitable method for preventing moisture ingress into the tapped blind holes is used.

#### **6.4.11 Valves and Location**

All valves up to and including 75 mm bore shall be made of gunmetal. Each Transformer shall be fitted with the following valves

as required for:-

- Draining the case (flanged-gate valve)
- Sampling oil from the extreme bottom of the tank.
- Lower filter press connection and complete drain.
- Upper filter press connection.
- Isolating each radiator.
- Air relief or venting from each radiator.
- Draining oil from each radiator.
- Nitrogen.
- Vacuum line connection.

The omission of any, or the provision of alternative arrangements to the above requirements, will not be accepted unless approved in writing by EFL before manufacture.

Valves shall be arranged so that the hand wheel moves in a clockwise direction to close the valve. The face of each hand wheel shall be clearly marked with the words "open" and "shut" and be provided with an arrow to indicate direction for opening and shutting. Valves shall not be fitted in an inverted position. Unless the valve is one that can only be either fully open or fully closed, valves of 50 mm nominal bore or larger shall have position indicators. These show the amount by which the valve is open or closed in relation to its full travel.

All valve hand wheels shall be fitted with nameplates. Suitable means shall be provided to protect the operating mechanisms of all valves against mechanical damage and dust or dirt. Adequate provision shall be made for the lubrication of the mechanism and guides and this shall be of the pressure type.

All valves that are part of the oil flow circuit, either via the radiators or to and from the main tank, shall be of the indicating lockable type.

Precautions shall be taken to prevent corrosion of the valve spindles in contact with the gland packing. Isolating valves for the radiators shall be the Butterfly type with lockable positions.

Radiator isolating valves, oil inlet valves, oil outlet valves, oil sampling valves and any on-line monitoring valves fitted to the main tank, conservators and radiators shall use bolted flange connections and be easily removable for maintenance purposes.

Isolating valves shall be Gate type valves with lockable positions.

#### **6.4.12 Pressure Relief Device**

An approved pressure relief device of sufficient size for the rapid release of any pressure that may be generated in the tank and designed to operate at a static pressure lower than the hydraulic test pressure called for in Schedule of Works Tests, shall be provided. In the event that the device is a spring operated valve type, it shall be provided with one set of normally open signaling contacts to trip the transformer. The relief device is to be mounted on the tank cover and is to be provided with a skirt to project at least 25 mm into the tank to prevent gas accumulation.

#### **6.4.13 Earthing Terminals**

External earthing terminals shall be provided as follows:

- a) Two earthing terminals located on the transformer tank, each one on opposite sides of the tank wall and located near to ground level for connection to the substation earth grid.
- b) One earthing terminal located on any separate associated radiator bank and located near to ground level.
- c) One earthing terminal for the neutral current transformer mounting bracket. The earthing terminal shall be located near the top of the tank wall, underneath the neutral current transformer mounting bracket.
- d) The external earthing terminals shall be a flat vertical lug, 100 mm x 50 mm, and drilled with two 14 mm diameter holes for M12 bolts, at 45 mm vertical centers. The terminals shall be stainless steel, suitable for use with copper

earthing connections, rated for 3 s of at least 31.5 kA. The earth terminals shall be located so they are readily accessible from both sides of the foundation pads. Dimension details of the arrangement offered shall be supplied with the tender.

- e) Every part of the equipment intended to be earthed shall be electrically continuous with the earthing terminals without relying upon fortuitous contacts. The earth lug shall be marked with an 'earth' symbol. An adequately rated electrical bond shall be provided across all bolted joints of the tank.

#### **6.4.13.1 Rating, Diagram and Valve Plates**

The following plates, or an approved combined plate, shall be fixed to each Transformer tank at an average height of 750 mm above the ground level:-

- a) A rating plate with the data specified in IEC 60076 Part 1. This plate shall also include a space for the Purchaser's serial number and in addition include the short-circuit current rating and time-factor for each winding.
- b) A diagram plate showing in an approved manner, the internal connections and the voltage relationship of the several windings, in accordance with IEC 60076 Part 1 with the Transformer voltage ratio for each tap and, in addition, a plan view of the Transformer giving the correct physical relationship of the terminals.
- c) A plate showing the location and function of all valves and air release cocks or plugs. This plate shall also if necessary warn operators to refer to the Maintenance instructions before applying vacuum.

Plates are to be of stainless steel or other approved material capable for continuous outdoor service and withstanding the climatic conditions of at site.

### **6.5 Magnetic Circuit and Windings**

#### **6.5.1 Magnetic Circuit**

The design of the magnetic circuit shall be such as to avoid static discharges development of short circuit paths internally or to the earthed clamping structure, and the production of flux components normal to the plane of the laminations. Each lamination shall be insulated with a material stable under the action of pressure and hot oil.

The winding structure and major insulation shall be designed to permit an unobstructed flow of cooling oil through core cooling ducts to ensure efficient core cooling. The magnetic circuit shall be insulated from all structural parts, and shall be capable of withstanding a test voltage to core bolts and to the frame of 2,500 volts RMS for one minute. In order to allow testing, the magnetic core shall be earthed to the tank cover at one point only through removable links in an appropriate terminal box, placed in an accessible position on the tank cover.

#### **6.5.2 Flux Density**

Core shall be constructed from cold rolled grain oriented steel sheets. Design shall be such that there will be no adverse effects due to core or stray flux heating with the quality of steel employed, and that when operating under the most onerous conditions envisaged in IEC 60076 and IEC. 60354, flux density in any part of the magnetic circuit does not exceed 15,000 lines per square centimetre (i.e. 1.5 Tesla). The maximum flux density in the legs and yokes of the core shall not exceed 1.5 Tesla at rated voltage and frequency.

#### **6.5.3 Windings**

All windings shall have copper conductors from reputable suppliers. Transformer 11kV windings shall have graded insulation as defined in IEC 60076 and 0.415kV winding shall have uniform insulation as defined in IEC 60076. All neutral points shall be insulated to withstand an applied voltage test specified in EFL's Requirements.

The windings shall also be thoroughly seasoned during manufacture by the application of axial pressure at a high temperature for such length of time as will ensure that further shrinkage is unlikely to occur in service. The windings and leads of all transformers shall be braced to withstand the shocks, which may occur through rough handling and vibration during transport,

switching and other transient service conditions including external short circuit.

If the winding is built up of sections or of disc coils splitted by spacers, the clamping arrangements shall ensure that equal pressures are applied to all columns of spacers.

#### 6.5.4 Internal Earthing

- a) General - All metal parts of the transformer with the exception of the individual core laminations, core bolts and associated individual clamping plates shall be maintained at some fixed potential.
- b) Earthing of Core Clamping Structure - The top main core clamping structure shall be connected to the tank body by a copper strap. The bottom main core clamping structure shall be earthed by one or more of the following methods.
  - i. by connection through vertically tie rods to the top structure;
  - ii. by direct metal to metal contact with the tank base maintained by the weight of the core and
  - iii. windings;
  - iv. by connection to the top structure of the same side of the core as the main earth connection to the Tank.
- c) Earthing of Magnetic Circuits - The magnetic circuit shall be earthed to the clamping structure at one point only through a removable link placed in an accessible position just beneath an inspection opening in the tank cover and which, by disconnection, will enable the insulation between the core and clamping plates, etc., to be tested at voltages up to 2.5 kV. The link shall have no detachable components and the connection to the link shall be on the same side of the core and the main earth connection. These requirements are compulsory. Magnetic circuits having insulated sectional construction shall be provided with a separate link for each individual section. The arrangement of the connections shall be subjected to the plane of the laminations divide the magnetic circuit into two or more electrically separate parts, the ducts and insulating barriers which have a thickness greater than 0.25 mm are to be bridged with tinned copper strips so inserted as to maintain electrical continuity.
- d) Earthing of Coil Clamping Rings - Where coil clamping rings are of metal at earth potential, each ring shall be connected to the adjacent core clamping structure on the same side of the Transformer as the main earth connection.
- e) Size of Earthing Connections - Main earthing connections shall have a cross-sectional area of not less than 200 sq. mm. but connections inserted between laminations may have cross-sectional areas reduced to 150 Sq. mm. when in close thermal contact with the core.

### 6.6 Impedance Voltage

The impedance voltage at rated current on principal tapping shall be specified in submission by Bidder as per Technical Schedules in the Appendices and shall comply with the values specified in these specifications.

### 6.7 Cooling

The method of cooling each transformer shall be ONAN.

### 6.8 Insulating Oil

Each transformer shall be supplied with standard mineral insulating oil that meets the requirements of AS 1767 and be proven to be non-corrosive by Method B of ASTM D1275-06 Standard Test Method for Corrosive Sulphur in Electrical Insulating Oils and, IEC 62535 Ed. 1.0: Insulating liquids — Test method for detection of potentially corrosive Sulphur in used and unused insulating oil.

The oil shall be new, supplied direct from the oil refinery and its bulk delivery shall be certified to contain less than 1 ppm of PCBs. The supplier shall follow approved quality procedures to ensure that the oil cannot be contaminated while under their control. The Bidder shall supply full identification, specifications and test results for any and each oil offered.

The quality of any offered insulating oil at the time of filling (i.e. on release from supplier) is such as to have a moisture content of at least <20 ppm and a Breakdown Voltage of >50kV.

The cold oil level shall be above the radiator inlet point (if radiators fitted).

## **6.9 Bushings and Terminals**

### **6.9.1 General**

All bushings will comply with AS/NZS 60137, AS 4436 and the Service and Environmental Conditions as specified in this technical specification. All porcelain components will be glazed and fully vitrified.

All terminal palms will be arranged vertically and comply with AS 62271.301. They will be copper with their contact.

### **6.9.2 LV Bushings**

The LV bushings will be mounted horizontally on the side of the transformer opposite the HV cable box.

The part of each LV bushing within the tank will be completely covered with oil when the transformer is old (with an outside temperature of 15°C), and will be readily accessible with the tank cover removed.

The distance between centre lines of the LV bushings will not be less than 200 mm. The taut string metal to metal clearances of the bushing terminals will be not less than 100 mm, phase to phase, and 60 mm phase to earth.

The neutral connection to the star point on the secondary winding will be brought out of the tank unearthed and insulated in the same manner as the phase terminals.

### **6.9.3 Marking of Terminals**

The terminals will be marked in accordance with AS 2374. The use of adhesives to attach marking plates will not be accepted.

## **6.10 Cables and Terminations**

### **6.10.1 Cable End Boxes**

11kV and 0.415kV HV/LV cable box shall be air insulated.

The 11kV cable box shall be supplied with 3 split gland plates. The gland plates shall be marine grade 8 mm thick aluminum.

The 0.415kV cable box shall be supplied with 4 split gland plates. The gland plates shall be marine grade 8 mm thick aluminum.

The arrangement shall allow cables to be connected to a separate terminal plate mounted on stand-off insulators on the back of the cable box. Each terminal plate shall be connected, by easily removable copper links, to the HV winding bushing.

The cable box shall have an open front design such that the cables can be slid into their final termination position. The top of the front opening in the cable box shall be equal to or greater than the height of the internal main busbars to allow easy access for bolting of the cable termination palms at site.

The front bolted cover of the cable box shall be marine grade 8 mm thick aluminum and fitted with two lifting handles. One lifting handle shall be positioned on the left hand side of the cover and one on the right hand side of the cover such that two people can lift the cover off for regular maintenance access inside the cable box.

The cable box design shall be such that with the cables supported at the gland plate (the support is part of this Contract), then with the cable box access cover removed and the gland plate unbolted, that the transformer and cable box can be removed.

Removable insulated barriers shall be provided between the phases. The cable box internal air electrical clearances shall comply in accordance with the system highest voltage requirements.

Except for the internal electrical clearances, the cable boxes shall comply with the requirements of BS 6435: 1984, and also the following specific requirements:



- i. They shall be suitable for through currents determined from this specification.
- ii. They shall be suitable for earth fault currents equivalent to the system MVA fault levels.
- iii. Electrical clearances with cables connected to the terminals shall be such as to provide the impulse withstand strength.
- iv. A pressure relief vent such as a square panel of at least 0.2 m<sup>2</sup>. The sides shall be sufficiently strong such that the vent panel cannot become detached from the cable box. The panel shall open at a pressure of at least 50 kPa lower than the internal withstand pressure of the cable box.
- v. The bushing to cable connections (solid or flexible) shall be supplied by the Supplier and from a reputable supplier.
- vi. The positioning of the cable to bushing connections shall be mechanically restrained in such a manner as to meet the short circuit conditions as specified in this specification.
- vii. The cable box shall have the following earthing facilities:
  - a. An earth bar for the separate connection of each individual cable's screen. The earth bar shall be mounted on stand-off insulators with a removable connection from the earth bar to an earth stud on the cable box wall to facilitate testing. The earth bar shall be located outside the cable box no more than 300 mm from the cable entry to enable in service cable testing. Each cable screen shall be brought outside the cable box through an insulation gland to connect separately onto the earth bar.
  - b. The cable box earthing points mentioned above shall be bonded together, and then connected to the transformer tank.
- viii. The cable box shall be weatherproof to IP 55 classification in IEC 60529.
- ix. The cable box shall be compact in size.

Where the cable box is bolted on to the main transformer tank, flange mountings for the gasket seal shall be provided.

## 6.10.2 Cables

Auxiliary power and multicore control cables between the integral parts of the transformer, its marshalling kiosk or tank mounted cubicle and ancillary equipment shall be installed, glanded and have individual cores identified and terminated under this contract. Cable from each transformer to its associated remote control and protective equipment to auxiliary supply switchboards and interconnections with other transformers will be supplied, glanded and have individual cores identified and terminated.

## 6.11 Sound Level

The transformer noise levels shall be measured as a type test and in accordance with IEC 60551. The noise level of the transformers shall be less than 52dB at a 1 metre radius from the transformer. When the bottom plate of the transformer tank will be in direct contact with the surface of the foundation anti- vibration pads shall be provided for insertion between the transformer and its foundation.

## 6.12 Radio and Television interference

The design and construction of each transformer shall be such that it will not cause unacceptable radio or television interference.

## 6.13 Galvanizing

### 6.13.1 General

- a) Galvanizing shall be in accordance with BS 729 and shall consist of a thickness of zinc coating of between 100 to 120µm.
- b) Hot dip galvanizing of metal, including the threads of bolts and screwed rods shall be carried out after all machining, bending, cutting, drilling, punching, marking and welding operations have been carried out.
- c) Nuts shall be tapped up to 0.4 mm oversize after galvanizing and the threads shall be lubricated by water-resisting rust-inhibiting oil.
- d) Where punching is used the draw shall be removed together with all burrs from drilling, punching etc prior to galvanizing.
- e) The zinc coating shall be smooth, clean and of uniform thickness and free from defect.
- f) The preparation for galvanizing and the galvanizing itself shall not adversely affect the mechanical properties of the coated material. Surfaces in contact with oil shall not be galvanized.
- g) Galvanizing Damage and Shipping Corrosion - If the extent of damage found on site to a galvanized part appears



capable of repair, the Manufacturer may, after receiving agreement from EFL, attempt to effect such repair by approved methods.

- h) This agreement shall not bind the EFL to accept the repaired part when it is reoffered for inspection.
- i) In the event that it is found that galvanized parts are subject to the formation of white rust during shipment or storage on site, the EFL shall either :
  - 1. Approve a system of scrubbing and protective painting to be applied on site if, in his opinion, this is expedient, or
  - 2. Reject the affected parts. Replacement parts shall be given special dip or spray treatment without extra charge to the EFL. Replacement parts are subject to the EFL's inspection and approval.

### **6.13.2 Castings**

- a) All castings shall be true to pattern, of uniform quality and condition, and free from blowholes, flaws, and cracks. No welding, filling or plugging of defective parts is to be done under any circumstances.
- b) The surfaces of castings, which do not undergo machining, shall be free from foundry irregularities and burrs.

### **6.13.3 Iron Castings**

All cast iron is to be of close-grained quality approved by the EFL. Iron casting material shall be in accordance with ASTM A 126 Class B, and shall be subject to appropriate tests and inspection as detailed therein.

### **6.13.4 Steel Castings**

Steel castings shall be manufactured in accordance with ASTM A27, and shall be subject to appropriate tests and inspection as detailed therein.

### **6.13.5 Non-ferrous Castings**

Non-ferrous casting material and castings shall be manufactured in accordance with the appropriate ASTM standards for the material concerned.

### **6.13.6 Welding**

- a. Welds across oil tight joints shall be subject to the approval of EFL. Such welds may be allowed providing the joining process is by automatic submerged arc welding with welding from both sides of the plate.
- b. Where gussets are provided cut-outs shall be provided and of sufficient size to allow welding behind. All tanks, fittings and flanges shall be double welded.
- c. No Space welding is allowed externally. No end-to-end jointing of steel sections shall be allowed. Joints between members connected by welding shall be completely sealed by a continuous weld.
- d. The Manufacturer is to submit evidence, satisfactory to EFL, that the welding operations are qualified in accordance with the requirements of the appropriate section of BS 4871, or such other standard approved by EFL.
- e. In all cases where welds are liable to be highly stressed such as in the case of containing short- circuit forces; the Manufacturer shall supply to EFL a general arrangement drawing of the proposed welding and the supporting evidence that the structure will contain the above mentioned forces.
- f. Subsequently, and before fabrication commences, a detailed drawing of all proposed weld preparations on the fabrication shall be supplied to EFL for approval.

## **6.14 Anti-Corrosion Design**

The design shall be based severe marine on worst atmospheric classification with a durability of minimum 20 years in accordance AS/NZS 2312.

In choosing materials and their finishes, due regard shall be given to the conditions under which equipment is to work, particularly since the corrosion of outdoor equipment is of continuing and serious concern to EFL. The equipment offered shall be constructed of suitable high-grade materials to minimize corrosion.

Metals of iron or steel shall be painted or galvanised as appropriate in accordance with this specification. Alternatively, indoor parts may have chromium or copper-nickel plated or other approved protective finishes. Materials and combinations of materials used to construct the equipment shall be selected and arranged to prevent bimetallic corrosion. Aluminum alloys containing Cu or Mg shall not be used. Current carrying parts shall be made from non-ferrous metal. Where practicable, all

surfaces shall be self-draining, and all air filled enclosures (e.g., terminal boxes) shall have an insect-proof drain hole. All surfaces, openings and flanges shall be designed and constructed to avoid the settling or accumulation of moisture, including condensation, and any other corrosive material.

Bolts, Screws, Nuts, Springs, Pivots, etc - Any cover bolts, nuts, washers etc shall be galvanized, and all others shall be 316 stainless steel bolts mated with 308 stainless steel nuts together with an anti-seize compound. When used, stainless steel screws shall be used when plating is not possible owing to tolerance limitations, be of corrosion-resisting steel. Instrument screws (except those forming part of a magnetic circuit) shall be brass or bronze. Springs shall be of non-rusting material, e.g., phosphor-bronze, or nickel silver.

Fabrics, Cork, Paper, etc. - These materials, which are not to be protected subsequently by impregnation, shall be adequately treated with an approved fungicide. Sleeving and fabrics treated with linseed oil or linseed varnishes shall not be used.

Gaskets - All joint faces shall be arranged to prevent the ingress of water or leakage of oil with a minimum of gasket surface exposed to the action of oil or air. Oil resisting synthetic rubber is not permissible except where metal inserts are provided to limit compression. Gaskets shall be as thin as is possible consistent with the provision of a good seal and full details of all gasket sealing arrangements shall be shown on the Plant drawings. All Gaskets shall be single piece without joints. Where joints are inevitable then dovetail or other approved joints shall be used. All "O" Ring gaskets shall be of the Green (or other nonblack colour) Viton high temperature type. Any alternative gasket type supplied shall be to the approval of EFL. All flat gaskets (including the LV Cable Box) shall be of the Klingerite type or the Green (or other nonblack colour) Viton high temperature type. NIBBER is also acceptable. Any alternative gasket type supplied shall be to the approval of EFL. Welded lid gaskets and all Control Cubicle gaskets may be of a suitable type at the discretion of the Supplier. Gaskets shall not deteriorate due to weathering or when exposed to transformer oil at operating temperature of 130°C. If sealing rings are used for the main oil retention control:

Machined flanges - The machined flanges shall be painted with the same external paint system as the main tank, excluding "O" ring seats and sealing surfaces. The method of effecting the above in relation to the sealing ring shall be to EFL's approval. It is required from the "O" ring outwards that a sealant be used to prevent ingress of moisture between faces after assembly of the flange. This can be in the form of a thin gasket or sealant to the approval of the Engineer and shall cover the surface from the "O" ring to the outside of the flange.

Non-machined flanges - Non-machined flanges shall be painted with the same external paint system as the main tank. The use of gaskets each side of the bolts in any flange is not acceptable. The flange shall have its mating surface fully covered by the gasket.

Main Flange - The joint shall be sealed by a restrained "O" ring, or full flange gasket that prevents moisture ingress.

#### **6.14.1 Finishes**

Special attention shall be given to ensure the integrity of all protective coatings during sea freight.

#### **6.14.2 Tanks, Accessories, Pipe-work**

Painting shall commence with the least possible delay after inspection of the cleaned surfaces by EFL. No visible deterioration as compared to a freshly cleaned area shall be allowed. A blast-cleaned surface shall not stand overnight without being coated. The tank base underside shall have the same paint system applied as other tank surfaces.

#### **6.14.3 Zinc Spraying of Main Tank Base**

The outside of the main tank base and all sides of the main tank wall up to a level of 500 mm from the bottom of the tank base shall be zinc sprayed prior to painting. The zinc spray applied shall have a minimum dry coating thickness of 120 µm.

#### **6.14.4 External Surface Preparation**

Air Filled Cable Box shall have only external surfaces painted to the same standard as the main tank external surface requirements.

Exterior surfaces to be painted shall be prepared by a dry method of blast-cleaning to one of the following standards :

1. "First Quality" in accordance with BS 7079, with the metallic abrasive conforming to BS EN ISO 11124-3 & 4.
2. "Class 2.5" in accordance with AS 1627.
3. "Sa 2.5" in accordance with Swedish Standard SIS 05 59 00.

The external colour of outdoor equipment shall be Neutral to BS 4800, reference 00A05. Each coat of paint shall have a contrasting colour to all the adjacent coats of paint.

First Coat - Exterior surfaces shall have an inorganic zinc silicate primer applied, "Dulux ICI" Zinkanode 304, or equivalent, with a dry film thickness between 65 to 75 microns, and with no porosity.

Second Coat - The second coat shall be "Dulux ICI" Ferreko No 3 Micaeous Iron Oxide Mid Grey, or equivalent, with a dry film thickness ranging between 80 to 100 microns.

Third Coat - the third coat shall be "Dulux ICI" Luxepoxy 4 White Primer, or equivalent, with a dry film thickness ranging between 30 to 40 microns.

Fourth Coat - The fourth coat shall be "Dulux ICI" Urethane or epoxy Enamel, or equivalent, with a dry film thickness ranging between 30 to 40 microns.

The total thickness shall range between 205 microns and 255 microns.

All corners, nuts, bolts, tap changer, fan and pump housings shall be covered to the above specified paint thickness.

#### **6.14.5 Interior Surfaces**

Interior voids and surfaces of all oil-filled chambers shall be free from all rust, scale and other detritus. Accessible interior surfaces shall be power brushed. The interior of all oil filled chambers (except for radiators), shall be painted with an oil resistant white anti-tracking varnish or enamel.

#### **6.14.6 Internal Fastings**

Spring washers shall not be used. The preferred method of locking nuts is to use a full nut and a half nut. After tightening a nut and washer or nut and lock nut assembly, the steel thread shall be "popped" with a sharp pointed punch to prevent loosening of the nut. Non-steel bolts and nuts shall use a locking system together with glue or ties.

### **6.15 Corona Inception Fields**

Under Induced and Impulse test voltage conditions, there shall be at any particular stress point a minimum 35% safety margin between the corona inception field strength and the actual figure determined from the field plots supplied by the Supplier for all oil ducts in both axial and radial dimensions. The corona inception field strength shall be referenced to the published curves A 41-5 (2) and A 41-6 (2) in Weidmann Book Band 1, Volume 1.

### **6.16 Harmonic Suppression**

Transformers shall be designed with particular attention to the suppression of harmonic voltages, especially the third, fifth and seventh harmonics and to minimize the detrimental effects resulting therefrom.

### **6.17 Transformer Losses**

Guaranteed load and no-load loss figures are to be specified in the Schedules. Load losses are to be corrected to a reference temperature of 75deg C.

#### **6.17.1 Guaranteed Losses**

In evaluating the tenders, EFL will capitalize the guaranteed losses and so determine the economic advantages of the transformers offered. Capitalization of losses will be based on the guaranteed losses at the required power rating for each item as stated in the Schedules. Load losses will be those specified on the principal tapping.

## 6.18 Minimum Power Efficiency

All transformers must meet or exceed the minimum power efficiency levels specified in Table 1 of AS 2374.1.2-2003 Minimum Energy Performance Standard. Transformers with efficiencies not meeting or improving performance upon these Minimum Energy Performance Standards are unacceptable.

## 6.19 Shipment and Drying Out

Each transformer when prepared for shipment shall be fitted with a shock indicator or recorder which shall remain in situ until the transformer is delivered to Site. In the event that the transformer is found to have been subjected to excessive shock in transit, such examination as is necessary shall be made in the presence of EFL. Transformers shipped under pressure of gas shall be fitted for the duration of delivery to Site and for such time thereafter as is necessary with a gauge and gas cylinder adequate to maintain internal pressure above atmospheric.

The transformers shall be thoroughly dried out at the manufacturer's works and shall be delivered filled with oil to the correct level and ready for service. All transformers shall be vacuum filled. The degree of vacuum applied to the production units shall be identical to that applied to the units that are type tested. The moisture content of the oil shall be less than 25 ppm at time of filling.

# 7.0 INSPECTION AND TESTING

The Supplier shall be responsible for carrying out tests to demonstrate the equipment and its components supplied, complies with the technical requirements in this specification.

The type, special and routine tests shall be carried out on the equipment and its components in accordance with this specification, prior to approval being granted for use by EFL.

## 7.1 Type Tests and Special Tests

A copy of the type test certificates shall be provided, free of charge, to EFL, for the transformers offered or of similar design and rating. If a specific item was not tested in the past, the tests shall be performed on units purchased at the Supplier's expenses. Where units are offered of a similar design to those previously tested, EFL may consider (in accordance with relevant standard) to accepting previous type test reports. The Bidder shall state if such tests, that would qualify for consideration exist. The Bidder may be requested during the tender evaluation period to substantiate that claim with written engineering evaluation. Such evaluation shall provide all relevant details permitting EFL to establish validity of existing type tests.

Should EFL require any test(s) to be repeated despite the earlier certificate being available for an identical or similar unit, the cost of such test will be borne by EFL.

Any modification, resulting from a type test failure or change of design instigated by the Supplier or change of design to comply with the specification, which could affect the result of earlier type tests, shall require a repeat of such earlier type test. Any repeat type tests to provide compliance with the Standard's requirements shall be to the Supplier's cost. EFL requires the following to be included as part of type testing:

1. Temperature rise test - Unless acceptable type test certificates can be submitted in respect of a transformer similar in design to that specified. A temperature rise test shall be carried out and the costs shall be included in the contract price. This test shall take into account temperature rise due to both the specified earth fault current and continuous operation at CMR of the auxiliary winding
2. Impulse-voltage withstand (full wave) test
3. Short-circuit current withstand test included in IEC 60289 Clause 32.9 and also the short-circuit tests for distribution transformer specified in BS.

At the conclusion of tests, EFL reserves the right to attend the out of tank inspection at the testing premises.

## 7.2 Routine Tests on Transformers

The following tests, as specified in IEC 60076 shall be carried out:

1. Measurement of Winding resistance
2. Measurement of zero-sequence impedance
3. Dielectric test
4. Ratio, polarity and phase relationships
5. Measurement of impedance voltage

6. Measurement of no-load loss and load current
7. Insulation resistance of each winding
8. Measurement of capacitance and power factor
9. Induced over voltage withstand test
10. Separate source over voltage withstand test

### **7.3 Witnessing of Tests**

The Supplier shall also make allowance for witnessing of routine tests by EFL engineers via video conference at no additional cost to EFL.

### **7.4 Test Certificates**

One certified copy of all test results shall be supplied to EFL. Electronic copies shall also be submitted.

All test certificates shall include the manufacturer's serial number. On allocation, the corresponding EFL transformer number, the order number, contract number, item number, specification number and guaranteed losses must be added to the certificate, or attachment to the test report.

Test reports must not be more than five (5) years old from the closing date of the tender.

## **8.0 RELIABILITY**

### **8.1 Service Life**

Suppliers are required to comment on the reliability of the equipment and the performance of the materials offered for a service life of 45 years under the specified system and environmental conditions.

### **8.2 Evidence in Support of Reliability**

Such comments will include evidence in support of the reliability and performance claimed including information on Failure Mode and Effect Analysis. Annual failure rate (AFR) and Mean time to Failure (MTTF) data shall be provided for all major components.

## **9.0 ENVIRONMENTAL CONSIDERATIONS**

Suppliers are required to comment on the environmental soundness of the design and material used in the manufacture of the items offered. In particular, comments should address such issues as recyclability and disposal at end of service life.

## **10.0 PACKAGING AND MARKING**

The packaging of items by the Supplier must ensure that they are capable of being delivered undamaged giving due consideration to the quantity, distance of transportation and the preferred method of handling at each location.

The Supplier shall take all necessary precautions to ensure safe handling of the Auxiliary Transformer and associated accessories.

## 11.0 QUALITY REQUIREMENTS

Suppliers are required to submit evidence of a Quality Management System that complies with ISO 9001.

Documentary evidence shall be provided concerning the level of Quality System Certification associated with the supplier and or manufacturer. This documentation shall include the Capability Statement associated with the Quality System Certification.

## 12.0 PRODUCT WARRANTY PERIOD

The Supplier is required to provide the warranty period as part of the proposal. A minimum warranty period of twenty-four (24) months from time of delivery to site shall be provided.

## 13.0 INFORMATION TO BE SUPPLIED BY THE SUPPLIER

### 13.1 Documentation to be supplied with the Tender

To enable EFL to fully evaluate the transformers offered, (in addition to the completed Specification Requirement and Guaranteed Performance schedules) the Bidder will submit the following information with their tender:

- List showing similar equipment supplied to or on order for other utilities in Australia or New Zealand or the Oceania region
- Typical arrangement drawings and full details of the dimensions of the transformer
- Type test certificates for the transformers offered, or transformers of similar design and rating (if available).
- Typical loading curves (for loading transformers in accordance with AS 2374, Part7)
- Short circuit test details for equipment of similar design and rating.
- Sample inspection and test plans for the transformers
- Typical installation and maintenance manuals for all components
- Full details of the protective coatings offered
- End of service life disposal method
- Calculations for MEPS efficiencies
- Detailed procedure for receiving, handling, lifting and storage
- A list of all departures of the tender from this specification
- Evidence of quality management systems
- Evidence of Health, Safety and Environmental plans
- Evidence of financial ability to provide the level of service and support
- Origin of materials used in manufacture of the transformer and switchgears

Bidders may be asked to provide additional information during tender assessment period or following award of contract.

### 13.2 Training

Training material in the form of drawings, instructions and/or audio visuals shall be provided for all the items offered and accepted by EFL.

This material shall include but is not limited to the following topics:

- Handling
- Storage
- Installation
- Maintenance program
- Environmental performance
- Electrical performance

- Mechanical performance
- disposal



## 14.0 SCHEDULE A: LIST OF EXPERIENCE, PERSONNEL & FINANCIAL STATEMENTS

### Previous Experience

The Tenderer is to submit a list of Projects worked under with a similar scope, involving the design and manufacture of similar auxiliary/earthing transformers, in chronological order of year completed.

Client	Project Scope and Description	Approx. Project Value	Year Completed	Duration of manuf & supply

### Project Personnel

The Tenderer is to submit list of personnel who will work on this project and also provide their resumes in its bid.

Name	Designation	Duration of Employment with Company	Years of Experience

### Financial Statements

The Tenderer shall also submit past three years audited financial statements and records showing its financial ability to undertake this project.

## 15.0 SCHEDULE B: PRICE AND PAYMENT SCHEDULE

The prices below are to be inclusive of shipping and delivery to Lautoka in Fiji Islands.

Currency of Tendered Price: .....

Component	Total Price
Design and Manufacture of 1 x 11kV/0.415kV 300kVA ZNyn1 ONAN Auxiliary Earthing Transformer for Korovou Power Station	
Packaging and Delivery of Transformers to Site	
<i>(Tenderer to add other items as required)</i>	
<b>Incoterm and Currency</b>	
<b>Total</b>	
<b>Delivery Period</b>	
<b>Price Validity</b>	120 Days

Total Contract Price (in Words):

.....  
.....

Authorized Signatory of Tenderer:

Signature:..... Name: .....

Note: EFL will retain 10% of the contract sum as retention which shall be released twelve (12) months from when the transformers are delivered to site and accepted by EFL.

## 16.0 SCHEDULE C: AS 4911 ANNEX A (TO BE SUBMITTED BY TENDERER)

All Tenderers are required to complete and submit a copy of this form with their bid submissions.

Item		
1	Purchaser (Clause 1)	Energy Fiji Limited (EFL)
2	Purchaser's Address	2 Marlow Street, Suva
3	Supplier (clause 1)	<i>Supplier to provide</i>
4	Supplier's Address	<i>Supplier to provide</i>
5	Stated purpose for equipment (clause 1 definition of acceptable)	<i>As stated in tender specifications and/or purchase order</i>
6	Period of time for delivery (Clause 1 and Sub-clause 19.1)	<i>Supplier to provide</i>
7	Delivery Place (Clause 1 and Sub-clause 19.1)	EFL's Kinoya Depot, Suva, Fiji
8	Mode of Delivery (Sub-clause 19.1)	<i>Supplier to provide</i>
9	Governing Law (Clause 1(h))	Laws of Fiji
10	a) Currency (clause 1(g))	<i>Supplier to provide</i>
	b) Place for payments (clause 1 (g))	<i>Supplier to provide</i>
	c) Place of Business of bank (clause 1(d))	<i>Supplier to provide</i>
11	Limits of Quantities to be supplied and delivered (clause 2.2)	As stated in tender specifications and/or purchase order
12	Suppliers security	Not applicable
13	Purchaser's security	Not applicable
14	Purchaser supplied documents (sub-clause 6.2)	Tender specifications and addenda (where issued).
15	Supplier Supplied documents (sub-clause 6.3)	<i>Supplier to provide</i>
16	Time for Purchaser's direction about documents (sub-clause 6.3(c))	14 calendar days
17	Sub-contract work requiring approval (sub-clause 7.2)	All work.
18	Legislative Requirements, those excepted (sub-clause 10.1)	Not applicable
19	Reference date (clause 1, sub-clause 10.2(b))	Deadline for Submission of Bids, as defined in tender specifications
20	Time by which insurance cover for the Equipment is to be effected (sub-clause 13.1)	Prior to tender award.
21	Public and product liability insurance (sub-clause 13.2)	<i>Supplier to provide</i>

22	Qualifying cause of delay, causes for which EOTs will not be granted (page 3, subparagraph (b) (iii) of Clause 1 and sub- clause 17.2)	None.
23	Liquidated damages, rate (subclause 17.5)	0.5% per day upto 10% of the purchase order value
24	Delay Damages	As assessed by EFL
25	Date for completion of acceptance testing (subclause 18.1 and 21.1)	As stated in tender specification
26	Party responsible for unloading the Equipment (subclause 19.1)	EFL
27	When risk in the Equipment passes (subclause 20.1)	At time of acceptance by Purchaser.
28	Time at which ownership of the Equipment passes to the Purchaser (subclause 20.2)	At time of acceptance by Purchaser.
29	Period for Purchaser's notice that Equipment are rejected (subclause 21.1)	14 calendar days
30	Period for Purchaser's notice accepting or rejecting Supplier's proposal (subclause 21.4)	14 calendar days
31	Defects liability period (clause 22)	12 months
32	Invoice (subclause 24.1) Time for Invoice	Within 5 days of delivery
33	Period for Payment (subclause 24.1)	30 calendar days from time of acceptance by Purchaser
34	Equipment for which prepayment may be claimed (subclause 24.2)	None.
35	Interest rate on overdue payments (subclause 24.5)	Nil.
36	Arbitration (subclause 28.3) a) Person to nominate an arbitrator	President of Fiji Institute of Engineers
	b) Rules for arbitration	Laws of Fiji
37	The Supplier's liability is limited as follows (clause 29)	The contract sum as adjusted pursuant to the Contract
38	The Purchaser's liability is limited as follows (clause 29)	The contract sum as adjusted pursuant to the Contract

Authorized Signatory of Tenderer:

Signature:..... Name: .....

## 17.0 SCHEDULE D: SPECIFICATION REQUIREMENTS

	<i>Item</i>	<i>Units</i>	<i>Required</i>	<i>Tendered</i>
<b>(A)</b>	<b>RATING &amp; PERFORMANCE</b>			
1.	Manufacturer's Name			
2.	Manufacturer's Address			
3.	Continuous Maximum rating (CMR) (ONAN)	MVA	0.3	
4.	Number of phases		3	
5.	Number of Windings		2	
6.	Applicable Standard – IEC		60076	
7.	System maximum voltage for both windings Um	HV	11 kV	
		MV	0.415 kV	
8.	Insulation type	HV		
		MV		
9.	Highest Voltage for equipment	HV	12 kV	
		MV	0.44 kV	
10.	Winding Insulation Level	HV		
		MV		
11.	Transformer Nominal ratio		11kV/0.415 kV	
12.	Phase Connections	HV	Zn	
		MV	Y	
	Vector group		Znyn1	
13.	Short circuit withstand fault level at terminals of			
	11kV busbars	kA	25	
14.	Type of Cooling		ONAN	
15.	External cooling medium		Air	
16.	Service conditions :			
	Altitude not exceeding	m	200	
	Air temperature not exceeding	°C	50	
	Average air temperature in any one year not exceeding	°C		
	In any one day	°C	32	
	Average in one year	°C	30	
18.	Size of tapping step with position nos.		+/- 2 x 2.5%	
19.	Approximate ONAN rating	MVA	0.75	
20.	Hot spot temperature rise at CMR under service and at 30°C ambient temperature	°C	55	
21.	Top oil temperature rise (average daily ambient air temperature 32°C)			
	(A) CMR	°C	50	
	(B) ONAN rating			

	<i>Item</i>	<i>Units</i>	<i>Required</i>	<i>Tendered</i>
22.	Maximum hot spot temperature when loaded according to IEC 60354	°C		
23.	Winding hot spot temperature on emergency overload not exceeding	°C		
24.	Flux density in iron at normal voltage and frequency and at normal ratio - (no load).			
	(A) Core	Tesla		
	(B) Yokes	Tesla		
25.	Magnetising current (approx) at nominal ratio and			
	at 0.9 x nominal voltage	%		
	at 1.0 x nominal voltage	%		
	at 1.1 x nominal voltage	%		
	at 1.2 x nominal voltage	%		
26.	Guaranteed Losses at nominal ratio			
	(A) No Load losses	kW		
	(B) Copper losses at CMR	kW		
	(C) Auxiliary losses at CMR	kW		
27.	Regulation at 75°C and normal ratio -			
	(A) At unity power factor	%		
	(B) At 0.8 lagging power factor	%		
28.	Impedance voltage at 75°C and CMR. Between HV and LV Windings at Tap			
	Maximum	%		
	Nominal	%	~3.50%	
	Minimum	%		
29.	Equivalent circuit zero sequence impedance between HV and LV windings			
	Maximum Tap (1)	Ω/phase		
	Nominal Tap (3)	Ω/phase		
	Minimum Tap (5)	Ω/phase		
30.	Maximum current density in windings at C.M.R.			
	(A) HV Winding	A/mm <sup>2</sup>		
	(B) LV Winding	A/mm <sup>2</sup>		
31.	Efficiency	%	99.5	
<b>(B)</b>	<b>GENERAL</b>			
1.	Type of oil preservation system		Silica Gel	
2.	Whether wheels, skid or flat bottom base required		Flat bottom	
3.	Whether anti-vibration pads required		Yes	
4.	Transformer sound pressure acceptance level	dB	65	
<b>(C)</b>	<b>DETAILS OF CONSTRUCTION</b>			
1.	Types of winding -			
	(A) HV			

	<b>Item</b>	<b>Units</b>	<b>Required</b>	<b>Tendered</b>
	(B) MV			
2.	Material of Insulation			
	(A) HV Windings			
	(B) MV Windings			
3.	Insulation of tapping connections			
4.	Insulation of -			
	(A) Yoke bolts.			
	(B) Side plates.			
5.	Winding connections brazed or crimped Specify material (winding material and the joint material)			
6.	Is facility provided for adjustment of axial pressure on windings?	Yes/No		
7.	Thickness of transformer tank			
	(A) Sides	mm		
	(B) Bottom	mm		
8.	Material used for gaskets for oil tight joints.			
9.	Top Cover flange:-			
	Level: Low/High			
	Joint: WELDED/GASKETTED		Welded	
<b>(f)</b>	<b>RADIATORS VALVES &amp; FANS</b>			
1.	Thickness of radiator plates and/or cooling tubes.	mm		
2.	Valve type/material:			
	75mm and below			
	above 75mm			
3.	Equipment for ONAN cooling state (A) or (B) -		A	
	(A) Radiator on main tank			
	(B) Separate cooler bank			
4.	Number of cooling air blowers per transformer			
5.	Speed of air blowers and air flow	rpm/m <sup>3</sup> per min		
6.	Rating of each air blower motor	kW		
7.	Starting current of each blower motor,	A		
<b>(g)</b>	<b>OIL VOLUMES &amp; WEIGHTS</b>			
1.	Total oil required including cooler system	Litres		
2.	Volume of oil to fill transformer to above the top yoke.	Litres		
3.	Total volume of conservator	Litres		
4.	Volume of oil in conservator between highest and lowest visible	Litres		
5.	Weight of core and winding assembly	Tons		
6.	Weight of each oil cooler bank complete with oil if mounted separately from transformer	Tons		

	<i>Item</i>	<i>Units</i>	<i>Required</i>	<i>Tendered</i>
7.	Total weights of complete transformers, including attached coolers, voltage regulating equipment, all fittings and oil	Tons		
8.	Weight of transformer arranged for transport	Tons		
<b>(h)</b>	<b>TRANSFORMER OIL</b>			
1.	Manufacture, type and class of oil to BS 148-1972	mm		
<b>(i)</b>	<b>TRANSFORMER PARTS SUBJECT TO SHORT-CIRCUIT TEST</b>			
1.	Brief description of Transformer or parts thereof subjected to short circuit test for which short- circuit calculations are available.	Yes/No		
<b>(j)</b>	<b>TRANSFORMER BUSHING (IF APPLICABLE)</b>			
1.	Manufacturer			
2.	Insulator material (solid/oil-paper):			
	a. HV bushing			
	b. Neutral bushing			
	c. MV bushing			
3.	Manufacturer's type reference and rated voltage			
4.	Rated current			
	a. HV bushing			
	b. Neutral bushing			
	c. MV bushing			
5.	Manufacturer of porcelain			
6.	Length of insulator (overall).			
	a. HV bushing	mm		
	b. Neutral bushing	mm		
	c. MV bushing	mm		
7.	Weight of insulator.			
	a. HV bushing	kg		
	b. Neutral bushing	kg		
	c. MV bushing	kg		
8.	Electrostatic capacity of complete bushings.			
	a. HV bushing	pF		
	b. Neutral bushing	pF		
	c. MV bushing	pF		
9.	Dry lightning impulse voltage withstand. (1.2/50 wave)			
	a. HV bushing	kV		
	b. Neutral bushing	kV		
	c. MV bushing	kV		
	50Hz dry voltage withstand			



	<b>Item</b>	<b>Units</b>	<b>Required</b>	<b>Tendered</b>
10.	a. HV bushing	kV		
	b. Neutral bushing	kV		
	c. MV bushing	kV		
11.	50Hz wet withstand voltage without arcing horns			
	a. HV bushing	kV		
	b. Neutral bushing	kV		
	c. MV bushing	kV		
12.	Total Creepage distance of shed (specified minimum 25mm/kV based on maximum system voltage)			
	a. HV bushing	mm		
	b. Neutral bushing	mm		
	c. MV bushing	mm		

Authorized Signatory of Tenderer:

Signature:..... Name: .....

## 18.0 SCHEDULE E: PROGRAMME OF WORK

The Tenderer is required to state the commencement and completion dates for the auxiliary earthing transformer in the project schedule format given below.

Component or Work	Commencement Date	Completion Date
1. Receipt of Official Purchase Order		
2. Submission of Design Drawings and Design Report and Design Review		
3. Procurement of Materials		
4. Manufacture of auxiliary earthing transformer		
5. Factory Testing of auxiliary earthing transformer		
6. Packaging and Shipping		
7. Expected Delivery on Site		
8. Commencement of Defects Liability Period		
9. End of Defects Liability Period		

The Tenderer is to note that the overall duration of the project shall remain same, if there is a delay in award of tender, the completion date will be shifted by an equal number of days.

Authorized Signatory of Tenderer:

Signature:..... Name: .....

## 19.0 SCHEDULE F: DEPARTURE FROM SPECIFICATIONS

The Supplier shall nominate the Clause or relevant section of the tender specification and describe the departure. If none exists, the Bidder shall state NONE on the form below.

Tender Specification Reference	Departure

Failing to submit a completed Schedule F Departure from Specifications form shall result in a bid being declared non-responsive and EFL shall reject the Bid outright.

Authorized Signatory of Tenderer:

Signature:..... Name: .....

---

<sup>i</sup> Where possible, the Tender shall refer to the specific clause of the tender specification.

## 20.0 TENDER SUBMISSION CHECK LIST

*The Bidders must ensure that the details and documentation mention below must be submitted as part of their tender Bid*

Tender Number \_\_\_\_\_

Tender Name \_\_\_\_\_

1. Full Company / Business Name:

**(Attach copy of Registration Certificate)**

2. Director/Owner(s): \_\_\_\_\_

3. Postal Address: \_\_\_\_\_

4. Phone Contact: \_\_\_\_\_

5. Fax Number: \_\_\_\_\_

6. Email address: \_\_\_\_\_

7. Office Location: \_\_\_\_\_

8. TIN Number:

**(Attach copy of the VAT/TIN Registration Certificate - Local Bidders Only (Mandatory))**

9. FNPF Employer Registration Number: \_\_\_\_\_ **(For Local Bidders only) (Mandatory)**

10. **Provide a copy of Valid FNPF Compliance Certificate (Mandatory- Local Bidders only)**

11. **Provide a copy of Valid FRCS (Tax) Compliance Certificate (Mandatory Local Bidders only)**

12. **Provide a copy of Valid FNU Compliance Certificate (Mandatory Local Bidders only)**

13. Detailed company profile and Insurance Cover \_\_\_\_\_

14. Contact Person: \_\_\_\_\_

I declare that all the above information is correct.

Name: \_\_\_\_\_

Position: \_\_\_\_\_

Sign: \_\_\_\_\_

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

## **21.0 TENDER SUBMISSION - INSTRUCTION TO BIDDERS**

Bidders are requested to upload electronic copies via Tender Link by registering their interest at: <https://www.tenderlink.com/efl>

**EFL will not accept any hard copy submission to be dropped in the tender box at EFL Head Office in Suva.**

**This tender closes at 4.00pm (1600hrs) on Wednesday 23<sup>rd</sup> April, 2025.**

For further information or clarification please contact our Supply Chain Office on phone **(+679) 3224360** or **(+679) 9992400** or email us on [tenders@efl.com.fj](mailto:tenders@efl.com.fj)

**The bidders must ensure that their bid is inclusive of all Taxes payable under Fiji Income Tax Act. Bidders are to clearly state the percentage of VAT that is applicable to the bid prices.**

The lowest bid will not necessarily be accepted as the successful bid.

**The Tender Bids particularly the “Price” must be typed and not hand written.**

**Any request for the extension of the closing date must be addressed to EFL in writing three (3) working days prior to the tender closing date.**

**Tender Submission via email or fax will not be accepted.**