THE HASHAIMITE KINGDOM OF JORDAN
NATIONAL ELECTRIC POWER CO.
P.O. BOX 2310
AMMAN 11181

المملكـــة الأردنيـــة الهاشميـــة
شركـــة الكهربـــاء الوطنيـــة م.ع
ص.ب. 2310
عمـان 11181

TENDER No. 50/2024

Power Transformers and Associated Equipment of Ishtafina, Abdali, Subeihi, Sabha and Manara 132/33 kV Substations

VOLUME 1 OF 1

TENDER

SECTION 1

INVITATION TO TENDER

&

TENDER ACKNOWLEDGEMENT

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INVITATION TO TENDER

The National Electric Power Company intends to replace power transformers and associated equipment in several existing 132/33 kV substations.

The National Electric Power Company hereby invites Tenderers to submit their offers for design, engineering, manufacture, inspection, and testing at the factory of **Power Transformers and Associated Equipment Ishtafina, Abdali, Subeihi, Sabha and Manara 132/33 kV Substations**, packing for export, supply CFR Aqaba Port – Jordan Incoterms 2020 and locally manufactured materials to be delivered at NEPCO warehouse or at the site, supervision of erection and supervision commissioning works at the site, setting to work and guarantee for a period of 36 calendar months from the date of receipt of the last consignment at the site or NEPCO warehouse of the equipment detailed in the Schedules included in the Tender Documents.

Interested Tenderers may obtain further information at the office of:

National Electric Power Company
PO Box 2310
11181 Amman
Jordan

Telephone: +962 6 5858615
Telefax: +962 6 5818336

A complete set of Tender Documents may be purchased by any interested Tenderer on application to the above and upon payment of a non-refundable fee of JD 500 (Five Hundred Jordan Dinars).

The enclosed Tender Acknowledgement should be returned to the National Electric Power Company immediately after collection, as any further correspondence shall be addressed accordingly.

Offers must be delivered to The Tender Committee in the form of **two envelopes** as follows:

1. Financial

2. Technical

The envelopes should be sealed and in duplicate (one marked Original and one marked Copy).

The losses shall be attached to the financial envelope. Technical envelope shall not contain the losses, any deviation from the guaranteed values as found during FAT will involve the application of a penalty as detailed in technical specifications taking in consideration the rights as applicable in the IEC.

Two Soft copies (USB/Flash Memory) of the **Technical offer** shall be submitted with the offer.

The Bidder shall prepare the Technical offer separate from the financial offer. No pricing information shall be included in the Technical offer.

The contractor is responsible for evaluating the existing system and determining the required data for the existing equipment at Ishtafina, Abdali, Subeihi, Sabha and Manara 132/33 kV Substations. A site visit is mandatory

All Tenderers shall submit their offers to National Electric Power Company at the above address before **closing time on the scheduled date** below.

Date	:	/ /2025
Time	:	14:00

All Tenders must be accompanied by a Tender Security (Bid Guarantee) in amount of **JD 100,000.00 (One Hundred Thousand Jordanian Dinars)** in the form of a Bank Guarantee issued by an approved Bank located in Jordan, in the form provided in the Tender Documents.

TENDER ACKNOWLEDGEMENT

National Electric Power Co
P.O. Box 2310
11181 Amman
Jordan

Telefax: 00 (962) 6-5818336

Attention: The Managing Director,

Dear Sirs

We the undersigned

_____

Acknowledge receipt of a complete set of Tender Documents for TENDER NO. 50/2024 Power Transformers and Associated Equipment of Ishtafina, Abdali, Subeihi, Sabha and Manara 132/33 kV Substations, comprising one copy of the following:

Volume 1:

- Invitation to Tender;
- Instructions to Tenderers;
- Conditions of Contract;
- Tender Forms
- Technical Specifications
- Technical Schedules
- Tender Drawings
- Price Schedules

We wish to receive all further information concerning these Tender Documents at the :following address:

Name:

_____

Address:

_____

_____

_____

Attention:

_____

Fax No.

_____

Our local agent in Jordan is:

Name:

_____

Address:

_____

_____

_____

Attention:

_____

Fax No.

_____

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SECTION 2
INSTRUCTIONS TO BIDDER

A. INTRODUCTION

1. Description of Works

1.1 Definite Work

The National Electric Power Company hereby invites Tenderers to submit their offers for 50/2024 Power Transformers and Associated Equipment design, engineering, manufacture, inspection, testing in factory, packing for export, supply CFR at AQABA port Jordan Incoterms 2020, supervision of erection & commissioning works at site and guarantee for a period of 36 months from the date of receipt of last consignment at site or NEPCO warehouses of the equipment detailed in the attached Schedules.

1.2 Work at the Option of the Employer

Where specified, the Bidder shall complete all Price Schedules for work at the Option of the Employer and submit all associated supporting technical documentation.

2. Source of Funds

The National Electric Power Company will finance the project from their own source .

3. Eligible BIDDER

A Bidder may be a private entity, government owned entity or any combination of such entities in the form of a Joint Venture, Consortium, or Association joint venture (JVCA).

3.1 This invitation to Tender is open to all bidders from all countries who's satisfy the requirements concerning experience for past projects, and who are able to satisfy the conditions set out in Clause ITT 15- (Documents Establishing the Qualifications of the Tender).

3.2 A Bidder shall not have a conflict of interest. All BIDDER found to have a conflict of interest should be disqualified. A Bidder may be considered to have a conflict of interest with one or more parties in this tendering process, if:

(i) they have controlling partners in common; or

(ii) they receive or have received any direct or indirect subsidy from any of them; or

(iii) they have the same legal representative for purposes of this tender; or

(iv) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the tender of another Bidder, or influence the decisions of the Employer regarding this Tender process; or

(v) A Bidder, its affiliates or parent organisation has participated as a consultant in the preparation of Tender.

3.3 Notwithstanding the provisions of ITT 3.2 above, a firm or a member of a JVCA may participate in only one tender for the Contract, either individually or as a member in a JVCA. Submission or participation by a Bidder in more than one tender for the Contract will result in the disqualification of all tenders for that Contract in which the party is involved. However, this does not limit the inclusion of the same subcontractors in more than one tender.

A subcontractor is not deemed to be a Bidder in the tender.

3.4 A Bidder shall be disqualified if the Bidder is under a declaration of ineligibility in accordance with Government Procurement Bylaw no. 8 in 2022, at the date of the deadline for tender submission or thereafter.

4. Prohibited Practices

4.1 Bidder, suppliers, sub-suppliers, contractors, sub-contractors, if any, shall observe the highest standard of transparency and integrity during the procurement, execution and implementation of such contracts[1].

4.2 Bidder, suppliers, sub-suppliers, contractors, sub-contractors, shall not authorise or permit any of their officers, directors, authorised employees, affiliates, agents or representatives to, engage in Prohibited Practices with respect to the procurement, award, or execution of the Contract.

For the purposes of this provision, the terms set forth below as follows:

(i) "Corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;[1]

(ii) "fraudulent practice" is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(iii) "Collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

[1] In this context, any action to influence the procurement process or contract execution for undue advantage is improper

(iv) "Coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

(v) "obstructive practice" is

(aa) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede Employer investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or

(bb) acts intended to materially impede the exercise of the inspection and audit rights

(vi) **Theft** which means the misappropriation of property belonging to another party.

4.3 Employer will reject a proposal for award if it determines that the Bidder recommended for award, or any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question; and will declare rejection to the Bidder taken timely and appropriate action satisfactory in accordance with applicable procurement Bylaw number 8 in 2022 to address such practices when they occur.

The BIDDER, suppliers, sub-suppliers, contractors, sub-contractors, shall require their officers, directors, employees or agents with knowledge of the Contract to respond to questions from the Purchaser and to provide to the Employer any information or documents necessary for the investigation of allegations of Prohibited Practices.

5. Cost of Tendering

The Bidder shall bear all costs associated with the preparation and submission of his tender, and the Employer will in no case be responsible or liable for these costs, regardless of the conduct or outcome of the Tender process.

6. Language of Tender

The Tender prepared by the Bidder and all correspondence and documents related to the Tender exchanged by the Bidder and the Employer, shall be written in the English language, supporting documents that any printed literature furnished by the Bidder may be written in another language so long as accompanied by an English translation of its relevant passages in which case, for purposes of interpretation of the Tender, the English translation shall govern.

B. THE TENDER DOCUMENTS

7. Content of Tender Documents

7.1 The Scope required, Tender procedures, contract terms and technical requirements are prescribed in the Tender Documents. The Tender Documents include:

Volume 1 Invitation to Tender;
Instructions to BIDDER;
Conditions of Contract;
Forms

Technical Specification

Technical Schedules and Price Schedules

7.2 A Bidder shall obtain the Tender Document from the source stated by the Employer in the Invitation for Tenders; otherwise the Employer is not responsible for the completeness of the Tender Document.

7.3 The Bidder is expected to examine all instructions, forms, terms, specifications and other information in the Tender Documents.
Failure to furnish all information or documentation required by the Tender Document or submission of tender not substantially responsive to the Tender Documents in every respect will be at the Bidder's risk and may result in rejection of the Tender.

8. Clarification of Tender Documents and site visits

8.1 The Bidder requiring any clarification of the Tender Document shall contact the Employer in writing or raise his enquiries during the clarification meeting if provided.

8.2 The Employer's response shall be in writing with copies to all BIDDER who have acquired the Tender Document, including a description of the inquiry but without identifying its source. Should the Employer deem it necessary to amend the Tender Document as a result of a request for clarification, it shall do so following the procedure described under ITT 9.

8.3 The Employer will respond in writing to any request for clarification of the Tender Documents, which it receives no later than 14 days prior to the closing date for submission of Tenders. Written copies of the Employer's response (including an explanation of the query but without identifying its source) will be sent to all prospective BIDDER who have received the Tender Documents.

8.4 Where applicable, The Bidder is required to visit and examine the sites of the Works and its surroundings and obtain for himself on his own responsibility all information that may be necessary for preparing the Tender and entering into a contract. The costs of visiting the site shall be at the Bidder's own expense.

8.5 Where the Bidder and any of its personnel or agents have been granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, the Bidder, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal

injury(whether fatal or otherwise), loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the visit.

8.6 Failure to investigate the Site shall not relieve the Bidder from responsibility for estimating properly the difficulty or cost of successfully performing the Works.

9. Amendment of Tender Documents

9.1 At any time prior to the deadline for submission of Tenders, the Employer may amend the Tender Document by issuing an amendment

9.2 Any amendment issued shall be part of the Tender Document and shall be communicated in writing to all who have obtained the Tender Document from the Employer in accordance with ITT 7.2.

9.3 In order to afford prospective BIDDER reasonable time in which to take the amendment into account in preparing their Tender, the Employer may, at its discretion, extend the deadline for the submission of Tenders.

C. PREPARATION OF TENDERS

10. Documents comprising the Tender

10.1 Documents comprising the Tender

The Tender prepared by the Bidder shall be based on the Tender Documents identified in ITT 7.1.

10.2 Documents to be submitted by BIDDER

The Tender shall comprise the following:

a) Letter of Tender duly completed and signed with the Covenant of Integrity attached thereto, based on the forms included in Forms in Section 4.

b) Duly authorised power of attorney by a Notary Public, indicating that the person(s) signing the tender have the authority to sign it; which is binding upon the Bidder during the full period of its validity.

c) Company Charter(s) and valid registration (incorporation) documents;

d) Statement of Compliance based on the forms included in Forms in Section 4.

e) Completed form and documentary evidence establishing the past experience qualification form in ITT 50.1 ,Tables 1 and 2 for financial qualification attached in ITT 50.2, manufacturer authorisation form ITT 50.3 and any other relevant document as required in ITT 15.

f) in the case of a tender submitted by a JVCA, the JVCA agreement or Letter of Intent;

g) The technical offer, Technical Schedule duly signed and filled, as required in the Tender documents;

h) Time Schedule, given in Schedule B1, required to achieve completion within the specified time

i) All Drawings as detailed in the respective Schedule E

j) The Price Schedules; and losses.

k) Contract cash flow forecast.

l) Any other documents and the additional information, if so required in the Tender documents.

m) Bid bond

The above shall be organised in envelopes as described invitation to tender and detailed below

Envelope1 – Marked "Envelope 1 Technical Contents- items (b), (c), (d), (e), (f), (g), (h), (i). (M)
Envelope 2 - Marked "Envelope 2 – Financial "Contents Items (a), (k) and (j)

Envelope 1 should not include any indication of the financial aspects used in Envelope 2.

Minor departures from the requirements of the Technical Specification, Drawings, Conditions of Contract and other commercial conditions on which the Bidder has based the Tender should be detailed in Schedule L.

11. Letter of Tender

The Bidder shall submit the Letter of Tender, which comply with the requirements of the Tender Document, using the forms furnished in Forms. These forms must be completed without any alterations to its format, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested

12. Alternative Tenders (Not Applicable)

BIDDER may submit Alternative Tenders, in addition to the requested Tenders, provided that they include complete technical justifications and meet the basic performance and technical criteria. BIDDER offering Alternative Tenders shall also indicate price differences from the

main Tender and any variations to the Time Schedule and other contractual and commercial terms of the Contract.

13. Tender Prices and Discounts

13.1 BIDDER shall quote for the entire Works on a "single responsibility" basis such that the total Tender price covers all the Contractor's obligations mentioned in or reasonably to be inferred from the Tender Documents including the acquisition of all permits, approvals and licences etc, and training services and such other items and services as may be specified in the Tender Documents, all in accordance with the requirements of the Conditions of Contract.

13.2 Prices quoted by the Bidder shall be fixed during the Bidder's performance of the Contract and not subject to variation on any account. A Tender submitted with an adjustable price quotation will be treated as non-responsive and rejected.

13.3 The Bidder shall fill in rates and prices for all items of the Price Schedules. Items against which no rate or price is entered by the Bidder will not be paid for by the Employer and shall be deemed covered by the rates for other items and prices in the Price Schedules.
13.4 In the Letter of Tender the Bidder shall quote any discounts and the methodology for their application.

14. Currencies of Tender

The BIDDER shall state the Tender Price in US dollar. If however, a portion of the BIDDER expenditure under the Contract is expected to be made in countries other than Jordan BIDDER should use US dollars only.

15. Documents Establishing the Qualifications of the Tender

To establish its qualifications to perform the Contract in accordance with Evaluation Methodology, Eligibility and Qualification Criteria, the Bidder shall provide the information requested.

Eligibility and Qualifications

In order to satisfy the requirements for eligible experience, the Bidder shall provide documentary evidence to establish:

- **Bidder Qualification.**

A. That, in the case of a Bidders offering to supply plant and equipment under the contract which the Bidders does not manufacture or otherwise produce, the Bidders has been duly authorized by the manufacturer or producer of the plant and equipment to supply them in the Employer's country for this specific tender.

B. Documentary evidence of the Bidders qualification to perform the Contract and the Bidders has the financial, technical and production capability necessary to perform the contract. in particular, it is required that:

- The Bidders has the financial capability (financial statements for the years 2021**,** 2022, and 2023 to be provided, supported and must be certified from independent legal auditor.

- Technical and production capability necessary to perform NEPCO contract. In particular, it is required that the Bidder shall have completed contracts involving plant and equipment rated as specified, or greater, of equivalent complexity and on a similar scope basis, on at least **three assignments,** from three different countries within the last 10 years. Documentary evidence from the end users must be provided.

c. Awarding Condition the Foreign Bidders must have a registered local agent or registered office in Amman.

- The Joint Venture, Consortium or Partnership Requirements

The Joint Venture or Consortium Agreement shall be signed by all members. Tenders submitted by a joint venture or consortium of two or more firms shall comply with the following requirements:

A. The tender shall be signed so as to be legally binding on all member firms of the joint venture or consortium;

B. One of the member firms of the joint venture or consortium, responsible for performing a key component of the contract and to be responsible for following up the procurement process procedures, shall be nominated as being in charge; this authorization shall be evidenced by submitting with the tender a power of attorney signed by legally authorized signatories of all member firms of the joint venture or consortium;

C. The member firm of the joint venture or consortium in charge shall be authorized to incur liabilities and receive instructions for and on behalf of any and all member firms of the joint venture or consortium, and the entire execution of the contract, including payment, shall be done exclusively with the member firm in charge. All payments shall be done on a single account.

D. All member firms of the joint venture shall be liable jointly and severally for the execution of the contract in accordance with the contract terms;

E. A copy of the duly authorized agreement entered into by the member firms of the joint venture or consortium shall be submitted with the tender or alternatively a Letter of Intent to execute a Joint Venture Agreement. In the event of a successful bid the agreement shall be signed by all members, duly authorised and submitted before awarding.

F. If a member of the JVCA withdraw from the JVCA after being qualified and before awarding, the change will be denied

G. The joint venture or consortium must satisfy collectively all the qualification criteria, in (ITT 15, Documents Establishing the Qualifications of the Tender) for the scope of work they are designated to perform and should be shown clearly in the JVCA agreement or in the letter of intent (as the evaluations and qualifications for each member depends in his scope of work in his agreement). Failure to comply with this requirement will result in rejection of the tender of the joint venture or consortium. The leader of the partnership should have project management experience on the similar Projects.

Failure to comply with this requirement will result in rejection of the tender of the joint venture or consortium. The leader of the partnership should have project management experience on the similar Projects.

The Employer reserves the right to accept or reject the joint venture or consortium qualifications depending on the provided documentation.

In case of the Joint Venture, Consortium or Partnership Agreement only one bid bond shall be provided for the total amount.

A firm can be a member in only one joint venture or consortium; tenders submitted by joint ventures or consortia including the same member firm will be rejected.

- **Equipment Eligibility and Qualifications**

A- The Bidder shall provide documentation, **certified by the owner (End user),** to show that the equipment to be supplied (132/33 kV transformers and earthing transformer), having the specified rating of voltage and capacity or greater and the same place of manufacture with similar complexity, is in successful commercial service for a minimum of Three years in **three different countries.**

The end user certificates should be within the last 10 years.

Three (3) End-User Certificates from different countries for the transformers, clearly showing the following:

- Certified (signed and stamped) by the owner of the plant (end user) not from the contractor.
- In English language, printed officially;
- Translation shall be in English language printed officially and legalized by the appointed governmental authority in the end user country.
- End-user certificate shall show clearly the following:

i. Name of customer/company and complete address where equipment is installed.
ii. Date of issuance of certificate.

iii. Date of putting into operation.
iv. Type, rating and capacity of related equipment which shall be the same or better than offered equipment,
v. Confirmation that related equipment perform satisfactorily since putting into operation,

Original performance certificate maybe returned, if required by bidder.

B- Type test for offered equipment (or equipment up to voltage of 245kV and rated power up to 100 MVA) should be submitted with the offer. Type test certificates shall be issued from recognized independent international laboratories accredited according to ISO/IEC 17025. The test should be according to the latest IEC and IEEE only.

The Bidder shall provide type test for main equipment offered for :(main transformers, voltage tap changers, bushings, oil and earthing transformer).

The experience and type test certificates should not be older than 10 years

The Contractor shall provide type test for any other required equipment's in the tender upon NEPCO request.

Conformation that short-circuit test or detailed calculation for the offered or similar transformers will be submitted during the engineering stage.

These requirements apply to machinery and apparatus from the same manufacturing unit which will supply the equipment for this project, experience of other manufacturing units will not be accepted.

Failure to supply all required qualification documentation (i.e. Equipment End User Certificates/Performance Certificates, Type Tests, Tender's Experience documentation, etc...) to the satisfaction of the Employer will result in rejection of the Tender.

NEPCO has the right to accept any equipment used before in NEPCO grid in the last ten years successfully in service (without any technical and operational problems) even if the end-user and the type test certificates are not completed.

Subcontractors proposed by the Bidder

The bidder shall include a list of all major items of Services or Plant and Equipment supply, which it proposes sub-letting, giving details of the name, and nationality of the proposed subcontractor for each item bidder shall list at least one subcontractor against each item. Quoted rates and prices will be deemed to apply and no adjustment of the rates and prices will be permitted.

The bidder shall be responsible for ensuring that any subcontractor proposed by it complies with the requirements of Clause 3 (Eligible BIDDER) or that any Plant, Equipment or Services to be provided by the subcontractor comply with the requirements of Clause 12 (bidder /Equipment eligibility and qualifications). The Employer reserves the right to reject any proposed subcontractor

16. Period of Validity

16.1 Tenders shall remain valid for the period of 180 days after the Tender submission deadline date prescribed by the Employer. A tender valid for a shorter period may be rejected by the Employer as non-responsive.

16.2 In the event that the evaluation and the awarding process cannot be completed, prior to the expiration of the Tender validity period, the Employer may request BIDDER to extend the period of validity of their tenders. The request and the responses shall be made in writing. If the Bidder refuse the request, the bid bond will be returned upon his written request. A Bidder granting the request shall not be required or permitted to modify its tender, except as provided in ITT 16.3.

16.3 The bidder agreeing to the request shall also extend validity of the bid bond.

17. Bid bond

The Bidder shall furnish with its Tender, the original of a bid bond, based on the form included in Forms, or in another substantially similar form approved by the Employer prior to tender submission. In either case, the form must include the complete name of the Bidder

17.1 The bid bond amount and currency shall be as specified in Invitation to Tender.

17.2 The bid bond shall be a demand guarantee in any of the following forms at the Bidder's option:

(a) an unconditional guarantee issued by a bank; or

(b) certified check;

Issued from an approved bank located in Jordan.

17.3 Any Tender not accompanied by a substantially responsive bid bond shall be rejected by the Employer as non-responsive.

17.4 The bid bond of unsuccessful BIDDER shall be returned to them pursuant to instructions of Government Procurement Bylaw no.8 of 2022.

17.5 The bid bond of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the performance security, required under the Contract.

17.6 The bid bond shall be forfeited:

a) If a Bidder withdraws or amended its tender after the deadline of submission tenders or if the bidder does not abide by its tender or part thereof.

b) if the successful Bidder fails to:

- sign the Contract; or
- furnish the performance security, required under the Contract; or
- accept the correction of arithmetical errors of the tender

- If the Bidder provided incorrect information or cheated in the information or documents that have been submitted for the purpose of participating in the tender.

17.7 The bid bond of a JVCA shall normally be in the name of the JVCA that submits the Tender.

17.8 The bid bond of a Joint Venture or Consortium can be in the name of a member of the Joint Venture or Consortium on condition that the bid bond clearly specifies the names of all member of the Joint Venture or Consortium and states that the security is submitted for and on behalf of the Joint Venture or Consortium.

18. Format and Signing of Tender

18.1 The Bidder shall prepare one original of the documents comprising the Tender as described in ITT 10.

The Bidder shall submit copy of the Tender, and clearly mark it “COPY”. In the event of any discrepancy between the original and the copies, the original shall prevail.

18.2 The original and the copy of the Tender, where appropriate, shall be made in writing and shall be signed by a person duly authorised to sign on behalf of the Bidder. This authorisation shall be in a form of a power of attorney, pursuant to ITT 10.

18.3 A tender submitted by a JVCA shall comply with the requirements:

(a) Shall be signed so as to be legally binding on all members; and

(b) Include the Representative's authorisation, consisting of a power of attorney signed by those legally authorised to sign on behalf of the JVCA.

18.4 Any amendments, interlineations, erasures, or overwriting shall be valid only if they are signed or initialled by the person signing the tender

19. Submission of Tenders

BIDDER shall submit their tenders, as specified in the Invitation to Tender.

Sealing and marking of Tender

19.1 The BIDDER shall seal the Original Tender containing the documents specified in ITT 10 (Documents to be submitted by BIDDER) in an inner envelope marked "Original" and the copy of the Tender, duly marked, a second inner envelope marked "Copy". The four inner envelopes shall be sealed in an outer envelope. Both inner and outer envelopes shall be addressed and marked.

19.2 The inner and outer envelopes shall be sealed and:

a. Addressed to the Employer;

b. Bear the Tender Number, the Contract Name and the words "DO NOT OPEN BEFORE (AS SHOWN IN THE INVITATION TO TENDER)

19.3 The inner envelopes shall each indicate the name and address of the Bidder to enable the Tender to be returned unopened in case it is declared "late". The outer envelope shall bear no indication as to the identity or address of the Bidder.

If the outer envelope is not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the Tender.

20. Withdrawal, and Modification of Tenders

20.1 At any time prior to the deadline of submission of tenders, stated in ITT 21.1, a Bidder may withdraw or modify its tender after it has been submitted, following the process specified pursuant to instructions of Government Procurement Bylaw no.8 of 2022.

20.2 The attention of BIDDER is drawn to the action of Customs Officers in the discharge of their duties, whereby air parcels are frequently opened.

In their own interests and in order to preserve the confidential nature of the Tender price, BIDDER are urged to pay attention to the following:

To dispatch the completed Tender Document and any covering letter only by Air Mail which should be endorsed and labelled in the manner laid down in the Instructions to persons tendering.

Technical literature and the like may reasonably be sent by Air parcel or Air freight but since this would then be separated from the actual tender, each parcel should contain specific evidence identifying the Tender to which the contents refer.
The Employer will not consider late or incompletely delivered Tenders or literature supporting Tenders due to the actions of any Customs Officer.

21. Deadline for Submission of Tenders

21.1 Tenders shall be received by the Employer at the address, and no later than the date and time, indicated in the Invitation to Tender.

21.2 The Employer may, at its discretion, extend the deadline for the submission of tenders by amending the Tender Document in accordance with ITT 9, in which case all rights and obligations of the Employer and BIDDER previously subject to the deadline shall thereafter be subject to the deadline as extended.

22. Late Tenders

The Employer shall not consider any Tender that arrives after the deadline for submission of Tenders.

23. Tender Opening

23.1 The Employer shall conduct the Tender Opening in accordance with Government Procurement Bylaw no. 8 dated 2022.

24. Confidentiality

24.1 Information relating to the evaluation of Tenders shall not be disclosed to BIDDER or any other persons not officially concerned with such process until information on Contract award is communicated to the BIDDER.

24.2 Any attempt by a Bidder to influence the Employer in the evaluation of the Tenders or Contract award decisions may result in the rejection of its Tender

24.3 Notwithstanding the above, from the time of Tender opening to the time of Contract award, if any Bidder wishes to contact the Employer on any matter related to the tendering process, it should do so in writing.

25. Clarification of Tenders

25.1 To assist in the examination, evaluation, and comparison of the Tenders and qualification of the BIDDER, the Employer may, at its discretion, ask any Bidder for a clarification of its Tender, allowing a reasonable time for response. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in the prices or substance of the Tender shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Tenders, in accordance with ITT 30.

25.2 If a Bidder does not provide clarifications of its Tender by the date and time set in the Employer's request for clarification, its Tender may be rejected.

26. Determination of Responsiveness

A substantially responsive Tender is one that meets the requirements of the Tender Document without material deviation, reservation, or omission as defined below:

(a) "Deviation" is a departure from the requirements specified in the Tender Document;

(b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Tender Document; and

(c) "Omission" is the failure to submit part or all of the information or documentation required in the Tender Document.

A material Deviation, Reservation, or Omission is one that, if accepted, would not:

(a) affect in any substantial way the scope, quality, or performance of the Requirements as specified

(b) Limit in any substantial way, inconsistent with the Tender Document, the Employer's rights or the Bidder's obligations under the proposed Contract; or if rectified, would unfairly affect the competitive position of other BIDDER presenting substantially responsive Tenders.

(c) The Employer shall examine the technical aspects of the Tender in particular, to confirm that all requirements of Tender documents, Contract Terms and Conditions, have been met without any material Deviation, Reservation, or Omission.

(d) The Employer shall use the criteria and methodology specified in ITT15.

27. Evaluation of Tenders

The Employer shall determine to its satisfaction whether the Bidder that will be selected as having submitted the most economically advantageous and substantially responsive Tender

meets the eligibility and qualification criteria and requirements, specified ITT 15 and ITT 3, as per the methodology, defined in ITT 29 Evaluation Methodology.

If a Tender is not substantially responsive to the requirements of the Tender Document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material Deviation, Reservation, or Omission.

28. Nonmaterial Nonconformities

28.1 Provided that a Tender is substantially responsive, the Employer may waive any quantifiable non conformities in the Tender that do not constitute material Deviations, Reservations or Omissions.

The cost of all quantifiable deviations or omissions shall be added to the offer price in question. A reasonable estimate of the cost will be made by the Employer, taking into consideration the corresponding tender prices of other responsive BIDDER, or other appropriate market prices. Such costs will be at the Employer's sole discretion. A Bidder will not be requested or permitted to offer a price adjustment for rectifying such deviations or omissions.

Deviations and other factors that are in excess of the requirements of the Tender Document or otherwise result in unsolicited benefits for the Employer shall not be taken into account in tender's evaluation.

28.2 Provided that a Tender is substantially responsive, the Employer may request the Bidder to submit any necessary missing information or documentation, within a reasonable period of time, to rectify nonmaterial omissions in the Tender. Requested information or documentation on such omissions shall not be related to any aspect of the price of the Tender.

28.3 Failure of the Bidder to comply with the request may result in the rejection of its Tender.

29. Evaluation Methodology

The Employer shall use the evaluation methodology indicated here in:

Tenders which meet the Eligibility and Qualifications criteria and requirements, specified in ITT 15 and ITT 3 will be evaluated and compared on a technical-economical basis (most economically advantageous Tender).

The bidding stage consists of a "Technical" stage plus a final "Financial" stage.

The overall technical analysis of the Tenders will be based on a "pass or fail" criterion.

At the end of the technical stage, the tenders that fulfil all the technical requirements, Qualification and Eligibility requirements (ITT 15,ITT 3) will be considered aligned ("pass"), while the other will be disregarded ("fail").

The subsequent "financial" stage will consider the financial offer of the BIDDER who passed the technical selection taking also into account the capitalization of the transformers and reactors losses.

In the following paragraphs more details about the criteria adopted for the Tenders evaluation during the two phases, "technical" and "financial".

29.1 Evaluation of the Technical Offer

The technical evaluation will be carried out with close reference to the indication/requirements stated in all the Technical Specifications and in the other documents for Tender; items considered in this evaluation are summarized in the list described below.

Notwithstanding any description, drawings or illustrations that may have been submitted with the tender, all details other than those shown in the Schedule of Departures from the Specification will be deemed to be in accordance with the Specification and the standard specifications and codes referred to therein.

No departures from the Specification, except those shown in the Schedule of Departures and approved by the Employer, shall be made without the written approval of the Employer.

If deviations or inconsistencies with the tender documents are mentioned in the Schedule of Departures, specific requests for clarification may be sent to the Bidder, in order to confirm the alignment of the technical proposal to the project requirements or confirm the exclusion of the tender.

Organization

It will be carried out an assessment of Contractor's indications relevant to the organizational and coordinating models that it is intended to be arranged for the activities of the supply for each foreseen phase: design, engineering, qualification, production, supply and transportation, supervision of installation and commissioning, post-sale items, if any.

The foreseen management of issues relevant to the communications/interfaces with NEPCO, and other local authorities may be involved in the project is also of interest, considering for example the presence of a local support office.

The quality and adequacy of the foreseen manufacturing plants from the Contractor, but also from the sub-suppliers, will be analysed on the basis of the information given by the Contractor.

Completeness of the offer

A general exam of the offer will be carried out, pointing out eventual discrepancies and unclear points between the proposal and the requirements stated in the Specifications.

Temporal plan

The compliance of the proposed supply schedule with the requirements stated by NEPCO will be assessed, in particular the respect of the foreseen milestones.

Technical quality of the offer

Transformer Design

Emphasis will be devoted to the basic design studies performed during the tender stage at a level of detail sufficient to verify that the proposed transformer design comply with the requirements stated in the Technical Specifications.

Components

Emphasis will regard the documentation relevant to the description and testing activities for the main components included in the supply, such as OLTC, bushings, insulating oil.

Special attention will be devoted to the detailed check of Schedule D2 and to the Technical Specifications set.

Supervision of Testing and commissioning

The overall Supervision of testing and commissioning program (according to Schedule K) presented in the offer will be considered. Its completeness and coherence with the requirements will be assessed.

Recommended Spare Part (OPTIONAL)

An additional list of spares shall be provided by the Bidder sufficient for three years maintenance of the works.

The proposed list of spare parts will be assessed in order to verify its suitability for the functionality of the transformer. The assessment will also consider their preservation, storage and maintenance requirements.

Summary table of the technical evaluation

General items	Sub-items
Completeness and technical/organizational quality of the offer	Organization
	General assessment of the offer: • Completeness of the offer; • Temporal plans;

	Technical quality of the offer: • Transformer/Reactor design • Components; • Supervision of Testing and Commissioning; • Recommended list of spare parts;

29.2 Evaluation of the financial offer

This evaluation will be carried out considering only the Tenders which have been considered acceptable from a technical point of view.

Price adjustment will be preliminary carried out to correct arithmetic errors, non-material non-conformities etc.

The guaranteed values declared by the manufacturer will be verified, in particular in order also to check the reference values to determine the capitalized cost of losses.

A detailed price analyses for any or all items of the Price Schedules will be carried out, to check the consistency of proposed prices and to identify any serious unbalance / distortion factor in the proposed quotation.

The overall economic offer of the Contractor will be calculated by adding the capital costs and the capitalized costs of the losses. In particular, the losses will be evaluated as indicated in Technical Schedule.

No other evaluation criteria or methodologies shall be permitted.

30. Correction of Arithmetical Errors

30.1 Provided that the Tender is substantially responsive, the Employer shall correct arithmetical errors on the following basis:

(a) Where there are errors between the total of the amounts given under the column for the price breakdown and the amount given under the Total Price, the former shall prevail and the latter will be corrected accordingly;

(b) If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected accordingly;

(c) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and

(d) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

(e) If the Bidder has not priced one or more of the items, these unquoted items shall be considered included in the total price.

30.2 If a Bidder does not accept the correction of errors, its Tender shall be declared non-responsive and rejected and its bid bond shall be forfeited.

31. Conversion to Single Currency

For evaluation and comparison purposes, the Employer will convert all Tender prices expressed in amounts in various currencies in which the Tender price is payable, to Jordanian Dinars at the selling exchange rate established for similar transactions by the Central Bank of Jordanian on the Tender final closing date.

32. Tender Adjustments

Any adjustment in price that result from ITT 30 and ITT 48 for the purpose of comparative evaluation only to arrive at an "Evaluated Tender price". Tender prices quoted by BIDDER shall remain unaltered.

Award of Contact

33. Post Qualification

33.1 The Employer shall determine to its satisfaction whether the Bidder that is selected as having submitted the most economically advantageous and substantially responsive Tender meets the qualifying criteria specified in Eligibility and Qualification Criteria.

33.2 The Employer will determine to its satisfaction whether the Bidder selected as having submitted the lowest evaluated responsive Tender is qualified to satisfactorily perform the Contract.

33.3 The determination will take into account the Bidder's financial, technical, legal and production capabilities. It will be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to Eligibility and Qualifications, as well as such other information as the Employer deems necessary and appropriate.

33.4 An affirmative determination shall be a prerequisite for award of the Contract to the Bidder. A negative determination shall result in disqualification of the Tender, in which event the Employer shall proceed to the next most economically advantageous Tender (as was determined pursuant to the methodology), to make a similar determination of that Bidder's qualifications to perform the Contract satisfactorily.

33.5 Notwithstanding the provisions of ITT 33.3, the Employer reserves the right to waive any minor deviations from the qualifying criteria specified that do not materially affect the capability of the Bidder to perform the Contract.

34. Employer's Right to Accept Any Tender, and to reject any or All Tenders

The Employer reserves the right to accept or reject any tender, and to annul the tendering process and reject all Tenders at any time prior to signing of the contract, without thereby incurring any liability to BIDDER. In case of annulment, all Tenders submitted and especially, Tender securities, shall be promptly returned to the BIDDER, in accordance with Government Procurement Bylaw no. 8 of 2022 and its instructions.

35. Award Criteria

The Employer shall award the Contract to the successful Bidder whose Tender is substantially responsive to the requirements of the Tender Document and has been determined to be the most economically advantageous and has been determined as the lowest evaluated Tender, provided further that the Bidder is determined to be qualified to perform the Contract satisfactorily

36. Notification of Award

36.1 Prior to the expiration of the period of Tender validity, the Employer shall notify the successful Bidder, in writing, that its Tender has been accepted. This notification of award shall be issued in the form of the Letter of Award.

36.2 The Bidder shall enclose the details of the bank account(s) to be used for the purpose of receiving payments due under the Contract.

36.3 The notification of Letter of Award will constitute the formation of the Contract, which shall be deemed effective from the date of the said notification, subject to the fulfilment of the conditions stated in the Conditions of Contract.

36.4 The Employer shall also notify all other BIDDER of the results of the Tendering, stating the Tender and the resulting Contract title, and providing the following information: (i) name of each Bidder, who submitted a tender; (ii) their tender prices as read out at Tender opening; (iii) respective evaluated prices of each tender; (iv) names of BIDDER whose tenders were rejected; and (v) the name of the winning Bidder, and the contract price, as well as the duration and the title of the contract awarded.

After receipt of the above notification, an unsuccessful Bidder may request, in writing, the Employer for a debriefing seeking further explanations on the grounds on which his tender was not selected.

37. Signing of Contract Agreement

Pursuant to ITT 36, The Employer will send the Bidder the Contract Agreement provided in the Tender documents incorporating all agreements between the parties.
.
Within twenty eight (28) calendar days of receipt of the Contract Agreement, the successful Bidder shall sign, date, and return it to the Employer

38. Complaint Procedure

In the event that any Bidder wishes to submit a formal complaint with regard to any aspect of the procurement process, the Bidder shall follow the procedures in accordance with Government Procurement Bylaw no. 8 of 2022 and its instructions.

39. Stamps and Fees:

Stamp duty and award fees are payable on Jordanian contracts. After the placing of a Contract, it is the Contractor's responsibility to purchase legal stamps to the requisite amount which is dependent on the contract value. These stamps duty revenue must be paid to the Ministry of Finance within 10 days (ten) from the date of the letter of acceptance, otherwise, penalty will impose according to the prevailing law. Also, extra stamp duty must be paid in case the Employer issues any variation.

40. Performance Bond

40.1 Before signing the contract and within 28 days from LOA the successful Bidder shall furnish an irrevocable and unconditional Performance Bond of 10% of the total contract price in the form given and in the same contract currency, and you are required to extend the validity of the Bid bond until the Performance Bond has been established and accepted by NEPCO.

40.2 The Performance Bond shall be valid for a period expiring at least one month after receipt of the last CONSIGNMENT at site or NEPCO warehouse and shall still enforce until submission of the Maintenance Guarantee for the Guarantee Period.

40.3 Failure of the successful Bidder to comply with the requirements of above Sub-Clause shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid bond, in which event the Employer may make the award to the next lowest evaluated Bidder or call for new tenders.

40.4 If any variation order has been issued to increase the contract price during the contract duration, the contractor must increase the performance bond to the value of 10% of the increased amount.

40.5 The contractor shall seek for releasing Performance Bond upon fully finalized all contractual terms required and the submittal of the Maintenance Guarantee.

41. Contract Incoterms:

For execution of this contract the chosen incoterm is as follows:

CFR at AQABA port Jordan, Incoterms 2020.

42. Insurance:

42.1 NEPCO undertakes to insure all the shipped material and equipment with local Jordanian Companies against all risk from the time they leave the works until they are delivered at site or at NEPCO warehouse.

42.2 The contractor must provide full details of the material to be dispatched in good time for NEPCO to arrange for marine Insurance before the material is actually dispatched.

43. Payments:

Terms of payment for this contract will be strictly according the Clause no. (8) Of the General Condition of this contract.

44. Compliance with Regulations and Standards

44.1 The successful Bidder shall abide by the commercial and professional regulations as required by the Ministry of Industry & Trade and other relevant Institutions in Jordan.

44.2 Where compliance with a specific Standard Specification is called for the Standard Specification used shall be that in force at the time of Tender.

44.3 Although IEC Recommendations and British Standards for workmanship, equipment and materials, have been selected in this Specification as a basis of reference, standards and specifications of other countries and recommendations of other international standard organizations will be acceptable provided they are substantially equivalent to the designated Standards and provided furthermore that the Bidder submits for approval Specifications which he proposes to use.

44.4 References to brand names or catalogue numbers, if any, in this Specification have been made only for that equipment for which it has been determined that a degree of standardization is necessary to maintain certain essential features, In certain instances such

references have also been made for purpose of Convenience to specify the requirements. In either case offers of alternative goods which have similar characteristics and provide performance and quality at least equal to those specified are acceptable.

44.5 Where compliance with a specific standard specification is called for the standard specification used shall be that in force at the time of the Tender.

45. Transport of Goods and Personnel

The shipping of goods, materials and Plant provided such companies ships call at the port of export. Shipment by sea freight must be on direct and regular vessel the life of the ships should not exceed 15 years at the time of shipment, the vessel should be classified and in accordance with (ISM) code and should be a member in the P&I club.

The Contractor shall be solely responsible to investigate and conform to all requirements of all announcements, which have been or are being issued by the governmental authorities in Jordan in this respect.

Temporary entry shall be permitted for vehicles and equipment of special type and which are required for the execution of the Works only. Such entry will be strictly according to the laws and regulations prevailing in Jordan.

The means and methods of transport and haulage shall comply with the rules, ordinances, or regulations and the specification of the equipment manufacturer concerning loads to be hauled, which should be not exceeded. Whenever loads exceed the limits of the roads and structures, the Contractor shall adapt at his own expenses the precautionary measures needed to prevent damages including construction of detours at the site of structures if necessary. The Contractor shall investigate characteristic of the routes and take necessary precautions as the case may be.

All necessary operations for execution of the Works shall be performed so as not to disturb the traffic or the access to private roads or the access to and from places being property of the Employer or other parties.

The Contractor shall be responsible for indemnification, which may arise from any claims, judicial acts, damages or disturbances resulting by local transportation works.

46. Customs, Sales Tax, Import License and Tariffs:

The prices are based on CFR at AQABA port Jordan, exempted from custom duties and sales tax.

The Contractor shall couriers needed documents to NEPCO before 7 days of arrival to Aqaba Port; all information on documents to be submitted to Customs must be checked and confirmed by the contractor; otherwise, the demurrage and other costs will be contractor sole responsibility. If the clearance procedures failed as a result of any fault or mistake caused by the contractor the risk transfers to the contractor.

Provided that those materials, equipment and supplies are not manufactured locally but have a substitute available from local products, especially if such products have been adopted by the

Jordanian Government. In this case, the Contractor shall be responsible for payment of all customs duties, sales tax and any other charges.
Sales Tax (if any) related to the locally purchased materials, goods or services shall be borne by the Contractor.

47. Variance with Government Procurement Bylaw no 8 of 2022.

In the event of there being any inconsistency between the provisions of this Instruction to Person Tendering, Conditions of Contract and the Government Procurement Bylaw no.28 of 2019 the provisions of the Government Procurement Bylaw no 8 of 2022 shall prevail and shall be considered as incorporated in the Contract.

48. Domestic Preferences:

Where BIDDER propose to import materials, equipment and supplies which are to be incorporated in the Works and those materials, equipment and supplies could be manufactured locally or have a substitute available from local products, than the Employer shall add 15% to the price of that specific item for the purpose of Evaluation. The Bidder shall be solely responsible to investigate which materials, equipment and supplies could be manufactured locally or have a substitute available from local products.

49. Compliance with Procurement Bylaw and its Instructions.

This Tender document is governed by Government Procurement Bylaw no. 8 of 2022 and its instructions.

50. Contract Management.

The Transmission Projects Administration (TPA), a dedicated division within NEPCO, will oversee the management and administration of the contract. TPA will serve as the main point of contact between the Employer and the Contractor, handling all matters related to project implementation, progress reporting, and any contract management issues.

51. ELIGIBILITY AND QUALIFICATION FORMS

51.1 Past experience qualification:

Place of Manufacture	Export to	Years in Service.	Rating (MVA)	Voltage (kV)	Phases	Tapping Range	End User, Country and Contact Address

Transformers shall be equipped with OLTC.

In successful commercial service for a minimum of three years in three different countries within the last 10 years.

51.3 Financial Capability Forms

Table No.1 Bidder Financial data for financial capability determination Company Name…… Tender No…….. Currency…

Financial Data Description	*last three Financial Statements*		
	insert year 1	*insert year 2*	*insert year 3*
Current Assets			
Inventory			
Current Liabilities			
Non Current Liabilities			
Net Profit (After Tax)			
Total Assets (Average)			
Operating Profit			
Net Sales			
Net Working Capital (Average)			
Net Accounts Receivable (Average)			
Total Assets			
Total Liabilities			
Owner's Equity			

Instructions for Table No.1:

1- *Financial statements for last three years with independent public accountant signed report shall be attached.*
2- *Fill the form according to figures and currency mentioned in the financial statements without any further adding or subtract or exchange to another currency.*
3- *Any wrong inserting is subject to correction.*
4- *Neither holding Company financial data nor subsidiary Co are required.*
5- *Financial data for each partner of Joint venture must be filled separately.*

Table 2 Bidder Financial analysis ratios for financial capability determination …. Company Name… Tender No…

Financial Analysis Ratios			Formula	last three Financial Statements		
				insert year 1	insert year 2	insert year 3
1. Liquidity Ratios		Current Ratio	Current Assets / Current Liabilities			
		Quick Ratio	Current Assets - inventory / Current Liabilities			
2. Profitability Ratios	Return on Investment		Net Profit (After Tax) / Total Assets (Average)			
	Operating Profit Ratio		Operating Profit / Net Sales			
	Net Profit Ratio		Net Profit (After Tax) / Net Sales			
3. Activity &Operating Ratios	Net Working Capital		Current Assets - Current Liabilities			
	Working Capital Turnover		Net Sales / Net Working Capital (Average)			
	Accounts Receivable Turnover		Net Sales / Net Accounts Receivable (Average)			
	Average Collection Period		365 / Accounts Receivable Turnover			
	Assets Turnover		Net Sales / Total Assets			
4.Coverage Ratio	Current liability to Total Assets Ratio		Current Liabilities / Total Assets			
	Non-Current liability to Total Assets Ratio		Non-Current Liabilities / Total Assets			
	Dept To Equity Ratio		Total Liabilities / Owner's Equity			

Instructions for Table No.2:

1- Ratios shall be calculated according to figures filled in Table No.1.

2- Any Wrong calculation is subject to correction.

51.4 Manufacturer's Authorisation

The Bidder shall require the Manufacturer to fill in this Form in accordance with the instructions indicated. This letter of authorisation should be signed by a person with the proper authority to sign documents that are binding on the Manufacturer. All text within square brackets [ ] is for use in preparing this form and shall be deleted from the final document.

Date**: [***insert date (as day, month and year) of Tender Submission***]**

Tender No.: **[***insert number of Tendering process***]**

To: National Electric Power Company.

WHEREAS

We **[***insert complete name of Manufacturer***],** who are official manufacturers of **[***insert type of goods manufactured***]**, having factories at **[***insert full address of Manufacturer's factories***],** do hereby **authorize [***insert complete name of Participant***]** to submit a tender the purpose of which is to provide the following goods, **[***insert name and or brief description of the goods***],** manufactured by us and to subsequently negotiate and sign the contract.

We hereby extend our full guarantee and warranty with respect to the goods offered by the above firm.

Signed**: [***insert signature(s) of authorised representative(s) of the Manufacturer***]**

Name**: [***insert complete name(s) of authorised representative(s) of the Manufacturer***]**

Title**: [***insert title***]**

Duly authorised to sign this Authorisation on behalf of: **[***insert complete name of Manufacturer***]**

Dated on _____ day of _____, _____ **[***insert date of signing***]**

SECTION 3

GENERAL CONDITIONS OF CONTRACT

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FOR THE SUPPLY AND DELIVERY OF MATERIALS
BASED ON UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE
PUBLICATION REF. : ME/ 188
GENEVA. MARCH 1953

1.**PREAMBLE**:

1.1 These General Conditions shall apply, save as varied by express agreement accepted in writing by both parties.

1.2 Definition Of Terms

The "company or employer" shall mean the "National Electric Power Company" hereinafter called "NEPCO", and shall include NEPCO legal personal representatives and duly appointed Engineers.

The "Engineer" shall mean the "National Electric Power Company" or persons for the time being or from time to time duly appointed in writing by the employer to act as Engineer for the purpose of the Contract.

The words "approved" and "approval" where used in these Conditions or in the specification shall mean "approved by" and "approval of" the employer respectively.

The "Vendor" shall mean the "Contractor" who's Tender has been accepted by the employer and shall include the Vendor's (Contractor's") legal personal representatives, successors and permitted assigns.

2.**FORMATION OF CONTRACT**:

2.1 The Contract shall be deemed to have been entered into when the Employer has sent an acceptance in writing before time set in the Tender for acceptance or any such later date extended by the Bidder at the request of the Employer.

2.2 Notwithstanding that the Contract and correspondence in connection with the Contract shall be in the English language, the Contract shall be and be deemed to be Jordanian Contract and shall accordingly be governed by to the laws for the time being in force in the Hashemite Kingdom of Jordan.

2.3 Power To Vary The Work

No alterations, amendments, omissions, additions, suspensions, or variations of the work, (hereinafter referred to as "variations") under the Contract as shown by the Contract Drawings or the Specification shall be made by the Contractor except as directed in writing by the Employer but the Employer shall have full Power, subject to the provision hereinafter contained, from time to time during the execution of the Contract by notice in writing to instruct the Contractor to make such variation without Prejudice to the Contract and the Contractor shall carry out such variations,

and be bound by the same conditions, as far as applicable, as though the said variations occurred in the Specification.

If any suggested variations would, in the opinion of the Contractor, if carried out, prevent him from fulfilling any of his obligations or guarantees under the Contract, he shall notify the Employer thereof in writing, and the Employer shall decide forthwith whether or not the same shall be carried out, and if the Employer confirms his instructions, the Contractor's obligations and guarantees shall be modified to such an extent as may be justified. The difference in cost, if any, occasioned by any such variations, shall be added to or deducted from the Contract Price as the case may require. The amount of such difference, if any, shall be ascertained and determined in accordance with the rates specified in the Schedule of Prices so far as the same may by applicable, and where the rates are not contained in the said Schedule, or are not applicable, they shall be settled by the Employer and the Contractor jointly. But the Employer shall not become liable for the payment of any charge in respect of any such variations, unless the instruction for the performance of the same shall have been given in writing by him.

In the event of the Employer requiring any variations, such reasonable and proper notice shall be given to the Contractor as will enable him to make his arrangements accordingly, and in cases where goods materials are already prepared, or any designs, drawings, or patterns made or work done that requires to be altered a reasonable sum in respect thereof shall be allowed by the Employer.

Provided that no such variation shall, except with the consent in writing of the Contractor, be such as will involve an increase or decrease of the total price payable under the Contract by more than 25 percent thereof.

The power given to the Employer to make any alteration, amendment, omission, addition or variation to, from or in any part of the works shall include power to vary from time to time the date for the completion of the works or any part thereof.

2.4 Precedence:

In the event of any discrepancy or contradiction between the provisions of the Conditions of Contract and of the Specification, the Conditions of Contract shall take precedence.

2.5 Prices

2.5.1 The Tender calls for firm prices for the definite works.

2.5.2 Provisional items may or may not in whole or in part be purchased by the Employer under the Contract.

3. **Drawings and Descriptive Documents**

3.1 The weights, dimensions, capacities, prices, performance ratings and other data included in catalogs, prospectuses, circulars, advertisements, illustrated matter, and price lists constitute an approximate guide.

These data shall not be binding save to the extent that they are by reference expressly included in the Contract.

3.2 Any drawings or technical documents intended for use in the construction of the plant or of part thereof and submitted to the Employer prior or subsequent to the formation of the Contract remain the exclusive property of the Vendor. They may not, without the Vendor's consent, be utilized by the Employer or copied, reproduced, transmitted, or communicated to a third party. Provided, however, that the said plans and documents shall be the property of the Employer:

a) If it is expressly so agreed, or.

b) If they are referable to a separate preliminary Development Contract on which no actual construction was to be performed and in which the property of the Vendor in the said plans and documents was not reserved.

3.3 Any drawings or technical documents intended for use in the construction of the plant or of part thereof and submitted to the Vendor by the Employer prior or subsequent to the formation of the Contract remain the exclusive property of the Employer. They may not, without his consent be utilized by the Vendor or copied, reproduce, transmitted or communicated to a third party.

3.4 Drawing Guidelines for Contract Drawings

All drawings shall confirm to the following:

1) All drawings are to be prepared on the international sizes as described in B.S. 3429. They are to be of "A" series.

Designation	Sheet Size
A4	**210x297**

2) The NEPCO title block must be added to all drawings produced for the Contract. The block may be reduced in size, depending on sheet size, The NEPCO drawing number must appear in bottom right hand corner of drawing, and the drawings must also include the Contractor's /Consultant's title block adjacent to NEPCO title block.

3) Each drawing to have its own individual number. For schedules, a drawing number to be given and then sheet 1 of x sheets.

4) All descriptive information must be entered in NEPCO title block. All drawings must contain NEPCO drawing numbers as so described and issued by NEPCO.

5) The title block should contain the following:

A. Revision block as NEPCO requirement.
B. Name of the subject i.e. power station, substation, equipment.
C. Nature of drawing i.e. site layout, general arrangement, single line diagram.
D. Any other information or notes.
E. Dimensions to be in MM or M.
F. Scale i.e. 1:50, 1:1000.
G. Contract No. i.e. Tender No.
H. DRG. No. NEPCO drawing numbers allocated by NEPCO.
I. Rev. to contain latest revision number.
J. Title block for Contractor/Consultant.
K. Graphical bar scales where required, not required for single line diagrams or reinforced concrete details.

6) Drawing sheet should be laid out according to NEPCO requirements.

7) Scales to be in multiples of 1:5, 1:10.

8) All information to be stenciled on drawings, block capital letters should be used throughout. No freehand printing on drawing except for "revision or hold" cloud.

9)

1. Revisions must be lettered and indicated block provided, all revisions to be checked and approved by Engineer.
2. Revisions must be interred and highlighted by penciling cloud around the part revised on the reverse side of the tracing sheet as shown rev. b

3. Vague descriptions of revisions such as "general revisions" should be avoided. Revisions should be specific. No matter how small the revisions, it should be recorded.

10) Notes, reference drawing, and legends should be recorded on drawing, if key plan and north point is required, and then apply NEPCO requirement.

11) Example of drawing title blocks and titles should be submitted to NEPCO for approval before commencement of drawings.

12) On completion of the contract, the final drawings submitted to NEPCO are to be marked "as built" dated and signed; the drawings must be accompanied by a complete drawing schedule,

listing all the drawings in the order of the NEPCO Numbers. The drawings schedule should be in the region of A3 or A4 size.

4. **Packing Of Materials And Shipping Marks**:

4.1 All materials, equipment and goods shall be very well packed, in seaworthy containers and/or wooden cases, etc. These should protect the material during shipping, handling, unloading, and for a reasonable period of storage at Aqaba and later storage at NEPCO central stores.

Packing for indoor materials should be done in such a manner as to adequately ensure no ingress of moisture during the shipping and storage periods.

Packing of fragile equipment (e.g. including instruments and porcelain) should be done in a way which ensures a reasonable resistance to impact breakage during transport.

Packing shall in general be adequate and in compliance with the best international practice.

A descriptive and fully itemized list shall be prepared for the contents of each packing case. A copy of this list shall be placed in a waterproof envelope under a metal or other suitable plate securely fastened to the outside of one end of the case, and its position adequately indicated by stenciling on the case. Where appropriate, drawings showing the erection markings of the item concerned shall be placed inside the case.

NEPCO will supply the successful bidder with a drawing of its shipping Mark for utilization.

All packing cases, crates, barrels and drums shall remain the property of the Employer.

5. Inspection And Tests:

5.1 The contractor is required to provide all facilities to enable the employer's representatives to carry out the necessary inspection and testing. the costs of all tests during manufacture and preparation of test records are to be borne by the contractor. In case of failure of test all costs of repeated trips of the employer’s representatives will be borne by the contractor. The performance of any such inspections and tests in the presence of the Employer and /or an independent testing authority does not relieve the contractor from his contractual obligations.

5.2 If as a result of such inspection and checking the Employer shall be of the opinion that any materials or parts are defective or not in accordance with the contract, he shall state in writing his objections and the reasons therefore.

5.3 Testing instruments shall be approved and shall, if required by the employer's representative, be calibrated by the national physical laboratory or such other body as may be approved, at the expense of the contractor.

5.4 Acceptance tests will be carried out and, unless otherwise agreed, will be made at the vendor's works instruments, if the tests are not specified in the contract, the tests will be carried out in accordance with the general practice obtaining in the appropriate branch of the industry in the country where the plant is manufactured.

5.5 The vendor shall give to the Employer sufficient notice of the tests to permit the Employer's representative to attend. If the Employer is not represented at the tests, the test report shall be communicated by the vendor to the Employer and shall be accepted as accurate by the Employer. After completed the FAT the vendor is required to send complete test report with request for shipping release.

The Employer will check test report/test results and if accepted a shipping release certificate will be issued within 10 days from the receipt of the report/ shipping release request.

5.6 If on any test (other than a test on site, where tests on site are provided for in the contract) the plant shall be found to be defective or not in accordance with the contract, the vendor shall be with all speed make good the defect or ensure that the plant complies with the contract thereafter, if the Employer so requires, the test shall be repeated.

5.7 Unless otherwise agreed, the vendor shall bear all the expenses of tests carried out in his works.

5.8 If the contract provides for tests on site, the terms and conditions governing such tests shall be such as may be specially agreed between the parties.

5.9 In case of third party testing the contractor will conduct all required tests by the employer through the appointed third party testing company of the list attached hereto all costs for a/m tests will be incurred by the contractor.

6. **Passing of Risk**:

In accordance with ITT 41 in Instruction to Person Tendering.

7. Delivery:

7.1 Unless otherwise agreed the delivery period shall run from the commencement date as stated in the LOA.

7.2 Any claim for extension of time for completion of the contract received after delivery period will be rejected.

7.3 Should delay in delivery be caused by any of the circumstances mentioned in Clause 10 or by an act or omission of the Employer and whether such cause occur before or after the time or extended time for delivery, there shall be granted subject to the provisions of paragraph 7.5 hereof such extension of the delivery period as is reasonable having regard to all the circumstances of the case.

7.4 If a fixed time for delivery is provided for in the Contract and the Vendor fails to deliver within such time or any extension thereof granted under paragraph 2 hereof, the Employer shall be entitled, on giving to the Vendor within a reasonable time notice in writing, to claim a reduction of the price payable under the Contract. Such reduction shall be calculated at the rate of **one half of one percent of that part of the price payable under the Contract which is properly attributable to such portion of the Plant as cannot in consequence of the said failure be put to the use intended for each complete week of delay commencing on the due date of delivery, but shall not exceed a maximum percentage reduction of %10 percent**. Such reduction shall be allowed when a payment becomes due on or after delivery. Save as provided in paragraph 7.5 hereof, such reduction of price shall be to the exclusion of any other remedy of the Employer in respect of the Vendor's failure to deliver as aforesaid.

7.5 If the time for delivery mentioned in the Contract is an estimate only, either party may after the expiration of two thirds of such estimated time require the other party in writing to agree on a fixed time.

Where no time for delivery is mentioned in the Contract, this course shall be open to either party after the expiration of 45 weeks from the formation of the Contract.

If in either case the parties fail to agree, either party may have recourse to arbitration, in accordance with the provisions of Clause 13, to determine a reasonable time for delivery and the time so determined shall be deemed to be the fixed time for delivery provided for in the Contract and paragraph 3 hereof shall apply accordingly.

7.6 If any portion of the plant in respect of which the Employer has become entitled to the maximum reduction provided for by paragraph 3 hereof, or in respect of which he would have been so entitled had he given the notice referred to therein, remains undelivered, the Employer may by notice in writing to the vendor require time to deliver and by such last mentioned notice fix a final time for delivery which shall be reasonable taking into account such delay as has already occurred. If for any reason whatever the Vendor fails within such time to do everything that he must do to effect delivery, the Employer shall be entitled by notice in writing to the Vendor, and without requiring the consent of any Court, to terminate the Contract in respect of such portion of the plant and thereupon to recover from the vendor any amount not exceeding that part of the price payable under the Contract which is properly attributable to such portion of the plant as could not in consequence of the Vendor's failure put to the use intended.

7.7 If the Employer fails to accept delivery on due date he shall nevertheless make any payment conditional in delivery as if the plant had been delivered. The Vendor shall arrange for the storage of the plant at the risk and cost of the Employer, If required by the Employer, Provided that if the delay in accepting delivery is due to one of the circumstances mentioned in clause 10 and the Vendor is in a position to store it in his premises without prejudice to his business, the cost of storing the plant shall not be borne by the Employer.

7.8 Unless the failure of the Employer is due to any of the circumstances mentioned in Clause 9, the Vendor may require the Employer by notice in writing to accept delivery within a reasonable time.
If the Employer fails for any reason whatever to do so within such time, the Vendor shall be entitled by notice in writing to the Employer, and without requiring the consent of any Court, to terminate the Contract in respect of such portion of the plant as is by reason of the failure of the Employer aforesaid not delivered and thereupon to recover from the Employer any loss, suffered by reason of such failure up to an amount not exceeding the value of the plant, the delivery of which has not been accepted.

8. Payment:

8.1 Terms of payment:
Subject to any deductions, which the Employer may be authorized to make under the contract, or subject to any additions or deductions provided for under clause 2.3 above, the contractor shall be entitled strictly of payment to foreign currency as follows:

Ten (10%) percent of material supply value Contract value as Advance Payment against:

1. Receiving accepted Advance Payment Bank Guarantee in the form given for the same advance payment value and same contract currency such guarantee may be progressively reduce by the amount repaid by the contractor as indicated in the payment certificate.

2. Receiving accepted Performance Guarantee as specified in Instructions to Persons Tendering ITT 40.

3. Commercial Invoices or payments request in two originals plus four copies.

4. Interim payment certificate issued and signed by NEPCO in one original and four copies.

Seventy (70%) percent of material supply value contract value against shipping documents within 60 days from the date of interim payment and in exchange for shipping documents for any portion of the plant from time to time dispatched by the contractor.

Shipping documents shall comprise the following documents:

1- Commercial Invoices in two originals plus four copies, showing commodity, description, quantity, unit price, total price and delivery base reference to items as per schedule of prices.

2- Interim payment certificate issued and signed by NEPCO in one original and four copies.

3- Bill of lading – three negotiable, four non-negotiable.

4- Packing list in one original plus four copies.

5- Certificate of origin in one original and four copies.

6- Inspection certificate and/or waived inspection certificate issued and signed by NEPCO (one original) and /or test certificates, two copies and /or shipping release notification fax issued and signed by NEPCO –two copies.

7- Vessel less than 15 years old certificate.

Fifteen (15%) percent of material supply value will be paid within (60) days after the arrival of the plant at the site or NEPCO warehouse against:

1. Receipt of an invoice or payment request in one original and four copies for the correct amount.
2. Receiving report issued and signed by NEPCO committee as evidence that the material has been received at the site or NEPCO warehouse in satisfactory condition.
3. Interim payment certificate issued and signed by NEPCO.

The remaining Five (5%) percent of material supply value will be paid against submitting of contractor invoice or payment request at the correct amount and an interim payment certificate issued and signed by NEPCO after (60) days of expiring the maintenance period or against submitting of maintenance bond of (5%) of the total contract amount (upon the employer approval).

Terms of payment for training and /or factory acceptance test:

- 100% will be paid after (60) days from the date an interim payment certificate issued and signed by NEPCO, and submitting of:

1. Invoice in one original and four copies for the correct amount.

2. Report issued and signed by NEPCO as evidence that the FAT and/or Training has been done according to NEPCO Instructions.

3. Interim payment certificate issued and signed by NEPCO

Terms of Payment for Local Transportation:

Any local transportation shall be done in order to execute contractor's obligations for delivery the good, such local transportation cost shall be invoiced separately according to price schedule and to be paid as the followings:

100% of local transportation amount against submitted the following documents within 30 days:

1. Material Receiving Report issued and signed by NEPCO committee as evidence that the materials have been received at site or NEPCO warehouse in satisfactory conditions.

2. Interim Payment Certificate issued and signed by NEPCO.

3. Receipt of an invoice or payment request in one original and four copies for the correct amount.

Terms of Payment for Supervision Value (Optional Works):

100% of the supervision value will be paid against below documents within 30 days from the date of an interim payment certificate; taking into consideration that contractor is **exempted** from taxes which imposes by law on services provided by non-Jordanian persons or companies

1. Commercial invoice in the correct amount in two original plus two copies.

2. Supervision report issued and signed by NEPCO as evidence that the supervision has been fully done, supported with time sheet reflects the number of working days and the related dates.

3. Interim payment certificate issued and signed by NEPCO

8.2 For any method of payment all bank charges; commissions and expenses inside and outside Jordan will be born by the contactor.

8.3 If delivery has been made before payment of the whole sum payable under the contract, plant delivered shall, to the extent permitted by the law of the country where the plant is situated after delivery, remain the property of the vendor until such payment has been effected. if such law does not permit the vendor to retain the property in the plant, the vendor shall be entitled to the benefit of such other rights in respect thereof as such law permits him to retain. The Employer shall give the vendor every assistance in taking any measures required to protect the vendor's right of property or such other rights as aforesaid.

8.4 A payment conditional on the fulfillment of an obligation by the vendor shall not be due until such obligation has been fulfilled, unless the failure of the vendor is due to an act or omission of the Employer.

8.5 If the Employer delays in making any payment, the vendor may postpone the fulfillment of his own obligations until such payment is made, unless the failure of the Employer is due to an act or omission of the vendor.

8.6 If delay by the Employer in making any payment is due to one of the circumstances mentioned in clause 10, the vendor shall not be entitled to any interest on the sum due.

8.7 Save as aforesaid, if the Employer delays in making any payment, the vendor shall on giving to the Employer within a reasonable time notice in writing be entitled, and without requiring the consent of any court, to terminate the contract and thereupon to recover from the Employer the amount of his loss up to the value of the plant, the payment for which has been unreasonably delayed.

Submission of shipping Documents & Invoices:

Shipping documents shall be submitted to the bank if payment made by CAD or LC. If payment is through bank transfer the shipping documents shall be submitted directly to NEPCO as specified.

Shipment:

Shipment by sea freight must be on direct and regular (liner) vessel less than 15 years old at the time of shipment. The vessel shall be classified and certified in accordance with the (ISM) code and shall be a member in the P&I club.

Performance Bond:

As mentioned in ITT 40 in Instruction to Persons Tendering.

Insurance:

As mentioned in ITT42 in Instruction to Persons Tendering

9.Guarantee:

9.1 Subject as hereinafter set out, the Vendor undertakes to remedy any defect resulting from faulty design, materials, or workmanship.

9.2 This liability is limited to defects that appear during the period (hereinafter called the Guarantee period) **of 36 months after the date of receipt of the last consignment at the site or NEPCO warehouses**

9.3 In fixing this period due account has been taken of the time normally required for transport as contemplated in the Contract.

9.4 In respect of such parts (whether of the Vendor's own manufacture or not) of the plant as are expressly mentioned in the Contract. The Guarantee Period shall be such other period (if any) as specified in respect of each of such parts.

9.5 In order to be able to avail himself of his rights under this clause the Employer shall notify the Vendor in writing without delay of any defects that have appeared and shall give him every opportunity of inspecting and remedying them.

9.6 On receipt of such notification the Vendor shall remedy the defect forthwith and at his own expense. Save where the nature of the defect is such that it is appropriate to effect repairs on site, the Employer shall return to the Vendor any part in which a defect covered by this Clause has appeared, for repair or replacement by the Vendor, and in such case the delivery to the Employer of such properly repaired or a part in replacement thereof shall be deemed to be a fulfillment by the Vendor of his obligations under this paragraph in respect of such defective part.

9.7 The guarantee Period is based on the continuous use of the plant in service for 24 hours every day.

9.8 The Vendor shall bear all the costs and risks of the transport of defective parts or equipment and their replacements.

9.9 Where, in pursuance of paragraph 7 hereof, repairs are required to be effected on-site, the conditions covering the attendance of the Vendor's representatives on-site shall be such as may be specially agreed between the parties.

9.10 Defective parts replaced in accordance with this Clause shall be placed at the disposal of the Vendor.

9.11 If/ the Vendor refuses to fulfil his obligations under this Clause or fails to proceed with due diligence after being required to do so, the Employer may proceed to do the necessary work at the Vendor's risk and expense.

9.12 The Vendor's liability does not apply to defects arising out of materials provided, or out of a design stipulated, by the Employer.

9.13 The Vendor's liability shall apply only to defects that appear under the conditions of operation provided for by the Contract and under proper use, It does not cover defects due to causes arising after the risk in the Plant has passed in accordance with Clause 6. In particular, it does not cover defects arising from the Employer's faulty maintenance or erection, or from alterations carried out without the Vendor's consent in writing, or from repairs carried out improperly by the Employer, nor does it cover normal deterioration.

9.14 Save as in this Clause expressed, the Vendor shall be under no liability in respect of defects after the risk in the plant has passed in accordance with Clause 5, even if such defects are due to causes existing before the risk so passed, It is expressly agreed that the Employer shall have no claim in respect of personal injury or of damage to property not the subject matter of the circumstances of the case that the Vendor has been guilty of gross misconduct.

9.15 "Gross misconduct" does not comprise any and every lack of proper care or skill, but means an act or omission on the part of the Vendor implying either a failure to pay due regard to serious consequences which a conscientious contractor would normally foresee as likely to ensure, or a deliberate disregard of any consequences of such act or omission.

9.16 A fresh guarantee period equal to that stated in paragraph 2 hereof shall apply, under the same terms and condition as those application to the original plant, to part supplied in replacement of defective part or to part renewed in pursuance of this clause this provision shall not apply to the remaining part of the plant, the guarantee period of which shall be extended only by a period equal to the period during which the plant is out of action as a result of defect covered by this clause.

10. Reliefs:

10.1 The following shall be considered as cases of relief if they intervene after the formation of the Contract and impede its performance. Industrial disputes and any other circumstances (e.g. fire, mobilization, requisition, embargo, currency restrictions, insurrection, shortage of transport, general shortage of materials, and restriction in the use of power) when such other circumstances are beyond the control of the parties.

10.2 The party wishing to claim relief by reason of any of the said circumstances shall notify the other party in writing without delay on the intervention and on the cessation thereof.

10.3 The effects of the said circumstances so far as they affect the timely performance of their obligations by the parties, are defined in Clauses 7 and 8. Save as provided in paragraphs 7.5, 7.7., and 8.7, if, by reason of any of the said circumstances, the performance of the contract within a reasonable time becomes impossible, either party shall be entitled to terminate the Contract by notice in writing to the other party without requiring the consent of any court.

10.4 If the Contract is terminated in accordance with paragraph 3 hereof, the division of the expenses incurred in respect of the Contract shall be determined by agreement between the parties.

10.5 In default of agreement it shall be determined by the arbitrator which party has been prevented from performing his obligations and that party shall bear the whole of the said expenses. Where the Employer is required to bear the whole of the expenses and has before termination of the Contract paid to the Vendor more than the amount of the Vendor's expenses, the Employer shall be entitled to recover the excess.

If the arbitrator determines that both parties have been prevented from performing their obligations, he shall apportion the said expenses between the parties in such manner as to him seems fair and reasonable, having regard to all the circumstances of the case.

10.6 For the purposes of this Clause "expenses" means actual out-of- pocket expenses reasonably incurred, after both parties shall have mitigated their losses as far as possible. Provided that as respects plant delivered to the Employer the Vendor's expenses shall be deemed to be that part of the price payable under the Contract which is properly attributable thereto.

11. Limitation Of Damages:

11.1 Where either party is liable in damages to the other, these shall not exceed the damage which the party in default could reasonably have foreseen at the time of the formation of the Contract.

11.2 The party who sets up a breach of the Contract shall be under a duty to take all necessary measures to mitigate the loss which has occurred provided that he can do so without unreasonable inconvenience or cost. Should he fails to do so, the party guilty of the breach may claim a reduction in the damages.

12. Arbitration And Law Applicable:

12.1 If any dispute, question, or controversy shall arise between the Employer and the Contractor concerning this Contract the matter in dispute shall be referred to an arbitration committee composed of three (3) arbitrators. One arbitrator shall be nominated by the Employer and one by the Contractor, and the third arbitrator shall be appointed by both parties.

If either party fails to appoint his arbitrator within one month of the appointment of the arbitrator by the other party, or if the two parties fail to agree on the third arbitrator within two months of the date of the request to refer the dispute to arbitration, such arbitrator shall be appointed by the president of the highest Court in Jordan at the request of either or both parties.

12.2 The decision of the arbitrators shall be final and binding on both the Employer and the Contractor. Any such reference shall conform to the statutory enactment or regulation governing arbitration's as may be in force in Jordan at the time. The assessment of costs incidental to the reference and award respectively shall be at the discretion of the arbitration committee.

SECTION 4

FORMS

Letter of Tender

Covenant of Integrity

Statement of Compliance

Form of Performance Guarantee

Form of Maintenance Guarantee

Form of Advance Payment Guarantee

Form of Tender Guarantee

Request for Shipping Release Form

Inspection Certificate Form

Waived inspection certificate form

Contract Agreement form

NATIONAL ELECTRIC POWER COMPANY

LETTER OF TENDER

TENDER NO. 50/2024 Power Transformers and Associated Equipment of Ishtafina, Abdali, Subeihi, Sabha and Manara 132/33 kV Substations

Managing Director
National Electric Power Company,
P.O. Box 2310,
Amman, 11181
The Hashemite Kingdom of Jordan.

Dear Sir,

1. Having examined the Conditions of Contract, Specifications and Schedules for the above Works, we, the undersigned, offer to The National Electric Power Company for design, engineering, manufacture, inspection, testing in factory, packing for export, supply CFR at AQABA port Jordan Incoterms 2020, supervision of erection & commissioning works at site and guarantee for a period of 36 months from the date of receipt of last consignment at site or NEPCO warehouses of the equipment detailed in the attached Schedules and in accordance with the said Conditions of Contract, for the sum of……
……..
Or such other sum as may be ascertained in accordance with the said Conditions.

2. We agree that this Tender shall be held open for acceptance or rejection for the validity period of **180** days from submission deadline date and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

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

4. If our Tender is accepted, we will deliver to National Electric Power Company within 28 days of being called upon to do so a Performance Bond/Guarantee by a Bank (to be approved by the Employer) to be jointly and severally bound with us in a sum equal to 10% of the value of the Contract. The form of the performance Bond will be as attached hereto.

We propose the following Bank as surety in this respect:-
……..
……..

5. We undertake if our Tender is accepted and on receipt of your acceptance to commence and manufacture works, test, and complete for delivery F.O.B, the whole of the Works offered within …….. Weeks calculated from the date of Letter of Award/Letter of Acceptance (i.e. commencement date), and to deliver on AQABA port, Jordan the whole of the works offered within a further …….. Weeks. **(Anyhow all delivery dates will be in accordance with the required completion date of CFR at AQABA port Jordan as specified)**

6. A Guarantee Period will apply to each section of the Works for **(36) months** from the date of receipt of last consignment at site or NEPCO warehouses.

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

Date this …… day of …… 202 ……

Signature ……in the capacity of ……..

Duly authorised to sign Tender for and on behalf of……..……..

……...…....

Address ……...
Occupation…….
Telephone No:
Fax No:

NOTE: price shall be filled in Ink without alteration

Covenant of Integrity
(Attachment 1 to Letter of Tender)

To: National Electric Power Company.

We declare and covenant that neither we nor anyone, including any of our subsidiaries and affiliates, and all of our directors, employees, agents or joint venture partners, as well as any subcontractors, suppliers, sub-suppliers, concessionaires, consultants or sub-consultants, where these exist, acting on our behalf with due authority or with our knowledge or consent, or facilitated by us, has engaged, or will engage, in any Prohibited Practice (as defined below) in connection with the procurement process or in the execution or supply of any works, goods or services for **[*insert the name of the Contract*]** (the "Contract") and covenant to so inform you if any instance of any such Prohibited Practice shall come to the attention of any person in our organization having responsibility for ensuring compliance with this Covenant.

We shall, for the duration of the procurement process and, if we are successful in our tender, for the duration of the Contract, appoint and maintain in office an officer, who shall be a person reasonably satisfactory to you and to whom you shall have full and immediate access, having the duty, and the necessary powers, to ensure compliance with this Covenant.

We declare and covenant that, except for the matters disclosed in this Covenant of Integrity:

(i) we, our subsidiaries and affiliates, and all of our directors, employees, agents or joint venture partners, where these exist, have not been convicted in any court of any offence involving a Prohibited Practice in connection with any procurement process or provision of works, goods or services during the ten years immediately preceding the date of this Covenant;

(ii) none of our directors, employees, agents or a representatives of a joint venture partner, where these exist, has been dismissed or has resigned from any employment on the grounds of being implicated in any Prohibited Practice;

(iii) we, our subsidiaries and affiliates and our directors, employees, agents or joint venture partners, where these exist, have not been excluded from participation in a procurement procedure or entering into a contract with any of such institutions on the grounds of engaging in a Prohibited Practice;

(iv) We, our directors, subsidiaries and affiliates, as well as any subcontractors, or suppliers or affiliates of the subcontracts or supplier are not subject to any sanction imposed by resolution of Applicable Laws and regulations.

(v) We further undertake to immediately inform the Purchaser/Employer if this situation were to occur at a later stage.

If applicable, provide full disclosure of any convictions, dismissal, resignations, exclusions or other information relevant to Articles (i), (ii), (iii) or (iv) in the box below.

Name of Entity Required to be Disclosed	Reason Disclosure is Required[1]

For the purpose of this Covenant, the terms set forth below define Prohibited Practices as:

(i) a **Coercive Practice** which means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of any party to influence improperly the actions of a party;

(ii) a **Collusive Practice** which means an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

(iii) a **Corrupt Practice** which means the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

(iv) a **Fraudulent Practice** which means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(v) an **Obstructive Practice** which means any of (1) deliberately destroying, falsifying, altering or concealing of evidence material to an investigation, which impedes the investigation; (2) making false statements to investigators in order to materially impede investigation into allegations of a Prohibited Practice; (3) failing to comply with requests to provide information, documents or records in connection with investigation; (4) threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to investigation or from pursuing the investigation; or (5) materially impeding the exercise of audit and inspection rights or access to information; and

(vi) A **Theft, which** means the misappropriation of property belonging to another party.

Following the submission of our tender, we grant the persons appointed by them, the right of inspection of our, and any proposed subcontractors, suppliers, sub-suppliers, concessionaires, consultants and sub-consultants accounts and records and permission to have any such accounts and records audited by auditors, if required , We accept to preserve these records generally in accordance with applicable law but in any case for at least six years from the date of substantial completion of the Contract.

[1] For each matter disclosed, provide details of the measures that were taken, or shall be taken, to ensure that neither the disclosed entity nor any of its directors, employees or agents commits any Prohibited Conduct in connection with the procurement process for the Contract.

Name:	
In the capacity of:	
Signed:	
Duly authorized to sign for and on behalf of:	
Date:	

Statement of Compliance

Tenderer Legal Name: _____

JVCA Partner's Legal Name: _____ ***[delete if not applicable]***

Date: _____

Tender No.:_____

Page _____ of _____ pages

Reference Number/ Technical Specifications	**Description**	**Specification parameter requested** **(the requirement shall be read in conjunction with the respective Requirements)**	**Detailed description of the essential technical and performance characteristics of the Goods offered**	**Commentary on the Purchaser's Requirements**
1. General Requirements…				

FORM OF PERFORMANCE GUARANTEE

GUARANTEE NO.

M/S., Beneficiary

Amman – Jordan

(Contract No. & Name)

At the request of the Bank… (The Foreign Bank) and on behalf of M/S. (The contractor Name and Address), we ...(The Local Bank) issue in your favor our irrevocable and unconditional performance guarantee No…xxx... In the amount of (XXX) (in words).

In this connection we…. **(local bank)** hereby consider ourselves responsible for the unconditional payment to you or your authorized representatives of the above sum on your first written demand in whole or in part not withstanding any objections on the part of the above named contractor and without any need for notarial warning or judicial proceedings.

This guarantee remains valid from the date of issue till its expiry date on / / then it will be automatically extended for three months, then extending for consecutive periods, and it will not be canceled unless receiving an official letter issued and signed by you.

Bank (Local Bank)

FORM OF MAINTENANCE GUARANTEE

GUARANTEE *NO.*

M/S., Beneficiary
Amman – Jordan

(Contract No. & Name)

At the request of bank… (The Foreign Bank) and on behalf of M/S…(The contractor Name and Address), we the…. (The Local Bank) issue in your favor our irrevocable and Unconditional ***Maintenance guarantee*** No…...in the amount of (XXXX) (In words).

In this connection we … (**Local bank)** hereby consider ourselves responsible for the unconditional payment to you or your authorized representatives of the above sum on your first Written demand in whole or in part not withstanding any objections on the part of the above named contractor and without any need for notarial warning or judicial proceedings.

This guarantee remains valid from the date of issue till its expiry date on / / then it will be automatically extended for three months, then extending for consecutive periods, and it will not be canceled unless receiving an official letter issued and signed by you.
.

Bank (Local Bank

FORM OF ADVANCE PAYMENT GUARANTEE

GUARANTEE *NO.*

M/S., National Electric Power Co. (NEPCO)
Amman – Jordan

(Contract No. & Name)

At the request of bank… (The Foreign Bank) and on behalf of M/S…(The contractor Name and Address), we the.… (The Local Bank) issue in your favor our irrevocable and Unconditional ***Advance Payment guarantee*** No…...in the amount of (XXXX) (In words).

In this connection we … (**Local bank)** hereby consider ourselves responsible for the unconditional payment to you or your authorized representatives of the above sum on your first Written demand in whole or in part not withstanding any objections on the part of the above named contractor and without any need for notarial warning or judicial proceedings.

This guarantee remains valid from the date of issue till its expiry date on / / then it will be automatically extended for three months, then extending for consecutive periods, and it will not be canceled unless receiving an official letter issued and signed by you.
.

Bank (Local Bank

NATIONAL ELECTRIC POWER COMPANY

FORM OF BID BOND

To: **M/S., NATIONAL ELECTRIC POWER COMPANY (NEPCO)**

AMMAN – JORDAN.

50/2024 Power Transformers and Associated Equipment of Ishtafina, Abdali, Subeihi, Sabha and Manara 132/33 kV Substations

WHEREAS (Name of Tenderer) (hereinafter called "the Tenderer") has submitted its Tender dated (date of Tender) for the performance of the above-named Contract (hereinafter called "the Tender").

At the request of _____ Bank (the Foreign Bank) and on Behalf of M/S._____(the Contractor Name and Address), we _____(the Local Bank) Issue in your favor our irrevocable and unconditional Tender Guarantee No. _____ In the amount of, **JD (Jordanian Dinars Dinars)**

_____ (in words)

This guarantee remains in full force for a period of 180 days from the tender closing date, and any demand in respect thereof must reach the Bank not later than the above date.

_____**Bank**

(The Local Bank)

REQUEST FOR SHIPPING RELEASE

Name of Contract: 50/2024 Power Transformers and Associated Equipment of Ishtafina, Abdali, Subeihi, Sabha and Manara 132/33 kV Substations

Request No: Date:

To: **National Electric Power Company**

Your contract reference:

Our contract reference:

We would be pleased to receive your shipping release.

Manufacturer	Equipment	Qty.	Total No. Of Packages

CONTRACTOR SIGNATURE	RECORD PURPOSE ONLY Local Release No: Date:

Date :				
INSPECTION CERTIFICATE NO.				
CLIENT	**NATIONAL ELECTRIC POWER COMPANY(NEPCO)**			
PROJECT	**Name of Contract: Power Transformers and Associated Equipment of Ishtafina, Abdali, Subeihi, Sabha and Manara 132/33 kV Substations**			
CONTRACT NO.	**TENDER NO. 50/2024**		**ORDER COMPLETE**	**(YES/NO)**
MAIN CONTRCTOR			**L/C NO.:**	
EMPLOYER	**NEPCO**			
TENDERER				
INSPECTED AT			**DATE OF INSPECTION**	
EQUIPMENT/ MATERIAL INSPECTED:				
NUMBER INSPECTED:-				
	According to Annex		**Quantity**	
RESULT OF INSPECTION :				
ATTACHMENTS:				
This is to certify that the Equipment/Material covered by this report has been examined				
in accordance with the relevant specification (s) as well as the drawings and diagrams,				
as appropriately tested and described and found to be in condition stated.				
Approved for Dispatch		**Approved for further Work**		**NOT APPROVED**
Inspection Engineer:		**For and on behalf of**		
		National Electric Power Co.		

Date :

WAIVED INSPECTION CERTIFICATE NO.

CLIENT	**NATIONAL ELECTRIC POWER COMPANY(NEPCO)**		
PROJECT	**Name of Contract: Power Transformers and Associated Equipment of Ishtafina, Abdali, Subeihi, Sabha and Manara 132/33 kV Substations**		
CONTRACT NO.		**ORDER COMPLETE**	**(YES/NO)**
MAIN CONTRCTOR		**L/C NO.:**	
EMPLOYER	**NEPCO**		
TENDERER			
INSPECTED AT		**DATE OF INSPECTION**	
Routine test by manufacturer not witnessed by NEPCO			
EQUIPMENT/ MATERIAL INSPECTED:			
NUMBER INSPECTED:-			
	According to Annex	**Quantity**	
RESULT OF INSPECTION :			
ATTACHMENTS:			
This is to certify that the Equipment/Material covered by this report has been examined in accordance with the relevant specification (s) as well as the drawings and diagrams, as appropriately tested and described and found to be in condition stated.			

Approved for Dispatch		**Approved for further Work**	**NOT APPROVED**
Waived Inspection Engineer:		**For and on behalf of National Electric Power Co.**	

FORM OF CONTRACT AGREEMENT

This Agreement made the _____ day of _____ 20_____

Between National Electric Power Company, PO Box 2310, 11181 Amman, Jordan (hereinafter called the "Employer") and _____ (hereinafter called the "Contractor).

Whereas the Employer requires that Goods and Related Services described as **Power Transformers and Associated Equipment of Ishtafina, Abdali, Subeihi, Sabha and Manara 132/33 kV Substations** and has accepted a Tender by the Tenderer for the specified scope, and the Employer agrees to pay the Tenderer the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

The Employer and the Contractor agree as follows:

_____

_____

__(hereinafter called the "Contract Price").

Now it is agreed as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. The following documents, in order of precedence, shall be deemed to be read and constructed as form of this Agreement: -

    a. The Letter of Acceptance/Letter of Award.

    b. Letter of Tender

    c. The Addenda Nos. and Tender Amendments.

    d. The Conditions of Contract

    e. The Specification

    f. The Employer's Drawings

    g. The Contractor's Drawings

    h. The completed Schedules and any other documents forming part of the Contract.

3. In consideration of the payments to be made by the Employer to the Tenderer as indicated in this Agreement, the Tenderer hereby covenants with the Employer to supply of the Goods and Related

Services and to remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The parties have entered into this Agreement in accordance with their respective laws on the date hereof.

SIGNED, SEALED AND DELIVERED BY:

_____

For and on behalf of the Contractor

in the presence of: -

_____

SIGNED, SEALED AND DELIVERED BY: -

_____

For and on behalf of the National Electric Power Company

in the presence of: -

_____

TECHNICAL PROPOSAL

TENDER NO. 50/2024 Power Transformers and Ancillary equipment of Ishtafina, Abdali, Subeihi, Sabha and Manara 132/33 kV Substations

MANUFACTURER'S RESPONSIBILITY STATEMENT

We hereby convey our interest to associate with the above project and supply the following Equipment:

Equipment Name/Description: _____

_____

_____

In the event of placement of purchase order on us we will comply with the COMPANY Term & Condition of "Manufacture's Responsibility" specified in technical Schedule and technical specification.

Name of Manufacturer: _____

Signature: _____

Name : _____

Date : _____

Manufacturer's Stamp

Name of Bidder: _____

Signature: _____

Name : _____

Date : _____

Bidder's Stamp

Table No.1

Bidder Financial data for financial capability determination

Company Name…

Tender No

Currency…

Financial Data Description	*last three Financial Statements*		
	insert year 1	*insert year 2*	*insert year 3*
Current Assets			
Inventory			
Current Liabilities			
Non-Current Liabilities			
Net Profit (After Tax)			
Total Assets (Average)			
Operating Profit			
Net Sales			
Net Working Capital (Average)			
Net Accounts Receivable (Average)			
Total Assets			
Total Liabilities			
Owner's Equity			

Instructions:

1- Financial statements for last three years with independent public accountant signed report shall be attached.
2- Fill the form according to figures and currency mentioned in the financial statements without any further adding or subtract or exchange to another currency.
3- Any wrong inserting is subject to correction.
4- Neither holding Company financial data nor subsidiary Co are required.
5- Financial data for each partner of Joint venture must be filled separately.

Table No.2

Bidder Financial analysis ratios for financial capability determination

Company Name…

Tender No

Financial Analysis Ratios		Formula	last three Financial Statements		
			insert year 1	insert year 2	insert year 3
1. Liquidity Ratios	Current Ratio	Current Assets / Current Liabilities			
	Quick Ratio	Current Assets - inventory / Current Liabilities			
2. Profitability Ratios	Return on Investment	Net Profit (After Tax) / Total Assets (Average)			
	Operating Profit Ratio	Operating Profit / Net Sales			
	Net Profit Ratio	Net Profit (After Tax) / Net Sales			
3. Activity &Operating Ratios	Net Working Capital	Current Assets - Current Liabilities			
	Working Capital Turnover	Net Sales / Net Working Capital (Average)			
	Accounts Receivable Turnover	Net Sales / Net Accounts Receivable (Average)			
	Average Collection Period	365 / Accounts Receivable Turnover			
	Assets Turnover	Net Sales / Total Assets			
4.Coverage Ratio	Current liability to Total Assets Ratio	Current Liabilities / Total Assets			
	Non-Current liability to Total Assets Ratio	Non-Current Liabilities / Total Assets			
	Dept To Equity Ratio	Total Liabilities / Owner's Equity			

1- Ratios shall be calculated according to figures filled in Table No.1.
2- Any Wrong calculation is subject to correction.

General Technical Specifications

GENERAL TECHNICAL SPECIFICATIONS

1. General

These General Technical Specifications, together with Particular Technical Specifications, shall ensure that the delivered equipment is manufactured and assembled in complete and following all the details according to the designed purpose. Thus, it is understood that the Contractor, by accepting the Contract, agree to properly manufacture and properly inspect & test the complete equipment, regardless of the omissions in the text and/or drawings in the General and/or Particular Technical Specifications.

Wherever possible, these General Technical Specifications shall be applied in conjunction with the Particular Technical Specifications. In case of discrepancies between the General and Particular Technical Specifications, the Particular Technical Specifications shall prevail.

Furthermore, in case of discrepancies between this Technical Specifications and the Conditions of Contract, the Conditions of Contract shall prevail.

The Contractor shall be responsible for any discrepancies, errors or omissions in the particulars and guarantees, whether or not such particulars and guarantees have been approved by the Client.

2. Scope of Works

These General Technical Specifications refer to the general technical requirements for the design, engineering, manufacture, inspecting and testing in factory, packing for export, supply CFR (Cost and Freight) Aqaba port, supervision of erection and commissioning activities at sites, putting into operation and guarantee (maintenance) for a period of 36 calendar months from the date of receipt of last consignment at site for the following equipment:

- Main Transformers (132/33 kV, oil-immersed, three-phase) of total of 5 sets as follows:
    1. Ishtafina Substation (replacement): 1 sets (42/63 MVA, ONAN/ONAF cooling).
    2. Abdali Substation (replacement): 1 set (54/80 MVA, ONAN/ONAF cooling).
    3. Subeihi Substation (Extension): 1 set (42/63 MVA, ONAN/ONAF cooling).
    4. Sabha Substation (Extension): 1 set (54/80 MVA, ONAN/ONAF cooling).
    5. Manara Substation (Extension): 1 set (54/80 MVA, ONAN/ONAF cooling).
- Main Transformer Remote Tap-Changer Control Panel (RTCC) total of 5 sets.
- Earthing & Auxiliary Power Supply Transformers (33/0.4 kV, oil-immersed, three-phase) of total of 5 sets as follows:
    1. Ishtafina Substation (replacement): 1 set (200 kVA, ONAN cooling).
    2. Abdali Substation (replacement): 1 set (200 kVA, ONAN cooling).
    3. Subeihi Substation (Extension): 1 set (200 kVA, ONAN cooling).
    4. Sabha Substation (Extension): 1 set (200 kVA, ONAN cooling).
    5. Manara Substation (Extension): 1 set (200 kVA, ONAN cooling).
- Information for civil works design for transformers basement (the Civil Works will be supplied by Other Contractor).
- Insulating oil for first filling of the transformers on site plus 10% as erection spare.
- Others (as specified in schedules and technical specification).

WORKS at the option of the Employer

This shall include but not be limited to:

(i) Additional/ Recommended Spare Part, apparatus and materials (Optional). The manufacture, testing, supply and delivery to stores as the Employer may require in accordance with the Conditions of Contract at the prices stated in the Schedules, of such quantities of the apparatus and materials enumerated and such repeats (if any) thereof as the Employer shall order from the Contractor at any time before the expiration of the Guarantee Period of the Definite Work.

2.1 Battery limits

The battery limits between the Transformers Contract and Other facilities are listed here below:

i. Battery limits with Substation Contract:

The substation Contractor is responsible for the works related to the HV Overhead line connection up to the terminal stud of transformer bushings (clamps are from substation contractor) both of 132 kV and 33 kV side and for the grounding connection, included neutral current transformer.

-Multicore cables with accessories between transformer and the AVR control panel are supplied by transformer contractor, cableways by substation contractor.

-LV auxiliary supply cables (AC and DC) to Transformer MDU, MK, cooling system, , AVR control panel should supply by substation contractor, the load list with MCB/MCCB quantities should be provided by transformer contractor.

-Multicore cables between the (Transformer MK, motor drive unit (MDU), MK and the AVR panel) to protection panels, switchgear, control panels and SCADA system are supplied by substation contractor.

The dimensional drawing of the transformers shall be provided to the Substation and Civil Contractors not later than 2 months from the date of LOA of the transformer contract.

2.2 BASIC REQUIREMENTS AND GUIDELINES

A. All components and accessories required for the completion and successful operation of the WORK covered under the scope of this contract, either specified in detail or not, shall be supplied by the CONTRACTOR as necessary.

B. The drawings enclosed with this Scope of Work and Technical Specifications are conceptual and for the information of the CONTRACTOR only. The CONTRACTOR should read these drawings in conjunction with this Scope of work and Technical Specifications. The successful CONTRACTOR shall develop detailed design drawings for construction purposes.

C. Copies of existing / ongoing project drawings, design calculations, technical reports and other information as deemed appropriate by the NEPCO might be provided to the CONTRACTOR upon request, if available. However, if such information is not available, then the CONTRACTOR should be responsible for the independent development of the information required to complete the specified CONTRACT.

D. The specification of equipment and materials specified herein are to be considered as the minimum requirements, and the bidders shall carry out their own basic and detailed design necessary for their proposed specifications.

E. NEPCO acceptance of the CONTRACTOR'S design does not relieve him of any part of his obligations to meet all the requirements of the CONTRACT nor the responsibility for the correctness of the design and construction drawings of the PROJECT.

F. The CONTRACTOR'S organizational chart shall be submitted for approval with their technical proposal

G. All the CV for the design team should be submitted for approval by NEPCO.

H. NEPCO has the right to change any engineer of the contractor's engineers during any period of the project, according to what the owner deems appropriate, the contractor must restrict and implement the change order, and he will bear the responsibility for the delay in design / project in the event that the owner does not respond by changing the engineer.

I. Sub-contracts
The Contractor shall supply three copies of all orders placed with sub-contractors. Information is to be given on each sub-order sufficient to identify the material or equipment to which the sub-order relates and to notify the sub-contractor that the conditions of the Specification apply.
All purchase order should be submitted within 10 days after letter of award as accepted on the evaluation stage on the technical offer.

3. Site Conditions

Aqaba, Jordan's only seaport can be reached by sea via the Red Sea and by air either from Amman, Cairo or directly from Europe.

Amman can be reached by road from Aqaba or by air directly from Europe.

All substations can be reached by existing roads. Rail access is not available to any of the substation sites.

The Site Conditions prevailing at the Sites has been given in the Table below.

Site Condition	Substation Sabha 132/33 kV	Substation Subeihi13 2/33 kV	Substation Ishtafina 132/33 kV	Substation Abdali 132/33 kV	Substation Manara 132/33 kV
Site Altitude (m a.s.l.)	≤1000	≤1000	≤1000	≤1000	≤1000
Minimum ambient temperature (°C)	-10	-10	-10	-10	-10
Maximum ambient temperature (°C)	45	45	45	45	45
Design maximum ambient temperature (°C)	50	50	50	50	50
Highest average daily temperature (°C)	38	38	38	38	38
Relative humidity (%)	36÷70	36÷70	36÷70	36÷70	36÷70
The climate –day	Dry & Hot	Dry & Hot	Dry & Hot	Dry & Hot	Dry & Hot
The climate – night	Cold	Cold	Cold	Cold	Cold
Pollution level	Heavy airborne contaminat ion	Heavy airborne contaminat ion	Heavy airborne contaminat ion	Heavy airborne contaminati on	Heavy airborne contaminati on
Insulator specific creepage distance SCD (mm/kV)	38	38	38	38	38
Insulator unified specific creepage distance USCD (mm/kV)	65.8	65.8	65.8	65.8	65.8
Wind velocity (m/s)	35	35	35	35	35
Ice loading, radial thickness (mm)	10	10	10	10	10
Isoceraunic level (days/annum)	15	15	15	15	15
Average annual rainfall (cm)	cca. 23	cca. 23	cca. 23	cca. 23	cca. 23
Seismic Conditions	Zone 2B	Zone 2B	Zone 2B	Zone 2A	Zone 2A
Solar radiation (W/m^2)	1150	1150	1150	1150	1150

4. General Requirements

4.1 Compliance with Technical Specifications

All equipment and materials supplied under this Contract shall be approved by Client.

The Contractor shall be responsible for any discrepancies, errors or omissions in the particulars and guarantees, whether or not such particulars and guarantees have been approved by the Client.

No deviations from the Technical Specifications shall be permitted.

4.2 Compliance with Standards

The equipment covered by these Specifications shall be manufactured and tested on the basis of the currently approved publications of the corresponding technical regulations, standards and norms accepted and recognized in the world.

The Contractor shall state, for the particular elements, as well as for the complete equipment, exactly the regulations, recommendations, standards etc., he applied or he will apply for dimensioning, selection of material, inspection and quality assurance, manufacture, installation and testing of equipment (in English language).

The latest publication of the following standards and codes, in particular, shall be used where applicable:

- IEC International Electro technical Commission,
- ISO International Standardization Organization,
- BSI British Standard Institution,
- ANSI American National Standard Institute,
- IEEE Institute of Electrical and Electronic Engineers,
- ASTM American Society for Testing Materials,
- NEMA National Electrical Manufacturer Association,
- DIN German Industrial Norms.

The Contractor can also use other internationally recognized standards or codes in the country where the equipment shall be manufactured provided that they are equal or higher quality than above mentioned but must have the approval of the Client obtained in writing. To obtain this approval the Contractor is obliged to submit in advance to the Client with copy of standards or codes he intends to use and to clearly explain the extent, reason and advantage for their application (in English language).

The Contractor shall provide one original copy of the latest standards (IEC, BS, ANSI, IEEE, DIN or other applicable standards) which are applicable to this Contract.

4.3 Compliance with Regulation

All supplied equipment and material, and all works carried out shall comply in all respects with such of the requirements of the Regulations and Acts in force in the Country of the Client as are applicable to the Contract Works and with any other applicable regulations.

4.4 Quality Assurance

The Contractor shall establish and maintain throughout the whole period of the Contract a project quality plan according to ISO 9001 which will ensure that a quality system of regular inspection, test and check procedures are carried out on every aspect of the work. Such work shall include but not be limited to materials, workmanship, design, preparation of drawings, factory acceptance tests (FAT), packing, shipping, storing, supervision of erection, site testing & commissioning.

Samples of all materials used shall be taken and tests performed to ensure compliance with the specifications. All test results shall be recorded, and test certificates supplied as required. Samples of materials and workmanship shall be provided to the Client from manufacturers as required.

All records shall be kept available for inspection by the Client.

4.5 Language and System of Units

The English language shall be used in all written communications between the Client and the Contractor with respect to the related services to be rendered as erection & commissioning supervision, training and with respect to all documents and drawings procured or prepared by the Contractor pertaining to the work, unless otherwise agreed by the Client.

All equipment labels or plates and the Operating and Maintenance Manuals shall be written in English.

The International System of Units, i.e. SI System Unit (*Systeme International d'Unites*), shall be applied.

4.6 Technical Documentation, Data, Information, Samples and Models

4.6.1 Documentation and Information to be Submitted to the Client

4.6.1.1 General

For the equipment to be delivered by the Contractor according to this Contract, the following shall be submitted to the Client for approval: drawings, design data, calculations, samples, catalogues, brochures, test programs, instructions for installation and testing, operation and maintenance manuals, training programs, certificates, test protocols, reports and other documentation, which might be necessary, or reasonably requested by the Client, or requested by the Particular Technical Specifications.

Documentation submission schedule must be such as to make them available for inspection of each particular document upon its reception. Above mentioned documentation of the Contractor formally submitted, must be accompanied by official statement of the Contractor that thus presented information are checked by the Contractor and correct for application.

Preliminary documentation, submitted as information, must be clearly identified.

For the equipment to be supplied and assembled according to this Contract, the Contractor shall not make any changes, or deviations in execution of works in comparison to the technical documents, which is an integral part of the Contract. However, if the necessity arises, the Contractor shall previously obtain written assent of the Client.

The Contractor shall, within the deadlines stated in the Particular Technical Specifications, submit drawings, presenting the procedure of the equipment assembly, together with corresponding information, for preparation of appropriate foundations on which the equipment shall be assembled and for realization of all the necessary links.

The Contractor is due to indicate all possible changes into the documentation, if made during Works execution.

All designs and other documentation shall be submitted by the Contractor to the Client in three (3) hard copies and one (1) electronic copy (pdf and editable version: word, excel, AutoCAD, etc.).

4.6.1.2 Program of Works

The Contractor shall, within one (1) month upon Contract Commencement Date (Letter of Acceptance), submit the Program of Works with key dates showing detailed partition of activities related to substations and equipment data acquisition, preparation of design documentation, manufacturing of the equipment including factory acceptance tests, transport of the equipment & materials to the delivery place (Aqaba port, Jordan), installation, commissioning and taking-over.

If at any time during the execution of the Contract, it is found necessary to modify the approved Program of Works, the Contractor shall inform the Client and shall submit a modified Program of Works for approval. Such approval shall not be deemed to be consent to any amendment of the completion dates stated in schedule B: *Delivery and Completion Requirements*.

4.6.1.3 Reports on the Works Progress

The reports on the works progress shall be submitted to the Client monthly, containing information on the progress of works from the previous month, as well as the actual condition and expected trends of works in the

factory and on the Site. The condition and trends of the works progress shall be illustrated by plans, schemes, diagrams, graphic charts, drawings, photographs, tables.

Each particular task, such as designing, materials acquisition, fabrication, testing in the factory, delivery to the Site, equipment installation, testing on the Site, commissioning, shall be included in separate chapters. The complete works will be presented in the chapter with summary.

If during execution of the Contract, the Client considers the progress position of any section of the work to be unsatisfactory, he will be at liberty to call such meetings, either at the Amman Office at Contractor Works or at Site, as deemed to be necessary. If required by the Client, a responsible representative from the Contractor's works shall attend such meetings.

The Work Progress Report shall be submitted in Primavera or MS Project.

4.6.1.4 Test Program

Upon signing the Contract, the Contractor shall submit for the Client's approval the Detailed Test Program for the equipment in the Factory and recommended Test Program for the equipment on the Site.

4.6.1.5 Drawings

A list of the drawings shall be submitted by the Contractor with his Tender. The list of drawings shall be submitted after the Contract Commencement Date stated in the Particular Technical Specifications.

The Contractor shall submit all drawings for approval in sufficient time to permit modifications to be made if such are deemed necessary, and the drawings shall be re-submitted without delaying the completion dates stated in schedule B *Delivery and Completion Requirements*.

Three (3) copies of all drawings shall be submitted for approval and three (3) copies of any subsequent revision. Following approval, four (4) further paper copies and one (1) soft/electronic copy shall be submitted for Issue of Construction to the Client.

The Contractor shall submit to the Client's approval outline drawings of the equipment which shall be delivered according to the Contract together with the estimated weights, forces, details on anchoring and sufficient total dimensions.

All dimensions marked on the drawings shall be correct ones.

All detailed drawings submitted for approval shall be to scale not less than 1:20. All important dimensions shall be given and the material of which each part is to be constructed shall be indicated.

The Contractor shall also provide free of charge any additional drawings and/or copies of any drawing required by the Client.

Drawings submitted by the Contractor and approved by the Client shall not be departed from, without the instruction in writing of the Client.

The Contractor shall be responsible for any discrepancies or errors or omissions from the drawings, whether such drawings have been approved or not by the Client. Approval given by the Client to any drawing shall neither relieve the Contractor from his liability to complete the Contract Works in accordance with this Specification and the Conditions of Contract nor exonerate him from any of his guarantees.

All drawings shall be submitted in accordance with the provisions of this Technical Specification and shall become the property of the Client.

4.6.1.6 Electric Diagrams

The Contractor shall submit to the Client's approval complete connection diagrams, as well as circuit diagrams for control, regulation, measurements, protection, signalling, synchronization, etc., covering all the delivered equipment under the Contract, as well as existing equipment to which the equipment from this Contract is connected.

Cables between parts or apparatus shall be properly enumerated and marked. Individual drawings and diagrams shall show reference numbers for all outgoing cables, but the other accompanying drawings shall show all the data required for mutual interconnections.

Circuit diagrams shall be with particularly marked contacts and enumerated columns. Relays and control switches shall be shown on the same diagram with their coils and their contacts, with indication of columns where the contacts are used.

Circuit diagrams shall be completed with the indication of the reference numbers of the terminals to which apparatus are connected, the numbers being taken from the wiring diagram.

In circuit diagrams of measurements, all the measurement devices and transformers, measuring transmitters, indication instruments and all other equipment using measuring signals shall be provided.

4.6.1.7 Technical Solution (Design Principle & Concept)

Before starting with the manufacture of equipment to be delivered by the Contract, the Contractor shall submit for approval the Technical Solution (Design Principle & Concept) which shall contain the necessary technical descriptions, calculations, technical data, drawings, etc., to completely demonstrate that all equipment is in compliance with the provisions and the purpose of the Contract, as well as the installation, operation and maintenance requirements.

Equipment manufacturing can start only after approval of the Technical Solution by the Client.

4.6.1.8 Detailed Design

Prior to starting with equipment factory testing, the Contractor shall submit to the Client for approval the Detailed Design.

The Detailed Design shall be prepared in accordance with the provisions stated under Clauses 4.6.1.5, 4.6.1.6 and 4.6.1.7 above.

4.6.1.9 Instructions for Equipment Installation

For the equipment to be delivered, the Contractor shall submit to the Client for approval all required documentation providing satisfactory equipment installation on the Site. Special instructions for equipment installation shall be submitted together with reduced copies of applied drawings showing the installation sequence. Instructions and drawings shall include information on handling of equipment, installation tolerances and special safety measures to be undertaken during installation.

4.6.1.10 Operation and Maintenance Manuals

The Contractor shall submit to the Client complete and special Operation and Maintenance (O & M) Manuals for equipment and all special tools which are a part of the Contract. Such manuals shall be as clear as possible and contain complete plans and diagrams.

4.6.1.11 Program of Training

The Contractor shall prepare and submit for the Client's approval the Program of Training for the installation, operation, maintenance and testing of the equipment to be delivered, which will include training of the Client's personnel on the Site.

4.6.1.12 As Built Design

After completion of site works, the Contractor shall be obliged to perform Site Visits to all substations in order to collect all information necessary to prepare As Built Design.

As Built Design shall include introduction to the scope of work, design principle & concept, technical descriptions, substation layouts & cross sections, approved civil drawings, detailed circuit diagrams, wiring diagrams, cable lists, block schemes, technical data, panel views, approved calculations submitted during engineering/design stage, operation and maintenance manuals, detailed Manufacturer's catalogues for supplied equipment revised where necessary to show equipment as installed.

Furthermore, As Built Design for replacement and extension projects shall include all modifications on existing equipment and systems necessary for proper functioning of complete substations.

All drawings and other documentation shall be revised where necessary to show the equipment as installed, and two (2) copies shall be submitted for approval.

After Client's approval, three (3) copies of final As Built Design shall be submitted to Client and shall be reproduced as follows:

- Two (3) copies as Books of approximately square size bound into strong black durable imitation of leather with covers inscribed with gold letters,
- One (1) main electronic copy in mutually agreed version of AutoCAD format on CD or similar storage media.

After receiving the final version of As Built Design, the Client shall issue the Taking-Over Certificate (TOC) to the Contractor.

4.6.2 Review of Contractor Documentation

Each Contractor document shall be submitted to the Client for approval.

A copy will be returned to the Contractor marked with "*Approved*", "*Approved with corrections*" or "*Not approved*", or as agreed between the Contractor and the Client after the Contract Commencement Date. The approval does not release the Contractor from the obligation to deliver the equipment according to the Contract, completely fulfilling its purpose. No corrections are to be made upon return of the document marked "*Approved*" to the Contractor.

When documents copies are marked with "*Not approved*" or "*Approved with corrections*", the Contractor shall undertake the necessary corrections and to indicate them clearly in the documents and submit again for review and approval.

The Contractor shall be responsible for not clearly indicated corrections. Each revision shall be marked by number, date and subject, in the revision block. Besides, each revised document must have clearly written number, date and subject of all previous revisions.

If an omission is found on the Contractor document during equipment erection, corrections, including all required changes, shall be marked on the document and it will be submitted for approval once again, without additional expenses to the Client.

The Contractor shall be responsible for all discrepancies, omissions or errors on its documents notwithstanding the fact whether such documents and details are approved or not by the Client.

The Contractor shall make all the changes in the documentation necessary for the completion of Works in compliance with the provisions stated in schedule B : *Delivery and Completion Requirements*, without additional expenses to the Client.

4.6.3 Documents Review Period

All documentation submitted by the Contractor to the Client for review shall be returned to the Contractor with the revision seal of the Client, or with any other remark he may make, within 21 (twenty-one) days upon the reception in the Client's office.

Exception is documentation of complicated assemblies, Detailed Design and As Built Design, for which this procedure shall be completed within 30 days.

If the Contractor needs urgent approval of any document in order to avoid delay in the completion of the Contract Works, he shall inform the Client to such effect when submitting the document.

If the Client deems it necessary to take more time for review of some documentation, he shall inform the Contractor in written within 10 (ten) days after their reception.

4.6.4 Samples and Models of the Equipment/Materials

The Contractor shall submit a list of the equipment/material samples and models after the Contract Commencement Date as stated in the Particular Technical Specifications.

The list of the equipment/material samples and models shall include at least the cable samples, conductor samples, earthing conductor samples, earthing rods, cable glands, HV connectors, clamps, fittings, etc.

The Contractor shall submit samples of materials for approval as required from time to time by the Client.

The Contractor shall submit samples and models for approval in sufficient time to permit modifications to be made if such are deemed necessary, and the samples and models to be re-submitted without delaying the completion dates stated in schedule B : *Delivery and Completion Requirements*.

All dimensions of the samples and models shall be exact as on the pertaining drawings.

The Contractor shall also provide free of charge any additional sample or model required by the Client.

Samples and/or models submitted by the Contractor and approved by the Client shall not be departed from, without the instruction in writing of the Client.

Approval given by the Client to any sample and/or model shall neither relieve the Contractor from his liability to complete the Contract Works in accordance with this Specification and the Conditions of Contract nor exonerate him from any of his guarantees.

All samples and models shall be submitted in accordance with the provisions of this Technical Specification and shall become the property of the Client.

4.6.5 Language

All Contractor's documents shall be in English language.

4.7 Packing, Shipping and Transport

The Contractor shall be responsible for the packing, loading and transport of the equipment and materials from the place of manufacture, whether this is at his own works or those of any supplier, to the Site.

All apparatus shall be carefully packed for transport by sea, rail and road as necessary and in such a manner that it is protected against climatic conditions.

Where oil for the first filling is to be provided it shall be supplied in non-returnable drums or non-returnable oil tank.

Precautions shall be taken to protect parts containing electrical insulation against the ingress of moisture.

All parts liable to rust shall receive a coat of anti-rusting composition and shall be suitably protected. The machined face of all flanges shall be protected by means of a blank disc bolted to each face.

Where appropriate all parts shall be boxed in substantial crates or containers to facilitate handling in a safe and secure manner. Each crate or container shall be marked clearly on the outside of the case to show where the mass is bearing and the correct position for the slings. Each crate or container shall also be marked with the notation of the part or parts contained therein, contract number and port of destination, and shall become the property of the Client after delivery.

The Client may require inspecting and approve the packing before the items are dispatched but the Contractor shall be entirely responsible for ensuring that the packing is suitable for transit and such inspection will not exonerate the contractor from any loss or damage due to faulty packing.

All the equipment shall be protected against damage during various transport manipulations. For these manipulations, hooks and/or slings shall be provided in adequate places so as to avoid damaging of equipment. These places shall be marked precisely on the drawings and manuals, and special protection against climate influences shall be also adequately provided.

Parts of equipment susceptible to dust and moisture shall be properly protected in an airtight package, along with utilization of moisture absorbers.

Fragile and sensitive equipment and its parts have to be adequately packed in shock resistant boxes and clearly marked by an adequate warning.

The Contractor shall be responsible for all damages to the equipment in transport, and for all damages resulting from insufficient packing, improper packing, negligent handling and loading and insufficient protection against

tumbling during transport, and such damages or defects shall be brought into proper condition by the Contractor, on his own expense.

4.8 Erection and Shipping Marks

Before leaving the Contractor's Works all equipment and materials shall be painted or stamped in two (2) places with a distinguishing number and/or letter corresponding to the distinguishing number and/or letter on an approved drawing and material list.

The erection marks on galvanized material shall be stamped before galvanizing and shall be clearly legible after galvanizing.

All markings shall be legible; weatherproof tags, where used, shall be durable, securely attached and duplicated.

Prior to dispatch each separate box, crate or package of equipment shall be clearly labelled in the English language and bear the markings shown on the appropriate Tender Drawing .

Marking shall be by means of block letters not less than 13 mm high, stencilled on the box, crate or package with black paint in an easily read location. When stencilling is not possible the information shall be marked on a durable metal tag that shall be securely wired to the box, crate or package.

4.9 Foundations and Building Work

The Contractor shall, in accordance with the requirements of this Specification, prepare and submit, within three (3) months of the commencement date, drawings of the Contract Works showing the arrangement of the other plant and the method of fixing. These drawings shall show the loading of the foundations at each point so that the foundation work may be designed to suit the conditions prevailing at each site. The drawings of the foundation work, which will be carried out under other contracts, will be submitted to the Contractor for his comments before the work is put in hand and he shall be responsible for checking the dimensions shown on the drawings and the resulting electrical clearances, in so far as these relate to the equipment being provided by him under this Contract.

Provision will be made by the Client during the construction of the foundations and of the buildings for the auxiliary plant and operating rooms, for ducts for oil and air pipes or cables, foundation bolts and other fixtures included in the Contract Works, if proper and sufficient drawings and templates and all materials required to be built into or otherwise affecting the foundations or building work are provided by the Contractor in time to avoid delay to any part of the building or foundation work.

The Contractor shall be responsible for ascertaining from the Client from time to time the dates by which such drawings, templates and materials will be required. If sufficient information, the necessary drawings, templates, and all above-mentioned material are not delivered by such dates, any alterations or additions to the foundation or building work shall be made by the Client at the expense of the Contractor, or with the agreement of the Client by the Contractor at his own expense.

For plant supplied under the Contract the Contractor shall supply all foundation bolts.

All civil foundations, building drawings necessary and template for the proper completion of the project shall form part of this Contract.

All support reactions shall be given without safety factor, and for each load case separately.

Unless otherwise specified all foundations, walls, roof coverings, concrete floor fittings, ducts and pipe work embedded in the foundations, trenches with floor plates for cables, etc will be provided as part of a separate civil contract.

The contractor shall supply within two months of the date of the order four copies of the foundation drawings including openings, holes, plinths, subsidiary foundations etc., and also loading diagrams, those even if not final in all respects shall be sufficiently accurate to permit design of the foundations to be put in hand, with the assurance that any subsequent modifications found necessary before plant erection commences shall be limited to those of a minor nature, not involving serious alterations to completed work.

In the event of the Contractor failing to provide whole or part of the preliminary loading or final dimensional foundation drawings by the dates specified and in the event that such default by delaying the construction of the

substation civil works leads to delay in the completion of the project, the Contractor shall be liable for penalty in accordance with the penalties for delays in delivery in the General Conditions of Contract in respect of each week by which the Contractor is late in providing the said drawings.

The civil works Contractor will shape only the pockets, holes, etc for holding down bolts depending upon the dimensions and details submitted in accordance with this clause. Provision of all holding down bolts, nuts, washers under this contract for packing and grouting them in foundations.

5. Equipment and Material Requirements

5.1 General

The Contract works shall be designed to facilitate inspection, cleaning, and repairs, and for operation where continuity of supply is the first consideration. All apparatus shall also be designed to ensure satisfactory operation in all atmospheric conditions prevailing at the Site(s) and during such sudden variation of load and voltage as may be appeared with working under conditions on the system, including those due to faulty synchronising and short circuit.

The design shall incorporate all reasonable precautions and provision for the safety of those responsible for the operation and maintenance of the Contract Works and of associated works supplied under other contracts.

All outdoor apparatus and fittings shall be designed so that water cannot collect at any point.

All water and oil pipe flanges shall be according to BS EN 1092 as regards both dimensions and drilling, unless otherwise approved.

Cast iron shall not be used for chambers of oil filled apparatus or for any part of the equipment which is in tension or subject to impact stresses.

Kiosks, cubicles, and similar enclosed compartments shall be adequately ventilated to restrict condensation. All contactor or relay coils and other parts shall be suitably protected against corrosion.

All apparatus shall be designed to avoid the risk of accidental short circuit due to animals, birds, insects, mites, rodents, or micro-organisms.

Corresponding parts shall be interchangeable. Where required by the Client the Contractor shall demonstrate this quality.

All equipment is to operate without undue vibration and with the least possible amount of noise and is not to cause a nuisance.

5.2 Selection of Materials

In choosing materials and their finishes, due regard shall be given to the humid tropical conditions under which equipment is to work, and the recommendations of British Standard Institution shall be observed, unless otherwise approved by Client. Some relaxation of the following provisions may be permitted where equipment is hermetically sealed, but it is preferred that tropical grade materials shall be used wherever possible:

- Metals: Iron and steel shall generally be painted or galvanised as appropriate. Indoor parts may alternatively have chromium or copper-nickel plated or other approved protective finish. Small iron and steel parts (other than rustless steel) of all instruments and electrical equipment, the cores of electromagnets and the metal parts of relays and mechanisms shall be treated in an approved manner to prevent rusting. Cores, etc., which are built up of laminations or cannot for any other reason be anti-rust treated, shall have all exposed parts thoroughly cleaned and heavily enamelled, lacquered or compounded.

  When it is necessary to use dissimilar metals in contact, these should, if possible, so be selected that the potential difference between them in the electrochemical series is not greater than 0.5 volts. If this is not possible, the contact surfaces of one or both of the metals shall be electroplated or otherwise finished in such a manner that the potential difference is reduced to within the required limits, or if practicable, the two metals shall be insulated from each other by an approved insulating material or a coating of approved varnish compound.

- Screws, nuts, springs pivots, etc.: The use of iron and steel is to be avoided in instruments and electrical relays wherever possible. Steel screws, when used, shall be zinc, cadmium or chromium plated, or when plating is not possible owing to tolerance limitations, shall be of corrosion-resisting steel.

  All wood screws shall be of dull nickel-plated brass or of other approved finish. Instrument screws (except those forming part of a magnetic circuit) shall be of brass or bronze. Springs shall be of non-rusting material, e.g. phosphor-bronze or nickel silver, as far as possible. Pivots and other parts for which non-ferrous material is unsuitable are to be of approved rustless steel where possible.

- Fabrics, cork, paper, etc.: Fabrics, cork, paper and similar materials, which are not subsequently to be protected by impregnation, shall be adequately treated with an approved fungicide. Sleeving and fabrics treated with linseed oil or linseed oil varnishes shall not be used.
- Wood: The use of wood in equipment shall be avoided as far as possible. When used, woodwork shall be of thoroughly seasoned teak or other approved wood which is resistant to fungal decay and shall be free from shakes and warp, sap and wane, knots, faults and other blemishes. All woodwork shall be suitably treated to protect it against the ingress of moisture and from the growth of fungus and termite attack, unless it is naturally resistant to those causes of deterioration. All joints in woodwork shall be dovetailed or tongued and pinned as far as possible. Metal fittings where used shall be of non-ferrous material.
- Adhesives: Adhesives shall be specially selected to ensure the use of types, which are impervious to moisture, resistant to mould growth, and not subject to the ravages of insects. Synthetic resin cement only shall be used for joining wood. Casein cement shall be used.
- Rubber: Neoprene and similar synthetic compounds, not subject to deterioration due to the climatic conditions, shall be used for gaskets, sealing rings, diaphragms, etc., instead of the standard rubber-based materials.

5.3 Equipment and Materials Workmanship

The materials to be used in fabrication of particular equipment shall be of such kind, composition and physical properties, which would best correspond to their purpose, and compliant with the most advanced practice in engineering. All the equipment shall comply with the standards applied regarding materials, fabrication, design and testing. Tolerance, adjustments, and final processing must comply with the most advanced contemporary practice in manufacture of products similar to those enclosed in the Special Technical Specifications.

All the equipment must be of reliable structure, designed for frequent putting into operation.

All the equipment shall operate without excessive vibrations and with minimum noise.

When the Contractor wishes to use materials which are not manufactured for the purpose of execution of the Works under this Contract, he must submit evidence that such materials correspond to the requirements of the General and Particular Technical Specifications, and in such case, material tests may be omitted, unless decided otherwise by the Client.

All the works shall be performed in detail and skilfully, and in compliance with the contemporary practice in the most advanced equipment fabrication, disregarding any possible shortages in the General and Particular Technical Specifications. All the works shall be performed by skilled labourers of various professions. All the parts shall be accurately produced according to the standard measure, wherever possible, to facilitate replacement and repair. Similar parts shall be interchangeable unless the Client approves otherwise. Basic equipment elements and their spare parts shall be manufactured of the same material.

Equipment, accessories for adjustments, fastening and other, shall be brand new, of the approved fabrication and standards, and of the first-class quality.

In case any deviation from the contracted drawings may occur in the course of manufacture, a written report on the nature of the deviation shall be submitted to the Client by the Contractor, and the Client will decide whether the modified part of equipment should be accepted or not.

The Client's acceptance of the deviation shall in no way release the Contractor of his obligation to deliver the equipment according to the Contract.

Materials and equipment, manufactured, used or installed without the Client's consent can be subsequently rejected.

All apparatus, connections and cabling shall be designed and arranged to minimize the risk of fire and any damage which might be caused in the event of fire.

5.4 Bolts and Nuts

All bolts, studs, screw threads, pipe threads, bolt heads and nuts shall comply with the appropriate IEC, ISO or BS Standards for metric threads, or the technical equivalent.

Except for small wiring, current carrying terminal bolts or studs, for mechanical reasons, shall not be less than 6 mm in diameter.

All nuts and pins shall be adequately locked.

Wherever possible bolts shall be fitted in such a manner that in the event of failure of locking resulting in the nuts working loose and falling off, the bolt will remain in position.

All bolts, nuts and washers placed in outdoor positions shall be treated to prevent corrosion of the threads and electrolytic action between dissimilar metals.

Where bolts are used on external horizontal surfaces where water can collect, methods of preventing the ingress of moisture to the threads shall be provided.

Each bolt or stud shall project at least one thread but not more than three threads through its nut, except when otherwise approved for terminal board studs or relay stems. If bolts and nuts are placed so that they are inaccessible by means of ordinary spanners, special spanners shall be provided.

The length of the screwed portion of the bolts shall be such that no screw thread may form part of a shear plane between members.

Taper washers shall be provided where necessary.

5.5 Galvanizing

All galvanizing shall be applied by the hot dip process and shall comply with BS EN ISO 1461. The thickness of the coating shall be such to secure 25 years of coating durability without maintenance, depending on site conditions, as per BS EN ISO 14713, but shall not be less than 0.61 kg/m^2. Coating thickness is subject to NEPCO approval.

All welds shall be de-scaled, all machining carried out and all parts shall be adequately cleaned prior to galvanizing. The preparation for galvanizing and the galvanizing itself shall not adversely affect the mechanical properties of the coated material.

The threads of all galvanized bolts and screwed rods shall be cleared of spelter by spinning or brushing. A die shall not be used for cleaning the threads unless specially approved by the Client. All nuts shall be galvanized with the exception of the threads which shall be oiled.

Surfaces which are in contact with oil shall not be galvanized or cadmium plated.

Partial immersion of the work shall not be permitted, and the galvanizing tank must therefore be sufficiently large to permit galvanizing to be carried out by one immersion.

Galvanizing of wires shall be applied by the hot dip process and shall meet the requirements of BS EN 10244-2.

5.6 Rating Plates, Labels and Markings

On each main and auxiliary item of equipment, permanent mark shall be fastened on a visible place and the mark shall be made of resistant material to atmospheric influence. It shall have engraved or impressed the name of the manufacturer and its hallmark, as well as type, serial number and mark of the equipment position and details related to performance characteristics.

On each panel, board, cubicle, boxes as well as on each equipment installed in such panel, board, cubicle and boxes, adequate rating plates shall be provided.

Rating plates for panels, boards, cubicles and boxes shall be fixed on front and rear side and shall contain the name of panel, board, cubicle and box including item designations.

Rating plates for equipment on which the item designations of equipment are indicated shall be fixed on the equipment themselves and in their immediate vicinity, to facilitate interchangeability, dismantling and assembly.

The rating plates of the equipment and data on them shall be in accordance with applicable IEC standards. NEPCO property plates of equipment shall be indicated as well. During engineering/design stage, the Client shall submit those details to the Contractor.

Thickness of rating plate shall be at least 2 mm.

Rating plates, labels and markings shall be subject of the Client's approval. The material of all labels and the dimensions, legend, and method of printing shall be subject of the Client's approval as well.

Colours shall be permanent and free from fading.

The surface of indoor labels shall have a matt or satin finish to avoid dazzle from reflected light.

All labels and rating plates for outdoor use shall be of stainless-steel material with black engraving.

Protective washers of suitable material shall be provided front and back on the securing screws.

All apparatus shall be clearly labelled indicating, where necessary, its purpose and service positions. Each phase of alternating current and each pole of direct current equipment and connections shall be coloured in an approved manner to distinguish phase or polarity.

Phases of three-phase alternating current systems shall be identified as follows:

Phases	Phases for Transformers	Colour
A R	U	Red
B S	V	Yellow
C T	W	Blue

Phases on outdoor equipment shall be identified by coloured discs attached to the structures at the following locations:

- On tubular busbars midway between taps and at tapping points,
- On tensioned busbars or other tensioned connection spans, next to the anchor points at one end of every span,
- On overhead line gantries, transformer gantries, next to the anchor points,
- On each transformer and circuit breaker.

Such nameplates or labels shall be of non-hygroscopic, non-transparent or translucent heat resisting material with engraved or impressed lettering of a contrasting colour or, alternatively, in the case of indoor circuit breaker, etc., of transparent plastic material with suitably coloured lettering engraved on the back. Size, colour and engravings shall be subject to acceptance by the Client.

All inscriptions on rating plates, labels and markings shall be in English except for "*Danger*" and "*Warning*" signs which shall be in both English and Arabic. Colour for "*Danger*" and "*Warning*" signs shall be approved by the Client.

Items of equipment, such as valves, which are subject to handling, shall be provided with an engraved chromium plated brass nameplate or label not less than 3 mm thick with engraving filled with enamel.

The interior of each piece of equipment shall be clearly marked to show the phases and for this purpose either coloured plastic discs screwed to fixed components or identification by means of plastic sleeve or tape shall be used.

In addition, each item of switchyard & switchgear shall have number plates bearing the switch number allocated by the Client according to his standard operational switch numbering scheme. Details of the number plates shall comply with NEPCO standard operational numbering system.

5.7 Cleaning and Painting

5.7.1 General

All paints shall be applied in strict accordance with the Manufacturer's instructions.

All painting shall be carried out on dry and clean surfaces and under suitable atmospheric and other conditions in accordance with the Manufacturer's recommendations.

5.7.2 Works Processes

All steelwork, equipment supporting steelwork and metalwork, except galvanised surfaces or where otherwise specified, shall be shot blasted to BS 7079 (second quality finish) or Swedish Standard SA2½.

All surfaces shall then be painted with one coat of epoxy zinc rich primer, two pack type, to a film thickness of 50 microns. This primer shall be applied preferably by airless spray and within twenty minutes (20 min) but not exceeding one hour (1 h) of shot blasting.

All rough surfaces of coatings shall be filed with an approved two pack filler and rubbed down to a smooth surface.

The interior surfaces of all steel tanks and oil filled chambers shall be shot blasted in accordance with BS 7079 (first quality finish) or SA3 and painted within a period of preferably twenty minutes (20 min) but not exceeding one hour (1 h) with an oil resisting coating of a type approved by the Client.

The interior surfaces of mechanism cubicles, boxes and kiosks, after preparation, cleaning and priming as required above, shall be painted with one coat zinc chromate primer, one coat phenolic based undercoating, followed by one coat phenolic based finishing paint to a light or white colour. For equipment for outdoor use this shall be followed by a final coat of anti-condensation paint of a type approved by the Client, to a light or white colour. A minimum overall paint film thickness of 150 microns shall be maintained throughout.

All steelwork and metalwork, except where otherwise specified, after preparation and priming as required above shall be painted with one coat metallic zinc primer and two coats of micaceous iron oxide paint to an overall minimum paint film thickness of 150 microns.

Galvanized surfaces shall not be painted in the works.

All nuts, bolts, washers etc, which may be fitted after fabrication of the equipment shall be painted as described above after fabrication.

5.7.3 Site Painting

After erection at site, the interior surfaces of mechanism cubicles and kiosks shall be thoroughly examined, and any deteriorated or mechanically damaged surfaces of such shall be made good to the full specification described in the Clause above.

All surfaces of steelwork and metalwork included in the Clause above shall be thoroughly washed down, any deteriorated or otherwise faulty paintwork removed down to bare metal and made good to the full specification described in the Clause above, then painted one further coat of phenolic based undercoating and one coat phenolic based hard gloss finishing paint to provide an overall minimum paint film thickness of 200 microns.

Any nuts, bolts, washers, etc, which have been removed during site erection, or which may be required to be removed for maintenance purposes shall be restored to their original condition.

All paintwork shall be left clean and perfect on completion of the works.

5.8 Oil and Insulating Compounds

The insulation oil shall comply with Standard IEC 60296:2020 (latest version) .

The transformer oil shall be a highly refined uninhibited mineral naphthenic oil suitable for use as an insulating and cooling medium in transformers. The oil shall be free from corrosive sulphur (as per IEC 62535), PCB, DBDS (dibenzyl disulphide), Antioxidant, passivator, metal deactivator and other additives.

Each 132 kV outdoor instrument transformer shall be impregnated and filled with oil of the grade specified in IEC 60296.

Where oil for the first filling is to be provided it shall be supplied by the manufacturer in non – returnable drums.

Resin insulation shall comply with the requirements of IEC 60455.

5.9 Impact on Environment

The equipment and materials shall be designed and manufactured with maximum care on environment.

5.10 Electromagnetic Compatibility

The equipment and materials shall comply with requirements for electromagnetic compatibility stated in IEC 61000 Standard.

5.11 Earthing

All metal parts, other than those forming part of any electrical circuit, shall be connected to the main substation earthing system by means of a hard drawn high conductivity copper earthing conductor with a cross sectional area such that the current density is not greater than 200 A/mm^2 for 1 second fault durations and not greater than 100 A/mm^2 for 3 second fault durations with a minimum of 60 mm^2.

5.12 Lubrication

Bearings, which require lubrication either with oil or grease, shall be fitted with nipples.

Grease lubricators shall be fitted with nipples complying with latest related IEC. Where necessary for accessibility, the nipples shall be placed at the end of extension piping. The Contractor shall supply at least one grease gun for each type of nipple provided. Where more than one special grease is required a grease gun for each special type shall be supplied and permanently labelled.

5.13 Motors

All motors shall comply with IEC 60034 and shall have dimensions according to with IEC 60072. They shall be capable of operating continuously under actual service conditions without exceeding the specified temperature rises, determined by resistance method, at any frequency between 48 and 51 Hz together with any voltage between ±5% of the nominal value.

All motors shall be totally enclosed, and if they shall be situated outdoor, they shall be weatherproof and suitable for outdoor working. They shall be provided with a suitable means of drainage to prevent accumulation of water due to condensation and with suitable means of breathing.

Motors operating in an ambient temperature not exceeding 40 °C shall have insulation Class F. The temperature rise shall be restricted to that associated with Class B insulation. Where the motor may be appreciably affected by conducted heat, the class of insulation shall be subject of the Client's approval.

All motors shall be suitable for direct starting at full voltage.

Motors shall have sealed ball or roller bearings.

The three-line connections of AC motors shall be brought out to a terminal box. Terminal markings shall be made in a clear and permanent manner and shall comply with IEC 60034. A permanently attached diagram or instruction sheet shall be provided giving the connections for the required direction of rotation. All terminal boxes shall be of the totally enclosed type designed to exclude the entry of dust and moisture and sealed from the internal air circuit of the motor. All joints shall be flanged with gaskets of neoprene or other approved material. Natural rubber insulation shall not be used.

Where single phase motors shall be used the motors will be grouped to form, approximately, a balanced three phase load.

5.14 Motor Control Gear

Motor control gear shall comply with the requirements of IEC 60947-4-1, and they shall be designed according to the duty imposed by the particular application.

Motor contactors shall comply with IEC 60947-4-1 and shall be capable of switching the stall current and shall have a continuous current rating of at least 50% greater than the full load current of the motors they control.

The operating currents of overload relays fitted to motor contractors shall be substantially independent of ambient temperature conditions, including the effect of direct sunlight on the enclosure in which the contactors are installed.

Where small motors are connected in groups, the group protection shall be arranged so that it will operate satisfactorily in the event of a fault occurring on a single motor. The control and protection equipment shall be accommodated in the control cabinet or marshalling kiosk.

Each motor or group of motors shall be provided with control gear for starting and stopping by hand and automatically. Overload and single-phasing protection shall be provided.

5.15 Cable Boxes

Cable boxes shall be suitable for cables entering from above or below as specified. They shall be weatherproof, rodent and insect-proof and shall be complete with all gaskets, glands and associated fittings as may be required to make-off the cables.

Gland plates shall be insulated from the cable boxes and in the case of single-core cables shall be of non-magnetic or insulating material. If metallic gland plates are used, single-core cable glands shall be insulated from the gland plate. Gland plate insulation shall be capable of withstanding a dry high voltage test of 2000 V AC for one minute (1 min).

Where cable boxes are provided for three-core cables, the sockets on the outer phases shall be inclined towards the centre to minimise opening of the cable cores. Cable sockets shall be supplied under this Contract.

Cable boxes for LV cables shall be suitable for XLPE or PVC insulated, steel-wire armoured, PVC covered cables with copper conductors. The boxes shall be air insulated and designed to accommodate all the fittings required by the cable Manufacturer. Front covers and gland plates shall be removable and a 12 mm diameter breathing hole covered with wire gauze shall be provided.

Cable boxes for 33 kV cables shall be air insulated and suitable for 3-core XLPE insulated, PVC covered cables with copper conductors.

Cable boxes shall be capable of withstanding on site the cable high voltage test in accordance IEC 60502.

5.16 Cubicle Wiring

Cubicle wiring shall be insulated with PVC according to IEC 60227. Wires shall not be jointed or tied between terminal points. Bus wires shall be fully insulated and shall run separately from one another along the top or bottom of the cubicle. Miniature circuit breakers or fuses and links shall be provided to enable all circuits in a cubicle, except a lighting circuit, to be isolated from the bus wires.

The DC trip and AC voltage circuits shall be segregated from each other. Circuits to main protection shall be segregated from those for back-up protection and also from protection apparatus for special purposes. Each such group shall be fed through separate miniature circuit breaker or fuse from the bus wires. There shall not be more than one set of supplies to the apparatus comprising each group. All wires associated with the tripping circuits shall be provided with red ferrules marked "*Trip*".

It shall be possible to work on small wiring for maintenance or test purposes without making a switchboard dead.

Insulated stranded wire shall have not less than seven (7) strands and each strand shall be not less than 0.67 mm diameter. If single conductor is used, it shall be annealed copper of circular cross-sectional area of not less than 2.5 mm^2. Flexible conductors of 1.5 mm^2 may be employed on indoor, independently mounted control and protection panels. Single strand 1.5 mm^2 or smaller sizes shall only be employed with a written approval of a Client.

Claw washers or crimped connectors of approved type shall be used to terminate all small wiring.

When connections rated at 380 V and above are taken through junction boxes they shall be adequately screened, and "*DANGER*" notices shall be affixed to the outsides of junction boxes or marshalling kiosk.

All metallic cases of instruments, control switches, relays, etc. mounted on control & protection panels or cubicles shall be connected by copper conductors of cross-sectional area not less than 3.5 mm^2 to the nearest earthing bar.

Where connections to other equipment and supervisory equipment are required the connections shall be grouped together.

For internal wires the identification ferrules shall have at each end the equipment and terminal number to which it connected and the other end equipment and terminal number destination.

5.17 Multicore and Conduit Wiring

All LV AC & DC power cables, control, signalling and measuring cables, communication cables, cable glands, ferrules, cable numbers, cable shoes, etc. shall be provided by Contractor

The design of cabling between the main equipment and the ancillary equipment shall be a part of the Contract.

The cables shall be XLPE, or PVC insulated, steel-wire armoured, PVC covered cables with copper conductors, according to IEC 60228.

In addition, wiring diagrams, cable lists, cable markers, etc. shall be provided.

Where conduit is used, the runs shall be laid with suitable falls and the lowest parts of the run shall be external to the equipment. All conduit runs shall be adequately drained and ventilated. Conduits shall not be run at or below ground level.

Multicore cable tails shall be so bound that each wire may be traced to its cable without difficulty. The spare cores of all multicore cables shall be numbered and terminated at a terminal block in the cubicle. Where cables are terminated in a junction box and the connections to a control and protection panel are continued in conduit, the spare cores shall be taken through the conduit and terminated in a cubicle.

The DC trip and AC voltage circuits shall be segregated from each other. Circuits to main protection and circuits to back-up protection shall be segregated from each other as well.

The screens of screened multicore cables shall be earthed at only one end of the cable. The position of the earthing connections shall be clearly indicated on the diagram.

All wires on panels and all multicore cables shall have ferrules that bear the same number at both ends. At those points of interconnection, between the wiring carried out by separate Contractors, where a change of number cannot be avoided double ferrules shall be provided on each wire. The change of numbering shall be shown on the appropriate diagram of the equipment. The same ferrule number shall not be used on wires in different circuits on the same panels.

5.18 Termination of Cables and Wires

Where cables leave the apparatus in an upward direction the cable boxes shall be provided with a barrier joint to prevent leakage of cable compound into the apparatus. Where cable cores are liable to contact with oil or oil vapour the insulation shall be unaffected by oil.

PVC sheathed cables shall be terminated by compression glands complying with BS 6121-1 and IEC 62444 (or equivalent).

Auxiliary cables in which the individual cores are not insulated with paper shall be terminated with compression type glands, clamps or armour clamps complete with all the necessary fittings.

Colours shall be marked on cable box tail ends and single core cables at all connecting points and/or any positions the Client may determine. Cable boxes shall be marked with stamped brass labels indicating the purpose of the supply where such supply is not obvious or where the purpose of the supply where such supply is not obvious or where the Client may determine.

All cables shall be identified and shall have phase colours marked at their terminations.

All incoming and outgoing connections shall be terminated at a terminal block. Direct termination into auxiliary switches shall not be accepted.

5.19 Terminal Blocks

Terminal blocks shall be of good quality non-flammable insulating material, with a Comparative Tracking Index (CTI) of not less than 500 according to IEC 60112.

Terminal boards shall be spaced not less than 100 mm apart and the bottom of each board shall not be less than 200 mm above the incoming cable gland plate. For relay panels, they shall be mounted at the sides of the cubicle

and set indirectly towards the rear doors to give easy access to terminations and to enable ferrule numbers to be read without difficulty. Separate studs shall be provided on each terminal strip for internal connection and outgoing cables including spare cores.

Studs of stud type terminal boards shall be locked in the base to prevent turning and all connections shall be made on the front of the terminal block using lock nuts or lock washers. Where crimped type terminations are provided, at least two (2) sets of crimping tools shall be supplied for each installation.

Terminals shall be of the insertion clamp type incorporating captive pressure screws, which do not bear directly on the wire but on a serrated clamping plate. The pressure screws shall have an inherent locking feature and terminal entries should be shrouded such that no current carrying metal is exposed.

Where connections are to be made between the multicore cables supplied and telephone type multicore cables, then the terminal block shall comprise a stud or clamp type terminal for the multicore cable and a soldered tag for the telephone cable joined by a withdrawable insulated link. These terminals shall also be provided with facilities for the insertion of test probes on both sides of the link.

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

The use of terminal blocks as junction points for wires which are not required in the associated cubicle shall be avoided wherever possible.

Terminal blocks shall include short circuiting links for CT circuits and open circuiting links for VT and other circuits as necessary and shall be suitable for the connection of test plugs.

All terminal blocks shall have a minimum of 20% spare terminals.

5.20 Miniature Circuit Breakers, Fuses and Links

For protection and isolation of circuits associated with protection, control and instruments, miniature circuit breakers or fuses and links shall be used, although miniature circuit breakers are preferred.

Miniature circuit breakers (MCBs) shall be designed and tested in accordance with IEC 60947-5-1 and supplementary requirements of this Technical Specification. They shall be suitable for use over the full range of expected voltage variations as specified in these Technical Specifications.

They shall be suitably rated for both the continuous and short circuit loadings of the circuits they are protecting under all service and climate conditions at the Site defined within Clause 3 of these General Technical Specifications.

For three phase circuits, the miniature circuit breakers shall be of the three-pole type, for single phase circuits they shall be of the single-pole type and for DC circuits they shall be of the double-pole type.

Where miniature circuit breakers are used in circuits containing inductive loads, e.g. operating coils, it is essential that they are suitable for satisfactory operation in the circuit in which they are used, i.e. account of the circuit time constant shall be considered.

All miniature circuit breakers shall be provided with an auxiliary contact(s) for remote indication of circuit breaker operation.

Means shall be provided to prevent the miniature circuit breakers being inadvertently switched to the "*OFF*" position.

Miniature circuit breakers shall be mounted in such a manner to give easily visible indication in order to facilitate identification and easy replacement.

Carriers and bases for fuses and links shall be in accordance with IEC 60269 and shall be colour coded to permit identification of the circuit rating.

The fuses and links mounted in cubicles for tripping circuits and protective gear test links shall be mounted on the front of the panel. Other links and fuses shall be accommodated within the cubicle or above the cubicle doors. Fuses and links shall be grouped and spaced according to their function in order to facilitate identification.

All incoming circuits in which the voltage exceeds 125 volts shall be fed through insulated fuses and/or links, and the supplies shall be connected to the bottom terminal. The contacts of the fixed portion of the fuse or link shall be shrouded so that accidental contact with live metal cannot be made when the moving portion is withdrawn.

Main supply fuse links shall be of the high rupturing capacity cartridge type.

Where fuse carriers are mounted vertically the incoming (supply) side shall be the bottom terminal.

Where either fuses or circuits breakers shall be used, it should be ensured that proper discrimination between main and sub-circuits is achieved.

5.21 Marshalling Kiosks and Junction Boxes

The Contractor shall provide, on the site adjacent to each circuit breaker as appropriate, a marshalling kiosk to which all outgoing connections from the associated main equipment will be run for housing ancillary apparatus.

Marshalling kiosks shall be made of steel sheet with minimum thickness of 2 mm, formed on a framework of standard rolled sections.

All outdoor kiosks and boxes shall be protected in accordance with the IP55 degree of mechanical protection according to IEC 60529 and shall be insect and rodent proof. Each marshalling kiosk and/or cabinet shall be provided by interior light, door switches, and heaters with thermostat.

Ventilation louvers shall be provided and divisions between compartments shall be perforated.

All cables shall enter kiosks and boxes at the base.

Each compartment of all kiosks and junction boxes shall be provided with access doors at the front and rear side. Doors and access covers shall not be secured by nuts and bolts but shall be fastened with integral handles with provision for locking.

Doors for kiosks shall be of the lift-off and hinged type and shall be provided with glazed windows of adequate size to facilitate reading of indicators from outside the kiosk.

Doors and covers under 15 kg mass may be of the slide-on pattern but above this mass hinged doors shall be used.

If three-phase connections are taken through a kiosk or box they shall be adequately screened or insulated and suitably marked with the phase colour code. A "*Danger*" notice, stating the voltage shall be fixed on the inside and outside of the kiosk or box.

A durable copy of the circuit and wiring diagram shall be affixed to the back of the kiosk door and labels shall be provided inside each kiosk or box to describe the functions of the various items of equipment.

A watertight 16 A, 3-pin, interlocked switched socket with plug for a 240 V AC supply shall be mounted externally on a marshalling kiosk. This switched socket shall be connected to the kiosk heater supply circuit through a 16 A fuse in the line lead. The earthing terminal shall be earthed.

5.22 Padlocks

Where required by the Technical Specification, non-ferrous padlocks with different key changes and three (3) keys for each lock and a master key for each substation, shall be provided.

Cabinets for the accommodation of padlocks and keys, whilst not in use, shall be provided and shall be suitably labelled so that keys will be readily identifiable.

5.23 Locking Facilities

Locking facilities shall be provided on each item of substation equipment as detailed below and shall be additional to the mechanical interlocking devices where specified.

Locks and keys shall be in accordance with the requirements of this specification.

Where a mechanism is to be locked in a specific position, the locks shall be fitted to that part of the mechanism where the operating power is applied and not remote or ancillary linkages.

The following locking facilities shall be provided:

- Circuit breaker mechanism in the open position and any associated manual operating device in the neutral position,
- Disconnector and earthing switches in both open and closed positions,
- Access doors or gates to circuit enclosures,
- Circuit breaker control switches in the neutral positions,
- Control position selector switches in all position provided,
- Marshalling, operating and terminal kiosks or cubicle access doors and panels,
- Air system isolating valves in open or closed positions.

Locks shall be designed construction and located on the equipment so that they will remain serviceable in the climatic conditions specified without operating or maintenance for continuous periods of up to two (2) years and with suitable maintenance shall be fit for indefinite service.

5.24 Special Tools

A complete set of spanners shall be supplied for each substation to fit every nut and bolt head on the apparatus supplied under this Contract, together with all special tools required for the adjustment and maintenance of the equipment. These tools shall be mounted in a lockable cabinet at each substation and shall also be provided under this Contract.

Eyebolts that have to be removed after use shall be accommodated in the cabinets.

Spanners and other maintenance equipment provided under the Contract shall not be used for the purpose of erection of the equipment.

5.25 Spare Parts and Materials

The Tenderer shall include in his Tender, the spare parts and materials which are stated in Price Schedules – Optional Goods.

The prices for these defined additional goods shall be stated within the Price Schedules – Optional Goods (Section V: *Tender Forms*) and the price of those additional activities shall not be included in the Total Tender Price.

The Client may order all or any of the stated spare parts and materials. These items shall be optional and shall be included in the definite work only with the written request from the Client.

Any spare apparatus, parts and tools shall be subject to the same technical specifications, tests and conditions as similar equipment supplied under the Definite Work section of the Contract. They shall be strictly interchangeable and suitable for use in place of the corresponding parts supplied with the equipment and must be suitably marked and numbered for identification and prepared for storage by greasing or painting to prevent deterioration.

All spare apparatus or materials containing electrical insulation shall be packed and delivered in cases suitable for storing such parts or material over a period of years without deterioration. Such cases shall have affixed to both the underside and topside of the lid a list detailing its contents. The cases shall remain the property of the Client.

5.26 Degrees of Mechanical Protection

The following degrees of protection shall be provided in accordance with IEC 60529:

- For outdoor applications: IP55.
- For indoor applications, where purpose-built building is provided, e.g. switch, control, and relay rooms in auxiliary/control buildings: IP41.
- Where dust can adversely affect equipment within the enclosure, this equipment should be separately housed with a degree of protection of IP51.

5.27 Supply Voltage

All incoming supplies, greater than 125 V (phase-to-earth) shall have their terminations shrouded by a suitable insulating material.

5.28 Control and Protection Panels and Facilities

All remote control, protection relay, alarm and instrumentation facilities shall be located in a control room within the substation control building, and mounted on panels arranged in suites according to their function i.e. control, protection, metering, etc.

All control, alarm and indication facilities shall be grouped on a per circuit basis each on its own section or complete control panel.

Protection relays shall also be panel mounted on a per circuit basis, each circuit being allotted its own panel.

All power operated equipment shall be operable either locally on site or remotely from the control room, but the two systems shall not be in operation simultaneously. Facility for selection of "*remote*" or "*local*" control shall be provided on site adjacent to the equipment being controlled.

Each cubicle shall be fully wired and equipped with all necessary equipment, including alarms, indication and test facilities, isolating facilities, instruments, fuses and cable terminations, etc. as specified.

All circuits, equipment, control switches, etc shall be clearly labelled with their purpose and function.

Indicating devices shall preferably be of the hand dressed discrepancy type.

Panels shall be constructed from steel sheet, designed to be self-supporting and be vermin and termite proof. They shall not be less than 600 mm wide, and in no case shall the depth exceed the width. The doors shall be hinged to lie back flat to avoid restricting access. Hinges shall be of the lift-off type. Doors shall be secured by lockable handles, which shall be placed not more than 1.8 m above floor level.

Circuit labels shall be provided on the front and back of each panel and on the outside of the cubicle doors.

Where specified, accommodation shall be provided for ancillary apparatus (remote metering and signalling equipment, transducers and interposing current transformers, etc.).

Alarm and indication equipment as specified, shall be provided in the control room to indicate the operation of the main and back-up system protections, operation of the equipment alarms including those on the power transformers, switchgear and all other alarms which are required for the satisfactory operation of the complete substation.

Alarm annunciator equipment as specified, shall be mounted adjacent to the mimic diagram panel, capable of accepting all the alarms required within the substation, and compatible with the relay equipment provided, i.e. capable of accepting the alarm signal generated.

Where mimic diagrams are not specified, indicating devices shall be provided adjacent to the circuit breaker control handle or switch to show whether the circuit breaker is open or closed.

A common bell or buzzer shall be provided to give audible alarm when any circuit breaker has tripped automatically. Means shall be provided for silencing the audible alarms whilst leaving it free to sound when the tripping of any other circuit breaker occurs.

Indicating lamps and lamp-holders shall be so arranged that replacement of lamps and the cleaning of glasses and reflectors can be readily carried out.

Indicating lamp glasses on control & protection panels shall be white.

All control and protection panels shall have a continuous earthing bar of sectional area not less than 70 mm^2, run along the bottom of the panels, each end being connected to the substation earthing system. Metal cases of instruments and metal bases of relays on the panels shall be connected to this bar by conductors of cross-sectional area not less than 3 mm^2.

The closing circuit, signalling circuits and each tripping circuit shall be separately fused.

All control circuits shall be provided with suitable means of isolation.

Control and protection panels shall be equipped with single-phase, service socket-outlet of an approved type and an interior light controlled by a door operated switch. Anti-condensation heaters controlled by thermostat shall be provided as well.

5.29 Control and Selector Switches

Switches shall comply with the requirements of IEC 60947, and they shall be designed according to the duty imposed by the particular application.

Switches shall be designed to prevent them from being operated inadvertently.

Means shall be provided for locking the control switches when they are in the "*neutral*" position.

Control switches of the discrepancy type shall require two independent movements to effect operation. The control switch shall be so designed that when released by the operator it shall return automatically to the "*neutral*" position after having been turned to the "*closed*" position and shall at the same time interrupt the supply current.

Means shall be provided for locking selector switches in the "*remote*" position. Where selector switches are required to have a "*neutral*" position, means for locking in this position shall be provided.

5.30 Indicating Lamps and Fittings

Indicating lamps shall be fitted onto the front of the cubicles & panels and shall be adequately ventilated. Lamps shall be easily removed and replaced from the front of the panel by manual means not requiring the use of extractors.

The base of metal or other approved material holding the lamp glass shall be of an approved finish and shall be easily removable from the body of the fitting so as to permit access to the lamp and lamp glass.

The lamps shall be clear and shall fit into an accepted standard form of lamp holder. The rated lamp DC voltage shall be 10% in excess of the auxiliary, supply voltage.

Colour	Class of Indication	Example
Red	Circuit breaker or contactor closed	Reserved only for the function mentioned.
Green	Circuit breaker or contactor open	Reserved only for the function mentioned.
White	Lamp normally alight	Voltage healthy, trip supply healthy, equipment in normal service, etc.

Annunciator Windows

Colour	Class of Indication	Example
Crimson Red	Trip indication on which action is necessary	Circuit breaker tripped due to fault, etc.
Amber	Alarm indication on which action is necessary	Transformer over temperature alarm, charger failure, circuit breaker tripped due to fault, etc.
Blue	Signal (with label)	Circuit breaker closing spring being charged, tap change in progress.

The colour shall be in the glass and not an applied coating and the different coloured glasses shall be interchangeable. Transparent synthetic materials may be used instead of glass, provided it can be shown that such materials have bright colours and are completely suitable for operating in tropical climates.

5.31 Instruments

All indicating instruments shall comply with IEC 60051 and shall have adequate scale. Unless otherwise indicated all indicating instruments shall have 100 mm dials. Instruments dials shall in general be white with black markings and shall be reversible where double scale instruments are specified.

Induction type watt hour meters shall comply with IEC 62053-11 and 62052-11. They shall be suitable for working from a 3-phase, 3-wire supply and be of the 2 or 3-element unbalanced load type (where applicable). Test terminals shall be provided to permit calibration checks to be made when required.

All instruments shall be flush-mounted.

5.32 Auxiliary Switches

Where appropriate, each item of equipment shall be equipped with all necessary auxiliary switches, contacts and mechanisms for indication, metering, control, interlocking, supervisory and other services. All auxiliary switches shall be wired up to a terminal block on the fixed portion of the equipment, whether they are in use or not in the first instance.

All auxiliary switches and mechanisms shall be mounted in approved accessible positions clear of the operating mechanisms and shall be protected in an approved manner. The contacts of all auxiliary switches shall be strong and shall have a positive wiping action when closing.

Groups of auxiliary switches and associated terminal blocks shall be arranged to facilitate extension.

The timing of the auxiliary contacts shall suit the particular application.

Auxiliary switch repeat relays may only be used where the requirements cannot be met by actual auxiliary switch contacts and with the specific approval of the Client.

5.33 Supervisory Control Facilities

Facilities shall be provided on all equipment to permit the repeat of appropriate indications, alarms and controls by telemetry to a remote-control centre. This shall suit a conventional SCADA system with hard wired connections taken to an interface-marshalling cubicle.

5.34 Power Supply Voltages

The available power supply voltages at the Substations shall be:

- 400 V, 50 Hz, 3-phase, 4-wire,
- 230 V, 50 Hz, single-phase,
- 110 V DC & 50 V DC.

Equipment provided under this Contract shall operate reliably within the voltage limits stated in the Particular Technical Specifications or in the appropriate IEC Standard. Where different limits are stated in the Particular Technical Specifications and the IEC Standard, the Particular Technical Specifications shall prevail. Where no limits are specified, the equipment shall be capable of operating reliably within the following operation ranges:

- AC equipment: From 80% to 110% of nominal voltage,
- DC equipment: From 80% to 120% of nominal voltage for general loads. For closing and opening releases required DC voltage range is specified in Particular Technical Specifications, section VI, Sub-Section 3.1.1.2.)

Particular Technical Specifications

PARTICULAR TECHNICAL SPECIFICATIONS

General

These Particular Technical Specifications together with the General Technical Specifications refer to the special technical requirements for the design, engineering, manufacture, inspection and testing in factory, packing for export, supply CFR (Cost and Freight) Aqaba port, supervision of erection and commissioning activities at sites, and guarantee (maintenance) for a period of 36 calendar months from the date of receipt of last consignment at site for the required transformers with associated equipment.

Wherever possible, these Particular Technical Specifications shall be applied in conjunction with the General Technical Specifications. In case of discrepancies between the Particular and Special Technical Specifications, the Particular Technical Specifications shall prevail.

Single line diagrams, layout and cross section drawings of the substations and main equipment have been presented within the Sub-Section 4: Drawings.

1.1. Main Requirements for New Equipment

The transformers (main transformers and neutral earthing & auxiliary power supply transformers), which are subject of these Technical Specifications, shall be installed in the following Substations:

1. Ishtafina Substation 132/33KV (Existing).
2. Abdali Substation 132/33KV (Existing).
3. Subeihi Substation 132/33KV (Existing).
4. Sabha Substation 132/33KV (Existing).
5. Manara Substation 132/33KV (Existing).

Transformers shall be designed in accordance with the requirements of the Standard IEC 60076 and other relevant Standards if not otherwise required in this Specification.

Transformers with associated auxiliary equipment shall be designed in such a manner to meet the requirements required in this Technical Specifications, Schedules D (Technical Data) and Drawings at climate conditions at the Site defined within Clause 3 of General Technical Specifications (Sub-Section 3.1).

The rated characteristics of main transformers and earthing & auxiliary transformers are given in schedule A: Scope of Supply & schedule D: Schedule of Technical Data.

The Contractor shall be responsible for complete scheme (transformer voltage control scheme, transformers parallel operation, transformer cooling scheme, etc.) and proper functioning of the equipment procured within this contract.

1.2. Technical Description and Data of Existing Equipment

Since the new transformers for the of Ishtafina, Abdali, Subeihi, and Sabha 132/33 kV substations shall be able to operate in parallel with the existing transformers at each respective substation, the characteristics of these existing transformers are provided in the following table.

Transformer Characteristic	Substation Abdali 132/33 kV				
	TR.1	TR.2	TR.3	TR. 4	TR.6
Manufacturer	BHARAT	BHARAT	TBEA	Electroputere	Electroputere
Rated power	40	40	80	80	80
Rated transformation ratio	132/33 kV				
Year of production	1992	1993	2024	2008	2008
Vector group	YNd1				
Short circuit impedance at principal tapping	10.74%	10.78%	12.5%	13%	12.2%

Transformer Characteristic	Substation Ishtafina 132/33 kV			Substation sabha 132/33 kV		
	TR.1	TR.2	TR.4	TR. 1	TR. 2	TR.3
Manufacturer	HAWKER Siddeley Power transformers limited	Electroputere	LEEEC	BHARAT	BHARAT	LEEEC
Rated power	45 MVA	40 MVA	63 MVA	40 MVA	40MVA	40 MVA
Rated transformation ratio	132/33 kV					
Year of production	1975	2001	2018	1993	1993	2018
Vector group	Ynd1					
Short circuit impedance at principal tapping	12.4%	13.24%	12.68%	12.89	12.9	12.39

Transformer Characteristic	Substation Manara 132/33 kV		Substation Subihi 132/33 kV	
	TR.1	TR.2	TR. 1	TR. 4
Manufacturer	Electroputere	Electroputere	Fuji	Electroputere
Rated power	80 MVA	80 MVA	63	63
Rated transformation ratio	132/33 kV			
Year of production	2009	2009	1985	2001
Vector group	Ynd1			
Short circuit impedance at principal tapping	12.45	12.53	12.73	12.70

The existing transformers AVR scheme shall be modified in order that the scheme shall be capable of performing the following functions:

- Each transformer shall be able to operate on master mode, while the other transformers working on the follower mode,
- Several transformers cannot be selected to master mode at same time,
- It shall be possible to operate each transformer independently,
- The scheme shall allow selecting any transformer to off position while the other transformers are selected to independent mode,
- All costs of these modifications shall be included in the Tender Price.

1.3. Guarantees, Penalties and Rejection of Supply

Contractor shall guarantee that transformers shall fully comply with characteristics given in: Schedule D Technical Data.

In case that the supplied equipment does not comply with requirements stated in these Particular Technical Specifications, as well as those stated in the Schedule of Technical Data, the Client has a right to reject the Supply.

For the transformers the following guarantees are of particular importance:

- Rated power (IEC 60076-1),
- Losses (IEC 60076-1),
- Transformer temperature rise (IEC 60076-2),
- Short-circuit impedance (IEC 60076-1),
- No-load current (IEC 60076-1),
- Voltage ratio,
- Sound pressure/sound power level (max. permitted values according to NEMA TR-1 Standard, calculation of sound power level according to IEC 60076-10).

Tolerances shall not exceed the values specified in IEC 60076.

Guaranteed maximum values of no-load and load losses and auxiliary losses (input to cooling system) shall be filled-in financial schedule.

For the (Transformers) evaluation purpose, main transformer no-load losses and load losses including the transformer cooling power (filled-in financial offer) shall be capitalized in accordance with the following formula:
Total Cost = IC + 9369.6 (P0 + Pc0) + 2343 (Pk + Pcs – Pc0),
Where:

- IC: Transformer initial cost;
- P0: No load losses at rated tap;
- Pc0: The cooling power for no load operation;
- Pk: Load losses at rated tap;
- Pcs: Total cooling power at rated Power.

Tenders for (Transformers) shall be evaluated based on the main transformer Total Cost.
Alternative proposals are not permitted.

The Client will determine for each tender the evaluated tender price by adjusting the tender price as follows:
(i) Making any correction for arithmetical errors;
(ii) Applying the discounts offered, if any, by the Participant;
(iii) Adding the cost of quantifiable non-material deviations and omissions;
(iv) Adding Capitalized Losses.

The most economically advantageous tender is the tender, which has the lowest evaluated tender price

If any of the measured values of losses exceeds the guaranteed values, NEPCO will have right to exercise one of the following options:

- Reject the any transformer,
- Penalty for complete shall be recovered from the Contractor for the excess losses of any transformer as under:
  - JOD 14054.4 per kW for the no-load losses,
  - JOD 3514.5 per kW for the load losses and auxiliary losses.

It is thereby understood that values of 0.5 kW and above will be rounded up to the next full kW.

In case of either the measured load loss at reference temperature or no-load loss is greater than +15%, or the total loss exceeds 10% of the guaranteed values, the respective transformers shall not be accepted.

For the qualification purpose of the offered transformer, Minimum Peak Efficiency Index requirements according to the applicable standards must be fulfilled**; otherwise, NEPCO will reject any offered transformer.**

The tenderer will use the following equation to calculate the minimum Peak efficiency index, according to BS EN 50708-1-1:2020, and **fill this value in Sch. D:**

$$min.PEI = 1 - \frac{2}{S}\sqrt[2]{(P_O + P_{CO})P_{K1}}$$

S = Maximum Rated Power
P_O = No load Losses

P_{CO} = Cooling Losses
P_{K1} = Load Losses

THE NO LOAD LOSSES, LOAD LOSSES AND COOLING LOSSES SHALL NOT BE MENTIONED IN THE TECHNICAL OFFER.

The reference Table 1 from EN 50708-3-1:2020.
TIER2 shall be applied from 1 July 2021 for the values of losses following Commission Regulation (EU) No548/2014 of 21 May 2014 and its amendment No 2019/1783 of 1 October 2019.
The guaranteed Min. PEI value is 99.758 % for 80 MVA 132/33KV transformer
The guaranteed Min. PEI value is 99.745 % for 63 MVA 132/33KV transformer

NEPCO will recalculate this value using the same formula after the qualification and during financial evaluation. The submitted value by the tenderer must be equal to the calculated value by NEPCO. Any deviation is not accepted, and if the value doesn't fulfil the requirement in reference table 1 from EN 50708-3-1:2020, the offer will be directly rejected.
During tests, the Peak Efficiency Index values obtained from the measured values of no load, load losses and auxiliary losses shall not be below the respective minimum values specified in EN 50708-3- 1:2020 without tolerances.
Actual min PEI shall be determined during FAT, and the tested transformer is subjected to rejection in case of failure of reaching the accepted min. PEI.

2. Design, Materials and Workmanship

2.1. General

The design, materials and workmanship shall be in compliance with the *General Technical Specifications* (Sub-Section 3.1) and particularly with the Clause 3 of these Particular Technical Specifications.
The transformers shall be designed and manufactured to fully correspond to the climatic and operating conditions specified in the *General Technical Specifications* (Sub-Section 3.1).

2.2. Applicable Standards

Unless otherwise specified, the transformers with associated equipment shall be fully designed and manufactured in accordance with these Technical Specifications and the latest editions of the following IEC, BS, and IEEE Standards:

- IEC 60050, International Electrotechnical Vocabulary (IEV),
- IEC 60417 DB, Graphical symbols for use on equipment,
- IEC 60617 DB, Graphical symbols for diagrams,
- IEC 60038, IEC standard voltages,
- IEC 60071, Insulation co–ordination,
- IEC 61936, Power installations exceeding 1 kV a.c.,
- IEC 60721, Classification of environmental conditions,
- IEC 60529, Degrees of protection provided by enclosures (IP Code),
- IEC 61000, Electromagnetic compatibility (EMC),
- IEC 60085, Electrical insulation,
- IEC 60068, Environmental testing,
- IEC 60076, Power transformers,
- BS EN 50708-3-1, Power transformers – Additional European requirements,
- IEC 60404, Magnetic materials,
- IEC 60214, Tap-changers,
- IEEE Std C57.91, Guide for Loading Mineral – Oil – Immersed Transformers,
- IEC 60616, Terminal and tapping markings for power transformers,
- IEEE Std C57.148, Standard for Control Cabinets for Power Transformers,
- IEC 60137, Insulated bushings for alternating voltages above 1000 V,
- IEC 60815, Selection and dimensioning of high-voltage insulators intended for use in polluted conditions,
- IEC 62155, Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1 000 V,
- IEC 60296 Fluids for electrotechnical applications – Mineral insulating oils for electrical equipment,
- IEC 62535 Insulating liquids - Test method for detection of potentially corrosive sulphur in used and unused insulating oil,
- IEC 61869-2, Instrument transformers - Additional requirements for current transformers.
- BS EN 50708-1-1:2020, Power transformers — Additional European requirements: Part 1-1: Common part — General requirements
- BS EN 50708-2-1:2020 Power transformers — Additional European requirements: Part 2- 1: Medium power transformer — General requirements,
- BS EN 50708-3-1:2020 Power transformers — Additional European requirements: Part 3-1 Large power transformer — General requirements,
- IEC TS 60076-20:2017, corr 2018, Energy efficiency

If the Tenderer offers design, equipment, workmanship or testing in compliance with any Standard which deviates from the above-mentioned Standards, such deviations shall be submitted along with his Tender.

Application of any Standard other than the above mentioned, shall be the subject of the Client's approval.

2.3. General Design Requirements

Transformers shall be three-phase, two-winding, oil immersed for outdoor installation.

The design and manufacture of the transformers with associated equipment shall be in accordance with the latest state-of-the-art technology in this field and it shall be envisaged for a long-term operation.

Particular attention shall be paid to preparation of adequate conceptual solution, easy access, simple operation and logical arrangement of individual parts.

Spare parts shall be fabricated to enable easy installation and accurate fitting, without the need for subsequent adjustments.

Easy and smooth maintenance of the transformers and associated equipment shall be ensured.

During continuous operation with rated characteristics, no part of the equipment shall be damaged due to overheating.

Transformers of the same type shall be identical and completely interchangeable. Furthermore, transformers parts and devices having the same rated values and characteristics shall be identical and completely interchangeable as well.

Transformers shall be designed to withstand earthquake loadings of the accelerations which are specified in the Clause 3 within Sub-Section 3.1: *General Technical Specifications*.

The transformers shall be capable to withstand for three seconds (3 s) an external short circuit between phases without any damage. The value of short-circuit current is specified in Schedule D Technical Data.

The transformers shall be able to withstand, without any damage, the highest voltages and loads, which might occur in any conceivable operating condition.

All elements exposed to significant wear shall have removable wearing parts in order to enable easy and cost-effective repair or replacement.

2.4. Operation at Voltage and Frequency Different than Rated Values

The transformers shall be designed and constructed to operate within voltage and frequency deviations in the electric power system as defined in the latest edition of NEPCO Transmission Grid Code.

2.5. Ability to Withstand Short Circuit

According to Standard IEC 60076-5, the transformers shall be designed and constructed to withstand without damage the thermal and dynamic effects of external short circuits. Contractor shall submit all necessary calculations to prove ability to withstand these thermal and dynamic effects of external short circuits.

The transformers and all associated facilities (e.g. tap-changer) shall be designed and constructed for the value and duration of the short-circuit current indicated in schedule D Technical Data, when operating on any tapping position

Thermal ability to withstand short-circuit shall be demonstrated by calculation (according to Standard IEC 60076-5).

The ability to withstand the dynamic effects of short-circuit shall be demonstrated by calculation and design consideration (according to Standard IEC 60076-5). Validation by comparison with a previously tested similar transformer or tests on representative models is required.

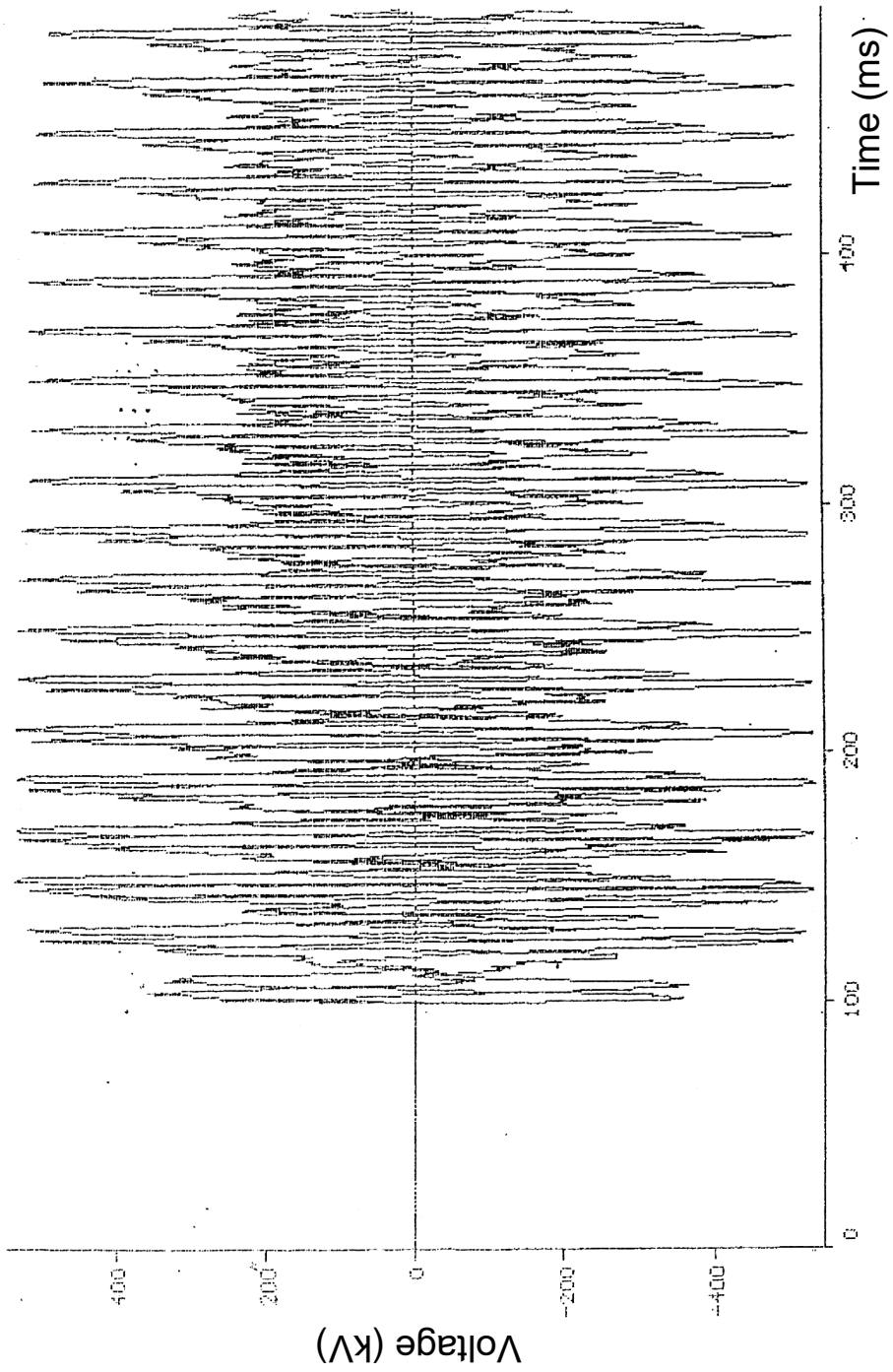
2.6. Ability to Withstand High Temporary Overvoltage (TOVs)

Electro Magnetic Transient Program (EMTP) studies of the NEPCO 132 kV system indicate that the system is characterised by high Temporary Overvoltage (TOVs). The design of the transformers shall take into account the presence of such TOV's and the Contractor shall guarantee that the life of the transformers shall not be significantly shortened if subjected to such overvoltage.

The voltage-time characteristic of the TOVs is given in the Table below.

Time (s)	132 (145) kV system (kV peak/p.u.)
0-1	170/1.45
1.5	160/1.35
2.0	150/1.27
6.0	140/1.2
10.0	130/1.1
15.0	(N/A)

A typical voltage waveform for the above conditions is presented on the Figure below.



2.7. Packing and Transport

2.7.1 General

Packing and transport shall be arranged according to Sub-Section 3.2: *General Technical Specifications*. In addition, the following requirements shall be fulfilled.

Transformer shall be transported with oil and they shall be filled to such a level as to cover the windings completely.

The method of packing shall provide adequate protection to the tank, and those parts contained within and attached without, for transportation.

All openings for transformer components, e.g. bushings that have been removed from the transformers during transport, shall be covered by blinking-off plates. Transformers shall be equipped with instruments to register "shock" loading suffered during transport.

All parts shall be carefully packed for transport in such a manner that they are protected against mechanical injury and the injurious effects of water and climatic conditions encountered during transit to their destination, as well as during long storage before installation.

2.7.2 Specification

According IEC 60076-1 Clause 9.5, the centre of gravity of the transformer in the transport configuration shall be permanently marked on at least two adjacent sides of the transformer.

The transformer shall be designed and manufactured to withstand a constant acceleration of at least 20 m/s^2 in all directions (in addition to the acceleration due to gravity in the vertical direction) without any damage, demonstrated by static force calculations based on a constant value of acceleration. The Calculation shall be submitted by Contractor along with the Tender.

The transformers shall be transported and shipped in a contamination and moisture proof, seaworthy container in accordance with international standards.

The transformer shall be well protected against rain during transportation to prevent rainwater from wetting the transformer.

2.7.3 Electronic Impact Recorder

One electronic impact (shock) recorder shall be rigidly attached to each transformer, in order to record all horizontal and vertical impacts suffered during transportation. The recorder is shall be of supplier/manufacturer property, to be suitably sealed, and the seal shall only be broken by the NEPCO on arrival at site in order to release the registered data.

The recorder is to be operative from time of packing in factory to whole Contract period, in order to provide an uninterrupted record of all registered data. All means to ensure uninterrupted work of impact recorders during that period shall be provided (e.g. spare batteries).

The instruments shall be removed by supplier/manufacturer after final installation at site. Impact recorder should be stopped before it is removed from the transformer.

The supplier / manufacturer has to provide data to NEPCO when transformer installed on site. Removal of impact recorder, downloading and interpretation of data shall be done in the presence of NEPCO representative. Impact recorder memory must not be erased before the data is proven complete and properly stored. Stored data should be easily accessible with recognizable file name backed up. Any irregularities concerning the impact recorders shall be noted.

Acceptance criteria for constant acceleration during transportation downloaded from impact recorder, at frequency 2 ÷ 20 Hz shall be:

- Longitudinal: max. 3 g,
- Vertical: max. 2 g,
- Transverse: max. 2 g.

An appropriate instruction book for interpretation of the registered data and a user manual for the equipment shall be supplied to the NEPCO, prior to shipment.

3. Detailed Requirements for the Equipment

3.1. Main Transformer

3.1.1 General

Transformers shall be designed in accordance with the requirements of the Standard IEC 60076 and other relevant Standards if not otherwise required in this Specification.

Irrespective of the direction of power flow, all transformers shall be capable of operating continuously without injurious heating when delivering the specified winding currents under conditions of continuous operation with voltages higher than tapping voltages, as stated in the Schedule D Technical Data. Temperature rise of the top oil, average winding and hot-spot winding shall not exceed the following limits:

Top oil	Average winding (by winding resistance variation)	Hot-spot winding
50 K	55 K	68 K

with reference on temperature rise correction -10 K from IEC 60076-2, Table 2, referred to the values given in Table 1. For the hot-spot winding temperature rise calculation, hot spot factor (H) shall be applied with 1.5 and 1.3 for main and earthing & auxiliary transformer respectively.

Transformers shall be suitable for normal cyclic loading, short-time and long-time emergency loading duties in accordance with IEC 60076-7 (the emergency overload of 50% for tap changer, bushings, CTs and all ancillary equipment). Tap changer, all bushings, CTs and ancillary equipment inside and outside the transformers should be rated for 50% overloading evidence to prove this fact is required.

The design and manufacture of the transformers and associated equipment shall be such that the noise level is a minimum and that the level of vibration does not adversely affect any clamping or produce excessive stress in any material. Transformer noise levels shall be measured in accordance with IEC 60076-10.

The maximum acceptable sound pressure level for transformer measured as per IEC 60076-10 shall be LpA=70 dB(A) considered no-load condition and all forced cooling in operation at 1 meter distance. The design and clamping of the core and windings shall be such that excessive vibrations shall not be transmitted from the magnetic circuits to the tank and accessories. The maximum limit of vibration shall be 100 µm.

The transformers shall be designed with particular attention to the suppression of harmonic voltages, especially the third and fifth ones, so as to eliminate wave form distortion and any possibility of high frequency disturbances, inductive effects or circulating currents between the neutral points at different substations reaching such a magnitude as to cause interference with communication circuits.

The transformers shall be designed to ensure that leakage flux does not cause overheating in any part of the transformer.

The transformers shall be designed to operate satisfactorily in parallel when the transformers tap-changers are in the same tap position.

Protective devices shall be high-quality product in accordance with IEC 60076-22-1 and shall be sourced from internationally reputed manufacturers only.

Accessories and fittings shall be high-quality product in accordance with IEC 60076-22-7 and shall be sourced from internationally reputed manufacturers only.

The Contractor shall provide the following information, data and documentation related to transformers:

- Information about materials, used for magnetic core, windings and insulation,
- Magnetic core material (grad, steel code name, insulation as per IEC 60404-11, hysteresis curve, etc.) and production description,
- Solid proof that no corrosion effect to any part of the magnetic core,
- Detailed windings materials certificate, testing report and product description.

3.1.2 Magnetic core

The transformer core shall be built up of high-grade, non-aging, low-loss, high-permeability, grain-oriented steel sheets (Hi-B-type; W17/50: max. 0.95 W/kg) without burrs and conforming to IEC 60404-8-7 and IEC 60404-1-1. (Note: 1.7 T is used only for the purpose of comparing the grade). The maximum magnetic flux density in the legs and yokes of the core shall not exceed 1.6 T at rated voltage and frequency.

Both sides of each steel sheet shall be insulated with a durable, hot oil and heat resistant baked enamel varnish or other chemical treatment. Cutting of lamination shall be done in such a way that magnetic field is applied in the direction of rolling.

The core shall be clamped and braced to withstand, without damage or deformation, the forces caused by short-circuit stresses, transportation, or handling, and to prevent the shifting of the core laminations. The bolts, nuts, and end plates of the assembly and clamp structure shall be of a nonmagnetic type and shall be effectively insulated and locked so that they ensure an even pressure on the whole core assembly and are not loosened by vibrations caused by transport and operation.

The supporting framework of the core shall be designed to avoid the presence of pockets which could prevent complete draining of the tank or cause the trapping of air when filling during service.

Suitable axial cooling ducts shall be provided to ensure free circulation of oil and efficient cooling of the core. The ducts shall be so dimensioned that the maximum temperature at any point remains with the admissible limits.

Particular care shall be given to the design and construction of the corner joints between columns and yokes to avoid concentration of mechanical and magnetic stresses whilst allowing an easy dismantling of the joint for maintenance at site.

Adequate metallic bridges shall be provided between the core lamination packets in order to keep all portions of the core assembly at the same potential.

Lifting eyes or lugs shall be provided at suitable points of the core assembly.

The transformer core shall be free from over fluxing liable to cause damage or to cause mal operation of the protection equipment when operating under the continuous overvoltage condition specified in the Schedules. Under this steady overvoltage condition, the maximum flux density must not exceed 1.9 T and the magnetising current must not exceed 5% of the rated load current at normal rated voltage.

Maximum flux density at 110% rated voltage shall be at least 10% below saturation flux density and the core shall be designed to exhibit linear magnetization characteristics up to 120% rated voltage.

The magnetic core shall be insulated from all structural parts and shall be capable to withstand a test voltage of 2.5 kV AC for 1 min. to core bolt (if any) and tank/frame.

Core and core clamps shall be insulated from each other and from the main body with a minimum of 2 kV AC for 1 min. Leads from core and clamps shall be brought outside to facilitate single point earthing through a disconnecting link and shall have a protective cover. Disconnecting link shall be arranged in such a way that It shall be possible to check the insulation resistance of core to earth, clamp to earth and core to clamp. Core and clamp shall also be identified using durable stainless-steel labels.

Structural members shall be made of steel.

3.1.3 Windings

The windings shall be of high conductivity electrolytic copper. Paper shall be used for conductor insulation.

Winding insulation and all non-metallic material used in winding stacks shall be so treated that no further shrinkage shall take place after assembly.

For transformer, only thermally upgraded insulation material and enamelled copper for conductors and lead connections shall be used. The conductors shall be transposed at sufficient intervals to minimize eddy currents and equalize the current and temperature distribution along the winding. Coils shall be constructed to avoid abrasion of the insulation, (e.g. on transposed conductors), allowing for the expansion and contraction set up by changes of temperature or the vibration encountered during normal operation.

The windings shall be so designed as to obtain an optimal value for series and shunt capacities in order to ensure a favourable distribution of the voltage for full impulse waves and chopped impulse waves. Also, windings shall be designed to reduce to a minimum the out-of-balance forces inherent in the transformer.

Leads from winding to bushings shall be adequately supported to prevent damage from vibration and short-circuit forces.

Permanent current-carrying joints or splices shall be welded or braced, properly formed, finished and insulated to avoid concentration of dielectric stresses.

The windings shall be subjected to a thorough shrinking and seasoning process. Compensation devices shall be provided for possible further shrinkage of the coils in service. The coils, windings and leads shall be sufficiently braced and fastened to form rigid assemblies, preventing any relative movement due to transport, vibrations or other circumstances that may occur in service.

Tapings shall be arranged at such positions on the windings as will preserve, as far as possible, electro-magnetic balance at all voltage ratios.

Tapings shall not be brought out from the inside of a coil nor from intermediate turns. The windings and connections shall be braced to withstand shocks, which may occur during transport or due to switching or other transient conditions during service.

Where the yoke supporting channels are adapted for taking up shrinkage in the windings, the arrangement shall be such as to throw a minimum amount of stress on any core bolt insulation.

If the winding is built up of sections or disc coils, separated by spacers, the clamping arrangements shall be such that equal pressure is applied to all columns of spacers. All such spacers shall be securely located and shall be of suitable material.

The assembled core and windings shall be dried in a vacuum to ensure proper moisture removal.

3.1.4 Internal Earthing Arrangements

All metal parts of the transformers apart from the individual core laminations, core bolts and associated individual side plates shall be maintained at some fixed potential.

The magnetic circuit shall be earthed to the clamping structure at one point only through a removable link with a captive bolt and nut, accessibly placed beneath an inspection opening on the tank cover. The connection to the link shall be on the same side of the core as the main earth connection and taken from the extreme edge of the top yoke in close proximity to the bridging pieces. Alternatively, the core earth connection may be brought out through a bushing for earthing to the outside of the tank, in close proximity to the main yoke clamping structure earth point.

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.

The main yoke clamping structures shall be connected to the tank body by a copper strap located at the top of the tank. If there is no metal-to-metal contact between the top and bottom clamping structure, the latter shall be earthed.

Core clamping structures having an insulated sectional construction shall be provided with a separate link for each individual section.

All earthing connections apart from those from the individual coil clamping rings shall have a cross-sectional area of not less than 80 mm^2. Connections inserted between laminations shall have a cross-sectional area of not less than 20 mm^2.

3.1.5 Tank

Transformer tank shall be of welded steel and designed to allow the complete transformer, when arranged for transport, to be lifted by crane and transported without overstraining any joints and without causing subsequent leakage of oil. Each tank shall be provided with a minimum of four jacking lugs, to enable the transformer, complete with all tank mounted accessories and filled with oil, to be raised or lowered by jacks. The jacking points shall be not less than 300 mm above base level for transport masses up to 10 tonnes and not less than 700 mm

for greater transport masses. Facilities shall also be provided to enable the transformer or reactor to be hauled or moved in any direction.

The base of each tank shall be so designed that it will be possible to move the complete transformer in any direction without injury when using rollers, plates, or rails. A design, which necessitates either slide, rails being placed in particular positions or detachable under bases shall not be used.

Precautions shall be taken to prevent corrosion between the base or under-base of tanks of aluminium alloy construction and the concrete plinth on which they are finally positioned.

The main tank body, tap changing compartments, radiators and coolers, shall each be capable of withstanding, when empty of oil, the vacuum test level specified in the Clause 4 of these Particular Technical Specifications. The plate thickness for the tank sides shall be a minimum of 6 mm.

Tank stiffeners and mounting brackets shall be continuously welded to the tank.

Wherever possible, the transformer tank and its accessories shall be designed without pockets wherein gas may collect. Where pockets cannot be avoided, pipes shall be provided to vent the gas into the main expansion pipe. The vent pipes shall have a minimum inside diameter of 20 mm and, if necessary, shall be protected against mechanical damage.

All joints other than those, which may have to be broken, shall be welded. Caulking of defective welded joints shall not be permitted. Such defective joints may be re-welded subject to the written approval of the Client.

Tank covers shall not permanently distort when lifted. Inspection openings of ample size shall be provided to give easy access to bushings, for changing ratio or winding connections, and for testing the earth connections. Inspection covers shall be provided with lifting handles. The tank cover shall be fitted with a thermometer pocket, with captive screwed cap, located in the position of maximum oil temperature at continuous maximum rating.

It must be possible to remove any bushing without removing the tank cover.

A pressure relief device of sufficient size capable of functioning without electrical power shall be provided for the rapid release of any pressure that may be generated within the tank and which might result in damage to the equipment, but it shall be capable of maintaining the oil tightness of the transformer under all conditions of normal service. The device shall operate at a static pressure of less than the hydraulic test pressure for transformer or tanks and shall be designed to prevent further oil flow from the transformer following its operation. If the device is a spring-operated valve type it shall be provided with one set of normally open contacts, which will be used for tripping purposes. The relief device shall be mounted on the main tank and if mounted on the cover it shall be fitted with a skirt projecting inside the tank to prevent an accumulation of gas within the device.

Terminals shall be provided close to each corner at the base of the tank for earthing purposes.

The following plates shall be fixed to the tank at an approximate height of 1.75 m above the ground level:

- A rating plate bearing the data specified in IEC 60076-1,
- A diagram plate on which the transformer tapping voltages in kV shall also be indicated for each tap, together with the transformer impedances at minimum and maximum voltage ratios and for the principal tapping,
- A property plate of approved design and wording,
- A valve location plate showing the location and function of all valves, drain and air release plugs and oil sampling devices.

The transformer design shall include ladder to be used during erection and maintenance work. The ladder shall have safety locking arrangement.

3.1.6 Transformer Bushings

Transformer bushings shall comply with the requirements of Standards IEC 60137 & IEC 62155 and other relevant Standards if not otherwise required in this Specification.

Bushings shall be of the highest quality, made of brown-glazed porcelain and they shall be envisaged for the minimum creepage distance defined in the Clause 3 of General Technical Specifications (Sub-Section 3.1). Provision shall be made for the fitting of arcing horns.

Since main transformers shall be subjected to overload duties in accordance with IEC 60076-7, bushings shall be suitably rated to accommodate these overload duties.

All the transformer bushings for power transformers delivered in this contract shall be interchangeable with creepage distance of 38 mm/kV.

Transformer bushings for HV side shall be either of the oil impregnated paper or resin impregnated type. When filled with transformer oil there shall be no connection with the oil in the transformer and an oil gauge shall be provided. The visible oil levels in the gauge shall correspond to average oil temperatures from the minimum ambient stated in the Schedules to plus 90 °C. The oil levels at 15 °C and 35 °C shall be marked. Connections from the main windings to bushings shall be flexible and shall be such that undue mechanical stresses are not imposed on them during assembly on site.

Bushings shall be mounted on the tank in such a manner that external connection can be made free of all obstacles. Neutral bushings shall be mounted in position from which a connection can be made to a neutral current transformer.

3.1.7 Conservator Vessels, Oil Level Gauges and Breathers

Each conservator shall have a filling cap, an adequate sump and be so designed that it can be completely drained by means of a drain valve. One end of the conservator shall have a removable end cover, complete with integral lugs for lifting purposes and secured by nut and bolt fixings, to permit internal cleaning of the conservator.

Where conservator tanks are mounted on the separate coolers, a flexible stainless-steel piece (expansion joint) shall be included in each oil pipe connection between the transformer or reactor and the conservator tank.

An oil level gauge shall be provided for each conservator. The indicated minimum oil level shall occur when the feed pipe to the main tank is covered with not less than 12 mm depth of oil. The indicated oil level range shall correspond to average oil temperatures from the minimum ambient temperature stated in the Clause 3 of General Technical Specifications (Sub-Section 3.1) to plus 90 °C. The oil levels at 15 °C and 35 °C shall be marked on the gauge. The oil level gauge shall incorporate alarm contacts, which close when the oil level falls below a predetermined level.

Taps or valves shall not be fitted to oil gauges.

The main oil feed pipe from the conservator vessel to the transformer shall be connected to the highest point of the tank and shall be arranged at a rising angle towards the conservator of from 3 to 7 degrees to the horizontal. A valve shall be provided at the conservator to cut off the oil to the transformer.

Whether or not the oil is in direct contact with air or gas the air outlet from each conservator vessel shall be connected to a dehumidifying breather, which shall be mounted at approximately 1.4 m above ground level. This breather should be generally according to IEC 60076-22-7 and at least one size larger than would be fitted for use in a temperate climate.

Where a conservator vessel contains two compartments, one for oil in the main tank and the other for the oil associated with the current making and breaking contacts of the tap change equipment, there shall be no communication between the two compartments in respect of the oil and air spaces. Each compartment shall be provided with the fittings detailed in the preceding paragraphs as if it were a separate conservator vessel.

3.1.8 Valves

Valves shall be of the fully sealing full-way type and shall be opened by turning counter-clockwise when facing the hand wheel. They shall be suitable for working between the minimum ambient temperature stated in the Clause 3 of General Technical Specifications (Sub-Section 3.1) and the maximum oil temperatures stated in Schedule D Technical Data.

Padlocks shall be provided for locking all valves other than individual radiator valves in the "open" and "closed" positions. Valves shall be provided with an indicator readily visible from ground level, to clearly show the position of the valve.

All valve hand wheels shall be fitted with nameplates, which shall be chromium plated brass not less than 3 mm thick with the engraving filed with enamel. All valves shall be fitted with spoked hand wheels, the spokes, and rims of which shall be smooth and where necessary, for appearance, shall be chromium plated.

All valves opening to atmosphere shall be fitted with blanking plates.

Each transformer tank shall be fitted with the following:

- One (1) 100 mm valve at the top and one (1) 100 mm valve at the bottom of the tank mounted diagonally opposite each other, for connection to oil circulating and oil filtering equipment. The lower valve shall also function as a drain valve,
- An oil sampling device for the top and bottom oil of the main tank,
- All parts containing oil, and liable to trap air during filling, shall be fitted with a flanged type air release plug at their highest points.

3.1.9 Transformer Mineral Insulating Oil

Mineral insulating oils shall be high-quality product in accordance with latest version of IEC 60296 and other relevant Standards if not otherwise required in this Specification and shall be sourced from internationally reputed manufacturers only.

The transformers shall be shipped filled with insulating oil.

The oil shall be a highly refined uninhibited mineral naphthenic oil suitable for use as an insulating and cooling medium in transformers. The oil shall be free from corrosive sulphur (as per IEC 62535), PCB, DBDS (dibenzyl disulphide), Antioxidant, passivator, metal deactivator and other additives.

Transformer oil shall be tested for its Full Chemical Analysis including oxidation stability, according to IEC 60296 and the test reports shall be submitted along with Factory Acceptance Test reports of the transformer. The Manufacturer shall also submit the compliance certificate for additives as per IEC 60296.

3.1.10 Cooling System

3.1.10.1 General

Transformers shall have 42/63 MVA ONAN/ONAF or 54/80 MVA ONAN/ONAF cooling system and facilities shall be provided at the transformer cooling system control cabinet for the selection of AUTOMATIC or MANUAL control of the cooling system.

Transformers shall be equipped with two (2) cooling groups/banks, each capable of dissipating 50% of the transformer losses at continuous maximum rating. Each transformer cooling group shall be complete with its radiators & fans, and other accessories.

The cooling fans shall have provision of LOCAL-MANUAL, REMOTE-MANUAL and REMOTE-AUTOMATIC controls, all in two (2) stages. The automatic operation of the cooling system shall be actuated from the Winding Temperature Indicator (WTI) contacts under "AUTOMATIC" condition of remote selector switch. All local control devices shall be mounted in the transformer cooling system control cabinet.

The cooling system shall be designed to meet the following requirements, with both cooling groups in service and without exceeding the specified temperature rise under continuous mode of operation:

- All fans running - 100% ONAF capacity,
- All fans stopped - 100% ONAN capacity.

Also, transformers shall be capable of remaining in operation at full load for 20 minutes in event of failure of the cooling fans without the calculated winding hot spot temperature exceeding 150°C. Failure of one (1) fan in each group of fans shall not reduce the continuous maximum capacity of the transformer.

3.1.10.2 Radiators

The radiators of the transformer cooling system shall be detachable type and shall be provided with suitable isolation valves at the top and bottom to enable the removal of radiators without completely draining the oil from the tank.

The radiators shall be designed for same pressure and vacuum conditions as specified for main tank.

Plugs shall be provided at the top and bottom of each radiator for draining and filling.

Radiators and other cooling system equipment shall be designed so that all painted surfaces can be readily cleaned and subsequently painted in position.

The oil circuit of all coolers shall be provided with the following:

- A valve at each point of connection to the tank,
- Isolating valves at the bottom of each individually detachable radiator. The valves shall be located on header side of the radiator attachment point,
- A valve in the main oil connection at the bottom of each cooler in addition to those mounted on the tank,
- Removable/Loose blanking plates to permit the blanking-off of the main oil connection to the top of each cooler,
- A 100 mm oil filtering valve at the top and bottom of each cooler, the bottom valve shall also function as a drain valve,
- A thermometer pocket fitted with a captive screwed cap on the inlet and outlet oil branches of each cooler.

The material of the tube plates and tubes shall be such that corrosion shall not take place due to galvanic action.

Where separately mounted cooling equipment is provided a flexible stainless-steel piece (expansion joint) shall be included in each oil pipe connection between the transformer and the oil coolers.

Drain plugs shall be provided in order that each section of pipe work can be drained independently.

3.1.10.3 Cooler Fans

The fans shall be so arranged that they are easily accessible and can be easily replaced.

The cooler fans used for air-forced cooling, shall be motor driven and shall be suitable for continuous outdoor operation and capable of dealing with the maximum output required in service. The fans shall be mounted such a way that airflow through the radiators will be upwards.

The cooler fan shall be capable of withstanding the stresses imposed when brought up to speed by the direct application of full line voltage to the motor.

The cooling fans and radiators shall be designed so that they operate with a minimum of noise or drumming. In order to reduce the transmission of noise and vibration, the fans shall be either mounted independently from the radiators, or, alternatively, an approved form of anti-vibration mounting shall be adopted. It shall be possible to remove the cooler fan complete with motor without disturbing or dismantling the cooler structure framework.

Blades or runners fabricated to form hollow sections shall not be used. Unless otherwise approved, blades shall be of galvanised steel and painted or aluminium casting.

The ducts and casings shall be made of galvanised steel not less than 2 mm thickness, suitably stiffened by angles or tees or made of aluminium casting of rigid construction to minimise undue vibration.

Galvanised/aluminium wire-mesh guards with a mesh not greater than 25 mm shall be provided to prevent accidental contact with the blades. Guards shall be provided over all moving shafts and couplings.

3.1.10.4 Cooler Control

Each transformer shall have two (2) independent sources of auxiliary power to ensure back-up of power supply in case of loss of one source. Auxiliary power supply shall not be looped from one transformer to another transformer.

Each motor or group of motors shall be provided with a three-pole electrically operated contactor fitted with auxiliary alarm contacts and with control gear of approved design both for starting and stopping the motor manually and also automatically from the contacts on the winding and oil temperature indicating devices.

The control arrangements shall be such that motors arranged in a minimum of two (2) groups shall be started sequentially.

The control arrangements shall be designed to prevent the starting of motors totalling more than 15 kW simultaneously either manually of automatically. Phase failure relays shall be provided in the main cooler supply circuit.

Auto start and stop of fans shall be arranged such that all fans shall be running in 2 stages during ONAF rating and stops during ONAN rating. Both Winding Temperature Indicators (WTI) and Oil Temperature Indicators (OTI) contacts shall be used in parallel for start/stop of cooler fans at stage 1 and stage 2. The temperature setting for cooler start/stop shall be subject to Client's approval.

If the second group starts on auto, it shall also bring in Group 1 if this had failed to start on its normal sequence.

An alarm indicating "*Transformer Cooling Fault*" is to be provided and initiated in the event of any cooling fan motor trips, power and control supplies are interrupted.

All contacts and other parts, which may require periodic renewal, adjustment, or inspection, shall be readily accessible.

The control equipment for transformer cooling system shall be accommodated in a weatherproof cabinet, with a IP55 degree of mechanical protection, mounted on the transformer.

All wiring for the control gear accommodated in the transformer cooling system control cabinet together with all necessary wiring between the control cabinet and the motors shall be provided by Contractor.

3.1.11 Tap Changer

Each main transformer shall be provided with an On-Load Tap-Changer (OLTC), on the HV winding, for varying its effective transformation ratio whilst the transformer is on load and without producing phase displacement. The voltage control equipment shall be designed so that it may be easily adapted to operate by automatic control.

On-load tap changer shall be high-quality product in accordance with IEC 60214-1 and other relevant Standards if not otherwise required in this Specification, of a robust construction and shall be sourced from internationally reputed manufacturers only.

Main transformer On-Load Tap-Changer shall be maintenance free with vacuum type interrupter in the diverter switch and the complete OLTC design shall be subject of the Client's approval.

The diverter switch unit shall be placed in a separate gas tight compartment, which shall be, like the whole tap-changer, integrated in the transformer tank (in-tank mounting).

The diverter switch shall have an oil system completely separated from other transformer's oil and shall be equipped with a conservator, pressure relief device with alarm/trip contacts and other devices stated for the main tank. A separate gas actuated relay shall be provided in the connection between the on-load tap-changer tank and conservator. Each diverter and/or selector switch (tap selector) shall be equipped with an internal suction pipe led to the ground of the compartment and to be connected to an external drain, filter and sampling valve mounted at a convenient floor height.

The diverter switch compartment shall be easily accessible for inspection and it shall be possible to remove the diverter switch without difficulties for maintenance purposes. The inspection and maintenance of the diverter switch shall be possible without lowering the oil level in the main tank. One set of each type of lifting device shall be supplied to facilitate removal of the tap-changer unit. Necessary attachment facilities shall be incorporated in the main tank design.

Padlock facilities shall be provided and tap change equipment shall be suitable for padlocking in any switch position.

Off circuit tapping switches shall be provided with mechanical end stops, which prevent movement beyond end position.

Equipment for local and remote/supervisory electrical and local hand operation shall be provided and shall comply with the following conditions:

- It shall not be possible to operate the electric drive when the hand-operating gear is in use,
- It shall not be possible for any two electric control points to be in operation at the same time,
- Each step movement shall require separate initiation at the control point,

- All electrical control switches and the local operating gear shall be clearly labelled in an approved manner to indicate the direction of tap changing,
- The local control switches shall be housed in the OLTC drive mechanism box (transformer OLTC control cabinet).

In the above context "*local*" means at the transformer, "*remote*" means at the remote tap-changer control (RTCC) panel and "*supervisory*" means via SCADA system.

The equipment shall be so arranged as to ensure that when a tap change has been commenced it shall be completed independently of the operation of the control relays or switches. If a failure of the auxiliary supply during a tap change or any other contingency would result in that movement not being completed, approved means shall be provided to safeguard the transformer and its auxiliary equipment. Electrical and mechanical means shall also be provided to prevent damage to the tap changing mechanism when end of operation has not been reached.

Apparatus of approved type shall be provided for each transformer:

- To give indication mechanically at the transformer and electrically at the remote and supervisory control point, of the tapping in use. The indicator at the transformer shall show the number of the tapping in use and the indicator at the remote and supervisory control point shall show clearly the actual voltage ratio in kilovolts and the tap number representing this ratio. The numbers shall range from 1 upwards, the lowest number representing the tapping position corresponding to the maximum number of winding turns, i.e. the plus percent position, and the highest number representing the tapping position corresponding to the minimum number of winding turns, i.e. the minus percent position,
- To give indication at the remote and supervisory control point that a tap change is in progress by means of an illuminated lamp and alarm buzzer. If the tap change is not completed within the specified time the buzzer shall continue to sound until switched off by hand, but the lamp shall remain illuminated until the tap change is completed,
- To give an indication at the remote and supervisory control point by means of an approved illuminated indicator and the buzzer alarm as described above when the units of a group of transformers arranged to operate in parallel are operating at different ratios.
- Full supervisory control facilities shall be provided. A selector switch located at the local point shall be provided to transfer control to the remote point. The facility shall also be provided, through the operation of auxiliary relays to select and deselect tap change control from the supervisory point. A lamp at the remote panel shall indicate when supervisory control is selected. All necessary equipment on the RTCC panels, including the provision of auxiliary relays and indication devices shall be included.

All indicating devices shall operate correctly at any voltage between the limits of 85% and 110% of nominal value.

The tap changing switches and mechanism shall be mounted in oil tanks or compartments mounted in an accessible position on the transformer tank and shall be supported from the main tank or its base. It is preferable that examination and repair of both selector and diverter switches including their associated equipment should be carried out without lowering the oil level in the main tank. Other designs of tap-changer shall be subject of Client's approval.

Any enclosed compartment not oil filled shall be adequately ventilated and designed to prevent the ingress of vermin. All contactors relay coils or other parts shall be suitably protected against corrosion or deterioration due to condensation.

The oil in those compartments of the main tap-change apparatus which do not contain contacts used for making or breaking current shall be maintained under conservator head by means of a pipe connection from the highest point of the chamber to the conservator. This connection shall be controlled by a suitable valve and shall be arranged so that any gas leaving the chamber will pass into the gas and oil actuated relay.

It shall not be possible for the oil, in those compartments of the tap change equipment which contain contacts used for making or breaking current, to mix with the oil in the main transformer or to mix with the oil in the compartments containing contacts not used for making or breaking current. A drain valve shall be provided.

When a conservator is provided and used to maintain oil level in compartments, which contain contacts used for making and breaking current, it shall be clearly separate from the main transformer conservator. Two oil gauges

shall be provided. One shall be of the prismatic type and the second one of the magnetic type shall be fitted with contacts for initiation of a low oil level alarm. A silica gel breather shall be fitted to each such conservator.

Each compartment in which the oil is not maintained under conservator head shall be provided with an oil level gauge of approved design.

Limit switches shall be provided to prevent over-running of the mechanism and shall be directly connected in the circuit of the operating motor. In addition, a mechanical stop, or other approved device shall be provided to prevent over-running of the mechanism under any condition. Limit switches may be connected in the control circuit of the operating motor provided that a mechanical declutching mechanism is incorporated.

Thermal devices fitted with alarm contacts or other approved means shall be provided to protect the motor and control circuits. All relays, switches, fuses, etc. shall be clearly marked to indicate their purpose. Switches for the initiation of a tap change shall bear the inscription "*Raise Tap Number*" or "*Lower Tap Number*".

Tripping contacts associated with any thermal devices used for the protection of tap changing equipment shall be suitable for making and breaking 150 VA between the limits of 30 V and 250 V AC and DC and for making 500 VA between the limits of 110 V and 250 V DC.

Complete tap changing equipment shall be of robust design and capable of giving satisfactory service without undue maintenance under the conditions to be met in service, including frequent operation.

A device shall be fitted to the tap changing mechanism to indicate the number of operations completed by the equipment.

A permanent legible lubrication chart shall be fitted within the driving mechanism chamber.

After installation and commissioning tests, the terminals of the operating motor shall be clearly and permanently marked.

Means shall be provided for ensuring that the tapping or other switches are making full contact. When such contact is made it shall be possible to lock the apparatus at any setting.

When two or more transformers are to be operated in parallel at the same substation, means shall be provided to ensure that the voltage control equipment is automatically synchronised before and while the transformers are operated in parallel. This feature shall operate irrespectively of whether the voltage control equipment is operated by the remote electrical operating gear or automatically. It shall be possible to operate the voltage control equipment for each transformer independently, whether on load or for test purposes, and to obtain independent indications.

A lifting device shall be provided to allow easy removal of the tap changer for maintenance.

3.1.12 Automatic Voltage Control

Approved means shall be provided for automatically maintaining within adjustable limits a pre-determined voltage value at the low-voltage (33 kV) busbars to which the main transformer is connected.

An automatic voltage control (AVC) relay and all other associated equipment shall be provided for each main transformer. The relay shall be responsive to variation in the measured voltage and cause the necessary tap change to be made to restore the voltage to the desired level within pre-determined limits.

The reference voltage shall be taken from the LV side of the main transformer. The measured voltages shall be derived from voltage transformers (in scope of supply for switchgear tenderer), having secondary windings rated at 110 V phase-to-phase and having accuracy class of 0.5. The relay shall have a nominal voltage rating equal to the VT secondary winding rating.

The voltage transformer secondary circuit to the AVC relay shall be monitored for failure.

The relay setting voltage, expressed as a percentage of the relay nominal voltage, shall be adjustable over a range of not less than ±10% of nominal.

The relay sensitivity band relative to the setting voltage shall be adjustable from not more than 1.5 times to not less than 2.5 times the percentage equivalent of one tap change step.

Settings for relay operating time shall be adjustable. For definite time relays, the setting range shall be from 10 s to 120 s and the timing device shall be of the "slow resetting" type. Relays having time dependent characteristics shall have a range of adjustments allowing a delay of up to at least 120 s for a voltage deviation 1% greater than

the sensitivity setting and not more than 10 s for a deviation of 5 times sensitivity or 10% voltage, whichever is the greater.

The relay shall be insensitive to frequency variation between the limits of 47 Hz and 51 Hz and shall incorporate an under voltage blocking facility to render the control inoperative if the reference voltage falls to 80% of nominal value with automatic restoration of control when the reference voltage rises to 85% of nominal value.

The relay setting voltage shall be adjustable from a remote/supervisory location. When selected to either supervisory or remote and selected for automatic operation the control signal shall vary the set point of the AVR relay. When selected to manual the control signal shall operate the tap changer directly to raise or lower the tap position as required. It shall be possible to select auto/manual control from the supervisory location.

The AVC relay shall be suitable to work in automatic independent control mode, where the tap-changer is controlled irrespectively of the method of control selected for the other associated transformer, and automatic parallel control mode, where in a group of parallel working transformers it shall be possible to select any transformer for master control from RTCC (Remote Tap-Changer Control) Panel and SAS (Substation Automation System). During a master/follower tap change operation, tap changing shall be sequential of slightly time staggered to ensure that at any time only one transformer is changing tap.

On-load tap change transformers provided with fully automatic control and required to operate in parallel as a group shall be provided with the means to ensure proportionate sharing of watts and VARs.

All transformers operating in a group shall be on the same tap. Operation with a tap difference between transformers n a group shall be automatically prevented by an “out-of-step” device and an ”out-of-step” alarm signal shall be transmitted to control point(s). The tap change scheme shall be arranged so that the maximum difference between the transformers during a tap changing sequence is one tap.

All equipment shall be suitable for operation within the limits of 85% and 110% of the nominal auxiliary supply voltage. In the event of the reference supply voltage being outside the specified operating limits the voltage control relay shall initiate an alarm and block further operation of the tap-changer until voltage is restored.

Requirement for remote adjustment (supervisory) of the AVC setting voltage shall be defined in accordance with the particular scheme. AVC relays equipped to accept electrical signals to control the actual set point shall be capable of set point adjustment in steps not exceeding 1%.

The AVC relay shall support IEC 61850 protocol and shall have a self-supervision and internal failure diagnostic function.

3.1.13 Remote Tap-Changer Control (RTCC) Panel

The control of transformer tap-changer shall be arranged in local, remote or supervisory modes.

A Remote Tap-Changer Control (RTCC) panel shall be provided with the following devices and accessories:

- Voltage regulator,
- Motorised voltage setting potentiometer,
- Auto/Manual selector switch,
- Raise/lower control selector switch,
- Remote/supervisory selector switch,
- Master/follower/Independent/off selector switch,
- Voltmeter,
- Tap position indicator,
- Oil temperature indicator and winding temperature indicator,
- Indicator lamps for "*Tap changer in progress*",
- Annunciator with accept (to silence the Buzzer), reset and lamp test push buttons applicable for the following alarms:
    - Tap changer incomplete,

- Out-off step,
- VT fail,
- Motor supply fail,
- AC supply fail,
- DC supply fail,
- Tap changer in progress,
- Stage 1 fan failure,
- Stage 2 fan failure,
- Stage 1 fan on,
- Stage 2 fan on,
- Fan auto/manual,
- Motor drive on local,
- Two (2) spare alarms,

– 4-20 mA Transducers for tap position,

– All necessary relays, contactors, supervisory control interposing relays, labels, wiring, terminals, test facilities, fuses, trip switches, etc. to complete the scheme.

The Contractor shall provide adequate number of step contact cards, BCD cards and transducers in RTCC panels and motor drive units according to Contractor's Design approved by Client.

"The AVR panel should include three step contact cards and two BCD cards."

The control switches on local tap-changer control cabinet and on the remote tap-changer control (RTCC) panel shall be either lockable spade type or push button as required by the Client.

Remote Tap-Changer Control Panel shall be completely wired, with voltage regulator, instruments, control switches, relays and other auxiliary devices.

The preferred front view of the RTCC panel has been presented on Drawings (Sub-Section 4).

RTCC Panels shall be made of steel sheet with thickness not less than 2 mm, painted in RAL 6019 colour. Panels shall be for indoor installation with IP41 degree of mechanical protection. The indication lamps on RTCC Panel shall be of neon or LED type.

3.1.14 Temperature Indicating Devices and Gas & Oil Actuated Relays

3.1.14.1 Temperature Indicating Devices and Alarms

Oil temperature indicating devices shall be fitted with alarm and trip contacts.

Winding temperature indicating devices shall indicate the temperature of the hottest spot of the winding and shall have a load-temperature characteristic approximating to that of the main winding. Alarm and trip contacts shall be provided.

Alarm contacts of oil and winding temperature indicating devices shall be adjustable over a range of 60 °C to 110 °C and trip contacts adjustable over a range of 80 °C to 150 °C. Alarm and trip contacts shall be suitable for making and breaking 150 VA at 0.35 power factor, between the limits of 30 and 250 V AC or breaking 150 VA and making 500 VA between the limits of 110 and 250 V DC.

Temperature indicating devices shall incorporate a dial and a pointer indicator and a separate pointer to register the maximum temperature reached.

The capillary connected sensing bulbs of temperature indicators shall be positioned in separate oil-tight pockets arranged in the top oil.

Where winding temperature indicators are specified, they shall be associated with one phase only.

The winding temperature indicating devices shall be so designed that it shall be possible to move the pointers by hand for the purpose of checking the operation of the contacts and associated equipment. The working parts of the instruments shall be made visible by the provision of cut-away dials and glass fronted covers.

The characteristics of the winding temperature indicating devices shall be submitted to the Client for approval prior to the delivery of the transformers and shall also be included in the operating and maintenance instructions.

All temperature indicators shall be housed in the transformer control cabinet and shall be mounted so that they will not be affected by vibration.

3.1.14.2 Gas and Oil Actuated Relays

Gas and oil actuated relays shall be fitted to each transformer and to each tap selector compartment. They shall have alarm contacts which close on collection of gas or at low oil level and tripping contacts which close following an oil surge.

The normally open, electrically separate, alarm and tripping contacts shall not be exposed to oil.

The relays shall be fitted in the expansion pipe connecting the transformer tank to the conservator.

Each relay shall be provided with a test cock to take a flexible pipe connection for checking the operation of the relay.

A 5.0 mm inside diameter pipe shall be connected to the gas release cock of the relay and brought down to a point approximately 1.4 m above ground level where it shall be terminated by a cock.

3.2. Earthing and Auxiliary Transformer

3.2.1 General

Since the main transformer secondary (LV) winding shall be connected in delta, for each power transformer, an earthing transformer shall be provided for the 33 kV system neutral point.

The earthing transformer shall be used as auxiliary power supply transformer as well.

The 33 kV neutral point shall be earthed through resistance and the protection will be arranged to limit the duration of earth fault current to the maximum of 10 s.

3.2.2 Requirements

Each earthing transformer shall be of the oil-immersed, ONAN type transformer, suitable for outdoor installation and shall have an interconnected star (zig-zag) winding which shall be directly connected to the LV winding of the main transformer and an auxiliary star connected winding arranged to give a 3-phase, 4-wire power supply, via a switch fuse unit. Switch fuse unit of adequate rating shall be installed within earthing & auxiliary transformer cabinet mounted on the transformer.

The neutral point of the interconnected star winding of each earthing transformer shall be brought out of the tank through a bushing insulator similar to those on the phase terminals. This point may be isolated or may be connected to earth either directly or through a resistance.

The maximum flux density at any point in the core with normal applied voltage shall not exceed 1.9 T.

The interconnected star winding of each earthing transformer, when at its maximum temperature due to continuous full load on the auxiliary winding, shall be designed to carry for 30 s, without injurious heating, an earth fault current not less than the value given in the Schedules. The current density under such condition shall not exceed 23 A/mm^2. The value of zero sequence impedance of the high voltage winding shall not exceed 45 Ω/phase.

Mineral insulating oils shall be high-quality product in accordance with IEC 60296 and other relevant Standards if not otherwise required in this Specification and shall be sourced from internationally reputed manufacturers only.

De-energized tap changer (DETC) shall be high-quality product in accordance with IEC 60214-1, of a robust construction and shall be sourced from internationally reputed manufacturers only.

Protective devices shall be high-quality product in accordance with IEC 60976-22-1 and shall be sourced from internationally reputed manufacturers only.

Accessories and fittings shall be high-quality product in accordance with IEC 60976-22-7 and shall be sourced from internationally reputed manufacturers only.

Earthing and auxiliary transformer shall be provided with the following accessories:

- One thermometer pocket with captive cap,
- Dehumidifying breather,
- Filter valve and combined filter and drain valve,
- A sampling device at the bottom of the tank,
- Conservator vessel with removable end cover and prismatic oil gauge,
- Double float gas oil actuated relay,
- Pressure Relief Device.

The earthing & auxiliary transformer shall comply with the requirements stated in Clause 3 of this Particular Technical Specifications relating to the main transformers wherever these are applicable.

3.3. Control, Operation, Indication and Alarm Circuits for Transformers

Item No	Device	Function	Operating supply voltage	Required	To be supplied by Contractor
1	Gas and/or oil actuated relay	a. Alarm b. Trip	110 V DC 110 V DC	Yes Yes	Yes Yes
2	Winding temperature indicator	a. Alarm b. Trip c. Cooler Control	110 V DC 110 V DC 230 V AC	HV LV	Yes Yes Yes
3	Winding temperature indicator remote repeater	Indication		HV LV	Yes Yes
4	Oil temperature indicator	a. Alarm b. Trip	110 V DC 110 V DC	Yes Yes	Yes Yes
5	Tap-changing equipment	a. Control b. Indication	230 V AC 110 V DC	Yes Yes	Yes Yes
6	Fan failure	Alarm	110 V DC	Yes	Yes
7	Oil flow failure	-	-	-	-
8	Remote electrical indicator to show if units of a group of transformers are in parallel on different tapping	a. Indication b. Alarm	110 V DC -	Yes No	Yes No
9	Transformer “tap change in progress” remote electrical indication	a. Indication b. Alarm	110 V DC 110 V DC	Yes Yes	Yes Yes

Item No	Device	Function	Operating supply voltage	Required	To be supplied by Contractor
10	Transformer “voltage ratio” remote electrical indication	Indication	110 V DC	Yes	Yes
11	Main transformer pressure relief device	Trip	Voltage operated relay 110 V DC	Yes	Yes
12	Earthing transformer pressure relief device	Trip	Voltage operated relay 110 V DC	Yes	Yes
13	Earthing transformer Oil temp alarm	Alarm Trip	110 V DC Voltage operated relay	Yes	Yes
14	Earthing transformer Oil level	Alarm	110 V DC	Yes	Yes

110 V VOLTAGE OPERATED RELAYS WILL BE USED FOR TRIP AND ALARMS

4. Inspection and Tests

4.1. General

In addition to the general requirements for inspection and tests stated within the Sub-Section 3.1: General Technical Specifications, the following shall also be applied:

- Tests shall be performed to determine whether the materials and the equipment comply with the technical requirements. All tests shall be performed in the conditions which, as much as possible, correspond to the operating conditions,
- The Contractor shall submit to the Client for approval, the Test Program for all the necessary tests. For each performed test, the Contractor shall prepare the appropriate Test Report and shall submit it to the Client for approval,
- All tests on the equipment, both at the Manufacturer's factory and after completion of installation at the Site, shall be performed in accordance with IEC, BS, and IEEE Standards, unless otherwise agreed with the Client. If IEC, BS, and IEEE Standards are not available for tests, the scope, Standard and procedures to be applied shall be specified by the Contractor and approved by the Client,
- All additional tests, except those specified further below, which might be necessary for confirmation of the equipment guaranteed characteristics, shall be performed at the Clients' request and with no additional cost to the Client,
- Appropriate standard instruments and other measuring equipment, as well as technical personnel, necessary for performance of the Factory Tests shall be provided by the Contractor,
- Appropriate measuring equipment, as well as technical personnel, necessary for performance of the Site Tests and Commissioning of the equipment shall be provided by the Client, while the Contractor shall provide technical Supervision during execution of Site Tests and Commissioning,
- The tests shall not diminish characteristics and reliability of the tested equipment or shorten its lifetime,
- The Detailed Program of the Factory Tests shall be submitted minimum 28 calendar days before commencement of the tests. These tests shall comprise minimum the tests specified in Clauses 4.2 & 4.3 of these Particular Technical Specifications. These Detailed Programs shall also comprise the procedures and all details of the procedures and charts of measurements, conditions, and implementation of the testing procedures, as well as the sequence of equipment preparation, the operating procedures to be applied, etc.,
- The Detailed Program of the Factory Tests shall be approved by the Client 21 calendar days after the documents have been submitted,
- The details of the tests are given further below.

4.2. Factory Tests on Transformer

4.2.1. General

Factory tests shall be performed in the presence of the Client; however, some tests may be performed in the Client's absence, with his prior consent.

Factory Acceptance Tests (FAT) shall include type tests for representative transformer and routine tests for each type of equipment to be installed.

After satisfactory completion of the witnessed tests at the Factory, the Contractor shall submit Shipping Release request for Client.

No item of equipment shall be dispatched to Site until the Client has given his approval and issued the relevant Shipping Release.

4.2.2. Type Tests Certificates

It is required that all offered equipment will have type test certificates. Type Tests Certificates shall be submitted for the equipment of the same or higher rated characteristics, issued by an international independent, recognized, accredited testing laboratory.

All testing laboratories shall be accredited according to ISO/IEC 17025 by ILAC (The International Laboratory Accreditation Cooperation).

The Certificates of performed type tests shall be submitted along with the Tender. The submitted Type Test Certificates shall not be older than ten (10) years.

At least the following type tests certificates for transformers (according to IEC 60076) shall be provided:

- Temperature-rise type test,
- Dielectric type tests,
- Determination of sound level (IEC 60076-10) for each method of cooling for which a guaranteed sound level is specified,
- Measurement of the power taken by the fans,
- Measurement of no-load loss and current at 90 % and 110 % of rated voltage,
- Evidence from demonstrably similar units and/or mechanical and thermal calculations shall be provided to demonstrate clear margins of short-circuit current withstand at system fault levels for transformers. All tests and calculations shall be fully in accordance with IEC 60076-5,
- Calculation proof of overloading capability according IEC 60076-7,
- Type tests for the transformer bushings, in accordance with IEC 60137,
- Type tests for tap changers in accordance with IEC 60214-1&2.
- Type tests for the current transformers within transformer bushings, in accordance with IEC 61869-1&2.

4.2.3. Type tests

Type tests shall be made on a transformer which is representative of other transformers, to demonstrate that these transformers comply with the specified requirements not covered by the routine tests. A transformer is considered to be representative of others if it is built to the same drawings using the same techniques and materials in the same factory.

The following tests shall be carried out as part of the Factory Acceptance Test (FAT):

- Temperature Rise Test. The test shall be in accordance with IEC 60076 and shall be carried out on one (1) main transformer and one earthing & auxiliary transformer. Type temperature-rise test at any time shall be performed by feeding transformer with the total measured losses or total guaranteed losses, whichever is higher. During temperature rise test, winding thermal time constants shall be estimated from the hot resistance cooling curve,

- During the temperature rise test the accuracy of oil and/or winding temperature indicating devices shall be determined,
- Capability of sustaining the guaranteed overload conditions shall be demonstrated by calculation method according IEC 60076-7. Measured (actual test) values of winding and oil thermal parameters (temperature rise and thermal time constant) defined during temperature-rise tests shall be used for calculation input data. Appropriate overload curves reflecting permissible duration of the overload as function of stated overloads and ambient temperatures should be provided,
- Noise level measured in accordance with IEC 60076-10,
- The measurement of zero sequence impedance,
- Leakage test,
- Vacuum test,
- Power consumption of cooling system.

Type tests shall be performed in accordance with the latest version of IEC 60076. Tests shall take place at an internationally recognised testing station or in manufacturer own accredited laboratories, witnessed by Client. All type testing costs shall be included in the tender prices for the transformers.

4.2.4. Routine Tests

Routine tests shall be performed at the Manufacturer's factory and in the Client's presence, on each part of the equipment foreseen for delivery, for the purpose of detecting failures in the material or in the structure. Tests shall be performed in accordance with the latest edition of the relevant IEC, BS, and IEEE Standards, unless specified otherwise. The test results shall be submitted to the Client for consideration, immediately after completion of the tests.

At least, but not limited to, the following routine tests for transformers (according to IEC 60076) shall be performed:

- Measurement of winding resistance,
- Measurement of voltage ratio and check of phase displacement,
- Measurement of short-circuit impedance and load losses,
- Measurement of no-load loss and current at rated frequency and rated voltage, 90% rated voltage and 110% rated voltage,
- Dielectric routine tests,
- Dielectric tests on oil including Dissolved Gas Analysis (DGA) before and after dielectric tests. Measurement of DGA in oil shall be from each separate oil compartment. All tests according to IEC 60296 and IEC 62535 shall be carried out on the samples from each type of oil supplied by the Contractor/Manufacturer and Test Certificate shall clearly indicate that oil is free from PCB, DBDS (dibenzyl disulphide), Antioxidant, passivator, metal deactivator and other additives),
- Tests on on-load tap-changers,
- Leak testing with pressure (tightness test),
- Check of the ratio and polarity of built-in current transformers,
- Check of core and frame insulation,
- Determination of capacitances windings-to-earth and between windings,
- Measurement of d.c. insulation resistance between each winding to earth and between windings,
- Measurement of dissipation factor (tanδ) of the insulation system capacitances.
- Routine tests for the transformer bushings, in accordance with IEC 60137,
- Routine tests for the current transformers within transformer bushings, in accordance with IEC 61869-1&2.

The Test Report shall be signed by all the parties involved.

4.3. Factory Tests on Transformer Components

4.3.1. General

Tests during and after manufacturing shall be carried out on the transformer components in order to verify compliance with the Specifications, good workmanship and their capability to perform the required duties when in service.

Unless otherwise specifically mentioned these tests shall be made in accordance with the one of the applicable international standards, subject to the approval of the Client, or according to a method proposed by the Contractor and approved by the Client.

4.3.2. Transformer Tanks and ONAN Coolers

4.3.2.1 Type Tests Certificates

Type Test Certificates shall be provided for the following:

Vacuum test:

One transformer tank, tap-changing compartment, radiator and cooler of each size shall be subjected when empty of oil to the vacuum test level specified in Schedule D Technical Data. There shall be no permanent deflection of the stiffeners, nor shall the permanent deflection of the panels exceed the value specified in the following Table.

Major dimension of panel between stiffeners (Metres) vertical or horizontal	Maximum permanent deflection
Up to 1.5 m	3 mm
1.5 m - 3 m	8 mm
Above 3 m	13 mm

Pressure test:

One transformer tank of each size shall be subjected to a pressure corresponding to the normal pressure plus 35 kN/m^2. After the release of the excess pressure there shall be no permanent deflection of the stiffeners nor shall the permanent deflection of panels between stiffeners exceed the value specified in the above table. This test may be combined with a routine oil leakage test.

The tap-changer barrier shall be shown to withstand an over pressure test of normal pressure plus 35 kN/m^2 for 12 hours.

If required by the Client one pressure relief device of each size shall be subjected to increasing oil pressure and shall operate before reaching normal pressure plus 35 kN/m^2.

The operating pressure shall be recorded on the Test Certificate.

4.3.2.2 Routine Tests

Oil leakage test:

All tanks and oil filled compartments including all forms of radiator shall be tested for oil tightness by being completely filled with oil of a viscosity not greater than that of IEC 60296 insulating oil at a temperature of 150 °C and subjected to a pressure equal to the normal pressure plus 35 kN/m^2. This pressure shall be maintained for a period of not less than 24 hours, during which time no leakage shall occur.

The tap-changer barrier shall be subjected to normal oil pressure head for 24 hours, during which time there shall be no leakage from the panel or bushings.

Detachable radiators may be tested as separate units.

4.3.3. Fans, Motors, Pipe work, Valves and Oil Sampling Devices

4.3.3.1 Type Tests Certificates

Type Test Certificates shall be provided for the following:

Motors:

Performance tests shall be in accordance with IEC 60034-1, however, certificates of type tests in accordance with IEC will be accepted.

Valves and Oil Sampling Devices:

Except for non-return valves, all valves and oil sampling devices which are subject to oil pressure in service or during maintenance shall withstand, when empty of oil, absolute pressure not exceeding 350 m bars. In the case of valves this test is to be applied to the body only. This type test shall subsequently be followed by a repeat oil leakage test.

4.3.3.2 Routine Tests

Oil filled equipment:

The bodies of all oil pumps complete with submerged motors, if any, and the oil pipe work, oil sampling devices and valves shall withstand a hydraulic pressure of 140 kN/m^2 for 15 minutes.

Fans:

Static and dynamic balance shall be checked on all fan impellers.

Control gear:

All control gear shall be subjected to the tests specified in the appropriate IEC.

Motors:

Each motor shall be subjected to the following tests where applicable:

- Measurement of winding resistance (cold),
- No load test at rated voltage for determination of fixed losses,
- An overvoltage test at 1.5 times rated voltage applied with the machine running at no load, for a period of 3 minutes, to test inter-turn insulation,
- High voltage in accordance with IEC 60034-1.

4.3.4. Transformer Oil

4.3.4.1 Type Tests Certificates

Type Tests Certificates for transformer oil shall be provided in accordance with IEC 60296.

4.3.4.2 Sample Tests

Oil samples shall be taken for testing during and after FAT. Samples of oil from each consignment shall be tested in accordance with IEC 60296 before dispatch and the oxidation stability test shall be included. Test Certificates shall be submitted to the Client.

Subject to the agreement with the Client, a Test Certificate, confirming that the oil from which the consignment was drawn has been tested in accordance with IEC 60296, may be accepted.

Test evidence from the Manufacturer shall be submitted for each type of oil and the Test Reports shall be submitted to the Client for the following contents:

- Corrosive Sulphur (tested as per IEC 62535),
- Antioxidants (tested as per IEC 60666),
- PCBs (tested as per IEC 61619),

- DBDS (tested as per IEC 62697),
- Passivator (tested as per IEC 60666),
- Metal Deactivator.

4.3.5. Gas and Oil Actuated Relays

4.3.5.1 Routine Tests

The following tests shall be made on relays when completely assembled. Where oil is referred to, it shall have a viscosity not greater than that of IEC 60296 insulating oil at 150 °C.

Oil leakage:

The relay, when filled with oil shall be subjected to an internal pressure of 140 kN/m^2 for 15 minutes. No leakage shall occur either from the casing or into normally oil free spaces, such as floats, within the casing.

Gas Collection:

With the relay mounted as in service and at a rising angle of 5 degrees (tank to conservator) and full of oil, gas shall be introduced into the relay until the gas collection contacts close. The oil level contacts shall not close when gas is escaping freely from the relay on the conservator side. These contacts shall, however, close when the pipe work is empty of oil.

The empty relay shall be tilted, as if mounted in pipe work rising from tank to conservator, at an increasing angle until the gas collection contacts open. The angle of tilt shall then be reduced, and the gas collection contacts shall close before the angle is reduced to less than 13 degrees to the horizontal.

With the relay mounted at a falling angle of 16 degrees to the horizontal and full of oil, the gas collection contacts shall be open.

Oil surge:

With the relay mounted as in service and full of oil at approximately 150 °C, the surge contacts shall close within the steady oil flow limits specified in Schedule D Technical Data. This operation shall not be adversely affected when the gas collection contacts have already closed and gas is escaping freely.

Voltage:

With the relay empty of oil, a voltage of 2 kV shall be applied in turn between each of the electrical circuits and the casing for one minute, the remaining circuits being connected to the casing.

4.3.5.2 Sample Tests

At the discretion of Client, the following tests shall be made:

- Variation of performance with mounting angle with the mounting conditions as in service, the mounting angle shall be varied within the rising angle limit 10 and 90 and tests repeated in the manner prescribed for the routine tests.

4.3.6. Voltage Control Equipment

Type test certificates and factory tests for transformer voltage control equipment shall be carried out in accordance with IEC 60214.

4.3.7. Transformer Bushings

It is not intended to test the bushings separately during the transformer factory tests.

Factory tests for transformer bushings shall be carried out in accordance with IEC 60137.

4.3.8. Current Transformers in Transformer Bushings

Factory tests for current transformers in transformer bushings shall be carried out in accordance with IEC 61869-1&2.

4.3.9. Secondary Wiring

4.3.9.1 Routine Tests

All secondary wiring, including panel wiring and control circuits and all apparatus connected thereto shall be subjected to the following routine tests:

- High voltage test with 2 kV applied for one minute, unless otherwise specified or required by a British Standard, to which item the appropriate test shall be applied,
- Insulation resistance measurement by megger of not less than 500 V.

4.3.10. Galvanizing

4.3.9.2 Sample tests

Samples selected by the Client of all galvanized material shall be subjected to the galvanizing tests set out in BS EN 10244 or BS EN ISO 1461, whichever is applicable.

4.3.11. Oil Filtering Equipment

All tests which Client considers necessary to show that the guaranteed particulars in Schedule D Technical Data are met.

4.3.12. Factory Acceptance Tests (FAT)

Prior to delivery, the transformers and associated equipment shall be factory tested.

Cubicles and panels shall be completely assembled in the factory and wired.

Factory Acceptance Tests (FAT) shall be performed at the Manufacturer's factory, in presence of the Client, according to the latest edition of the relevant IEC, BS, and IEEE Standards, unless specified otherwise, in order to prove that the equipment corresponds to the General and Particular Technical Specifications

The scope of tests shall be in accordance with the Detailed Test Program approved by the Client, but any of the tests performed during manufacturing can be repeated. Reports from tests performed during production shall be available to the Client during the FAT.

For the purpose of FAT tests, the Contractor shall provide all necessary works and conditions needed to conduct all tests, sufficient number of copies of detail Design documentation, Test reports from previously conducted tests, testing protocols and procedures, as well as other required by these Technical Specifications.

The Contractor is obliged, after the conducted tests, to prepare Test Report from FAT tests. Test results shall be submitted to the Client for approval. The Test Report shall be signed by all parties involved.

All expenses including economy class air fares, hotel accommodation with meals, local transportation, visa fees, medical insurance, etc. of the Client's personnel during FAT shall be borne by the Contractor. Any costs incurred regarding the re-inspection and re-testing as a result of a failure of the equipment under test, shall be borne by the Contractor.

The Contractor shall also give priority to the Royal Jordanian Airlines for airfreights shipment and transport of personnel.

It is anticipated that the Client will have continuous presence during execution of the Factory Acceptance Tests.

In line with Schedule G and its notes, the Contractor shall include the expenses for three employer representatives attending the test in the Price Schedule (G).

Note: The offered FAT period shall be specified in days, excluding travel days, and must be sufficient to conduct all required tests as per IEC and Particular technical specifications.

5. Documentation

5.1. Documentation to be Submitted with the Tender

Together with the Tender, completed with pertaining Schedule of Technical Data duly filled-in, the Tenderer shall submit the following documentation/information:

- General arrangement drawings, showing particulars of all associated equipment and accessories, their overall dimensions, shipping and lifting dimensions, mass of the complete transformers, their components, and oil, etc. as well as details about the required foundations. These drawings shall also indicate the necessary capacity of the crane for transformer installation and size of lifting lugs or eyes. Parts to be removed for transport shall be indicated and their masses stated as well,
- Detailed descriptions with characteristics of the proposed transformers and associated equipment (catalogues, descriptive literature, manufacturing Specifications),
- Reference list of similar transformers installed in similar climatic and service conditions,
- Type Test Certificates (according to Clause 4.2.2.) for the equipment (transformers, voltage control equipment (tap changers and AVR), bushings, and oil) to be supplied under this Contract issued from an international independent, recognized, accredited testing laboratories according to the relevant standards (All testing laboratories shall be accredited according to ISO/IEC 17025 by ILAC (The International Laboratory Accreditation Cooperation),
- Three (3) End-User Certificates from different countries for the transformers, clearly showing the following:
  - Name of End-User (Owner Company) and complete address and where the equipment has been installed,
  - Date of issuance of Certificate,
  - Date of putting in operation,
  - Type, rating and capacity of related equipment which shall be the same or better than offered equipment,
  - Confirmation that related equipment perform satisfactorily since putting into operation,
  - Stamp and signature by the End-User company.

Note:

Type Test and End-User Certificates are mandatory and shall be provided for each type of equipment, as specified above. In case this is not provided, Tenderer's offer can be rejected. All Certificates shall be written in English language.

5.2. Documentation to be Submitted after Contract Commencement Date

Within the one (1) month upon Contract Commencement Date, the Contractor shall submit the following documentation as a minimum to Client for review and approval:

- Detailed Time Schedule for execution of Works under this Contract (Program of Works), comprising all activities from the design to taking-over,
- List of complete documentation to be submitted under this Contract,
- Type Tests Certificates for the equipment to be supplied under this Contract.

Within the three (2) months upon Contract Commencement Date, the Contractor shall submit the following documentation as a minimum to Client for review and approval:

- Outline drawings of the transformers and associated equipment to be supplied under this Contract,
- Outline drawing showing the transformer accommodation in the truck for transport to the Site,

- Foundation drawings with all necessary details for fixation for the equipment to be supplied under this Contract,
- Detailed technical description of the complete equipment to be supplied under this Contract,
- Details (Information, data, etc.) necessary for connection with the equipment which shall be supplied under other switchgear Contracts.
- Necessary calculations for dimensioning/sizing of the equipment,
- All other data that Contractor considers as necessary for submission to the Client.

Within the five (5) months upon Contract Commencement Date, the Contractor shall submit the following documentation as a minimum to Client for review and approval:

- Detailed front view and cross section drawings of the equipment supplied under this Contract, including all dimensions, weights and transport details,
- Detailed layout drawings of the equipment supplied under this Contract, including the existing equipment,
- Detailed electrical schematic diagrams, including block-diagrams, single line diagrams, circuit diagrams, I/O signal list, wiring diagrams and connection diagrams.
- Cable list with defined interconnections of the equipment supplied under this Contract, with connections between the equipment supplied under this Contract and the equipment to be supplied under other switchgear Contracts and existing equipment as well,
- Detailed Program of the Factory Tests,
- Detailed Program of the recommended Site Tests,
- Instructions for Equipment Installation (review only),
- Operation and Maintenance Manuals (review only),
- Program of Training for the installation, operation, maintenance and testing of the equipment to be delivered,
- All other data that Contractor considers as necessary for submission to the Client.

At least one (1) month prior to shipment, the Contractor shall submit the following documentation as a minimum to Client for review and approval:

- Signed approved Factory Test Reports,
- Clear evidence that all comments during FATs have been corrected,
- Detailed packing lists, transport program and insurance documentation,
- Instructions for loading, unloading, handling and particular safety measures to the applied during storage (review only).

6. Related Services

6.1 General

In addition to the defined equipment delivery, the Contractor for shall also provide the following related services:

- Training for the installation, operation, maintenance and testing of Main Transformer, Remote Tap-Changer Control Panel and Neutral Earthing & Auxiliary Power Supply Transformer (optional work).

Site activities jointly with the Client staff and whose CVs shall be subject to approval of the Client.

6.2 Training for the Installation, Operation, Maintenance and Testing (Not Applicable for this tender)

The Contractor shall include in his Tender, the weekly prices for potential Training for the installation, operation, maintenance and testing of the Client's personnel on the Site for the following equipment to be delivered with specified scope and durations:

- ~~Transformers (e.g. calculations, overloading capability, installation, maintenances, operation, tap changer, oil filtering, testing, cooling, vacuuming, unit protection) for 2 weeks.~~

The Training for the installation, operation, maintenance and testing of the above stated equipment shall commence only with the written request from the Client.

~~The Contractor cannot limit the number of trainees, whereas the course documentation (technical and other documentation) shall be provided for at least five (5) Client's representatives in soft and paper copies.~~

The training shall be arranged in such a way as to provide knowledge required for efficient and successful installation, operation, maintenance and testing of the above stated equipment. Training shall be organized on such a level that the trainees shall be prepared to take full responsibility for the maintenance and operation of the above stated equipment.

All training Instructors shall be experienced in their subject areas, shall be proficient at both writing and speaking the English language and shall have a detailed knowledge of the actual equipment and systems supplied under the Contract, particularly regarding any custom hardware and software which is unique to the Contract.

All training courses shall be given in the English language and full course documentation shall be provided in the English language.

The Contractor shall determine the necessary expenses for potential Training for the installation, operation, maintenance and testing of the above stated equipment. All costs related to the training (including costs of living, accommodation, local transport, airfares for all trips, insurance and any other costs associated with this matter) shall be included within the Price Schedules – Optional related services (Section V: *Tender Forms*) and the price of those additional activities shall not be included in the Total Tender Price.

LIST OF GOODS			
LIST NO.	**NAME OF GOODS**	**BRIEF DESCRIPTION**	**QUANTITY**
A 1.1	Main Transformer for Ishtafina 132/33 kV Substation	Three-phase, two-winding, oil immersed main transformer, for outdoor installation with Bushing Type Terminals and rated output of 42/63 MVA for ONAN/ONAF type of cooling, rated transformation ratio of 132/33 kV/kV with on-load tap changer on HV side (+3×1.67%/-9×1.67%), vector group Ynd1, all in accordance with IEC 60076. **132kV and 33kV side line and Neutral terminals shall be air bushing type, suitable for outdoor overhead conductor connections.**	**1 set**
A 1.2	Main Transformer Remote Tap-Changer Control Panel for Ishtafina 132/33 kV Substation	Remote Tap-Changer Control (RTCC) Panel for control of main transformer On-Load Tap-Changer (OLTC), completely wired, with voltage regulator, instruments, control switches, relays and other auxiliary devices, for indoor installation with IP41 degree of mechanical protection.	**1 set**
A 1.3	Earthing & Auxiliary Power Supply Transformer for Ishtafina 132/33 kV Substation	Three-phase, two-winding, oil immersed earthing and auxiliary power supply transformer, for outdoor installation with HV Bushing type Terminal with rated output of 200 kVA for ONAN type of cooling, rated transformation ratio of 33/0,4 kV/kV with off-load tap changer on HV side (±2×2.5%), vector group ZNyn11, all in accordance with IEC 60076. **33kV line and neutral terminals shall be air bushing type, suitable for outdoor overhead conductor connection.**	**1 set**

LIST OF GOODS			
LIST NO.	**NAME OF GOODS**	**BRIEF DESCRIPTION**	**QUANTITY**
A 2.1	Main Transformer for Substation Abdali 132/33 kV - Replacement	Three-phase, two-winding, oil immersed main transformer, for outdoor installation with Bushing Type Terminals and rated output of 54/80 MVA for ONAN/ONAF type of cooling, rated transformation ratio of 132/33 kV/kV with on-load tap changer on HV side (+3×1.67%/-9×1.67%), vector group Ynd1, all in accordance with IEC 60076. **132kV and 33kV side line and Neutral terminals shall be air bushing type, suitable for outdoor overhead conductor connections.**	1 set
A 2.2	Main Transformer Remote Tap-Changer Control Panel for Substation Abdali 132/33 kV - Replacement	Remote Tap-Changer Control (RTCC) Panel for control of main transformer On-Load Tap-Changer (OLTC), completely wired, with voltage regulator, instruments, control switches, relays and other auxiliary devices, for indoor installation with IP41 degree of mechanical protection.	1 set
A 2.3	Earthing & Auxiliary Power Supply Transformer for Substation Abdali 132/33 kV - Replacement	Three-phase, two-winding, oil immersed earthing and auxiliary power supply transformer, for outdoor installation with HV Bushing type Terminal and rated output of 200 kVA for ONAN type of cooling, rated transformation ratio of 33/0,4 kV/kV with off-load tap changer on HV side (±2×2.5%), vector group ZNyn11, all in accordance with IEC 60076. **33kV line and neutral terminals shall be air bushing type, suitable for outdoor overhead conductor connection.**	1 set

LIST OF GOODS			
LIST NO.	**NAME OF GOODS**	**BRIEF DESCRIPTION**	**QUANTITY**
A 3.1	**Main Transformer for Substation Subeihi 132/33 kV - Extension**	Three-phase, two-winding, oil immersed main transformer, for outdoor installation with Bushing Type Terminals and and rated output of 42/63 MVA for ONAN/ONAF type of cooling, rated transformation ratio of 132/33 kV/kV with on-load tap changer on HV side (+3×1.67%/-9×1.67%), vector group Ynd1, all in accordance with IEC 60076. **132kV and 33kV side line and Neutral terminals shall be air bushing type, suitable for outdoor overhead conductor connections.**	**1 set**
A 3.2	**Main Transformer Remote Tap-Changer Control Panel for Substation Subeihi 132/33 kV - Extension**	Remote Tap-Changer Control (RTCC) Panel for control of main transformer On-Load Tap-Changer (OLTC), completely wired, with voltage regulator, instruments, control switches, relays and other auxiliary devices, for indoor installation with IP41 degree of mechanical protection.	**1 set**
A 3.3	**Earthing & Auxiliary Power Supply Transformer for Substation Subeihi 132/33 kV - Extension**	Three-phase, two-winding, oil immersed earthing and auxiliary power supply transformer, for outdoor installation HV Bushing type Terminal and rated output HV of 200 kVA for ONAN type of cooling, rated transformation ratio of 33/0,4 kV/kV with off-load tap changer on HV side (±2×2.5%), vector group ZNyn11, all in accordance with IEC 60076. **33kV line and neutral terminals shall be air bushing type, suitable for outdoor overhead conductor connection.**	**1 set**

LIST OF GOODS			
LIST NO.	**NAME OF GOODS**	**BRIEF DESCRIPTION**	**QUANTITY**
A 4.1	**Main Transformer for Substation Sabha 132/33 kV - Extension**	Three-phase, two-winding, oil immersed main transformer, for outdoor installation with Bushing type Terminal and rated output of 54/80 MVA for ONAN/ONAF type of cooling, rated transformation ratio of 132/33 kV/kV with on-load tap changer on HV side (+3×1.67%/-9×1.67%), vector group Ynd1, all in accordance with IEC 60076. **132kV and 33kV side line and Neutral terminals shall be air bushing type, suitable for outdoor overhead conductor connections.**	**1 set**
A 4.2	**Main Transformer Remote Tap-Changer Control Panel for Substation Sabha 132/33 kV - Extension**	Remote Tap-Changer Control (RTCC) Panel for control of main transformer On-Load Tap-Changer (OLTC), completely wired, with voltage regulator, instruments, control switches, relays and other auxiliary devices, for indoor installation with IP41 degree of mechanical protection.	**1 set**
A 4.3	**Earthing & Auxiliary Power Supply Transformer for Substation Sabha 132/33 kV - Extension**	Three-phase, two-winding, oil immersed earthing and auxiliary power supply transformer, for outdoor installation with HV Bushing type Terminal and rated output of 200 kVA for ONAN type of cooling, rated transformation ratio of 33/0,4 kV/kV with off-load tap changer on HV side (±2×2.5%), vector group ZNyn11, all in accordance with IEC 60076. **33kV line and neutral terminals shall be air bushing type, suitable for outdoor overhead conductor connection.**	**1 set**

LIST OF GOODS			
LIST NO.	**NAME OF GOODS**	**BRIEF DESCRIPTION**	**QUANTITY**
A 5.1	**Main Transformer for Substation Manara 132/33 kV - Extension**	Three-phase, two-winding, oil immersed main transformer, for outdoor installation with rated output of 54/80 MVA for ONAN/ONAF type of cooling, rated transformation ratio of 132/33 kV/kV with on-load tap changer on HV side (+3×1.67%/-9×1.67%), vector group Ynd1, all in accordance with IEC 60076. **132kV line terminals shall be inside cable box (oil insulated), provided on HV side of transformer, suitable for transformer cable termination connection, in accordance with IEC 62271-209 and EN 50299. Minimum132kV cable cross section is 1000 mm² per phase.** **33kV line terminals shall be inside cable box (air insulated) provided on LV side of transformer, suitable for connection of 33kV cables for SWG and Earthing transformer.** **Neutral terminal shall be at air bushing suitable for overhead conductor connection.**	**1 set**
A 5.2	**Main Transformer Remote Tap-Changer Control Panel for Substation Sabha 132/33 kV - Extension**	Remote Tap-Changer Control (RTCC) Panel for control of main transformer On-Load Tap-Changer (OLTC), completely wired, with voltage regulator, instruments, control switches, relays and other auxiliary devices, for indoor installation with IP41 degree of mechanical protection.	**1 set**
A 5.3	**Earthing & Auxiliary Power Supply Transformer for Substation Manara 132/33 kV - Extension**	Three-phase, two-winding, oil immersed earthing and auxiliary power supply transformer, for outdoor installation with rated output of 200 kVA for ONAN type of cooling, rated transformation ratio of 33/0,4 kV/kV with off-load tap changer on HV side (±2×2.5%), vector group ZNyn11, all in accordance with IEC 60076. **33kV line terminals shall be inside cable box (air insulated) provided on HV side of earthing transformer, suitable for 33kV cable connection.** **33kV neutral terminal shall be air bushing type, suitable for outdoor overhead conductor connection.**	**1 set**

NOTE:

A sample of the offered transformer oil (from each type) shall be provided with certificate of origin and tested from independent laboratory (the same patch) for NEPCO approval before FAT.

Delivery and Completion Requirements

The delivery schedule expressed as ***weeks*** stipulates hereafter a delivery date which is the date of delivery of the Goods and Related Services, as per the terms of the Contract.

GOODS

The Goods shall be delivered within the periods stated below starting from the Commencement Date, defined as the date of letter of Award.

Item	Description	Qty.	Destination	Delivery period
1 . ISHTAFINA 132/33 kV substation				
1.1	Main Transformer 63MVA, 132/33 kV	1 set	Aqaba port, Jordan	50 weeks
1.2	Main Transformer Remote Tap-Changer Control Panel	1 set	Aqaba port, Jordan	50 weeks
1.3	Earthing & Auxiliary Power Supply Transformer	1 set	Aqaba port, Jordan	50 weeks
2 . ABDALI 132/33 kV Substation				
3.1	Main Transformer 80MVA, 132/33 kV	1 set	Aqaba port, Jordan	50 weeks
3.2	Main Transformer Remote Tap-Changer Control Panel	1 set	Aqaba port, Jordan	50 weeks
3.3	Earthing & Auxiliary Power Supply Transformer	1 set	Aqaba port, Jordan	50 weeks
3 . Subeihi 132/33 kV Substation				
3.1	Main Transformer 63MVA, 132/33 kV	1 set	Aqaba port, Jordan	50 weeks
3.2	Main Transformer Remote Tap-Changer Control Panel	1 set	Aqaba port, Jordan	50 weeks
3.3	Earthing & Auxiliary Power Supply Transformer	1 set	Aqaba port, Jordan	50 weeks
4 . Sabha 132/33 kV Substation				
4.1	Main Transformer 80 MVA, 132/33 kV	1 set	Aqaba port, Jordan	50 weeks
4.2	Main Transformer Remote Tap-Changer Control Panel	1 set	Aqaba port, Jordan	50 weeks

Item	Description	Qty.	Destination	Delivery period
4.3	Earthing & Auxiliary Power Supply Transformer	1 set	Aqaba port, Jordan	50 weeks
5 . Manara 132/33 kV Substation				
5.1	Main Transformer 80 MVA, 132/33 kV	1 set	Aqaba port, Jordan	50 weeks
5.2	Main Transformer Remote Tap-Changer Control Panel	1 set	Aqaba port, Jordan	50 weeks
5.3	Earthing & Auxiliary Power Supply Transformer	1 set	Aqaba port, Jordan	50 weeks
6	Site location			ISHTAFINA, ABDALI, SUBEIHI, SABHA and Manara 132/33 kV Substations
8.1	Within which the material will be ready for inspection and testing Calendar months			
8.2	Within which the material will be ready for shipment Calendar months			
8.3	Within which the material will be delivered to Site Calendar months			
8.4	Within which the Contractor will require access for Supervision to the Site Calendar months			
8.5	Within which Supervision of the Works will be completed, tested and ready for continuous use Calendar months			

Periods from Commencement Date By Which the Information Specified In the Schedules Will Be Submitted (Information to be supplied with Tender)

Item No	Description	Time in months
1	Contract drawings as listed in the schedules for:	
1.1	Equipment arrangements	
1.2	Foundation details	
1.3	Equipment details	
1.4	Schematic diagrams of control and protection	
1.5	Details of auxiliary equipment	
1.6	Design calculation	

(Information to be supplied with Tender)

TRANSFORMERS

Item	Manufacturer	Place of Manufacture	Place of testing and Inspection
Main transformers, complete			
Earthing/auxiliary transformers complete			
Core plates			
Tanks			
Radiators			
Marshalling kiosk and/or cabinets			
132 KV / 33 KV Bushings			
132 kV neutral Bushings			
Porcelain for insulators			
Cable boxes			
Voltage control apparatus (tap changer)			
Automatic Voltage Control Relay			
Temperature indicators			
Oil			
Oil pumps			
Oil valves			
Oil coolers			
Air blowers			
Oil pump motors			
Cooling Fans with motors			
Motor control gear for tap changer.			
Alarm devices			
Gas And Oil Actuated Relays			
Oil Temperature Indicators			
Winding Temperature Indicators			
Ammeters			
MCBs			
Silicagel Breather			
Valves			
Pressure Relief Devices			
Buchholz Relays			
CTs			
Contactors			
Fuses			

- This information will be contractually binding. Missing or incomplete information or information not accepted by Employer/Engineer can cause the rejection of the Bid.
- Any deviation from this Schedule shall be notified as soon as possible for the Engineer's approval
- One manufacturer only to be specified

Schedules of Technical Data (STD)

The Schedule of Technical Data (STD) shall be filled-in and dully signed by the Tenderer.

If Tenderer plans to use multiple types of equipment and devices for which there are no fields in Schedules of Technical Data, he is obliged to create additional fields in tables.

Schedule of Technical Data (STD)

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
1.	**Main Transformer 80 MVA, with Bushing Type Terminals For (Sabha and Abdali 132 kV substations)**			
1.1	**General Data**			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Three-phase, two-winding, oil immersed, with conservator	
	Type designation by the manufacturer			
	Standards		IEC 60076 IEC 60214	
	Installation		Outdoor, without wheels	
	Type of cooling (acc. to IEC 60076)		ONAN/ONAF	
	Method of earthing:			
	- HV winding		Solid	
	- LV winding		Via Neutral Earthing Resistor through Earthing Transformer	
	Transformer painting colour (RAL)		RAL 7001	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Min. Peak Efficiency Index (PEI)	%	99.758	
1.2	**Site/ Design Conditions**			
	Altitude above sea level	m		
	Minimum ambient temperature	°C	-10	
	Maximum ambient temperature	°C	38	
	Design maximum ambient temperature	°C	50	
1.3	**Rated Data and Characteristics**			
	Rated power at site conditions:			
	- with ONAN cooling	MVA	54	
	- with ONAF cooling	MVA	80	
	Rated frequency	Hz	50	
	Efficiency at 100% of rated power:			
	- with ONAN cooling	%		
	- with ONAF cooling	%		
	Rated voltages:			
	- HV winding	kV	132	
	- LV winding	kV	33	
	Highest voltage for equipment:			
	- HV winding	kV	145	
	- LV winding	kV	36	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min):			
	- HV winding	kV	275	
	- LV winding	kV	70	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs):			
	- HV winding	kV	650	
	- LV winding	kV	≥170	
	Rated current at rated voltage:			
	- HV winding	A		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	- LV winding	A		
	Connection phase displacement symbol (Vector group)		YNd1	
	Short circuit impedance	%	12.5	
	No-load current (% of rated current):			
	- at 85% of rated voltage			
	- at rated voltage			
	- at 105% of rated voltage			
	Maximum temperature rises at rated power at:			
	- average windings	K	55	
	- hot spot of winding	K	68	
	- top oil	K	50	
	- oil at inlet of cooler	K		
	- oil at outlet of cooler	K		
	- core	K		
	Hot-spot factor (H)		1.3	
	Maximum No-load losses at rated tap and rated frequency	kW	The losses shall provide in financial part The detailed losses table in schedule G	
	Maximum Load losses at 75 ºC, rated tap and rated frequency:			
	- at ONAN rated power	kW		
	- at ONAF rated power	kW		
	Cooling power for no-load operation	kW		
	Total cooling power at rated power	kW		
	Min. PEI (acc. To equation mentioned in Particular Technical Specifications (PTS) Page 4	%	Not less than 99.758	
	Symmetrical short circuit withstand current (duration 3 s) at the terminals of the transformer:			
	- HV winding	kA	40	
	- LV winding	kA	31.5	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Temperature rise of winding due to short circuit in duration of 3 s and:			
	- HV side short circuit current of 40 kA	K		
	- LV side short circuit current of 31.5 kA	K		
	Magnetizing current (HV winding)			
	- at 85% of rated voltage	A		
	- at rated voltage	A		
	- at 105% of rated voltage	A		
	Short circuit impedance at 75 ºC, rated voltage and frequency:			
	- at principal tapping	%		
	- at extreme plus tapping	%		
	- at extreme minus tapping	%		
	Noise level measured in accordance with IEC 60076-10	dB	≤70	
1.4	**Structural Characteristics**			
	Type (graded/non-graded) of windings:			
	- HV winding			
	- LV winding			
	Winding arrangement (i.e. core/LV/HV/Taps)			
	Winding conductor material:			
	- HV winding		enamelled copper	
	- LV winding		enamelled copper	
	Winding conductor cross section:			
	- HV winding	mm^2		
	- LV winding	mm^2		
	Winding insulation:			
	- HV winding		thermally upgraded paper	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	- LV winding		thermally upgraded paper	
	Insulation system thermal class of the winding:			
	- HV winding		105	
	- LV winding		105	
	Maximum current density in the windings at rated power and at rated voltage:			
	- HV winding	A/mm^2		
	- LV winding	A/mm^2		
	Winding resistance at 75°C:			
	- HV winding	Ω/phase		
	- LV winding	Ω/phase		
	Magnetic core construction:			
	- taped/banded/bolted limbs			
	- taped/banded/bolted yokes			
	- taping/banding material			
	- number of limbs			
	- type of joints in magnetic core			
	- type of core laminations			
	- maximum specific loss in core laminations at 1.7 T	W/kg	0.95	
	Maximum flux density in the core at rated voltage and at rated frequency:			
	- limbs	T	1.7	
	- yokes	T	1.7	
	Insulation of magnetic core:			
	- core laminations			
	- core screws			
	- washers for core screws			
	- end plates			
	Material of transformer tank			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Thickness of transformer tank:			
	- sides	mm		
	- bottom	mm		
	- top	mm		
	Tank anticorrosion protection			
	Thickness of radiator plates	mm		
	Thickness of final paint	µm		
	Conservator vessel, radiators, fan grilles, control cabinets or boxes and pipework anticorrosion protection		Hot dip galvanized and painted	
1.5	**Tap Changer**			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Maintenance free, Vacuum type	
	Type designation by the manufacturer			
	Standards		IEC 60214	
	Type of regulation		On-load	
	Position of tap changer		At HV winding	
	Range of regulation	%	+5%/-15%	
	Regulation step	%	1.67	
	Number of tap positions		13	
	Contact life (operations)		min. 300000	
	Tap changer local control cabinet		Yes	
	Location of transformer OLTC control cabinet		Mounted on transformer	
	OLTC control cabinet painting colour (RAL)			
1.6	**Transformer Protective Devices & Accessories**			
	Standards		IEC 60076-22-1	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
			IEC 60076-22-7	
	Transformer cooling system control cabinet		Yes	
	Location of transformer cooling system control cabinet		Mounted on transformer	
	Control cabinet painting colour (RAL)			
	Heater inside transformer control cabinet		Yes	
	HV winding temperature indicator		Yes	
	LV winding temperature indicator		Yes	
	Oil temperature indicator		Yes	
	Buchholz relay		Yes	
	Pressure relief device		Yes	
	Transformer conservator		Yes	
	Total volume of conservator	litres		
	Dehydrating breather		Yes	
	Type of dehydrating breather		Air bag + Dehydrating agent, Maintenance free	
	Type of oil level gauge			
	Transformer wheels		No	
	Supply voltage for transformer auxiliaries	V	400/230 AC	
	Control & Protection voltage	V	110 DC	
	Impact recorder		Yes	
	Designed and manufactured constant acceleration in all directions	m/s^2	min. 20	
1.7	**Cooling System**			
	Total number of coolers (radiators) per transformer	pcs		
	Number of stand-by coolers (radiators)	pcs		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Total number of fans	pcs		
	Number of stand-by fans	pcs		
	Rating of each fan	kW		
1.8	**Transformer Bushings**			
	Terminal type			
	HV line terminals		Bushing	
	HV neutral terminal		Bushing	
	LV line terminals		Bushing	
	Connection on Transformer HV side **Note:** Transformer will have HV bushings in air, for connection of 132kV conductor, without cable box.			
	Connection on Transformer LV side **Note:** Transformer will have LV bushings in air, for connection of 33kV conductor, without cable box			
	HV Bushings			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Oil/ air	
	Type designation by the manufacturer			
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	145	
	Rated frequency	Hz	50	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	275	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV	650	
	Minimum creepage distance	mm	5510	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Arcing horns and other accessories		yes	
	HV Neutral Bushing			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Oil/air	
	Type designation by the manufacturer			
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	As per manufacture design	
	Rated frequency	Hz	As per manufacture design	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	As per manufacture design	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV	As per manufacture design	
	Minimum creepage distance	mm	As per manufacture design	
	Arcing horns and other accessories		As per IEC	
	LV Bushings			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Oil/air	
	Type designation by the manufacturer			
	Standards		IEC 60137	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
			IEC 60815	
	Material			
	Highest voltage for equipment	kV	36	
	Rated frequency	Hz	50	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	70	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV	≥170	
	Minimum creepage distance	mm	1368	
	Arcing horns and other accessories		As per manufacture design	
1.9	**Current Transformers**			
	Current Transformer in HV Bushing			
	Number of current transformers per transformer	pcs	2	
	Number of secondary cores	pcs		
	Rated transformation ratio	A/A		
	Accuracy class			
	Rated output	VA		
	Current Transformer in LV Bushing			
	Number of current transformers per transformer	pcs	2	
	Number of secondary cores	pcs		
	Rated transformer ratio	A/A		
	Accuracy class			
	Rated output	VA		
1.10	**Dimensions and Masses**			
	- core	kg		
	- windings	kg		
	- total mass excluding oil	kg		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	- oil mass in tank	kg		
	- oil mass in radiators	kg		
	- total oil required	kg		
		litres		
	Dimensions of transformer arranged for transport:			
	- length	mm		
	- width	mm		
	- height	mm		
	Mass of transformer arranged for transport	kg		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
2.	**Main Transformer 63 MVA, with Bushing Type Terminal (Ishtafina and Subeihi 132 kV substations)**			
2.1	**General Data**			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Three-phase, two-winding, oil immersed, with conservator	
	Type designation by the manufacturer			
	Standards		IEC 60076 IEC 60214	
	Installation		Outdoor, without wheels	
	Type of cooling (acc. to IEC 60076)		ONAN/ONAF	
	Method of earthing:			
	- HV winding		Solid	
	- LV winding		Via Neutral Earthing Resistor through Earthing Transformer	
	Transformer painting colour (RAL)		RAL 7001	
	Min. Peak Efficiency Index (PEI)	**%**	99.745	
2.2	**Site/ Design Conditions**			
	Altitude above sea level	m		
	Minimum ambient temperature	°C	-10	
	Maximum ambient temperature	°C	38	
	Design maximum ambient temperature	°C	50	
2.3	**Rated Data and Characteristics**			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Rated power at site conditions:			
	- with ONAN cooling	MVA	42	
	- with ONAF cooling	MVA	63	
	Rated frequency	Hz	50	
	Efficiency at 100% of rated power:			
	- with ONAN cooling	%		
	- with ONAF cooling	%		
	Rated voltages:			
	- HV winding	kV	132	
	- LV winding	kV	33	
	Highest voltage for equipment:			
	- HV winding	kV	145	
	- LV winding	kV	36	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min):			
	- HV winding	kV	275	
	- LV winding	kV	70	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs):			
	- HV winding	kV	650	
	- LV winding	kV	≥170	
	Rated current at rated voltage:			
	- HV winding	A		
	- LV winding	A		
	Connection phase displacement symbol (Vector group)		YNd1	
	Short circuit impedance	%	12.5	
	No-load current (% of rated current):			
	- at 85% of rated voltage			
	- at rated voltage			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	- at 105% of rated voltage			
	Maximum temperature rises at rated power at:			
	- average windings	K	55	
	- hot spot of winding	K	68	
	- top oil	K	50	
	- oil at inlet of cooler	K		
	- oil at outlet of cooler	K		
	- core	K		
	Hot-spot factor (H)		1.3	
	Maximum No-load losses at rated tap and rated frequency	kW	The losses shall provide in financial part The detailed losses table in schedule G	
	Maximum Load losses at 75 ºC, rated tap and rated frequency:			
	- at ONAN rated power	kW		
	- at ONAF rated power	kW		
	Cooling power for no-load operation	kW		
	Total cooling power at rated power	kW		
	Symmetrical short circuit withstand current (duration 3 s) at the terminals of the transformer:			
	- HV winding	kA	40	
	- LV winding	kA	31.5	
	Temperature rise of winding due to short circuit in duration of 3 s and:			
	- HV side short circuit current of 40 kA	K		
	- LV side short circuit current of 31.5 kA	K		
	Magnetizing current (HV winding)			
	- at 85% of rated voltage	A		
	- at rated voltage	A		
	- at 105% of rated voltage	A		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Short circuit impedance at 75 ºC, rated voltage and frequency:			
	- at principal tapping	%		
	- at extreme plus tapping	%		
	- at extreme minus tapping	%		
	Noise level measured in accordance with IEC 60076-10	dB	≤70	
2.4	**Structural Characteristics**			
	Type (graded/non-graded) of windings:			
	- HV winding			
	- LV winding			
	Winding arrangement (i.e. core/LV/HV/Taps)			
	Winding conductor material:			
	- HV winding		enamelled copper	
	- LV winding		enamelled copper	
	Winding conductor cross section:			
	- HV winding	mm^2		
	- LV winding	mm^2		
	Winding insulation:			
	- HV winding		thermally upgraded paper	
	- LV winding		thermally upgraded paper	
	Insulation system thermal class of the winding:			
	- HV winding		105	
	- LV winding		105	
	Maximum current density in the windings at rated power and at rated voltage:			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	- HV winding	A/mm^2		
	- LV winding	A/mm^2		
	Winding resistance at 75°C:			
	- HV winding	Ω/phase		
	- LV winding	Ω/phase		
	Magnetic core construction:			
	- taped/banded/bolted limbs			
	- taped/banded/bolted yokes			
	- taping/banding material			
	- number of limbs			
	- type of joints in magnetic core			
	- type of core laminations			
	- maximum specific loss in core laminations at 1.7T	**W/kg**	**0.95**	
	Maximum flux density in the core at rated voltage and at rated frequency:			
	- limbs	**T**	**1.7 T**	
	- yokes	**T**	**1.7 T**	
	Insulation of magnetic core:			
	- core laminations			
	- core screws			
	- washers for core screws			
	- end plates			
	Material of transformer tank			
	Thickness of transformer tank:			
	- sides	mm		
	- bottom	mm		
	- top	mm		
	Tank anticorrosion protection			
	Thickness of radiator plates	mm		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Thickness of final paint	µm		
	Conservator vessel, radiators, fan grilles, control cabinets or boxes and pipework anticorrosion protection		Hot dip galvanized and painted	
2.5	**Tap Changer**			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Maintenance free, Vacuum type	
	Type designation by the manufacturer			
	Standards		IEC 60214	
	Type of regulation		On-load	
	Position of tap changer		At HV winding	
	Range of regulation	%	+5%/-15%	
	Regulation step	%	1.67	
	Number of tap positions		13	
	Contact life (operations)		min. 300000	
	Tap changer local control cabinet		Yes	
	Location of transformer OLTC control cabinet		Mounted on transformer	
	OLTC control cabinet painting colour (RAL)			
2.6	**Transformer Protective Devices & Accessories**			
	Standards		IEC 60076-22-1 IEC 60076-22-7	
	Transformer cooling system control cabinet		Yes	
	Location of transformer cooling system control cabinet		Mounted on transformer	
	Control cabinet painting colour (RAL)			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Heater inside transformer control cabinet		Yes	
	HV winding temperature indicator		Yes	
	LV winding temperature indicator		Yes	
	Oil temperature indicator		Yes	
	Buchholz relay		Yes	
	Pressure relief device		Yes	
	Transformer conservator		Yes	
	Total volume of conservator	litres		
	Dehydrating breather		Yes	
	Type of dehydrating breather		Air bag + Dehydrating agent, Maintenance free	
	Type of oil level gauge			
	Transformer wheels		No	
	Supply voltage for transformer auxiliaries	V	400/230 AC	
	Control & Protection voltage	V	110 DC	
	Impact recorder		Yes	
	Designed and manufactured constant acceleration in all directions	m/s^2	min. 20	
2.7	**Cooling System**			
	Total number of coolers (radiators) per transformer	pcs		
	Number of stand-by coolers (radiators)	pcs		
	Total number of fans	pcs		
	Number of stand-by fans	pcs		
	Rating of each fan	kW		
2.8	**Transformer Bushings**			
	Terminal type			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	HV line terminals		Bushing	
	HV neutral terminal		Bushing	
	LV line terminals		Bushing	
	Connection on Transformer HV side			
	Note: Transformer will have HV bushings in air, for connection of 132kV conductor, without cable box.			
	Connection on Transformer LV side			
	Note: Transformer will have LV bushings in air, for connection of 33kV conductor, without cable box			
	HV Bushings			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Oil/ air	
	Type designation by the manufacturer			
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	145	
	Rated frequency	Hz	50	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	275	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV	650	
	Minimum creepage distance	mm	5510	
	Arcing horns and other accessories		yes	
	HV Neutral Bushing			
	Manufacturer			
	Place and country of Manufacture			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Place of Factory Inspection and Testing			
	Type		Oil/air	
	Type designation by the manufacturer			
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	As per manufacture design	
	Rated frequency	Hz	As per manufacture design	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	As per manufacture design	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV	As per manufacture design	
	Minimum creepage distance	mm	As per manufacture design	
	Arcing horns and other accessories		As per IEC	
	LV Bushings			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Oil/air	
	Type designation by the manufacturer			
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	36	
	Rated frequency	Hz	50	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	70	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV	≥170	
	Minimum creepage distance	mm	1368	
	Arcing horns and other accessories		As per manufacture design	
2.9	**Current Transformers**			
	Current Transformer in HV Bushing			
	Number of current transformers per transformer	pcs	2	
	Number of secondary cores	pcs		
	Rated transformation ratio	A/A		
	Accuracy class			
	Rated output	VA		
	Current Transformer in LV Bushing			
	Number of current transformers per transformer	pcs	2	
	Number of secondary cores	pcs		
	Rated transformer ratio	A/A		
	Accuracy class			
	Rated output	VA		
2.11	**Dimensions and Masses**			
	Overall dimensions of the assembled transformer in operation:			
	- length	mm		
	- width	mm		
	- height	mm		
	Total mass of the assembled transformer in operation	kg		
	Individual masses of transformer:			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	- core	kg		
	- windings	kg		
	- total mass excluding oil	kg		
	- oil mass in tank	kg		
	- oil mass in radiators	kg		
	- total oil required	kg		
		litres		
	Dimensions of transformer arranged for transport:			
	- length	mm		
	- width	mm		
	- height	mm		
	Mass of transformer arranged for transport	kg		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
3.	**Main Transformer 80 MVA, with cable Box line Terminals For (Manara 132 kV substations)**			
3.1	**General Data**			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Three-phase, two-winding, oil immersed, with conservator	
	Type designation by the manufacturer			
	Standards		IEC 60076 IEC 60214	
	Installation		Outdoor, without wheels	
	Type of cooling (acc. to IEC 60076)		ONAN/ONAF	
	Method of earthing:			
	- HV winding		Solid	
	- LV winding		Via Neutral Earthing Resistor through Earthing Transformer	
	Transformer painting colour (RAL)		RAL 7001	
	Min. Peak Efficiency Index (PEI)	**%**	99.758	
3.2	**Site/ Design Conditions**			
	Altitude above sea level	m		
	Minimum ambient temperature	°C	-10	
	Maximum ambient temperature	°C	38	
	Design maximum ambient temperature	°C	50	
3.3	**Rated Data and Characteristics**			
	Rated power at site conditions:			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	- with ONAN cooling	MVA	54	
	- with ONAF cooling	MVA	80	
	Rated frequency	Hz	50	
	Efficiency at 100% of rated power:			
	- with ONAN cooling	%		
	- with ONAF cooling	%		
	Rated voltages:			
	- HV winding	kV	132	
	- LV winding	kV	33	
	Highest voltage for equipment:			
	- HV winding	kV	145	
	- LV winding	kV	36	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min):			
	- HV winding	kV	275	
	- LV winding	kV	70	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs):			
	- HV winding	kV	650	
	- LV winding	kV	≥170	
	Rated current at rated voltage:			
	- HV winding	A		
	- LV winding	A		
	Connection phase displacement symbol (Vector group)		YNd1	
	Short circuit impedance	%	12.5	
	No-load current (% of rated current):			
	- at 85% of rated voltage			
	- at rated voltage			
	- at 105% of rated voltage			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Maximum temperature rises at rated power at:			
	- average windings	K	55	
	- hot spot of winding	K	68	
	- top oil	K	50	
	- oil at inlet of cooler	K		
	- oil at outlet of cooler	K		
	- core	K		
	Hot-spot factor (H)		1.3	
	Maximum No-load losses at rated tap and rated frequency	kW	The losses shall provide in financial part The detailed losses table in schedule G	
	Maximum Load losses at 75 ºC, rated tap and rated frequency:			
	- at ONAN rated power	kW		
	- at ONAF rated power	kW		
	Cooling power for no-load operation	kW		
	Total cooling power at rated power	kW		
	Min. PEI (acc. To equation mentioned in Particular Technical Specifications (PTS) Page 4	%	Not less than 99.758	
	Symmetrical short circuit withstand current (duration 3 s) at the terminals of the transformer:			
	- HV winding	kA	40	
	- LV winding	kA	31.5	
	Temperature rise of winding due to short circuit in duration of 3 s and:			
	- HV side short circuit current of 40 kA	K		
	- LV side short circuit current of 31.5 kA	K		
	Magnetizing current (HV winding)			
	- at 85% of rated voltage	A		
	- at rated voltage	A		
	- at 105% of rated voltage	A		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Short circuit impedance at 75 ºC, rated voltage and frequency:			
	- at principal tapping	%		
	- at extreme plus tapping	%		
	- at extreme minus tapping	%		
	Noise level measured in accordance with IEC 60076-10	dB	≤70	
3.4	**Structural Characteristics**			
	Type (graded/non-graded) of windings:			
	- HV winding			
	- LV winding			
	Winding arrangement (i.e. core/LV/HV/Taps)			
	Winding conductor material:			
	- HV winding		enamelled copper	
	- LV winding		enamelled copper	
	Winding conductor cross section:			
	- HV winding	mm^2		
	- LV winding	mm^2		
	Winding insulation:			
	- HV winding		thermally upgraded paper	
	- LV winding		thermally upgraded paper	
	Insulation system thermal class of the winding:			
	- HV winding		105	
	- LV winding		105	
	Maximum current density in the windings at rated power and at rated voltage:			
	- HV winding	A/mm^2		
	- LV winding	A/mm^2		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Winding resistance at 75°C:			
	- HV winding	Ω/phase		
	- LV winding	Ω/phase		
	Magnetic core construction:			
	- taped/banded/bolted limbs			
	- taped/banded/bolted yokes			
	- taping/banding material			
	- number of limbs			
	- type of joints in magnetic core			
	- type of core laminations			
	- maximum specific loss in core laminations at 1.7 T	W/kg	0.95	
	Maximum flux density in the core at rated voltage and at rated frequency:			
	- limbs	T	1.7	
	- yokes	T	1.7	
	Insulation of magnetic core:			
	- core laminations			
	- core screws			
	- washers for core screws			
	- end plates			
	Material of transformer tank			
	Thickness of transformer tank:			
	- sides	mm		
	- bottom	mm		
	- top	mm		
	Tank anticorrosion protection			
	Thickness of radiator plates	mm		
	Thickness of final paint	µm		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Conservator vessel, radiators, fan grilles, control cabinets or boxes and pipework anticorrosion protection		Hot dip galvanized and painted	
3.5	**Tap Changer**			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Maintenance free, Vacuum type	
	Type designation by the manufacturer			
	Standards		IEC 60214	
	Type of regulation		On-load	
	Position of tap changer		At HV winding	
	Range of regulation	%	+5%/-15%	
	Regulation step	%	1.67	
	Number of tap positions		13	
	Contact life (operations)		min. 300000	
	Tap changer local control cabinet		Yes	
	Location of transformer OLTC control cabinet		Mounted on transformer	
	OLTC control cabinet painting colour (RAL)			
3.6	**Transformer Protective Devices & Accessories**			
	Standards		IEC 60076-22-1 IEC 60076-22-7	
	Transformer cooling system control cabinet		Yes	
	Location of transformer cooling system control cabinet		Mounted on transformer	
	Control cabinet painting colour (RAL)			
	Heater inside transformer control cabinet		Yes	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	HV winding temperature indicator		Yes	
	LV winding temperature indicator		Yes	
	Oil temperature indicator		Yes	
	Buchholz relay		Yes	
	Pressure relief device		Yes	
	Transformer conservator		Yes	
	Total volume of conservator	litres		
	Dehydrating breather		Yes	
	Type of dehydrating breather		Air bag + Dehydrating agent, Maintenance free	
	Type of oil level gauge			
	Transformer wheels		No	
	Supply voltage for transformer auxiliaries	V	400/230 AC	
	Control & Protection voltage	V	110 DC	
	Impact recorder		Yes	
	Designed and manufactured constant acceleration in all directions	m/s^2	min. 20	
3.7	**Cooling System**			
	Total number of coolers (radiators) per transformer	pcs		
	Number of stand-by coolers (radiators)	pcs		
	Total number of fans	pcs		
	Number of stand-by fans	pcs		
	Rating of each fan	kW		
3.8	**Transformer Bushings**			
	Terminal type			
	HV line terminals		Cable box	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	HV neutral terminal		Bushing	
	LV line terminals		Bushing at cable box	
	Connection on Transformer HV side **Note:** HV cable box shall be provided for TR , where 132kV cable terminations, supplied by other contractor, will be installed inside transformer HV connection box. Design of HV cable connection box shall be subject of Client's approval.			
	Cable box on Transformer LV side **Note:** LV cable box is applicable for TR , where 33kV cable terminations, supplied by other contractor, will be installed inside transformer LV box. In the LV side transformer cable box, provision for separation of cables going to 33kV SWG and to Earthing transformer shall be foreseen. Design of LV cable box shall be subject of Client's approval.			
	HV Bushings			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Oil/ Oil	
	Type designation by the manufacturer			
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	145	
	Rated frequency	Hz	50	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	275	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV	650	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Minimum creepage distance	mm		
	Arcing horns and other accessories		yes	
	HV Neutral Bushing			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Oil/air	
	Type designation by the manufacturer			
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	As per manufacture design	
	Rated frequency	Hz	As per manufacture design	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	As per manufacture design	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV	As per manufacture design	
	Minimum creepage distance	mm	As per manufacture design	
	Arcing horns and other accessories		As per manufacture IEC	
	LV Bushings			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Oil/air	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Type designation by the manufacturer			
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	36	
	Rated frequency	Hz	50	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	70	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV	≥170	
	Minimum creepage distance	mm	1368	
	Arcing horns and other accessories		As per manufacture design	
3.9	**Current Transformers**			
	Current Transformer in HV Bushing			
	Number of current transformers per transformer	pcs	2	
	Number of secondary cores	pcs		
	Rated transformation ratio	A/A		
	Accuracy class			
	Rated output	VA		
	Current Transformer in LV Bushing			
	Number of current transformers per transformer	pcs	2	
	Number of secondary cores	pcs		
	Rated transformer ratio	A/A		
	Accuracy class			
	Rated output	VA		
3.10	**Dimensions and Masses**			
	- core	kg		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	- windings	kg		
	- total mass excluding oil	kg		
	- oil mass in tank	kg		
	- oil mass in radiators	kg		
	- total oil required	kg		
		litres		
	Dimensions of transformer arranged for transport:			
	- length	mm		
	- width	mm		
	- height	mm		
	Mass of transformer arranged for transport	kg		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
4.	**Main Transformer Remote Tap Changer Control (RTCC) Panel**			
4.1	**General Data**			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Free-standing type	
	Type designation by the manufacturer			
	Standards			
	Installation		indoor	
	Panels painting colour (RAL)		RAL 6019	
	Degree of mechanical protection		IP41	
4.2	**Voltage Regulator**			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type			
	Type designation by the manufacturer			
	Standards			
4.3	**Panel Design Characteristics**			
	Anti-condensation heater		Yes	
	Internal lighting		Yes	
	Type of indication lamps		Neon/LED	
	Panel steel sheet thickness	mm		
	Dimensions and masses of the RTCC panel:			
	- width	mm		
	- depth	mm		
	- height	mm		
	- mass	kg		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
5.	**Earthing & Auxiliary Transformer, with H.V Bushing Type Terminal for (Ishtafina, Sabha, Subeihi and Abdali 132/33 kV Substations)**			
5.1	**General Data**			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Three-phase, Two-winding, oil immersed, with conservator	
	Type designation by the manufacturer			
	Standards		IEC 60076	
	Installation		Outdoor, without wheels	
	Type of cooling (acc to IEC 60076)		ONAN	
	Method of earthing:			
	- HV winding		Via Neutral Earthing Resistor	
	- LV winding		Solid	
	Transformer painting colour (RAL)		RAL 7001	
5.2	**Site / Design Conditions**			
	Altitude above sea level	m	<1000	
	Minimum ambient temperature	°C	-10	
	Maximum ambient temperature	°C	38	
	Design maximum ambient temperature	°C	50	
5.3	**Rated Data and Characteristics**			
	Rated power of LV star winding at site conditions	kVA	200	
	Rated frequency	Hz	50	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Current ratings of HV interconnected star winding:			
	- 30 s earth fault current in neutral	A		
	- Rated continuous current	A		
	Efficiency at 100% of rated power			
	Rated voltages U_r:			
	- HV winding	kV	33	
	- LV winding	kV	0.4	
	Highest voltage for equipment U_m:			
	- HV winding	kV	36	
	- LV winding	kV	1.1	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min):			
	- HV winding	kV	70	
	- LV winding	kV	3	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs):			
	- HV winding	kV	≥170	
	- LV winding	kV		
	Rated current at rated voltage:			
	- HV winding	A		
	- LV winding	A		
	Connection phase displacement symbol (Vector group)		ZNyn11	
	Short circuit impedance	%		
	No-load current (% of rated current):			
	- at 95% of rated voltage			
	- at rated voltage			
	- at 105% of rated voltage			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Maximum temperature rises at rated power at:			
	- average windings	K	55	
	- hot spot of winding	K	68	
	- top oil	K	50	
	- oil at inlet of cooler	K		
	- oil at outlet of cooler	K		
	- core	K		
	Hot-spot factor (H)		1.1	
	Maximum No-load losses at rated voltage and rated frequency	kW	The losses shall provide in financial part The detailed losses table in Schedule G	
	Maximum Load losses at 75 ºC and rated frequency	kW		
	Symmetrical short circuit withstand current for HV winding in duration of 3 s at the terminals of the transformer:	kA	31.5	
	Temperature rise of HV winding due to short circuit current of 31.5 kA in duration of 3 s	K		
	Temperature rise of HV winding due to earth fault current of 1000 A in duration of 30 s	K		
	Magnetizing current (HV winding)			
	- at 95% of rated voltage	A		
	- at rated voltage	A		
	- at 105% of rated voltage	A		
	Short circuit impedance at 75 ºC, rated voltage and frequency:			
	- at principal tapping	%		
	- at extreme plus tapping	%		
	- at extreme minus tapping	%		
	Noise level measured in accordance with IEC 60076-10	dB	≤70	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
5.4	**Structural Characteristics**			
	Type (graded/non-graded) of windings:			
	- HV winding			
	- LV winding			
	Winding arrangement (i.e. core/LV/HV/Taps)			
	Winding conductor material:			
	- HV winding		enamelled copper	
	- LV winding		enamelled copper	
	Winding conductor cross section:			
	- HV winding	mm^2		
	- LV winding	mm^2		
	Winding insulation:			
	- HV winding		thermally upgraded paper	
	- LV winding		thermally upgraded paper	
	Insulation system temperature class of the winding:			
	- HV winding		105	
	- LV winding		105	
	Maximum current density in the windings at rated power and at rated voltage:			
	- HV winding	A/mm^2		
	- LV winding	A/mm^2		
	Maximum current density in the interconnected star winding, with the earth fault current specified, for:			
	- 30 s fault current rating	A/mm^2	23	
	- 15 s fault current rating	A/mm^2		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Maximum current density in the interconnected star winding at 3 second rating	A/mm^2		
	Winding resistance at 75°C:			
	- HV winding	Ω/phase		
	- LV winding	Ω/phase		
	Zero sequence impedance at 75°C:			
	- HV interconnected star winding (LV winding open-circuited)	Ω/phase	≤45	
	Magnetic core construction:			
	- taped/banded/bolted limbs			
	- taped/banded/bolted yokes			
	- taping/banding material			
	- number of limbs			
	- type of joints in magnetic core			
	- type of core laminations			
	- maximum specific loss in core laminations at 1.7 T	W/kg		
	Maximum flux density in the core at rated voltage and at rated frequency:			
	- limbs	T	1.7	
	- yokes	T	1.7	
	Insulation of magnetic core:			
	- core laminations			
	- core screws			
	- washers for core screws			
	- end plates			
	Material of transformer tank			
	Thickness of transformer tank:			
	- sides	mm		
	- bottom	mm		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	- top	mm		
	Tank anticorrosion protection			
	Thickness of radiator plates	mm		
	Thickness of final paint	µm		
	Conservator vessel, radiators, boxes and pipework anticorrosion protection		Hot dip galvanized and painted	
5.5	**Tap Changer**			
	Type of regulation		Off-load	
	Position of tap changer		At HV winding	
	Range of regulation	%	±5%	
	Regulation step	%	2.5	
	Number of tap positions		5	
5.6	**Transformer Protective Devices & Accessories**			
	Standards		IEC 60076-22-1 IEC 60076-22-7	
	Fuse switch disconnector on LV side		Yes	
	Location of fuse switch box		Mounted on transformer	
	Fuse switch box painting colour (RAL)			
	Thermometer		Yes	
	Thermometer setting:			
	- alarm	°C		
	- trip	°C		
	Buchholz relay		Yes	
	Pressure relief device		Yes	
	Transformer conservator		Yes	
	Total volume of conservator	litres		
	Dehydrating breather		Yes	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Type of dehydrating breather		Air bag + Dehydrating agent, Maintenance free	
	Type of oil level gauge			
	Transformer wheels		No	
	Supply voltage for transformer auxiliaries	V	400/230 AC	
	Control & Protection voltage	V	110 DC	
5.7	**Cooling System**			
	Total number of coolers (radiators) per transformer	pcs		
	Number of stand-by coolers (radiators)	pcs		
5.8	**Transformer Bushings**			
	Terminal type			
	HV line terminals		Bushing	
	HV neutral terminal		Bushing	
	LV line terminals		Cable box	
	HV Bushings		Bushing in air	
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type			
	Type designation by the manufacturer			
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	36	
	Rated frequency	Hz	50	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	70	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV	≥170	
	Minimum creepage distance	mm	1368	
	Arcing horns and other accessories		yes	
	HV Neutral Bushing		Bushing in air	
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type			
	Type designation by the manufacturer			
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	36	
	Rated frequency	Hz	50	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	70	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV	≥170	
	Minimum creepage distance	mm	1368	
	Arcing horns and other accessories		As per IEC	
	LV Bushings		Cable box	
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type			
	Type designation by the manufacturer			
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	1.1	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Rated frequency	Hz	50	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	3	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV		
	Minimum creepage distance	mm	42	
	Arcing horns and other accessories		As per manufacture design	
5.9	Dimensions and Mass			
	Overall dimensions of the assembled transformer in operation:			
	- length	mm		
	- width	mm		
	- height	mm		
	Total mass of the assembled transformer in operation	kg		
	Individual masses of transformer:			
	- core	kg		
	- windings	kg		
	- total mass excluding oil	kg		
	- oil mass in tank	kg		
	- oil mass in radiators	kg		
	- total oil required	kg		
		Litres		
	Dimensions of transformer arranged for transport:			
	- length	mm		
	- width	mm		
	- height	mm		
	Mass of transformer arranged for transport	kg		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
6.	**Earthing & Auxiliary Transformer, with HV cable box Terminal for (Manra 132/33 kV Substation)**			
6.1	**General Data**			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Three-phase, Two-winding, oil immersed, with conservator	
	Type designation by the manufacturer			
	Standards		IEC 60076	
	Installation		Outdoor, without wheels	
	Type of cooling (acc to IEC 60076)		ONAN	
	Method of earthing:			
	- HV winding		Via Neutral Earthing Resistor	
	- LV winding		Solid	
	Transformer painting colour (RAL)		RAL 7001	
6.2	**Site / Design Conditions**			
	Altitude above sea level	m	<1000	
	Minimum ambient temperature	°C	-10	
	Maximum ambient temperature	°C	38	
	Design maximum ambient temperature	°C	50	
6.3	**Rated Data and Characteristics**			
	Rated power of LV star winding at site conditions	kVA	200	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Rated frequency	Hz	50	
	Current ratings of HV interconnected star winding:			
	- 30 s earth fault current in neutral	A		
	- Rated continuous current	A		
	Efficiency at 100% of rated power			
	Rated voltages U_r:			
	- HV winding	kV	33	
	- LV winding	kV	0.4	
	Highest voltage for equipment U_m:			
	- HV winding	kV	36	
	- LV winding	kV	1.1	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min):			
	- HV winding	kV	70	
	- LV winding	kV	3	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs):			
	- HV winding	kV	≥170	
	- LV winding	kV		
	Rated current at rated voltage:			
	- HV winding	A		
	- LV winding	A		
	Connection phase displacement symbol (Vector group)		ZNyn11	
	Short circuit impedance	%		
	No-load current (% of rated current):			
	- at 95% of rated voltage			
	- at rated voltage			
	- at 105% of rated voltage			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Maximum temperature rises at rated power at:			
	- average windings	K	55	
	- hot spot of winding	K	68	
	- top oil	K	50	
	- oil at inlet of cooler	K		
	- oil at outlet of cooler	K		
	- core	K		
	Hot-spot factor (H)		1.1	
	Maximum No-load losses at rated voltage and rated frequency	kW	The losses shall provide in financial part The detailed losses table in Schedule G	
	Maximum Load losses at 75 ºC and rated frequency	kW		
	Symmetrical short circuit withstand current for HV winding in duration of 3 s at the terminals of the transformer:	kA	31.5	
	Temperature rise of HV winding due to short circuit current of 31.5 kA in duration of 3 s	K		
	Temperature rise of HV winding due to earth fault current of 1000 A in duration of 30 s	K		
	Magnetizing current (HV winding)			
	- at 95% of rated voltage	A		
	- at rated voltage	A		
	- at 105% of rated voltage	A		
	Short circuit impedance at 75 ºC, rated voltage and frequency:			
	- at principal tapping	%		
	- at extreme plus tapping	%		
	- at extreme minus tapping	%		
	Noise level measured in accordance with IEC 60076-10	dB	≤70	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
6.4	**Structural Characteristics**			
	Type (graded/non-graded) of windings:			
	- HV winding			
	- LV winding			
	Winding arrangement (i.e. core/LV/HV/Taps)			
	Winding conductor material:			
	- HV winding		enamelled copper	
	- LV winding		enamelled copper	
	Winding conductor cross section:			
	- HV winding	mm^2		
	- LV winding	mm^2		
	Winding insulation:			
	- HV winding		thermally upgraded paper	
	- LV winding		thermally upgraded paper	
	Insulation system temperature class of the winding:			
	- HV winding		105	
	- LV winding		105	
	Maximum current density in the windings at rated power and at rated voltage:			
	- HV winding	A/mm^2		
	- LV winding	A/mm^2		
	Maximum current density in the interconnected star winding, with the earth fault current specified, for:			
	- 30 s fault current rating	A/mm^2	23	
	- 15 s fault current rating	A/mm^2		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Maximum current density in the interconnected star winding at 3 second rating	A/mm^2		
	Winding resistance at 75°C:			
	- HV winding	Ω/phase		
	- LV winding	Ω/phase		
	Zero sequence impedance at 75°C:			
	- HV interconnected star winding (LV winding open-circuited)	Ω/phase	≤45	
	Magnetic core construction:			
	- taped/banded/bolted limbs			
	- taped/banded/bolted yokes			
	- taping/banding material			
	- number of limbs			
	- type of joints in magnetic core			
	- type of core laminations			
	- maximum specific loss in core laminations at 1.7 T	W/kg		
	Maximum flux density in the core at rated voltage and at rated frequency:			
	- limbs	T	1.7	
	- yokes	T	1.7	
	Insulation of magnetic core:			
	- core laminations			
	- core screws			
	- washers for core screws			
	- end plates			
	Material of transformer tank			
	Thickness of transformer tank:			
	- sides	mm		
	- bottom	mm		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	- top	mm		
	Tank anticorrosion protection			
	Thickness of radiator plates	mm		
	Thickness of final paint	µm		
	Conservator vessel, radiators, boxes and pipework anticorrosion protection		Hot dip galvanized and painted	
6.5	**Tap Changer**			
	Type of regulation		Off-load	
	Position of tap changer		At HV winding	
	Range of regulation	%	±5%	
	Regulation step	%	2.5	
	Number of tap positions		5	
6.6	**Transformer Protective Devices & Accessories**			
	Standards		IEC 60076-22-1 IEC 60076-22-7	
	Fuse switch disconnector on LV side		Yes	
	Location of fuse switch box		Mounted on transformer	
	Fuse switch box painting colour (RAL)			
	Thermometer		Yes	
	Thermometer setting:			
	- alarm	°C		
	- trip	°C		
	Buchholz relay		Yes	
	Pressure relief device		Yes	
	Transformer conservator		Yes	
	Total volume of conservator	litres		
	Dehydrating breather		Yes	

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Type of dehydrating breather		Air bag + Dehydrating agent, Maintenance free	
	Type of oil level gauge			
	Transformer wheels		No	
	Supply voltage for transformer auxiliaries	V	400/230 AC	
	Control & Protection voltage	V	110 DC	
6.7	**Cooling System**			
	Total number of coolers (radiators) per transformer	pcs		
	Number of stand-by coolers (radiators)	pcs		
6.8	**Transformer Bushings**			
	Terminal type			
	HV line terminals		Bushing at cable box	
	HV neutral terminal		Bushing	
	LV line terminals		Cable box	
	Cable connection box on Earthing transformer HV side **Note:** HV cable box shall be provided for ET , where 33kV cable terminations, supplied by other contractor, will be installed inside transformer 33 connection box. Design of 33 cable connection box shall be subject of Client's approval.			
	HV Bushings		Inside cable box	
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type			
	Type designation by the manufacturer			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	36	
	Rated frequency	Hz	50	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	70	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV	≥170	
	Minimum creepage distance	mm	1368	
	Arcing horns and other accessories		yes	
	HV Neutral Bushing		Bushing in air	
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type			
	Type designation by the manufacturer			
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	36	
	Rated frequency	Hz	50	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	70	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV	≥170	
	Minimum creepage distance	mm	1368	
	Arcing horns and other accessories		AS Per IEC	
	LV Bushings		Cable box	
	Manufacturer			
	Place and country of Manufacture			

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
	Place of Factory Inspection and Testing			
	Type			
	Type designation by the manufacturer			
	Standards		IEC 60137 IEC 60815	
	Material			
	Highest voltage for equipment	kV	1.1	
	Rated frequency	Hz	50	
	Power frequency withstand voltage (r.m.s. value), AC (50 Hz, 1 min)	kV	3	
	Lightning impulse withstand voltage (peak value), LI (1.2/50 µs)	kV		
	Minimum creepage distance	mm	42	
	Arcing horns and other accessories		As per manufacture design	
6.9	Dimensions and Mass			
	Overall dimensions of the assembled transformer in operation:			
	- length	mm		
	- width	mm		
	- height	mm		
	Total mass of the assembled transformer in operation	kg		
	Individual masses of transformer:			
	- core	kg		
	- windings	kg		
	- total mass excluding oil	kg		
	- oil mass in tank	kg		
	- oil mass in radiators	kg		
	- total oil required	kg		

ITEM	DESCRIPTION	UNIT	DATA	
			Required	Offered
		Litres		
	Dimensions of transformer arranged for transport:			
	- length	mm		
	- width	mm		
	- height	mm		
	Mass of transformer arranged for transport	kg		

No.	ITEM	Unit	Data	
			Required	Offered
7	**Transformer Mineral Insulating Oil for all transformers**			
	Manufacturer			
	Place and country of Manufacture			
	Place of Factory Inspection and Testing			
	Type		Uninhibited mineral naphthenic oil	
	Type designation by the manufacturer			
	Standards		IEC 60296 IEC 62535	
	Insulation oil meeting special applications		Yes	
	Free of corrosive Sulphur (as per IEC 62535), PCB, DBDS (dibenzyl disulphide), Antioxidant, passivator, metal deactivator and other additives		Yes	
	Additional test method for corrosive Sulphur according to ASTM D1275 B		Yes	
	Viscosity:			
	- at 40 ºC	mm^2/s	≤ 12	
	- at -30 ºC	mm^2/s	≤ 1800	
	Pour point	ºC	≤ -40	
	Water content	mg/kg	< 30	
	Breakdown voltage:			
	- before treatment	kV	> 30	
	- after treatment	kV	> 70	
	Density at 20 ºC	kg/dm^3	≤ 0.895	
	DDF at 90 ºC		< 0.005	
	Oxidation stability at 120 °C, 164 h according to IEC 61125 C			
	- total acidity	mg KOH/g	≤1.2	

No.	ITEM	Unit	Data	
			Required	Offered
	- sludge	wt%	<0.80	
	- DDF at 90 ºC		<0.5	
	Corrosive sulphur		non-corrosive	
	PCB		Not detectable	
	DBDS as per IEC 62697-1		Not detectable (<0.5 mg/kg)	
	Inhibitors of IEC 60666		Uninhibited (U): not detectable (< 0,01 %) Trace inhibited (T): ≥ 0,01 < 0,08% Inhibited oil (I): 0,08 % to 0,40 % (See 3.5 to 3.7)	
	Metal passivator additives of IEC 60666		Not detectable (< 5 mg/kg), or as agreed upon with the purchaser	
	furfural and related compounds content (IEC 61198)		Not detectable (<0.5 mg/kg) for each individual compound	
	Color ISO 2049		Max. 1,5	
	Appearance		Clear, free from sediment and suspended matter	
	Acidity IEC 62021-2a or 62021-1		Max. 0,01 mg KOH/g	
	Interfacial tension IEC 62961 a or ASTM D971		Min. 40 mN/m	
	Flash point ISO 2719		Min. 135 °C Min. 100 °C	
	PCA content (IP 346)		(< 3 %)	
	PCB content (IEC 61619)		Not detectable (< 2 mg/kg)	
	Other tests as per IEC and ISO standards		Yes	

No.	ITEM	Unit	Data	
			Required	Offered
	Stray gassing under thermo-oxidative stress (see 6.19) is not included as a normative test for mineral oils Type B, because there has been insufficient data to determine appropriate limits. The requirement for a stray gassing test, as well as the limit values, if stipulated, can be negotiated between the user and supplier. a) Reference method. b) This is the standard LCSET for a transformer oil (see 6.1) and can be modified depending on the climatic condition of each country. Pour point should be minimum 10 °C below LCSET. c) Standard LCSET for low temperature switchgear oil. d) For bulk supply. e) For delivery in drums and IBC. f) After laboratory treatment (see 6.4). g) The supplier shall declare the function and chemical family of all additives (3.3), and the concentrations in the cases of inhibitors antioxidants and passivators (3.4). h) In agreement with the customer, oils with a higher furfural content can be delivered, when these values do not jeopardize the application. i) In some countries there can be lower requirements for oxidation stability. j) At the end of oxidation stability tests. k) In some countries there can be additional requirements, e.g., REACH in the EU. l) Some individual PAH compounds can be determined by EN 1614			

Annex A: Equipment's suppliers

Item	Manufacturer	Place of Manufacture	Place of testing and Inspection
Main transformers, complete			
Earthing/auxiliary transformers complete			
Core plates			
Tanks			
Radiators			
Marshalling kiosk and/or cabinets			
132 outdoor Bushings 33 kV outdoor Bushings Main transformer neutral Bushings Earthing transformer neutral bushings			
Cable Box			
Voltage control apparatus (Tap Changer)			
Oil			

Item	Manufacturer	Place of Manufacture	Place of testing and Inspection
Oil Valves			
Air Blowers			
Motor Control Gear of tap changer			
Fan Motors			
Alarms			
Gas And Oil Actuated Relays			
Oil Temperature Indicators			
Winding Temperature Indicators			
Digital Meters			
MCBs			
Silicagel Breather			
Valves			
Pressure Relief Device			
Buchholz Relays			
OFF Load Tap changer			
CTs			
Contactors			
Terminal blocks			
Fuses			
AVR Relay			
Oil level indicator			

ANNEX B: NEPCO PROPERTY PLATE DETAILS (WILL PROVIDE AT ENG STAGE)

POWER TRANSFORMER

SERIAL NO.	NEPCO SERIAL NO.	S/S NAME	RATING M.V.A	RATIO K.V
	ABD.TR02.248	Abdali	80 MVA	132/33
	ITF.TR01.250	Ishtafina	63 MVA	132/33
	SB.TR04.251	Subeihi	63 MVA	132/33
	SBH.TR04.252	Sabha	80 MVA	132/33
	MA.TR03.255	Manara	80 MVA	132/33

Earthing Transformers

SERIAL NO.	NEPCO SERIAL NO.	S/S NAME	RATING V.A	RATIO K.V
	ABD.ETR02.248	Abdali	200 K	33/0.4
	ITF.ETR01.250	Ishtafina	200 K	33/0.4
	SB.ETR04.251	Subeihi	200 K	33/0.4
	SBH.ETR04.252	Sabha	200 K	33/0.4
	MA.ETR03.255	Manara	200 K	33/0.4

SCHEDULE G
QUANTITIES AND PRICES FOR DEFINITE WORK

The total prices entered below whether or not they are fully described, shall include everything necessary to leave the equipment complete and in working order at the expiration of the defects liability period in accordance with the provisions of the Contract. They shall include the cost of supervisory staff and all other charges

SCHEDULE G

Item A	Description	Quantities	CFR at AQABA port Jordan			
			Unit price	TOTAL PRICE (FOB)	FREIGHT	TOTAL PRICE (CFR)
			USD	USD 1x2	USD	USD 3+4
		1	2	3	4	5
Definite works						
Section A1 Definite Works for Ishtafina 132/33 kV Substation						
A 1.1	132/33 kV, 63 MVA Transformer	1 set				
A 1.2	Remote control panel	1 set				
A 1.3	Earthing transformer	1 set				
Total price of Definite work for Ishtafina (A1.1+ A1.2 + A1.3)						
Section A2 Definite Works for Abdali 132/33 kV Substation						
A 2.1	132/33 kV, 80 MVA Transformer	1 set				
A 2.2	Remote control panel	1 set				
A 2.3	Earthing transformer	1 set				
Total price of Definite work for Abdali (A2.1+ A2.2 + A2.3)						
Section A3 Definite Works for Subeihi 132/33 kV Substation						
A 3.1	132/33 kV, 63 MVA Transformer	1 sets				
A 3.2	Remote control panel	1 sets				

Item A	Description	Quantities	CFR at AQABA port Jordan			
			Unit price	TOTAL PRICE (FOB)	FREIGHT	TOTAL PRICE (CFR)
			USD	USD 1x2	USD	USD 3+4
		1	2	3	4	5
A 3.3	Earthing transformer	1 sets				
Total price of Definite work for Subeihi (A3.1+ A3.2 + A3.3)						
Section A4 Definite Works for Sabha 132/33 kV Substation						
A 4.1	132/33 kV, 80 MVA Transformer	1 sets				
A 4.2	Remote control panel	1 sets				
A 4.3	Earthing transformer	1 sets				
Total price of Definite work for Sabha (A4.1+ A4.2 + A4.3)						
Section A5 Definite Works for Manara 132/33 kV Substation						
A 5.1	132/33 kV, 80 MVA Transformer	1 sets				
A 5.2	Remote control panel	1 sets				
A 5.3	Earthing transformer	1 sets				
Total price of Definite work for Manara (A5.1+ A5.2 + A5.3)						
J1	Mandatory Spare Part and Tools	As per Schedule J1				
Total price of Definite works (A1+A2+A3+A4+A5+J1)						
Optional works						

Item A	Description	Quantities	CFR at AQABA port Jordan			
			Unit price	TOTAL PRICE (FOB)	FREIGHT	TOTAL PRICE (CFR)
			USD	USD 1x2	USD	USD 3+4
		1	2	3	4	5
1.	Additional Supervision work	Schedule K				
2.	Recommended Spare Part	Schedule J2				
Total price of Optional Works (K+J2)						
Grand Total (Definite Works+ Optional Works)						

TOTAL CONTRACT PRICE is .....

-The above price shall appear on the Letter of Tender.

-All items must be priced any unpriced has to be provided and its price is deemed to be included in the contract price.

Description	Period of FAT (days)	Price
Witnessing cost of FAT of the transformers (including flights, transportations, insurance and all accommodation for 3 persons employer representative)	To be filled by bidder	Included in your total price

Note: The offered FAT period shall be specified in days, excluding travel days, and must be sufficient to conduct all required tests as per IEC and Particular technical specifications.

SCHEDULE G

Rate of Losses

A. Capitalization For the purposes of Bid evaluation, these losses are capitalized in accordance with the following formula:

Total Cost = IC + 9369.6 (P0 + Pc0) + 2343 (Pk + Pcs – Pc0),

where:

- IC: Transformer initial cost, in JOD;
- P0: No load losses at rated tap;
- Pc0: The cooling power for no load operation;
- Pk: Load losses at rated tap;
- Pcs: Total cooling power at rated Power.

Tenders for (Transformers) shall be evaluated based on the main and earthing transformer Total Cost.

B. Energy performance - Peak efficiency index evaluation

- Tender evaluation is relatively simple because it is only to check that guaranteed energy performance proposed by Bidder fulfil NEPCO energy performance requirements. NEPCO will use the following equation to calculate the minimum Peak efficiency index, according to BS EN 50708-1-1:2020:
- $min.PEI = 1 - \frac{2}{s}\sqrt[2]{(P_O + P_{CO})P_{K1}}$
- S = Maximum Rated Power
- P_O= No load Losses
- P_{CO}= Cooling Losses
- P_{K1}= Load Losses

The reference Table 1 from EN 50708-3-1:2020.

TIER2 shall be applied from 1 July 2021 for the values of losses following Commission Regulation (EU) No548/2014 of 21 May 2014 and its amendment No 2019/1783 of 1 October 2019.

- The guaranteed PEI value is 99.758 % for 80 MVA
- The guaranteed PEI value is 99.745 % for 63 MVA

80 MVA Main Transformer

1	No load losses at rated No load losses at rated voltage ratio :	
1.1	At IEC rating kW	
1.2	Input to cooling plant kW	
2	Load losses at 75°C and rated voltage ratio : When operating under site conditions:	
2.1	HV/LV kW	
2.2	At ONAN rating (HV/LV) kW	
3	Total losses at 75°C and rated voltage ratio and with all winding loaded at HV/LV excluding Cooling losses:	
3.1	At CMR when operating under site condition kW	
3.2	At ONAN rating kW	
3.3	Total losses at site condition kW	
3.4	Tap position on which maximum losses occur at CMR.	
3.5	Load losses at C.M.R on tap position with maximum losses kW	
3.6	Proportion of sum of fixed and load losses at rated	
3.7	Power which will be supplied during the temperature rise test per cent	
3.8	Regulation at 75°C and C.M.R : -at unity P.F per cent of normal Voltage -at 0.8 P.F Lagging	
4	Number of coolers or cooler banks per transformers	
4.1	Number of fans	
5	Rating of each cooler or cooler bank kW	
5.1	rating of each fan kW	
5.2	Starting current of each fan A	

63 MVA Main Transformer

1	No load losses at rated No load losses at rated voltage ratio :	
1.1	At IEC rating kW	
1.2	Input to cooling plant kW	
2	Load losses at 75°C and rated voltage ratio : When operating under site conditions:	
2.1	HV/LV kW	
2.2	At ONAN rating (HV/LV) kW	
3	Total losses at 75°C and rated voltage ratio and with all winding loaded at HV/LV excluding Cooling losses:	
3.1	At CMR when operating under site condition kW	
3.2	At ONAN rating kW	
3.3	Total losses at site condition kW	
3.4	Tap position on which maximum losses occur at CMR.	
3.5	Load losses at C.M.R on tap position with maximum losses kW	
3.6	Proportion of sum of fixed and load losses at rated	
3.7	Power which will be supplied during the temperature rise test per cent	
3.8	Regulation at 75°C and C.M.R : -at unity P.F per cent of normal Voltage -at 0.8 P.F Lagging	
4	Number of coolers or cooler banks per transformers	
4.1	Number of fans	
5	Rating of each cooler or cooler bank kW	
5.1	rating of each fan kW	
5.2	Starting current of each fan A	

Earthing Transformer

1	No load losses kW	
2	Load losses (at CMR of lower voltage winding) at 75°C kW	

- **Rate of losses and price Schedules should be included with the financial envelope which should be closed and separated from the technical envelope.**

Quantities and Prices for Mandatory Spare Part

#	Qty	Description	CFR AQABA PORT				
			Unit price		FREIGHT	Total price	
	UNIT		Foreign currency	Local currency		Foreign currency	Local currency
	Main Transformers						
1-	3 sets	132 kV air-oil bushing					
2 -	3 sets	33 kV air-oil bushing					
3-	2 set	132 kV Neutral air-oil bushing					
4-	4 sets	Complete Fan with motor					
5-	3 sets	Gas/oil relay					
6-	2 set	Surge relay for Tap Changer					
7-	3 sets	Oil level Gauge					
8-	3 sets	Oil level gauge for OLTC					
9-	4 sets	Silica gel breather Main Tank					
10-	2 set	Silica gel breather for tap changer					
12-	3 sets	Tap position indicator					
13-	3 sets	Pressure relief valve					
14-	2 sets	Spare Cooling Radiators					
15-	1 set	Set of gaskets complete					
16-	2 set	H.V Winding Temperature Gauge					
17-	2 set	L.V Winding Temperature Gauge					
18-	3 set	Various butterfly valves					
19-	2 set	Oil temperature gauge					
	Earthing Transformer						
19-	2 set	33 kV Neutral air-oil Bushings					
20-	2 set	Silica gel breather					
21-	2 set	Pressure relief valve					
22-	1 set	Gas/oil relay					
23-	2 set	Spare Cooling Radiator					
24-	1 set	Set of gaskets complete					
	Total Schedule J1 To Summary Of Prices Schedule G						

Quantities and Prices for Recommended Spare Part (OPTIONAL)

An additional list of spares shall be provided by the Tenderer sufficient for three years maintenance of the works.

These items are optional and shall only be included in the definite work on written instructions of the Engineer/Employer

No. Off	Description		CFR AQABA PORT			
		Unit price		FREIGHT	Total price	
		Foreign currency	Local currency		Foreign currency	Local currency
Total Schedule **J2**						

1. Definite Supervision Works:

1- All costs related to the supervision of erection & commissioning works (cost of living, accommodation, local transport, airfares for all trips, insurance, and any other costs associated with this matter) for all equipment supplied under the scope of the Contract are **deemed to be included in the definite work price** (schedule G).

1- The working supervisors should be competent personnel (only from offered transformer. manufacturer) who are capable of supervising, installing, commissioning, and carrying out various site activities and to speak &write the English language). with at least 20 years of relevant experience) who are capable of supervising erection, commissioning and carrying out various Site activities jointly with the Client staff and whose CVs shall be subject to approval of the Client.

2- The supervision during erection and commissioning shall commence only with the written request from the Client.

3- Sunday to Thursday inclusive is considered as working days and works will be carried out on-site during the normal working hours locally recognized 8-hour daily. This working period does not include any travel times to the site as this will be the responsibility of the supervisor to be available on site 8 hours daily) the Engineer may direct that work shall be done at other times in order to speed up the works or to complete the works within the time for completion.

2. Additional Supervision work (Optional works)

These items are optional and shall only be included on the written instructions of the Employer.
These rates shall apply to any additional minor work that the Employer may require, the Contractor to carry out on a time and material basis. The rates shall be deemed to include all costs related to the supervision of erection & commissioning works (cost of living, accommodation, local transport, airfares for all trips, insurance and any other costs associated with this matter).
Payment shall be made only for additional work authorised in writing by the Employer and on receipt of a detailed statement of the services supplied, endorsed by the Employer and Contractor's representatives.

Engineer	per working day JD
Foreman	per working day JD
Charge hand	per working day JD
Skilled fitter/electrician	per working day JD

SCHEDULE L

DEPARTURES FROM THE SPECIFICATION

IT WILL BE ASSUMED THAT THE WORKS OFFERED WILL CONFORM TO THE SPECIFICATION IN ALL RESPECTS UNLESS DEPARTURES ARE MENTIONED IN THIS SCHEDULE AND APPROVED BY THE EMPLOYER

Details to be entered to show as a minimum: -

- Quality Assurance Statement
- Specimen Project Quality Plan
- Proposed Project Organization to include the proposed management, design office, quality assurance and site organization with interface to sub-contractors.
- Qualification and experience of the proposed Project Manager, Project Design Manager and Resident Site Manager.

DRAWINGS

Attention is called to the general requirements for submission of drawings for approval and to the details laid out below:-

Drawings sizes shall be from the ISO `A' series, shall not exceed AO standard dimensions and shall contain the title block shown in the tender drawing in the bottom right hand corner of the drawing containing the following information:

National Electric Power Co
Contract No 50/2024
Transformers and Ancillary Equipment
NEPCO Drawing No.
Substation Name (Ishtafina, Abdali, Subeihi, Sabha and Manara 132/33 kV S/S)

All drawings must contain the Contractor's name, date, scale, number and title irrespective of whether they are drawings produced specifically for the contract or standard drawings.

All drawings shall have a NEPCO drawing number which shall be selected from a block of numbers issued by the Employer.

Drawings are to be prepared for issue in AutoCad release 14 format and suitable for issue of a transparency copy that requires that outlines shall be 0.5 to 0.7 mm thick, dimension lines 0.3 mm thick and characters at least 3.5 mm high.

On completion of installation the Contractor is required to provide a complete drawing schedule listing the drawings in the order of the NEPCO drawing numbers. The maximum drawing schedule size shall be A3.

Each drawing must have its own individual number, and the use of sheet numbers will only be permitted for the drawing schedule.

1 Drawings to be submitted with Bid

a. Dimension outline drawings, showing outline of transformer and arrangement and position of important external features including conservator, tap-changer, terminals, cooling equipment and other essential appurtenances.

b. Shipping drawings, showing masses, crane lift necessary for un-tanking and size of lifting lugs or eyes. Parts to be removed for transport shall be indicated and their masses stated.

c. Drawings showing the arrangement of shield or core and windings.

d. Drawings giving typical mechanical and electrical details of the voltage control apparatus.

e. Diagram of connections showing method of voltage control.

f. Magnetization curve of the transformer.

2 Drawings and documents to be submitted by Contractor for the Employer/Engineer approval

a. Outline and foundation plan drawings for the transformer., including oil containment and/or drainage detail drawings

b. Outline drawing showing the transformer accommodation on the truck for transport to the Site.

c. Outline, general arrangement, sectional and detail drawings of the transformer including cooling equipment.

d. Thermal calculation of cooling system.

e. Drawings showing the construction of the transformer tank, tank cover and terminal arrangements, with details of all accessories.

f. Detailed sectional arrangement drawings of the windings with details of the insulation at each point, method of coil bracing and directed oil flow arrangement, core construction, core earthing and any magnetic (leakage flux) shield.

g. Name, diagram and rating plate and diagrams of connections of transformers, and voltage control apparatus showing exact voltage ratios and exact relation of leads taken out of the tanks.

h. Detailed arrangement drawings of the connections between the windings and terminals with details of terminal boards for tapping connections.

i. Drawings giving mechanical and electrical details of voltage control equipment.

j. Detailed drawings of

k. cooling plant and apparatus.

l. Details of valves.

m. Details of motors and control gear.

n. Sectional and elevation drawings showing details of bushing insulators, cable boxes and fittings and provision for current transformers.

o. Details and diagrams of connections of transformer and winding temperature alarm, trip and cooler control arrangements.

p. Mounting instructions and drilling templates of all apparatus to be mounted on panels not supplied by the Contractor.

q. Arrangement and details of outdoor, weather proof marshalling kiosk or steel cabinet for housing control and indicating equipment.

r. Drawings showing any special features likely to need special attention during inspection, testing, maintenance or repair.

s. Multicore cable schedule.

t. Drawings showing any special features incorporated in the design to minimize the possibility of damage within the transformer during transport to site.

u. Schematic diagram of tap-changer and automatic voltage control systems including parallel operation.

v. Schematic diagram of cooler control system.

w. Schematic diagram of monitoring system.

x. Cable list/terminal list/wiring list with all details to complete the connection for all schematics and connections.

3 Operating and maintenance instructions

Four months before the specified completion date for the first Section of the contract works, the Contractor shall submit operating and maintenance instructions and diagrams for approval by the Engineer. The instructions shall be fully detailed and shall cover the main plant and all associated ancillary equipment as supplied under the Contract, Manufacturer's standard brochures will not be accepted as part of the text unless they refer particularly to the equipment supplied and are free from extraneous matter.

The information provided should include essential flow and circuit diagrams, pipe work, general arrangement and detailed drawings of the installation, make mention of special materials, where used, and include schedules of lubricants and all ball and roller races employed on the plant. The drawings and diagrams, which may be approved existing drawings reduced to a convenient size, should be bound into the volume and not inserted into cover pockets. If the complete text of the manual is unduly bulky, then this shall be appropriately sub-divided and produced in multi-volume form.

When approved, three copies of the complete text, diagrams and drawings as made up in draft form shall be handed to the Engineer for use during erection and these shall be provided not later than one month before erection commences.

Four copies of the manual shall also be reproduced as books of approximate quarto size bound. These books shall have strong black durable imitation leather covers inscribed with gold letters on the front. The covers inscription should include the title of this document section "Operating and Maintenance Instructions", and references to Specification, Conditions of Contract, Drawings, etc, shall not be included on the cover.
The name of the main Employer, substation or other identification followed by a brief description of the plant shall be inscribed upon the spine of the cover and, if the instructions are contained in several books, these shall be marked with the appropriate volume number.