



**MINISTRY OF ELECTRICITY
REPUBLIC OF IRAQ**

**GENERAL DIRECTORATE OF ELECTRICAL
TRANSMISSION PROJECTS**

TENDER DOCUMENT

FOR: P.C. 49 /NT/2013

**Supply of (132 kV) , (1*2000) mm² Underground Cables
& Accessories for Joining Projects (Substations):-**

Zayouna 132 kv S/S - AL Amean 400 kv S/S

Rassafa Center 132 kv S/S – Baghdad North 400 kv S/S

Issued in

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LETTER OF TENDER:

Tender No: P.C 49 / NT / 2013

**General Directorate of
Electrical Transmission Projects
Ministry of Electricity
Baghdad
Republic of Iraq**

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CC: 71_commercial_dept.mgr@moelc.gov.iq
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[REDACTED]

[REDACTED]

Dear Sir,

LETTER OF TENDER

- I. The General Directorate for Electrical Transmission Projects (GDETP) of the Ministry of Electricity (MOE), Government of Iraq has initiated the implementation of several electricity sector development projects in order to improve electricity supply reliability and availability of the country by enhancing the capacity of supply in the Iraq National Grid.

The GDETP / MOE invites sealed tenders from eligible Tenderers for the supply of 132kV Underground Cables & Accessories for joining projects (substations):-

Zayouna 132 kv S/S - AL Amean 400 kv S/S

Rassafa Center 132 kv S/S – Baghdad North 400 kv S/S

- II. **Two envelope** tendering procedure will be adopted. Tenderers are required to submit simultaneously two sealed envelopes, one containing the Technical Proposal and the other containing the Financial Proposal. Initially only the technical proposals are opened. Technical proposals which are not substantially responsive will be rejected. The substantially responsive technical proposals will be considered for further evaluation and discussion.
- III. Tenderers are requested to fully aware of local conditions and take them into account in preparing the proposals.
- IV. Tenders containing Technical and Financial Proposals must be delivered to the address given in the Tender Data Sheet on or before **12.00 p.m** (Baghdad, Iraq local time) on [REDACTED] Tenders received after this time and date shall not be considered and will be returned un-opened.
- V. **The date of opening technical and commercial offers at the same closing date .**
- VI. Please note that (i) the costs of preparing the proposals and of negotiating the contract, including a visit to the MOE, are not reimbursable as a direct cost of the tender; and (ii) the MOE is not bound to accept any of the proposals submitted.
- VII. The Tender Document contains following sections;

Letter of Tender

Section 1 – Instructions to Tenderers

Section 2 – Tender Data Sheet

Section 3 – Technical Proposal Forms

Section 4 – Financial Proposal Forms

Section 5 – Employer's Requirements

Section 6 – General Conditions of Contract

Section 7 – Special Conditions of Contract

Section 8 – Contract Forms

Section 9 - Underground Cables Technical Requirements and Specifications

Section 10- Standard Specification for Pilot Cable and Telecommunication & SCADA System

Please send your confirmation or / regrets (to participate in this Tender) in writing (by email or by post), upon receipt of the Tender.

Yours Sincerely,

Director General - Electricity Transmission Projects

**General Directorate of Electricity Transmission Projects
Ministry of Electricity
Al Mustinsiria Square
Baghdad
Republic of Iraq**

Tel: +964 _____

SECTION 1: INSTRUCTIONS TO TENDERERS

1.1 DEFINITIONS

- i. "Employer" means the General Directorate of Electricity Transmission Projects (GDETP) or the Ministry of Electricity (MOE).
- ii. "Contract" means the Contract signed by the Parties and all the attached documents listed in Sections 6, 7 and 8 that is the General Conditions of Contract (GC), the Special Conditions of Contract (SC), and the Appendices.
- ii. "Tender Data Sheet" means such part of the Instructions to Tenderers used to reflect specific country and tender conditions.
- iv. "Day" means calendar day.
- v. "Government" means the Government of Iraq (GOI).
- vi. "Instructions to Tenderers" (Section 1 of the Tender Document) means the document which provides short-listed Tenderers with all information needed to prepare their Tender Proposals.
- vii. "Personnel" means professionals and support staff provided by the Tenderer and assigned to execute the tender scope or any part thereof; "Foreign Personnel" means such professionals and support staff who at the time of being so provided had their domicile outside Iraq; "Local Personnel" means such professionals and support staff who at the time of being so provided had their domicile inside Iraq.
- viii. "Proposal" or "Tender Proposal" means the Technical Proposal and the Financial Proposal.

1.2 GENERAL

- **Scope of the Tender**

- I. In connection with the Letter of Tender indicated in the Tender Data Sheet, the Employer, as indicated in the Tender Data Sheet, issues this Tender Document for the procurement of plant and services as specified in Section 5 (Employer's Requirements). The name, identification, and number of lots (contracts) of the Tendering Process are **provided in the Tender Data Sheet**.
- II. The successful Tenderer will be expected to complete the overall scope of works, within the delivery period **indicated in the Tender Data Sheet**.

- **Source of Funds**

The Employer intends to finance these substation development projects through funds received from the Government of Iraq, for which this Letter of Tender is issued.

- **One Tender per Tenderer**

Each Tenderer shall submit only one tender proposal either by itself, or as a partner in a joint venture. A Tenderer who submits or participates in more than one tender will cause all those tenders to be rejected.

- **Mission facilitate**

- The second party should ask for (mission facilitate) letter from the first party within a period not less than (45) days prior to arrival of shipment to the Iraqi border, otherwise employer will not be

responsible for delay in custom clearance.

- Materials and equipments shall exclusively shipped from the north Iraqi borders/Ibraheem Al khaleel (Zakho) or from the southern custom /Um Qasar.

- **Origin of material**

All certification of origin should be issued from the commercial and industrial chambers in the country of manufactured company and certified from the Iraqi commercial attache (in that country) not from supplier country and shall be submitted by the contractor to E.T.P before entering of material to the Iraqi border taking in consideration that certification of origin issued from one of the Arabic, market cooperation and officially certified in country of origin are accepted.

1.3 TENDER DOCUMENT

- **Contents of Tender Document**

- i. The Tender document contains the sections stated below, and should be read in conjunction with any Addenda issued in accordance with Clause 1.3.3.

Section 1 – Instructions to Tenderers

Section 2 – Tender Data Sheet

Section 3 – Technical Proposal Forms

Section 4 – Financial Proposal Forms

Section 5 – Employer’s Requirements

Section 6 – General Conditions of Contract

Section 7 – Special Conditions of Contract

Section 8 – Contract Forms

Section 9 - Underground Cables Technical Requirements and Specifications

Section 10- Standard Specification For Pilot Cable and Telecommunication &SCADA System

- ii. The Tenderer is expected to examine carefully the contents of the Tender documents. Failure to comply with the requirements of tender submission will be at the tenderer’s own risk. Pursuant to Clause 1.6.3, tenders which are not substantially responsive to the requirements of the tender document will be rejected.

- **Clarifications of Tender Document, Site Visits, Pre-Tender Meeting**

- I. A prospective Tenderer requiring any clarification of the Tender Document shall contact the Employer in writing at the Employer’s address **indicated in the Tender Data Sheet** or raise his enquiries during the pre-tender meeting if provided for in accordance with Clause 1.3.2.iv. The Employer will respond to any request for clarification, provided that such request is received no later than seven (07) days prior to the deadline for submission of tenders. The Employer’s response shall be in writing with copies to all Tenderers who have received 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 under Clause 1.3.3 and Clause 1.5.2.ii.
- II. The Tenderer is requested, as far as possible, to submit any questions in writing, to reach the Employer not later than one week before the stipulated time for clarifications.
- III. Answers for the clarifications of any one of the Tenderer, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Tenderers who have received the tender document. Any modification to the tender document that may become necessary as

a result of the clarification shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause 1.3.3 and not through an answer to a clarification.

- IV. Non-attendance at the pre-tender meeting will not be a cause for disqualification of a Tenderer.

- **Amendment of Tender Document**

- I. At any time prior to the deadline for submission of tenders, the Employer may amend the tender document by issuing addenda.
- II. Any addendum issued shall be part of the tender document and shall be communicated in writing or by email to all Tenderers who received the tender documents. Tenderers shall acknowledge receipt of each addendum by email to the Employer.
- III. To give prospective Tenderers reasonable time in which to take an addendum into account in preparing their tender proposals, the Employer may extend the deadline for submission of tenders, in accordance with Clause 1.5.2.

1.4 PREPARATION OF TENDER PROPOSALS

- **Cost of Tendering**

The Tenderer shall bear all costs associated with the preparation and submission of its tender proposal and the Employer shall not be responsible or liable for those costs, regardless of the conduct or outcome of the tendering process.

- **Language of Tender Proposal**

The tender proposal, as well as all correspondence and documents relating to the tender proposal exchanged by the Tenderer and the Employer, shall be written in the English language. Supporting documents and printed literature that are part of the tender proposal may be in another language provided they are accompanied by an accurate translation of the relevant passages into the English language, in which case, for purposes of interpretation of the tender proposal, such translation shall govern.

- **Documents Comprising the Tender Proposal**

- i. The tender proposal shall comprise two envelopes submitted simultaneously, one called the Technical Proposal containing the documents listed in Clause 1.4.3.ii and the other the Financial Proposal containing the documents listed in, Clause 1.4.4, both envelopes enclosed together in an outer single envelope.
- ii. The Technical Proposal submitted by the Tenderer shall comprise the following:
 - a. Letter of Technical Proposal;
 - b. Alternative tender proposals, if permissible, in accordance with Clause 1.4.5;
 - c. Written confirmation authorizing the signatory of the Tender Proposal to commit the Tenderer, in accordance with Clause 1.4.14;
 - d. Documentary evidence in accordance with Clause 1.4.7 establishing the Tenderer's eligibility and qualifications to perform the contract if its proposal is accepted;
 - e. Any other document required **in the Tender Data Sheet**.

- iii. The Financial Proposal submitted by the Tenderer shall comprise the following:

- a. Letter of Financial Proposal;
- b. Completed schedules as required, including Price Schedules, in accordance with Clause 1.4.4 and Clause 1.4.10;
- c. Any other document **required in the Tender Data Sheet.**

- **Letters of Tender Proposal and Schedules**

The Letters of Technical Proposal and Financial Proposal, and the Schedules, and all documents listed under Clause 1.4.3, shall be prepared using the relevant forms furnished in Section 3 and 4 (Tender Proposal Forms). The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested.

- **Alternative Tender Proposals**

- I. Alternative tender proposal **shall not be** considered in this tender.
- II. Alternatives to the project Time Schedule shall not be considered in this tender.

- **Tender Prices and Discounts**

- i. Tenderers are required to quote the price for the commercial, contractual and technical obligations outlined in the Tender Document. If a Tenderer wishes to make a deviation, such deviation shall be listed in the relevant form in Section 4 (Tender Proposal Forms). The Tenderer shall also provide the additional price if any, for withdrawal of the deviation
- ii. Tenderers shall give a breakdown of the prices in the manner and detail called for in the Price Schedules included in Section 4 (Financial Proposal Forms). Separate numbered Schedules included in Section 4 (Financial Proposal Forms) shall be used for each of the following elements. The total amount from each Schedule (1 to 2) shall be summarized in a Grand Summary (Schedule 3) giving the total tender price(s) to be entered in the Letter of Tender Proposals.

Schedule No. 1/1: Material and equipment, including (cable & accessories)

Schedule No 1/2: Supply of Fiber Optic Cable and Telecommunication & SCADA system

Schedule No. 1/3: Mandatory Spare Parts.

Schedule No 1/4:- Supply of Cable Protection Systems.

Schedule No. 2/1: Staff Training

Schedule No. 2/2 : Factory Acceptance Tests.

Schedule No. 3 : Grand Summary (Schedules 1 to 5).

Schedule No. 4 : Country of origin declaration form.

- **Currencies of Tender and Payment**

- i. The currency (ies) of the proposal shall be, as **specified in the Tender Data Sheet.**

- ii. Tenderers shall indicate in the Schedule of Prices and the Letter of Tender Proposal the portion of the Tender Price that corresponds to expenditures incurred in the currency of the Employer's country.

- **Period of Validity of Tender Proposals**

- i. Tender Proposal shall remain valid for the period specified in the Tender Data
- ii. Sheet after the tender submission deadline date prescribed by the Employer. A tender valid for a shorter period shall be rejected by the Employer as non-responsive.
- iii. In exceptional circumstances, prior to the expiration of the tender validity period, the Employer may request Tenderers to extend the period of validity of their tenders. The request and the responses shall be made in writing. If a Tender Security is requested in accordance with Clause 1.4.13, it shall also be extended for a corresponding period. A Tenderer may refuse the request without forfeiting its Tender Security. A Tenderer granting the request shall not be required or permitted to modify its proposal.

- **Tender Security (Bid Bond)**

As the tender is open for all tenderers, the Tenderers are required to furnish a Tender Security in this tender with amount (1%) from the total offer price and through TBI.

- **Format and Signing of Tender Proposals**

- i. The Tenderer shall prepare one original of the Technical Proposal and one original of the Financial Proposal comprising the Tender Proposal as described in Clause 1.4.3 and clearly mark it "ORIGINAL - TECHNICAL PROPOSAL" and "ORIGINAL - FINANCIAL PROPOSAL". In addition, the Tenderer shall submit copies of the Tender Proposal, in the number specified in the Tender Data Sheet and clearly mark each of them "COPY." In the event of any discrepancy between the original and the copies, the original shall prevail.
- ii. The original and all copies of the Tender Proposal shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Tenderer. This authorization shall consist of a written confirmation as specified in the Tender Data Sheet and shall be attached to the Tender Proposal. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Tender P
- iii. Proposal where entries or amendments have been made shall be signed or initialed by the person signing the Tender Proposal.
- iv. Any interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Tender Proposal.

1.5 SUBMISSION AND OPENING OF TENDER PROPOSALS

- **Submission, Sealing and Marking of Tender Proposals**

- I. Tenderers may submit their tender proposals by hand. When so specified in the Tender Data Sheet, Tenderers shall have the option of submitting their tender proposals electronically. Procedures for submission, sealing and marking are as follows:
Tenderers submitting tender proposals by mail or by hand shall enclose the original and each copy of the Tender proposal, in separate sealed envelopes, duly marking the envelopes as "ORIGINAL", and "COPY." These envelopes containing the original and the copies shall then be enclosed in one single envelope. The rest of the procedure shall be in accordance with Clauses 1.5.1 and 1.5.2.
- II. The inner and outer envelopes shall:
 - a. bear the name and address of the Tenderer;

- b. be addressed to the Employer in accordance with Clause 1.5.2;and
 - c. bear the specific identification of this tender process indicated **in the Tender Data Sheet 1.2.1 i.**
- III. If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the tender .

- **Deadline for Submission of Tender Proposals**

- i. Tender Proposals must be received by the Employer at the address and no later than the date and time **indicated in the Tender Data Sheet.**
- ii. The Employer may, at its discretion, extend the deadline for the submission of Tenders by amending the Tender Document in accordance with Clause 1.3.3, in which case all rights and obligations of the Employer and Tenderer's previously subject to the deadline shall thereafter be subject to the deadline as extended.

- **Late Tender Proposals**

The Employer shall not consider any Tender Proposal that arrives after the deadline for submission of tender proposals, in accordance with Clause 1.5.2. Any tender proposal received by the Employer after the deadline for submission of tender proposals shall be declared late, rejected, and returned unopened to the Tenderer.

- **Tender Opening**

- i. The Employer shall conduct the opening of Technical Proposals in the presence of Tenderers` designated representatives who choose to attend, and at the address, date and time **specified in the Tender Data Sheet.**
- ii. First, envelopes marked "ORIGINAL - TECHNICAL PROPOSAL" shall be opened and read out and the envelope with the corresponding proposal as "COPY" shall not be opened, but retained with the employer.
- iii. All envelopes holding the Technical Proposals shall be opened one at a time, and the following read out and recorded:
 - a.the name of the Tenderer;
 - b.whether there is a modification or substitution; and
 - c.any other details as the Employer may consider appropriate.

Only Technical Proposals read out and recorded at tender opening shall be considered for evaluation. No Tender shall be rejected at the opening of Technical Proposals except for late tenders, in accordance with Clause 1.5.3.

- iv. The Employer shall prepare a record of the opening of Technical Proposals that shall include, as a minimum: the name of the Tenderer and the presence or absence of a tender security or a tender securing declaration, if one was required. The Tenderer's representatives who are present shall be requested to sign the record. The omission of a Tenderer's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Tenderers who submitted tenders in time, and posted online when electronic tendering is permitted.
- v. At the end of the evaluation of the Technical Proposals, the Employer will invite Tenderers who have submitted substantially responsive Technical Proposals and who have been determined as being qualified for award to attend the opening of the Financial Proposals. The date, time, and location of the opening of Financial Proposals will be advised in writing by the Employer. Tenderers shall be given reasonable notice of the opening of Financial Proposals.
- vi. The Employer will notify Tenderers in writing who have been rejected on the grounds of their Technical Proposals being substantially non-responsive to the requirements of the Tender Document and return their Financial Proposals unopened.

- vii. The Employer shall conduct the opening of Financial Proposals of all Tenderers who submitted substantially responsive Technical Proposals, in the presence of Tenderer's representatives who choose to attend at the address, date and time specified by the Employer. The Tenderer's representatives who are present shall be requested to sign a register evidencing their attendance.
- viii. All envelopes containing Financial Proposals shall be opened one at a time and the following read out and recorded:
 - a. the name of the Tenderer;
 - b. the Tender Prices, including any discounts and alternative offers;
 - c. any other details as the Employer may consider appropriate.

Only tender prices, discounts, and alternative offers read out and recorded during the opening of Financial Proposals shall be considered for evaluation. No tender shall be rejected at the opening of Financial Proposals.

- ix. The Employer shall prepare a record of the opening of Financial Proposals that shall include, as a minimum: the name of the Tenderer, the Tender Price (per lot if applicable), any discounts, and alternative offers. The Tenderer's representatives who are present shall be requested to sign the record. The omission of a Tenderer's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Tenderers who submitted tenders in time, and posted online when electronic tendering is permitted.

1.6 EVALUATION AND COMPARISON OF TENDERS

- **Confidentiality**

- i. Information relating to the evaluation of tenders and recommendation of contract award, shall not be disclosed to Tenderers or any other persons not officially concerned with such process until information on Contract award is communicated to all Tenderers.
- ii. Any attempt by a Tenderer to influence the Employer in the evaluation of the tenders or Contract award decisions may result in the rejection of its tender.
- iii. Notwithstanding Clause 1.6.1.ii, from the time of tender opening to the time of Contract award, if any Tenderer wishes to contact the Employer on any matter related to the tendering process, it should do so in writing.

- **Clarification of Tenders**

- i. To assist in the examination, evaluation, and comparison of the Technical and Financial Proposals, and qualification of the Tenderer, the Employer may, at its discretion, ask any Tenderer for a clarification of its tender. Any clarification submitted by a Tenderer 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 substance of the Technical Proposal or prices in the Financial Proposal 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 Clause 1.6.9.
- ii. If a Tenderer 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.

- **Deviations, Reservations, and Omissions**

During the evaluation of tenders, the following definitions apply:

- 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.

- **Preliminary Examination of Technical Proposals**

- i. The Employer shall examine the Technical Proposal to confirm that all documents and technical documentation requested in Clause 1.4.3.ii have been provided, and to determine the completeness of each document submitted. If any of these documents or information is missing, the tender may be rejected.
- ii. The Employer shall confirm that the following documents and information have been provided in the Technical Proposal. If any of these documents or information is missing, the offer shall be rejected.
 - a. Letter of Technical Proposal;
 - b. written confirmation of authorization to commit the Tenderer;
 - c. Tender Security, if applicable; and
 - d. Technical Proposal in accordance with 1.4.9.

- **Responsiveness of Technical Proposal**

- i. The Employer's determination of a tender's responsiveness is to be based on the contents of the tender itself, as defined in Clause 1.4.3.
- ii. A substantially responsive Technical Proposal is one that meets the requirements of the Tender Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,
 - a. if accepted, would:
 - affect in any substantial way the scope, quality, or performance of the plant and services specified in the Contract;
 - limit in any substantial way, inconsistent with the Tender Document, the Employer's rights or the Tenderer's obligations under the proposed Contract;
 - b. if rectified, would unfairly affect the competitive position of other Tenderers presenting substantially responsive tenders.
- iii. The Employer shall examine the technical aspects of the tender submitted in accordance with Clause 1.4.9, Technical Proposal, in particular to confirm that all requirements of Section 5 (Employer's Requirements) have been met without any material deviation or reservation.
- iv. 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

- **Non-material Non-conformities**

- i. Provided that a tender is substantially responsive, the Employer may waive any nonconformity in the tender that do not constitute a material deviation, reservation or omission.
- ii. Provided that a tender is substantially responsive, the Employer may request that the Tenderer to submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the tender related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the Financial Proposal. Failure of the Tenderer to comply with the

request may result in the rejection of its tender.

- iii. Provided that a tender is substantially responsive, the Employer shall rectify nonmaterial nonconformities related to the Tender Price. To this effect, the Tender Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component.

- **Detailed Evaluation of Technical Proposals**

- i. The Employer will carry out a detailed technical evaluation of the tenders not previously rejected as being substantially non-responsive, in order to determine whether the technical aspects are in compliance with the Tender Document. In order to reach such a determination, the Employer will examine and compare the technical aspects of the tenders on the basis of the information supplied by the Tenderers, taking into account the following:
 - a. Overall completeness and compliance with the Employer's Requirements; deviations from the Employer's Requirements; consistency and detail will be rejected for non-responsiveness;
 - b. type, quantity and long-term availability of mandatory and recommended spare parts and maintenance services.
- ii. Where alternative technical solutions have been allowed in accordance with Clause 1.4.5, and offered by the Tenderer, the Employer will make a similar evaluation of the alternatives. Where alternatives have not been allowed but have been offered, they shall be ignored.

- **Eligibility and Qualification of the Tenderer**

The capabilities of the manufacturers and subcontractors proposed in its tender to be used by the Tenderer will also be evaluated. Their participation should be with a letter of intent between the parties, as needed. Should a manufacturer or subcontractor be determined to be unacceptable, the tender will not be rejected, but the Tenderer will be required to substitute an acceptable manufacturer or subcontractor without any change to the Tender price. Prior to signing the Contract, the corresponding Appendix to the Contract Agreement shall be completed, listing the approved manufacturers or subcontractors for each item concerned.

- **Correction of Arithmetical Errors**

- i. During the evaluation of Financial Proposals, 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. where there are errors between the total of the amounts of Schedule Nos. 1 to 4 and the amount given in Schedule No. 5 (Grand Summary), the former shall prevail and the latter will be corrected accordingly; and
 - c. 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 arithmetical error, in which case the amount in figures shall prevail subject to (a) and (b) above.
- ii. If the Tenderer who has submitted the lowest evaluated tender, does not accept the correction of errors, its tender shall be disqualified and the tender shall be awarded to next eligible Tenderer. Further legal measures shall be taken against the Tenderer.

- **Conversion to Single Currency**

For evaluation and comparison purposes, the currency(ies) of the tender shall be converted into a single currency as **specified in the Tender Data Sheet** .

- **Margin of Preference**

Unless otherwise **specified in the Tender Data Sheet**, a margin of preference shall not apply.

- **Evaluation of Financial Proposal**

The Employer shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be permitted.

To evaluate a Financial Proposal, the Employer shall consider the following:

- a. the tender price, excluding provisional sums and the provision, if any, for contingencies in the Price Schedules;
 - b. price adjustment for correction of arithmetical errors in accordance with Clause 1.6.9.i;
 - c. price adjustment due to discounts offered in accordance with Clause 4.1.iv;
 - d. converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with Clause 1.6.10; and
 - e. the evaluation factors indicated in Section 3 (Evaluation and Qualification Criteria).
- i. If price adjustment is allowed in accordance with Clause 1.4.10.vi, the estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in tender evaluation.
 - ii. If the tender, which results in the lowest evaluated tender price, is seriously unbalanced or front loaded in the opinion of the Employer, the Employer may require the Tenderer to produce detailed price analyses for any or all items of the Price Schedules, to demonstrate the internal consistency of those prices with the methods and time schedule proposed. After evaluation of the price analyses, taking into consideration the terms of payments, the Employer may require that the amount of the performance security be increased at the expense of the Tenderer to a level sufficient to protect the Employer against financial loss in the event of default of the successful Tenderer under the Contract.

- **Comparison of Tenders**

The Employer shall compare all substantially responsive tenders to determine the lowest evaluated tender, in accordance with Clause 1.6.12.ii.

- **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 tender process and reject all tenders at any time prior to contract award, without thereby incurring any liability to Tenderer. In case of annulment, all tenders submitted and specifically, tender securities (if any), shall be promptly returned to the Tenderers.

1.7 AWARD OF CONTRACT

- **Award Criteria**

- i. The Employer shall award the Contract to the Tenderer whose offer has been determined to be the lowest evaluated tender and is substantially responsive to the Tender Document, provided further that the Tenderer is determined to be eligible and qualified to perform the Contract satisfactorily.
- ii. The Employer reserves the right to accept any of the deviations submitted in accordance with

Clause 1.4.10.ii by the lowest evaluated Tenderer, at the price shown for the deviation in the tender.

- **Notification of Award**

- i. Prior to the expiration of the period of tender validity, the Employer shall notify the successful Tenderer, in writing, that its tender has been accepted. The notification letter (hereinafter and in the Conditions of Contract and Contract Forms called the "Letter of Acceptance") shall specify the sum that the Employer will pay the Contractor in consideration of the execution and completion of the plant and services (hereinafter and in the Conditions of Contract and Contract Forms called "the Contract Price").
- ii. Until a formal contract is prepared and executed, the notification of award shall constitute a binding Contract.
- iii. The Employer shall promptly respond in writing to any unsuccessful Tenderers who, after notification of award in accordance with Clause 1.7.2, requests in writing the grounds on which its tender was not selected.

- **Signing of Contract**

- i. Promptly after notification, the Employer shall send the successful Tenderer the Contract Agreement.
- ii. Within fourteen (14) days of receipt of the Contract Agreement, the successful Tenderer shall sign, date, and return it to the Employer.

- **Performance Security**

- i. Within fourteen (14) days of the receipt of notification of award from the Employer, the successful Tenderer shall furnish the performance security in accordance with the conditions of contract, subject to Clause 1.7.4.ii, using for that purpose the Performance Security Form included in Section 8 (Contract Forms), or another form acceptable to the Employer. The performance bond shall be from any reliable bank via the Trade Bank of Iraq (TBI). The performance bond shall be released at the successful completion and the end of the warranty period .
- ii. In the case of the failure of the successful Tenderer to submit the above-mentioned Performance Security and signing the contract in aforesaid 14 days period, employer shall extend a period of another 14 days to fulfill the same requirement with the notice of annulment of the award on further failure of submitting the Performance Security and signing the contract. After the extended period of 14 days the employer shall nullify the award and the tender shall be awarded to the next eligible Tenderer. In such event the employer may also take legal action to black list the Tenderer who has failed in fulfilling the requirements **and confiscation the bid bond (1%).**
- iii. The above provision shall also apply to the furnishing of a domestic preference security if so required.

SECTION 2: TENDER DATA SHEET

2.1 GENERAL

2.1.1.i	<p style="text-align: center;">Tender Number : P.C 49 / NT / 2013 The Employer : MINISTRY OF ELECTRICITY, REPUBLIC OF IRAQ</p> <p style="text-align: center;">Name of Tender : Supply of (132 kV) Underground Cables & Accessories for Joining Projects (Substations):-</p> <p style="text-align: center;">Zayouna 132 kv S/S - AL Amean 400 kv S/S</p> <p style="text-align: center;">Rassafa Center 132 kv S/S – Baghdad North 400 kv S/S</p> <p style="text-align: center;">Substation Site Locations: The number of Lots (contracts) : One (01)</p>
2.1.1.ii	<p>Overall Delivery Period : Maximum 360 Days from the Contract Effective Date should be in three lots (batches)in 360Days total shipments:-</p> <p>A. First shipment to be delivered not later than 120 Days after contract effective date with 30% of total power cables.</p> <p>B. The remaining two shipments should be deliver in sequence of 120 Days interval between them, each shipment contain 35% of power cable and 50% of the other items and accessories.</p>
2.1.2	Source of Fund : Government of Iraq

2.2 TENDER DOCUMENT

2.2.2	<p>For <u>clarification purposes</u> the Employer's address is:</p> <p>Mr . Mohammed Fawzi AL - Zaidi Director General – Electrical Transmission Projects General Directorate of Electrical Transmission Projects Ministry of Electricity Al Mustinsiria Sq. Baghdad Republic of Iraq</p> <p style="text-align: center;">Telephone: +964 _____</p> <p style="text-align: center;">Facsimile number: +964 _____</p>
	Electronic mail address: <u>71 DG@moelc.gov.iq</u>
2.2.2.ii	Site <u>visits will not be organised</u> for this tender.
2.2.2.iv	A Pre-Tender meeting shall <u>not</u> be taken place for this tender.

2.3 PREPARATION OF TENDER PROPOSALS

2.3.3.ii	<p>The Tenderer shall submit with its Technical Proposal the following additional documents:</p> <ol style="list-style-type: none"> 1. Schedule of manufacturers, place of manufacture and testing 2. Schedule of technical particulars and guarantees 3. Schedules of departures from specifications 4. Schedule of manufacturers" and subcontractors" statement of experience. 5. Schedule of other documents and drawings to be submitted with the tender. 6. Any other material required to be completed and submitted by Tenderers in accordance with these instructions to Tenderers. 7. Tenders shall include the details of their local agent.
2.3.5.i	Alternative tender proposals are not permitted in this tender.
2.3.5.ii	Alternatives to the Time Schedule shall not be permitted.
2.3.8.i	<p>The prices shall be quoted either in Euro (EUR) or in United States Dollars (USD).</p> <p>For purposes of payment: Tenderer shall identify the portion of the tender price that corresponds to expenditures incurred in the currency of the Employer's country, which shall be paid in this currency</p>
2.3.9.i	The tender validity period shall be 120 days .
2.3.10	the value of Tender securities should be 1% of total offer price
2.3.11.i	<p>In addition to the original of the Tender Proposal, the number of copies required is: Three (03)</p> <p>In addition, an electronic copy of the proposal shall be submitted by the Tenderers.</p> <p>Marking the envelopes of Tenders as "ORIGINAL", "FIRST COPY", "SECOND COPY" and "THIRD COPY".</p>
2.3.11.ii	The written confirmation of authorization to sign on behalf of the Tenderer shall consist of notarized Power of Attorney.

2.4 SUBMISSION AND OPENING OF TENDER PROPOSALS

2.4.1.i	Tenderers shall not have the option of submitting their tenders electronically.
2.4.1.i.b	If Tenderers shall have the option of submitting their tenders electronically, the electronic tendering submission procedures shall be: Not applicable
2.4.2.i	<p>For tender submission purposes, the Employer's address is;</p> <p>Commercial Department General Directorate of Electrical Transmission Projects Ministry of Electricity Al Mustinsiria Sq. Baghdad Republic of Iraq</p> <p>Telephone: +964 _____</p> <p>Facsimile number: +964 _____</p> <p>Electronic mail address: <u>71 commercial.dept.mgr@moelc.gov.iq</u></p> <p>The deadline for tender submission is:</p> <p>Date: The date of opening technical and commercial offers at the same closing date .</p> <p>Time: 12.00 (P.M)</p>
2.4.4.i	<p>The tender opening of Technical Proposals shall take place at:</p> <p>General Directorate of Electrical Transmission Projects Ministry of Electricity Al Mustinsiria Sq. Baghdad Republic of Iraq</p> <p>Date: On the date of submission as same as in Clause 2.4.2.i above.</p> <p>Time: Immediately after the time in Clause 2.4.2 above</p>
2.4.5.i	If electronic tender submission is permitted in accordance with Clause 1.5.1.i, the specific tender opening procedures shall be: Not applicable

2.5 EVALUATION, AND COMPARISON OF TENDERS

2.5.10	<p>The currency that shall be used for tender evaluation and comparison purposes to convert all tender prices expressed in various currencies into a single currency is: UNITED STATES DOLLARS (USD)</p> <p>The source of exchange rate shall be: Central Bank of Iraq</p> <p>The date for the exchange rate shall be: Date of Closing of the tenders</p>
2.5.11	Margin of preference shall not apply for this tender.

2.6 AWARD OF CONTRACT

2.6.3	Signing of contract: 14 days from the receipt of Notification of Award and Contract Agreement
2.6.4	<p>Performance Security: 5% of the tender (contract) price</p> <p>Shall be from any reliable bank via the Trade Bank of Iraq (TBI) and to be submitted to the Employer within 14 days of from the contract award, before signing the contract agreement.</p>

SECTION 3: TECHNICAL PROPOSAL FORM

3.1 LETTER OF TECHNICAL PROPOSAL

[Tenderer's Letterhead]

Date:

Tender No: P.C 49 / NT / 2013

To: Director General - Electric Transmission Projects General Directorate of Electric Transmission Projects Ministry of Electricity Al Mustinsiria Sq. Baghdad Republic of Iraq

Dear Sir,

We, the undersigned, declare that:

- I. We have examined and have no reservations to the Tender Documents, including Addenda issued in accordance with Instructions to Tenderers Clause 1.3.3;
- II. We offer to design, manufacture, test, deliver, in conformity with the Tender Document the following : Supply of (132 kV) Underground Cables & Accessories for Joining Projects (Substations):-

Zayouna 132 kv S/S - AL Amean 400 kv S/S

Rassafa Center 132 kv S/S – Baghdad North 400 kv S/S

- III. Our Tender consisting of the Technical Proposal and the Financial Proposal shall be valid for a period of 120 days from the date fixed for the tender submission deadline in accordance with the Tender Document, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
- IV. We hereby confirm that we are not participating, as a Tenderer or as a subcontractor, in more than one tender in this tender process;
- V. Our firm, its affiliates or subsidiaries, including any Subcontractors or Suppliers for any part of the contract, has not been declared ineligible, under the Employer's country laws or official regulations

Yours sincerely,

Name.....

In the capacity of

Signed

..... Duly

authorized to sign the Tender for and on behalf of Date

.....

3.2 TP 2 – JOINT VENTURE INFORMATION

[Each member of a JV must fill in this form]

JV Information	
Tenderer's legal name	
JV Partner's legal name	
JV Partner's country of constitution	
JV Partner's year of constitution	
JV Partner's legal address in country of constitution	
JV Partner's authorized representative Information (name, address, telephone numbers, fax numbers, e-mail address)	

Signature of Tenderer:

Name of Tenderer:.....

3.3 TP 7/2 – RESUME OF PROPOSED PERSONNEL

Position		
Personnel information	Name	Date of birth
	Professional qualifications	
Present employment	Name of employer	
	Address of employer	
	Telephone	Contact (manager / personnel officer)
	Fax	E-mail
	Job title	Years with present employer

Summarize professional experience in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

From	To	Company / Project / Position / Relevant technical and management experience

3.4 TP 8 – EQUIPMENT

The Tenderer shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Tenderer.

Item of Equipment		
Equipment Information	Name of manufacturer	Model and power rating
	Capacity	Year of manufacture
Current Status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment <input type="checkbox"/> Owned <input type="checkbox"/> Rented <input type="checkbox"/> Leased <input type="checkbox"/> Specially manufactured	

Omit the following information for equipment owned by the Tenderer.

Owner	Name of owner	
	Address of the Owner	
	Telephone	Contact name and title
	Fax	Telex
Agreements	Details of rental / lease / manufacture agreements specific to the project	

SECTION 4: FINANCIAL PROPOSAL FORMS

4.1 LETTER OF FINANCIAL PROPOSAL

[Tenderer's Letterhead]

Date:

Tender No: P.C 49 / NT / 2013

**To: Director General – Electric Transmission Projects
General Directorate of Electric Transmission Projects
Ministry of Electricity
Al Mustinsiria Sq.
Baghdad
Republic of Iraq**

Dear Sir,

We, the undersigned, declare that:

We have examined and have no reservations to the Tender Document, including Addenda issued in accordance with Instructions to Tenderers Clause 1.3.3;

We offer to design, manufacture, test, deliver, in conformity with the Tender Document the following Plant and Services: Supply of (132 kV) Underground Cables & Accessories for Joining Projects (Substations):-

Zayouna 132 kv S/S - AL Amean 400 kv S/S

Rassafa Center 132 kv S/S – Baghdad North 400 kv S/S

The total price of our Tender, excluding any discounts offered in item (iv) below is the sum of:

.....;

The discounts offered and the methodology for their application is:

Our tender shall be valid for a period of days from the date fixed for the submission deadline in accordance with the Tender Document, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

If our tender is accepted, we commit to obtain a performance security in accordance with the Tender Document;

We have paid, or will pay the following commissions, gratuities, or fees with respect to the tendering process or execution of the Contract 1

Name of Recipient	Address	Reason	Amount
-------------------	---------	--------	--------

W e .

Yours sincerely

Name.....

In the capacity of.....

Signed

.....Duly
authorized to sign the Tender for and on behalf of..... Date
.....

1 If none has been paid or is to be paid, indicate "none"

4.2 PRICE SCHEDULES

- i. The Price Schedules are divided into separate Schedules as follows:

Schedule No.1/1: Material and equipment, including (cable & accessories)

Schedule No. 1/2: Supply of Fiber Optic Cable and Telecommunication & SCADA system

Schedule No.1/3 : Mandatory Spare Parts.

Schedule No 1/4:- Supply of Cable Protection Systems.

Schedule No. 2/1: Staff Training

Schedule No. 2/2: Factory Acceptance Tests.

Schedule No. 3 : Grand Summary (Schedules 1 to 5).

Schedule No. 4 : Country of origin declaration form.

The Schedules do not generally give a full description of the plant to be supplied and the services to be performed under each item. Tenderers shall be deemed to have read the Employer's Requirements and other sections of the Tender Document and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to cover the full scope as aforesaid, including overheads and profit.

- ii. If Tenderers are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with Clause 1.3.2 prior to submitting their tender.
- iii. Prices shall be filled in indelible ink, and any alterations necessary due to errors, etc., shall be initialed by the Tenderer.
- iv. As specified in the Tender Data Sheet and Special Conditions of Contract, prices shall be fixed and firm for the duration of the Contract.
- v. Tender prices shall be quoted in the manner indicated and in the currencies specified in the Instructions to Tenderers in the Tender Document.
- vi. For each item, Tenderers shall complete each appropriate column in the respective Schedules, giving the price breakdown as indicated in the Schedules.
- vii. Prices given in the Schedules against each item shall be for the scope covered by that item as detailed in Section 5 (Employer's Requirements) or elsewhere in the Tender Document.
- viii. Payments will be made to the Contractor in the currency or currencies indicated under each respective item.
- ix. When requested by the Employer for the purposes of making payments or part payments, valuing variations or evaluating claims, or for such other purposes as the Employer may reasonably require, the Contractor shall provide the Employer with a breakdown of any composite or lump sum items included in the Schedules.

4.3 SCHEDULE NO. 1: MATERIAL & EQUIPMENT, INCLUDING (CABLE & ACCESSORIES)

Schedule No. 1/1.A : Supply of (132 kV) Underground Cables & Accessories for Joining Projects (Substations):- **(Zayouna 132 kv S/S - AL Amean 400 kv S/S) (2×1×2000) (10 km)**

Note: Tenderers are requested to check the below schedule of & equipment carefully against the design and notify the Employer immediately if there are any missing items and modifications to the items given below:

No.	Description	Quantity	Unit	Unit Price (USD/km)	Total Price (USD)	Country of Origin
1.	XLPE power cables, Rated Voltage 132 kV Segmental Aluminum conductor (1×2000) mm ² , Copper Wire & Lead Metallic sheathed to verify (40 kA/ 1sec), HDPE covering according to IEC standard , with drum length (500m)	80	km			
2.	Premoulded (prefabricated) earthing straight joint for XLPE power cables, Rated Voltage 132 kV round Aluminum conductor (1*2000 mm ²) cross section suitable for the above cable with outer jacket to prevent the water penetration with all necessary elements to complete the joints. with metallic sheath to verify 40 kA / 1sec earth fault short circuit current . The semi conductive region of the stress cone must be (massive semi conductive /electrode) (not coated).	60	Pcs.			
3.	Premoulded (prefabricated) cross bonding joint for XLPE power cables, Rated Voltage 132 kV round Aluminum conductor (1*2000 mm ²) cross section suitable for the above cable with outer jacket to prevent the water penetration with all necessary elements to complete the joints. with metallic sheath to verify 40 kA / 1sec earth fault short circuit current . The semi conductive region of the stress cone must be (massive semi conductive /electrode) (not coated).	120	Pcs.			
4.	Outdoor type conventional termination for XLPE power cables ,Rated Voltage 132kV round aluminum conductor (1×2000 mm ²) cross section suitable for the above cable with all necessary elements to complete the joint. The creepage distance not less than 4000 mm. and The semi conductive region of the stress cone must be (massive semi conductive /electrode) (not coated).	20	Pcs.			
5.	Copper earth rod (2.25m) length,(16 mm ²) size with all accessories(suitable clamps,parallel groove)	150	Pcs.			
6.	Copper earth wire size 300 mm ²	2	km			
7.	Cross bonding coaxial cable 300 /300 mm ² suitable with cross bonding joint mension in item no. (3)	2	km			
8.	Protection mesh for underground buried services,with (1m) wide 30m/roll (400gm/1m)	30	km			
9.	Underground Warning tape length (250 m), thickness (0.17 mm) and width (150 mm)	40	km			
10.	Special tools complete for jointing and terminating 132kV power cables	3	SET			
11.	Disconnecting box for outdoor terminations suitable for the power cable (10 KA)	6	Pcs.			
12.	Cross bonding box suitable for C.B joints and cable (ip 68) , shortcircuit current 40 KA/ 1sec	35	pcs			

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13.	Earth link box 3 phase suitable for C.B joints and cable (ip 68) , shortcircuit current 40 KA/ 1sec	20	Pcs.																														
14	<p>Portable Computer high version:- Specifications for Portable computers Cpu :3rd gen Intel Core i7-3920XM Processor(2.9 GHzTurbo, 8MB,Upgradable to Intel vPro technology) Operating System: Genuine Windows® 7 Ultimate(64-Bit). Chipset: Mobil Intel® QM77 Express Memory1.2 : 4 DIMM slots up to 32GB 1600MHz Graphics Options2 :NVIDAQuadro K5000M with 4GB GDDR5 dedicated memory Display Options2 :17.3" FHD(1920× 1080): Dell UltraSharp™with Premier Color technology, IPS,wide view,anti-glare,LED-backlit,100% AdobeRGB color Gamut,Premium Panel Guarantee4 Storage Options5 :2x1 TB 2.5 inch Serial ATA (5.400 Rpm) Hard Drive Communication Options :</p> <ul style="list-style-type: none"> •Wired :integrated Intel 82579M/V 10/100/1000 Gigabit Ethernet. •Wireless LAN : Intel Centrino®Ultimate- N 6300 (802.11n 3×3 half Mini-Card). •Mobile Broadband & GPS: Dell Wireless™ DW5630 Multi-mode HSPA-EVDO mini-Card(Gobi™3D) with A-GPS. •Bluetooth: Dell Wireless 380 MBluetooth® 4.0. •Multimedia: Dual integrated high quality speakers and dual integrated noise cancelling digital array microphones standard. <p>Optical Drive: DVD-ROM; Slot load DVD+/-RW; Blu-ray Disc™writer. Standard I/O Ports:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">Left</td> <td style="width: 33%;">Rear</td> <td style="width: 33%;">Right</td> </tr> <tr> <td>1- Lock Slot</td> <td>1- VGA</td> <td>2- USB 3.0</td> </tr> <tr> <td>2- USB 2.0</td> <td>1- RJ-45</td> <td>1- Display Port</td> </tr> <tr> <td>1- IEEE 1394</td> <td>1-eSATA / USB 2.0</td> <td>1- Wireless switch</td> </tr> <tr> <td>1-Microphone</td> <td>1- HDMI</td> <td></td> </tr> <tr> <td>1- Headphone</td> <td></td> <td></td> </tr> <tr> <td>1- 10-in-1 media card reader7</td> <td></td> <td></td> </tr> <tr> <td>1- Smart Card reader</td> <td></td> <td></td> </tr> <tr> <td>1- 54mm ExpressCard slot</td> <td></td> <td></td> </tr> </table> <p>Chassis: Materials: aluminum and magnesium alloy. Slots: 2 full and 2 half Mini-Card Slots. Input</p> <ul style="list-style-type: none"> •Full size keyboard with number pad protected by an anti-microbial coating standard; backlit optional. •Multi-touch touchpad with three buttons; track stick with three buttons. <p>Security Options9:Lock slot, Trusted Platform Module 1.2 (TPM 1.2); Setup/BIOS password; I/O Interface Security; Intel Anti-Theft Protection(iATP); ContactlessSmartCard reader; standard or FIPS certified fingerprint reader; FIPS certified self encrypting drive; DellData Protection / Encryption solution.</p>	Left	Rear	Right	1- Lock Slot	1- VGA	2- USB 3.0	2- USB 2.0	1- RJ-45	1- Display Port	1- IEEE 1394	1-eSATA / USB 2.0	1- Wireless switch	1-Microphone	1- HDMI		1- Headphone			1- 10-in-1 media card reader7			1- Smart Card reader			1- 54mm ExpressCard slot			6	Pcs.			
Left	Rear	Right																															
1- Lock Slot	1- VGA	2- USB 3.0																															
2- USB 2.0	1- RJ-45	1- Display Port																															
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1- 10-in-1 media card reader7																																	
1- Smart Card reader																																	
1- 54mm ExpressCard slot																																	
Sub Total Schedule No. 1/1.A																																	

Signature of Tenderer:

Name of Tenderer:

**Schedule No. 1/1.B : Supply of (132 kV) Underground Cables & Accessories for Joining Projects
(Substations):- Rassafa Center 132 kv S/S – Baghdad North 400 kv S/S (2×1×2000) (15 km)**

Note: Tenderers are requested to check the below schedule of & equipment carefully against the design and notify the Employer immediately if there are any missing items and modifications to the items given below:

No.	Description	Quantity	Unit	Unit Price (USD/km)	Total Price (USD)	Country of Origin
1.	XLPE power cables, Rated Voltage 132 kV Segmental Aluminum conductor (1×2000) mm ² , Copper Wire & Lead Metallic sheathed to verify (40 kA/1sec), HDPE covering according to IEC standard, with drum length (500 m).	120	km			
2.	Premoulded (prefabricated) earthing straight joint for XLPE power cables, Rated Voltage 132 kV round Aluminum conductor (1*2000 mm ²) cross section suitable for the above cable with outer jacket to prevent the water penetration with all necessary elements to complete the joints. with metallic sheath to verify(40 kA /1sec) earth fault short circuit current. The semi conductive region of the stress cone must be (massive semi conductive /electrode) (not coated).	80	Pcs.			
3.	Premoulded (prefabricated) cross bonding joint for XLPE power cables, Rated Voltage 132 kV round Aluminum conductor (1*2000 mm ²) cross section suitable for the above cable with outer jacket to prevent the water penetration with all necessary elements to complete the joints. with metallic sheath to verify 40 kA / 1sec earth fault short circuit current. The semi conductive region of the stress cone must be (massive semi conductive /electrode) (not coated).	160	Pcs.			
4.	Outdoor type conventional termination for XLPE power cables, Rated Voltage 132kV round aluminum conductor (1×2000 mm ²) cross section suitable for the above cable with all necessary elements to complete the joint. The creepage distance not less than 4000 mm. and The semi conductive region of the stress cone must be (massive semi conductive /electrode) (not coated).	20	Pcs.			
5.	Copper earth rod (2.25m) length,(16 mm ²) size with all accessories(suitable clamps,parallel groove)	200	Pcs.			
6.	Copper earth wire size 300 mm ²	3	km			
7.	Cross bonding coaxial cable 300 /300 mm ² suitable with cross bonding joint menssion in item no. (3)	2.5	km			
8.	Protection mesh for underground buried services ,with 1m wide 30m/roll (400gm/1m ²)	45	km			
9.	Underground Warning tape length (250 m), thickness (0.17 mm) and width (150 mm)	60	km			
10.	Special tools complete for jointing and terminating 132kV power cables	3	SET			
11.	Disconnecting box for outdoor terminations suitable for the power cable (10 KA)	6	Pcs.			
12.	Cross bonding box suitable for C.B joints and cable (ip 68) , shortcircuit current 40 KA/ 1sec	25	pcs			
13.	Earth link box 3 phase (ip 68)	50	Pcs.			

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	Tools for laying and installation:					
	a- Rope protection roller,galvanizedas shown in (fig.1)	40	Pcs			
	b- Class fibre rod spooled on a galvanized vertical wheeled cage, complete of starting / ending junctions spinner and shackl as shown in (fig. 2)	10	Pcs			
	c- Starting roller as shown in (fig.3)	15	Pcs			
	d- Cable pulling grips made of galvanized steel wire, with 1 eyed thimble and pressed clamp, open at one end as shown in (fig.4):					
	-For dia.(100-120)mm.	20	Pcs			
	-For dia (80-100)mm.	20	Pcs			
	e- Cable pulling grips made of galvanized steel wire, with 2 eyed thimbles and pressed clamps, open at both ends as(as shown in fig.5):.					
	-For dia.(100-120)mm.	10	Pcs			
	-For dia (80-100)mm.	10	Pcs			
	f-. Cable roller (standard), galvanized (as shown in fig.6)	400	Pcs			
	g-. Cable roller (wide), galvanized (as shown in fig.7)	40	Pcs			
	h- Cable roller with ground plate (standard), galvanized(as shown in fig.8)	40	Pcs			
	i- Corner roller with plug-in hinges (standard), galvanized(as shown in fig.9)	200	Pcs			
	j- Cable guide and run-off frame, galvanized(as shown in fig.10)	20	Pcs			
	k- Hydraulic lifting jacks for cable drums, galvanized as(as shown in fig.11):					
	- For Carrying cappcity10 t.	10	pair			
	- For Carrying cappcity20 t.	15	pair			
	<u>Note:</u> (for the above item related with rollers (a,f,g&h) must be suitable with reinforced concrete truogh width 45 cm					
14	Cable pulling winches with : Max pull=70 kn. Speed at max pull=1.8 km/h. Max speed=4 km/h Pull at max speed=32 kn Bull-wheel diameter=400 mm. Max rope diameter=16 mm. Mass=2100 kg. Air cooling system. Electrical system=12 v. Diesel=60 kw(81 hp)with mechanism that could produce the following : Releasing the rop manually without starting machine Seperating the Drum reel of rope from the machine when needed	8	Pcs			
15	Cable Drum Transport and Laying Trailer with: Payload : 20000 kg Max. drum dia : 3600mm Clear loading width:at less 2500 mm Brake: Air press Operation The operating controls for starting the hydraulic power pack , loading and unreeling the drum are all accommodated within easy reach at the left front side	8	Pcs			
16	Caravan Houses used at Joining of cables. (the houses are equipped with air-conditioning, outdoor generator(20 KVA), crane unit inside and all other facilities with dust proof environment inside. To be used for joining cables, can be re used and relocated easily at another location anywhere on the cable route), (according to drawing no. R002)	20	NO			

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17	Ray flat Duct sealing system (RDSS) for power cables suitable for cable diameters range clip-125 (90-130) mm All RDSS sizes must be packed in boxes of (10) pieces with (1) libricant despenser and installation instruction (us/english) RDSS clips must be packed in boxes of (5) pieces Inflation tool complete with an (on/off)switch and an automatic pressyre monitoring system	200	set			
18	Ray flat Duct sealing system (RDSS) for power cables suitable for cable diameters ranges clip-150 (160-200) mm All RDSS sizes must be packed in boxes of (10) pieces with (1) libricant despenser and installation in struction (us/english) RDSS clips must be packed in boxes of (5) pieces Inflation tool complete with an (on/off)switch	300	set			
Sub Total Schedule No. 1/1.B						

Signature of Tenderer

Name of Tenderer

4.4 SCHEDULE NO.1/2. A : SUPPLY OF FIBER OPTIC CABLE AND TELECOMMUNICATION EQUIPMENT FOR JOINING PROJECTS (SUBSTATIONS):-

Zayouna 132 kv S/S - AL Amean 400 kv S/S (2×1×2000) (10 km)

Note: Tenderers are requested to check the below schedule of plant & equipment

carefully against the design and notify the Employer immediately if there are any missing items and modifications to the items given below.

No.	Description	Quantity	Unit	Unit Price (USD/km)	Total Price (USD)	Country of Origin
1.	Optical Fiber Single mode non-zero dispersion shifted fiber according to ITU-T G655 containing 24 optical fiber, it is to be directly buried inside suitable non-metallic pipes, and can withstand severe soil environment like water increase, temperature fluctuations, type of armoring is (PE). Optical fiber cable to be lay with the power cable. Optical Fiber drum shall be not less than 2 km.	25	km			
2.	Optical fiber cable joint with enclosure.	11	Pcs			
3.	Optical fiber accessories (including non metallic protective pipes) Dura Line. Dura Line - Outer diameter = 40 (mm) - Inner diameter = 34 (mm) - Minimum pressure 15 bar Durra line drum not less than 2 km	25	km			
4.	Accessories materials for optical fiber cable: a- Coupling Parts :- PE couplers Different dimensions according to different duct diameters, pressure tolerance up to 16 bar, used to connect Silicone ducts	10	pcs			
	b- Simplex plug :- Different dimensions according to different duct diameters. Used to seal the duct after the placement of (Optical fiber) cables to prevent dust and water from getting in.	10	pcs			
	c- Blank plug :- Different dimensions according to different duct diameters. Used to seal the duct before the placement of (Optical fiber) cables to prevent dust and water from getting in	10	pcs			
	d- Repairing duct :- Different dimensions according to different duct diameters. Used to repair broken ducts after the placement of (Optical fiber) cables.	10	pcs			
5.	Multiplexer : To be used for transmitting speech , data signal and protection signals of 2 Mbps transmission rate. The line distance up to 100 km The Multiplexer should have the capability to operate on pilot cable and optical fiber (single mode non-zero dispersion shifted fiber according to ITU-T G655). i.e. equipped with all necessary interfaces to be connected to copper wire and optical fiber, at the same time , the Multiplexer should include the following interfaces .:	2	Pcs.			
	- 4 wire interface E&M	16	interfaces in each MUX			

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	- 2 wire interface exchange side	12	interfaces in each MUX			
	- 2 wire interface subscriber side	12	interfaces in each MUX			
	- Data transmission for MUX.	8	interfaces in each MUX			
	- E1 (2 Mb/s).	8	interfaces in each MUX			
	- Ethernet / TCP / IP modules	4	interfaces in each MUX			
	- Hot line with telephone	1	Pcs. in each MUX			
	SDH (equipment or card) with STM-1 S1+1 optical interface and 21x2 Mb/s tributaries.	1	Pcs in each MUX			
	-Protection Signaling Equipments (PSE) to be operate with : 1. Digital Protection relays , G.703 (64 kbit) 2. Analog Protection relays ,4 teleprotection commands (PSE should be internal card) The supplier should guarantee that the signal transmitted on optical fiber will be received on the other side within the allowed margin of attenuation . - All required accessories for installation and connecting the MUX to MDF should be provided	2pcs. 8 port 4 port	in each MUX in each Mux.			
6	Cabinet for Multiplexer should be provided for the Multiplexers in the station as well as in opposite station to accommodate all Multiplexer links. Cabinets could be used fully i.e. commanding two Multiplexers. Cabinet specification: (Internal swing door, Front door should not contain glass, plate thickness is 2 mm , 42 U height, Fan unit, Internal light, AC plug with fuse and Cabinet dimension : 2 mt height , 80 cm width and 60 cm depth .	2	Cab.			
7	ODF: Optical Distributed Frame to distribute and connect the big tails with all connectors required to connect the ODF to the Mux (Cabinet type). (96 optical interfaces)	2	pcs			
8	Installation , commissioning, Operation and Maintenance manuals in English language for all the above items should be provided (hard and soft copy)	3	copies			
9	Typical Cable Jet: For installation of long section of fiber optic. Cable jacketed with PE material, their outside diameter ranging between 10-22 mm(with all required accessories). PE ducts (HDPE) with an external diameter 40mm.	1	Pcs.			
10	Cable Fleeting Device The Fleeter is designed to work in conjunction with the Cable Blowing Machine, which provides the cable feed in and out of the "Fleeter". The unit accepts 3,000 metres of 10-22 mm cable, allowing drum lengths of 6,000 metres to be utilized.	1	pc			

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11	Instruments & Commissions Equipment: - Portable Computer Pentium 4 high version (CPU: 2.0 GHz or higher, RAM: 2.0 GByte or higher, Serial port RS232) including software packages for (MUX) programming.	2	Pcs			
	- fusion splicer	1	Pcs			
	- OTDR	1	Pcs			
	- complete optical fiber preparation tool kit	1	pcs			
Sub Total Schedule No. 1/2.A						

Schedule No.1/2. B: Supply of Fiber Optic Cable and Telecommunication Equipment for Joining Projects (Substations):- **Rassafa Center 132 kv S/S – Baghdad North 400 kv S/S (2×1×2000) (15 km)**

Note: Tenderers are requested to check the below schedule of plant & equipment carefully against the design and notify the Employer immediately if there are any missing items and modifications to the items given below.

No.	Description	Quantity	Unit	Unit Price (USD/km)	Total Price (USD)	Country of Origin
1.	Optical Fiber Single mode non-zero dispersion shifted fiber according to ITU-T G655 containing 24 optical fiber, it is to be directly buried inside suitable non-metallic pipes, and can withstand severe soil environment like water increase, temperature fluctuations, type of armoring is (PE). Optical fiber cable to be lay with the power cable. Optical Fiber drum shall be not less than 2 km.	40	km			
2.	Optical fiber cable joint with enclosure.	16	Pcs			
3.	Optical fiber accessories (including non metallic protective pipes) Dura Line. Dura Line - Outer diameter = 40 (mm) - Inner diameter = 34 (mm) - Minimum pressure 15 bar Durra line drum not less than 2 km	40	km			
4.	Accessories materials for optical fiber cable: a- Coupling Parts :- PE couplers Different dimensions according to different duct diameters, pressure tolerance up to 16 bar, used to connect Silicone ducts	10	pcs			
	b-Simplex plug :- Different dimensions according to different duct diameters. Used to seal the duct after the placement of (Optical fiber) cables to prevent dust and water from	10	pcs			
	c-Blank plug :- Different dimensions according to different duct diameters. Used to seal the duct before the placement of (Optical fiber) cables to prevent dust and water from	10	pcs			
	d-Repairing duct :- Different dimensions according to different duct diameters. Used to repair broken ducts after the placement of (Optical fiber) cables.	10	pcs			
5.	Multiplexer : To be used for transmitting speech , data signal and protection signals of 2 Mbps transmission rate. The line distance up to 100 km The Multiplexer should have the capability to operate on pilot cable and optical fiber (single mode non-zero dispersion shifted fiber according to ITU-T G655). i.e. equipped with all necessary interfaces to be connected to copper wire and optical fiber, at the same time , the Multiplexer should include the following interfaces .:	2	Pcs.			
	- 4 wire interface E&M	16	interfaces in each			

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MINISTRY OF ELECTRICITY, IRAQ

	- 2 wire interface exchange side	12	interface s in each			
	- 2 wire interface subscriber side	12	interface s in each			
	- Data transmission for MUX.	8	interface s in each			
	- E1 (2 Mb/s).	8	interface s in each			
	- Ethernet / TCP / IP modules	4	interface s in each			
	- Hot line with telephone	1	Pcs. in each			
	SDH (equipment or card) with STM-1 S1+1 optical interface and 21x2 Mb/s tributaries.	1	Pcs in each MUX			
	-Protection Signaling Equipments (PSE) to be operate with 1. Digital Protection relays , G.703 (64 kbit) 2. Analog Protection relays ,4 teleprotection commands (PSE should be internal card) The supplier should guarantee that the signal transmitted on optical fiber will be received on the other side within the allowed margin of attenuation . - All required accessories for installation and connecting	2 pcs 8 port 4 port	in each MUX in each MUX			
6	Cabinet for Multiplexer should be provided for the Multiplexers in the station as well as in opposite station to accommodate all Multiplexer links. Cabinets could be used fully i.e. commanding two Multiplexers. Cabinet specification: (Internal swing door, Front door should not contain glass, plate thickness is 2 mm , 42 U height, Fan unit, Internal light, AC plug with fuse and Cabinet dimension : 2 mt height , 80 cm width and 60 cm depth .	2	Cab.			
7	ODF: Optical Distributed Frame to distribute and connect the big tails with all connectors required to connect the ODF to the Mux (Cabinet type). (96 optical interfaces)	2	pcs			
8	Installation , commissioning, Operation and Maintenance manuals in English language for all the above items should be provided (hard and soft copy)	3	Copies			
9	Instruments & Commissions Equipment: - Portable Computer Pentium 4 high version (CPU: 2.0 GHz or higher, RAM: 2.0 GByte or higher, Serial port RS232) including software packages for (MUX) programming.	2	pcs			
	- fusion splicer	1	pcs			
	- OTDR	1	pcs			
	Complete optical fiber preparation tool kit.	1	pcs			
	Sub Total Schedule No. 1/2.B					

4.5 SCHEDULE NO.1/3 : MANDATORY SPARE PARTS.

No.	Description	Quantity	Unit	Unit Price (USD/ EURO)	Total Price (USD/ EURO)
1	Spar parts for Multiplexer: list of all recommend spare parts are to be provided with break down prices.	2	Lot		
2	- Card 4 wire interface E&M	2	Pcs. (in each mux)		
3	- Card 2 wire interface exchange side	2	Pcs. (in each mux)		
4	- Card 2 wire interface subscriber side	2	Pcs. (in each mux)		
5	- Card Ethernet / TCP / IP modules	2	Pcs. (in each mux)		
6	- Card Data transmission	2	Pcs. (in each mux)		
7	- Card E1 (2 Mb/s).	2	Pcs. (in each mux)		
8	- SDH with STM-1	2	Pcs. (in each mux)		
9	-power supply	2	Pcs. (in each mux)		
Sub- total for mandatory spare parts : Schedule No.1/3					

Signature of Tenderer:

Name of Tenderer:

4.6 SCHEDULE NO 1.4:- SUPPLY OF CABLE PROTECTION SYSTEMS

No.	Description	Quantity	Unit	Unit Price (USD or EURO)	Total Price (USD or EURO)	Country of Origin
1	<p>Supply of total Cable Protection Systems – for 2 circuits including panels, interfacing with existing systems (It should include Differential Protection Relay for two line ends with Software and connection cables: quantity 4 nos.) And the specification of Protection Relay as below: Protection function:</p> <ul style="list-style-type: none"> • Differential Protection for universal use with power lines and cables on all voltage levels with phase-segregated measurement (87 L) • Two line ends capability • Suitable for transformers in protected zones (87 T) • Restricted earth-fault protection (87N) if a transformer is within the protection zone • Well-suited for serial compensated lines • Two independent differential stages: One stage for sensitive measuring for high resistance faults and fast fault clearance • Breaker-failure protection (50 BF) • Phase and earth over current protection with directional element (50,50N,51,51N,67,67N) • Ohase-selective inter tripping (85) • Overload protection (49) • Over/under voltage protection (59/27) • Over/under frequency protection (81O/U) • Auto-reclosure single/three-pole (79) <p><u>Control function:</u></p> <ul style="list-style-type: none"> • Command and inputs for ctrl. Of CB and disconnectors (isolators) <p><u>Monitoring functions:</u></p> <ul style="list-style-type: none"> • self – supervision of the relay • trip circuit supervision (74TC) • 8 oscillographic fault records • CT-secondary current supervision • Event logging /fault logging • Switching statistics <p><u>Front design</u></p> <ul style="list-style-type: none"> • User – friendly local operation • PC front port for convenient relay setting • Function keys and 8 LEDs f. local alarm <p><u>Communication interfaces:</u></p> <ul style="list-style-type: none"> • Serial protection data (R2R) interface • Front interface for PC connection • System interface • IEC 61850 Ethernet • IEC 60870-5-103 protocol • PROFIBUS-DP, DNP 3.0 and MODBUS • Service / modem interface (rear) • Time synchronization via IRIG-B , DCF77 or system interface <p><u>Features:</u></p> <ul style="list-style-type: none"> • Browser –based commissioning tool <p>Direct connection to digital communication networks</p>	12	No.			
	Sub Total of Price Schedule 1.4 (To Grand Summary)					

4.7 SCHEDULE NO. 2: STAFF TRAINING AND FACTORY ACCEPTANCE TESTS SCHEDULE NO. 2/1: STAFF TRAINING

These training programmes will aim to provide opportunity for the Employer's technical staff to acquire better knowledge on the jointing and terminating of High Voltage Cables, which are going to be installed under this contract.

No.	Description	Unit	Total Price USD or EURO
1	Training 132 KV outdoor sealing ends & straight joint in two delegations in (2) group with the shipments, each delegation from (5) five persons.	(20) persons (14) working days	
2	Cable pulling winches and Cable Drum Transport	(4) person for (7) working day	
3	Training for engineers & technicians test and commission with certification for : Optical fiber(OTDR , Splicer , Cable jet)	(2) person for (7)Working days	
4	Mux.	(2) Person for (7) working days	
5	Electrical System Design and Engineering Works Comprehensive Training on Cable design calculations including internal structure of the cable, Rating Calculation, Voltage drop and loss calculation both manual methods & Software based, general training for all similar power cables, with the cable used for this tender. A comprehensive training at cable manufacturer's	(2) Electrical Engineers (14) Working days	
6	Civil System Design and Engineering Works Civil aspects of cable laying, different methods, including effect on ratings and other issues, typical problems encountered in the site, new methods in cable laying such as horizontal drilling technology and methods used in this tender A comprehensive training at cable manufacturer's	(2) Civil Engineers (14) Working days	
Sub-Total for Staff Training: Schedule 2/1			

Notes(1) :

- The training should be in the manufacturing factory
- The bidder should provide training course details in the offer
- Schedule of training appointment should be sent at least 2 months before the date

Notes(2) : The above costs shall include;

- i. Inland transportation from Baghdad city to Baghdad international Airport
- ii. International and inland transportation (out of Iraq)
- iii. Accommodation costs of Employer's staff
- iv. Visa and insurance charges of Employer's staff
- v. Daily allowance amounting to USD 200 per person (including meals) for Employer's staff
- vi. Communication expenses of USD 200 per person for Employer's staff

Signature of Tenderer: _____

Name of Tenderer: _____

SCHEDULE NO. 2/2 : FACTORY ACCEPTANCE TESTS (FAT)

Person to witness all the tests before shipping at manufacturing factory for following:

- 132 kV Cables
- 132 kV Cable Accessories
- Optical Fiber

No.	Description	Unit	Total Price USD or EURO
1	Engineers: Type test and routine test on the 132 kV power cable in (2) delegation.	(4) Eng.for (7) working days.	
2	132 kV outdoor sealing ends & earthing straight and crossbonding joint for (2) delegation	(4) Eng. for (7) working days.	
3	Engineers : Optical Fiber	(2) Eng. for (5) working days	
4	Engineers : Mux.	(2) Person for (5) working days	
Sub-Total for FAT : Schedule 2/2			

Notes: The above costs shall include;

- i. Inland transportation from Baghdad city to Bagdad international Airport
- ii. International and inland transportation (out of Iraq)
- iii. Accommodation costs of Employer's staff
- iv. Visa and insurance charges of Employer's staff
- v. Daily allowance amounting to USD 200 per person (including meals) Employer's staf f
- vi. Communication expenses of USD 200 per person for Employer's staff
- x .The training should be in the manufacturing factory.
- xi. The bidder should provide training course details in the offer.
- xii. Schedule of training appointment should be sent at least 2 months before the training date.

Signature of Tenderer: _____

Name of Tenderer: _____

4.8 SCHEDULE NO.3 : GRAND SUMMARY

Based on above Schedule 1-5, the total project cost for Supply 132kV under ground cables

No.	Description	Total Price USD or EURO
1	Schedule No.1/1(A,B) :material and equipment, including(cables & accessories)	
2	Schedule No.1/2 (A,B):Supply of fiber optic cables and telecommunication Equipement.	
3	Schedule No.1/3:Mondatory Spare Parts	
4	Schedule No. 1/4: Supply of Cable Protection Systems	
5	Staff Training And Factory Acceptance tests(Included schedule No.2/1 & Schedule No.2/2)	
Grand total (TENDER PRICE to be carried forward to letter of Financial Proposal)		

Signature of Tenderer: _____

Name of Tenderer: _____

4.9 SCHEDULE NO. 4: COUNTRY OF ORIGIN DECLARATION FORM

ITEM	DESCRIPTION	MANUFACTURER	PLACE OF FACTORY	PLACE OF TESTING
1	XLPE power cables			
2	joint for XLPE power cables			
3	conventional termination for XLPE power cables			
4	Stranded copper conductor			
5	Cross bonding cable Type GKN 150 /150 mm ²			
6	Protection mesh for underground buried services ,with 1m wide 30m/roll(200gm/1m)			
7	Underground Warning tape size (150*0.1)mm			
8	Special tools complete for jointing and terminating 132kV power cable			
9	Cross bonding Box suitable for C.B joints and cable			
10	Digital differential protection relay according to technical specifications			
11	Witnessing according to schedule No. 2/2			
12	Training according to schedule No. 2/1			
13	Power cable clamps aluminum casting with two stainless steel screws and rubber sole			
14	Power cable clamps aluminum casting with six stainless steel screws and rubber sole .			
15	Optical Fiber			
16	Optical fiber cable joint with enclosures			
18	Optical fiber accessories			
19	Portable Computer			
20	Tools for laying and installation			
21	GIS System			
22	Cable pulling winches			
23	Cable Drum Transport and Laying Trailer			
24	Dura line			
25	ODF: Optical Distributed Frame			
26	Typical cable jet			
27	Cable fleeting device			
28	Protection signaling equipment (PSE)			
29	Multiplexer			
30	Cabinet for Multiplexer			
31	Instruments & Commissions equipment			

Signature of Tenderer: _____

Name of Tenderer: _____

4.10 IMPORTANT NOTE:

MANUFACTURERS AND PLACES OF MANUFACTURING , TESTING AND INSPECTION

Item	COUNTRY OF MANUFACTURER	PLACE OF TESTING AND INSPECTION
XLPE power cables 132 kV	USA , JAPAN , SOUTH KOREA , WEST EUROPE , SAUDI ARABIA, TURKEY , IRAN , MALAYSIA,EGYPT	
(straight Joints, cross bonding Joints,Outdoor type conventional terminations) for XLPE power cables.	-ABB(SWITZERLAND) - BRUGG (SWITZERLAND) -NEXANS (SWITZERLAND) -PRYSMIAN (ITALY) -ELASTIMOLD(USA) -PFISTERER(SWITZERLAND)	
Optical fiber	USA , JAPAN ,EUROPE	
MUX.	EUROPE	
Protection signaling equipment (PSE)	EUROPE	

SECTION 5: EMPLOYER'S REQUIREMENTS ORDER OF PREFERENCE

Technical General conditions given under clause 5.2 shall supersede the 132 kV. UNDERGRUOND CABLES TECHNICAL REQUIREMENTS AND SPECIFICATIONS.

5.1 TECHNICAL SPECIFICATIONS REFER THE:

- 132kV UNDERGRUOND CABLES TECHNICAL REQUIREMENTS AND SPECIFICATIONS
- STANDARD SPECIFICATION FOR FIBER CABLE AND TELECOMMUNICATION & SCADA SYSTEM

5.2 TECHNICAL GENERAL CONDITIONS

- **Basic Design Criteria**

All design works shall be in accordance with the basic parameters herein after described, MOE Specifications and relevant IEC/VDE standards. In case of contradictions between the specifications and the below given data, the below given data shall prevail and shall have the precedence.

5.2..1 SERVICE CONDITIONS

Ambient Temperature	
Maximum peak Maximum daily average Maximum	55°C
yearly average Lowest minimum	45°C
Maximum Ground temp. at 100mm depth	35°C
	35°C
Humidity	
Maximum Relative	92%
Minimum Relative	12%
Yearly Average	38 -44%
Maximum Design Wind Speed (Equipment/structures at height 10m above ground)	145km/hr
Altitude Level above sea level	< 1000m
Rain Fall	
Max. per year	500mm
Min. per year	50mm
Max in one day	72mm
Yearly Average	150.8mm

5.2..2 HV & MV Equipment Design & Safety Clearances (omitted)

b) Design Clearances (N/A) (omitted)

5.3 TECHNICAL SCHEDULES

Refer the TECHNICAL SCHEDULES

- SECTION 9 : 132kV. UNDERGRUOND CABLES TECHNICAL REQUIREMENTS AND SPECIFICATIONS

- SECTION 10 : STANDARD SPECIFICATION FOR FIBER OPTIC CABLE AND TELECOMMUNICATION & SCADA SYSTEM

Note: Tenderers are required to provide electronic copy of the technical schedules in addition to the signed copies included in Technical Proposal.

SECTION 6: GENERAL CONDITIONS OF CONTRACT

Refer the General Conditions of Contract (GCC).

SECTION 7: PARTICULAR CONDITIONS OF CONTRACT

Refer the Particular Conditions of Contract (PCC).

SECTION 8: CONTRACT FORMS

This Section contains the Letter of Acceptance, the Contract Agreement and Appendices to the Contract Agreement which, once completed, will form part of the Contract.

8.1 NOTIFICATION OF AWARD

Notification of Award

[*Employer's letter head*]

Letter of Acceptance

[*date*]

To: [*Name and address of the Contractor*]

This is to notify you that your Tender consisting of the Technical and Financial Proposals dated [*date*] for execution of the [*name of the Contract and identification number, as given in the Contract Data*] for the Contract Price in the aggregate of [*amounts in numbers and words*] [*name of currency*], as corrected and modified in accordance with the Instructions to Tenderers is hereby accepted by the Ministry of Electricity, Republic of Iraq.

You are requested to furnish the Performance Security within 14 days in accordance with the Conditions of Contract, using for that purpose one of the Performance Security Forms included in Section 8 (Contract Forms) of the Tender Document

[*Authorized Signature*]

Name and Title of

Signatory

Ministry of Electricity

Republic of Iraq

Attachment: Contract Agreement

8.2 CONTRACT AGREEMENT

Contract Agreement

THIS AGREEMENT made the _____ day of _____, _____,

BETW EEN

(1) [name of Employer], a corporation incorporated under the laws of [country of Employer] and having its principal place of business at [address of Employer] (hereinafter called "the Employer"), and (2) [name of Contractor], a corporation incorporated under the laws of [country of Contractor

] and having its principal place of business at [address of Contractor] (hereinafter called "the Contractor").

WHEREAS the Employer desires to engage the Contractor to design, manufacture, test, deliver, install, complete and commission certain Facilities, viz. [list of facilities] ("the Facilities") and the Contractor have agreed to such engagement upon and subject to the terms and conditions hereinafter appearing.

NOW IT IS HEREBY AGREED as follows:

Article 1: Contract Documents

1.1 Contract Documents

The following documents shall constitute the Contract between the Employer and the Contractor, and each shall be read and construed as an integral part of the Contract:

- a. This Contract Agreement and the Appendices hereto
- b. Letter of Financial Proposal and Price Schedules submitted by the Contractor
- c. Letter of Technical Proposal and Technical Proposal submitted by the Contractor
- d. Special Conditions
- e. General Conditions
- f. Specification
- g. Drawings
- h. Other completed Tender Forms submitted with the Letters of Technical and Financial Proposals
- i. Any other documents part of the Employer's Requirements
- j. Any other documents shall be added here
- k. General Conditions of civil, electrical, mechanical and Chemical Works 1987, issued by the Ministry of Planning.
- l. The contract will be subjected to the instructions of the executing governmental contracts No.1, 2008.

1.2 Order of Preference

In the event of any ambiguity or conflict between the Contract Documents listed above, the order of precedence shall be the order in which the Contract Documents are listed in Article 1.1 (Contract Documents) above.

Also in the event of any ambiguity or conflict between this Contract and items listed in 1.1.k and 1.1.l then the contract will be powerful.

Items listed in 1.1.k and 1.1.l will be applied only for the scope of works and activities indicated in this Contract .

1.3 **Definitions**

Capitalized words and phrases used herein shall have the same meanings as are ascribed to them in the General Conditions.

Article 2: Contract Price and Payment

2.1 Contract Price

The Employer hereby agrees to pay to the Contractor the Contract Price in consideration of the performance by the Contractor of its obligations hereunder. The Contract Price shall be the aggregate of: [. . . amounts of foreign currency in words], [. . . amounts in figures. . .] as specified in Price Schedule No. 3 (Grand Summary), [... amounts of local currency in words . . .], [. . . amounts in figures. . .], or such other sums as may be determined in accordance with the terms and conditions of the Contract. The abase prices will be according to the LME prices in theOne day before closing date as specified in Appendix 2 .

2.2 Terms of Payment

The terms and procedures of payment according to which the Employer will reimburse the Contractor are given in the Appendix1 (Terms and Procedures of Payment) hereto.

The Employer shall instruct its bank to issue an irrevocable documentary credit made available to the Contractor in a bank in the country of the Contractor. The credit shall be for an amount of [. . . amount equal to the total named in Schedule 1 less the advance payment to be made for Plant and Equipment supplied from abroad. . .]; and shall be subject to the Uniform Customs and Practice for Documentary Credits 1993 Revision, ICC Publication No. 500.

In the event that the amount payable under Schedule No. 1 is adjusted in accordance with GCC Clause 11.2 or with any of the other terms of the Contract, the Employer shall arrange for the documentary credit to be amended accordingly.

Article 3: Effective Date

3.1 Effective Date

The Effective Date upon which the period until the Time for Completion of the Facilities shall be counted from the date when all of the following conditions have been fulfilled:

- a. This Contract Agreement has been duly executed for and on behalf of the Employer and the Contractor by signing by both parties;
- b. Opening letter of credit in favour of contractor (24 hours) from issuing date of letter of credit for the purpose of metal fixation with adjusted prices.

3.2 The third party inspection should be as a member of International Federal Inspection Association (IFIA) and acceptable from us, (SGS) Inspection Company Certificate is not accepted.

Each party shall use its best efforts to fulfill the above conditions for which it is responsible as soon as practicable.

Article 4: Communications

4.1 The address of the Employer for notice purposes, pursuant to GCC Clause 4.1 is:

Al Mansour, P O Box 55243, Baghdad, Republic Of Iraq

4.2 The address of the Contractor for notice purposes, pursuant to GCC Clause 4.1 is: [

Contractor's address].

Article 5: Appendices

The Appendices listed in the attached List of Appendices shall be deemed to form an integral part of this Contract Agreement.

Reference in the Contract to any Appendix shall mean the Appendices attached hereto, and the Contract shall be read and construed accordingly.

IN WITNESS WHEREOF the Employer and the Contractor have caused this Agreement to be duly executed by their duly authorized representatives the day and year first above written.

Signed by, for and on behalf of the Employer

[**Signature**]

[**Title**]

in the presence of

[**Signature**]

[**Title**]

Signed by, for and on behalf of the Contractor

[**Signature**] [**Title**]

in the presence of

[**Signature**] [**Title**]

APPENDICES

- Appendix 1 - Terms and Procedures of Payment
- Appendix 2 - Price Escalation (Metals Fixation with Adjusted Prices)
- Appendix 3 - Insurance Requirements
- Appendix 4 - Time Schedule
- Appendix 5 - List of Documents for Approval or Review

- **Appendix 1 - Terms and Procedures of Payment**

In accordance with the provisions of GCC Clause 12 (Terms of Payment), the Employer shall pay the Contractor in the following manner and at the following times, on the basis of the Price Breakdown given in the section on Price Schedules. Payments will be made in the currencies quoted by the Tenderer unless otherwise agreed between the parties. Applications for payment in respect of part deliveries may be made by the Contractor as work proceeds.

TERMS OF PAYMENT

Prices to be on CIP delivery to site Baghdad / Warehouse basis of Incoterms (2010 in USD or Euro .

The payment conditions to be by irrevocable, LC issued by first class through Trade Bank of Iraq (TBI) as follows:

(*) the letter of credit shall open with rate (100%) from the total contract price and the payments will be as follows :

- 1- 35% (thirty five percent)** of each shipment price to be paid upon across of goods at Iraqi border and payable at sight against presentation of shipping documents listed below:
 - a- Commercial invoice. (original) and two copies.
 - b- Packing list. (original) and two copies.
 - c- CMR documents stamped by (MOE) representative at Iraqi border or **B/L** (original)
 - d- Certificate of Origin. (original) and one copy
 - e- Insurance Certificate. (original)
 - f-Third party's inspection certificate. (original) and two copies.

- 2- 60% (sixty percent)** of each shipment price , to be paid after arrival of goods to site warehouse in compliance with our specifications and requirement and received by first party committee and approved the receiving of materials according to photo copy of the shipping documents mentioned above.

- 3- Retention (5%) of total price contract will be paid as follow:**
 - **(2.5%)** (PAC) (Primary acceptance certificate) - of total price will be released after arrival all the shipments and compilation all the contract items **items after issuing the (PAC).**

 - **(2.5%)** (FAC) (Final acceptance certificate) - of total price will release until the end of the warranty period.

- **Appendix 2 - Price Escalation (Metals Fixation with Adjusted Prices)**

The Contract Prices shall be CIP (as defined in the latest INCOTERMS) Employer's warehouses in Baghdad Republic of Iraq, the prices of the power cables in Price Schedule No. 1/1 are variable and will be adjusted according to the below metal fixation formula after Clause 3.1 of the Contract Agreement is fulfilled.

$$\text{NSP} = \text{O.P.} + \text{V.F. CU (LME2 – LME 1) for Copper} \\ + \text{V.F. AL (LME2 – LME1) for Aluminum} \\ + \text{V.F. PB (LME2 – LME1) for Lead}$$

NSP = Net Selling Price USD/ KM after metal fixation
OP= (after (24 hour) of closing date).

LME1= Price in USD/ kM (at the date of closing date) based on :

(CU) = USD/MT (metric tone)

(AL) = USD/MT

(PB) = USD/MT

V.F.CU = variation factor MT/kM for Copper

V.F.AL = variation factor MT/kM for Aluminum

V.F.PB = variation factor MT/kM for Lead

LME2 = Price per MT of copper / Aluminum / Lead in USD/MT (cash settlement) ruling on the next working day after fulfillment of the condition in Clause 3.1 of the Contract Agreement

Metals fixation will be effected by Employer on the next LME working day after the condition in Clause 3.1 have been fulfilled. The Contractor will inform the Employer about the final LME prices for Copper, Aluminum and Lead, and will submit adjusted unit price calculations. Total Contract Price will be firmed and fixed and the quantity will be changed according to metal fixation.

- Accredited the base price for metal one day before the closing date of tender.
- Accredited the changing price for metals after (24) hours from the date of opening the LC Through **TBI**.
- Fixing the a/m two conditions in signed contract.

- **Appendix 3 - Insurance Requirements**

Insurances to be taken out by the Contractor

The Goods supplied under the Contract shall be fully insured, in a freely convertible currency from an eligible country, against loss or damage incidental to manufacture or acquisition, transportation, storage, and delivery, in accordance with the applicable Incoterms or in the manner specified (CIP) in the PC 12.

- **Appendix 4 - Time Schedule**

Overall Delivery Period Maximum **360 Days** from the Contract Effective Date should be in three lots (batches) in **360 Days** total shipments:-

- A** First shipment to be delivered not later than 120 days after contract effective date with 30% of total power cables.
- B** The remaining two shipments should be delivered in sequence of 120 Days interval between them, each shipment contain 35% of power cable and 50% of the other items and accessories.

- **Appendix 5 - List of Documents for Approval or Review**

Pursuant to GCC Clause 20.3.1, the Contractor shall prepare, or cause its Subcontractor to prepare, and present to the Project Manager in accordance with the requirements of GCC Clause 18.2 (Program of Performance), the following documents for;

A. Approval

1. Test reports, standards certificates, quality control reports etc.
2. Design reports
3. Method statements
4. Any other documents specified in the specification or as request by the Engineer

B. Review

1. Operation and maintenance manuals
2. Any other documents specified in the specification or as request by the Engineer

8.3 BANK GUARANTEE FORMS

- **Bank Guarantee Form for Performance Security**

Performance Bond

STANDARD WORDING

Please very urgently issue under our risk and responsibility your Performance Bond for an amount of (amount in numbers) (amount in words) for account of (the Customer) and in favor of [the Beneficiary], valid until (date) and covering (description).

Please issue in the following forma:

QUOTE

To: (Beneficiary). Date:

We Trade Bank of Iraq, are issuing this Performance Bond guarantee to you at the request of (name of Customer) (the "Customer") for a maximum aggregate amount of up to (amount in numbers) (amount in words) between you and' the Customer relating to (description)

We hereby guarantee to pay to you such amount as you may claim from us hereunder upon presentation of your first written demand at our counters purporting to be signed by your authorized signatory specifying the amount claimed hereunder, certifying that the Customer has failed to fulfill its obligations to you under (the Contract and that accordingly you are entitled to receive payment under the Performance Bond provided that:

1. more than one demand may be made hereunder prior to the Expiry Date (as defined below).
2. The payment of any claim should be made on first demand regardless of any contestation between the parties concerned.
3. We confirm to you that the necessary approval of the Foreign Exchange Authorities has been already obtained for issuing this Performance Bond.
4. The payment of any claim should be made according to the prevailing exchange rate at the actual date of payment.
5. In case of dispute, (this Performance Bond is subject to Iraqi law).
6. This Performance Bond is not subject to any conditions other than those conditions stated above.

Let it be known that this Performance Bond being solely in your favour as Beneficiaries is not assignable or transferable to any third party, (likewise it is not transferable by the principal to any other beneficiary or third party whom so ever is not permissible), as same being personal to all parties concerned.

By this Performance Bond, we undertake to pay to you any amount or claim not exceeding under any circumstances the above mentioned amount, provided the claim falls within the direct scope of the matter to be indemnified and is irrelevant to any other matter even if these matters resulting from the subject to be indemnified or relevant thereto, when particular to any party, whatsoever its origin, since this Performance Bond is in your favor as the sole Beneficiary and subject to our receipt of your claim in this office not later than the official working hours of day xxx of the month xxx in the year xxx (the "Expiry Date"), otherwise, should we not receive any claim from you by that date our liability will cease and the present Performance Bond will become null and void and it will be removed from our records.

In any event or for any reason our maximum liabilities under this Performance Bond will not exceed the sum to be indemnified shown here above.

Yours faithfully, AUTHORISED SIGNATURE UNQUOTE

In consideration of you issuing your Performance Bond as requested above we hereby open in your favour our Irrevocable Standby Letter of Credit number XXX for an amount of (amount in numbers) (amount in words) available against your claim transmitted by authenticated SW IFT / that you have duly issued your Performance Bond as requested by ourselves and that you have received a claim in accordance with the terms of the Performance Bond.

This Standby Letter of Credit expires on (Performance Bond Expiry Date+15 days) and is subject to Uniform Customs and Practice for Documentary Credits (Revision) International Chamber of Commerce Publication No, 600.

In the event of a drawing under this Standby Letter of Credit our maximum aggregate liability is restricted to (amount in numbers) (amount in words).

We undertake to pay to you on your first authenticated SW IFT / Tested Telex demand any amount that you may claim not exceeding the total value of the said Performance Bond provided that such demand is in accordance with our Standby Letter of Credit.

- **Tender Security (Bid Bond)**

As the tender is open for all tenderers, the Tenderers are required to furnish a Tender Security in this tender with amount (1%) from the total offer price and through TBI.

SECTION 9: 132kV. UNDERGRUOND CABLES TECHNICAL REQUIREMENTS AND SPECIFICATIONS

TECHNICAL SPECIFICATIONS FOR MANUFACTURING AND TESTING OF 132kV UNDERGROUND CABLE

9.1 INTRODUCTION

These specifications point out the contract characteristics for design , manufacture , testing, packing , shipping and delivery CIP Baghdad of underground cables with their accessories for operation in a three phase 132kV - 50 HZ system . They refer to following one - core cables :- -Extruded polyethylene (PE) - Cross - linked polyethylene (XLPE)

9.2 TECHNICAL RULES

• **IEC Recommendations**

The selection of materials , design , calculation and testing of equipments shall be carried out according to the last issue of the International Electromechanical Commissions recommendations , as far as they exist. The installed cable system shall be designed for a reliable service life of at least 40 years.

• **Standards**

As a general rule ,all materials , stuffs and products used , for the manufacture of equipment, shall be in conformity with standards to which it is referred or, if there is no standard, shall have necessary qualities for a blameless manufacture of equipment.

9.3 GENERAL WORKING CONDITIONS

The general conditions , in which cable and their accessories shall be able to work without any failure , are as follows :-

• **System Electrical Conditions**

Rared voltage of the three phases 50 HZ system	U = 132kV
Highest system voltage : U+ 10 %	Um = 145kV
Specified voltage	Eo = 76kV
Maximum impulse withstand voltage (1,2 / 50)	Ep = 650kV
Earth Fault Current & duration	= 40kA per (1sec).

• **Electrical Conditions Considering Metallic Sheath Earthing**

Cables laid in trefoil formation in a single concrete trough shall have their sheath earthed at both ends at junction points as often as required by the manufacturer. Each sheath shall be able to transmit the maximum fault current without damage .

• **Operating Temperature of Cables**

Maximum allowable temperatures of conductor are according to the type of insulation :

	Permanent load	short - circuit
Low density polyethylene (LDPE)	70 °C	150 °C
High density polyethylene (HDPE)	75 °C	160 °C
Cross linked polyethylene (XLPE)	90°C	250 °C

However ,as it is not possible to make sure that the thermal resistivity of the surrounding soil is constant, the conductor size will take in to consideration temperatures when operating with constant current .

LDPE : 66 °C	XLPE : 83°C	HDPE : 70°C
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- **Climatic Conditions**

Climatic conditions in Baghdad are severe .In summer, the ambient temperature of air reaches 50 °C in shadow and a black object in direct sunlight can have a temperature of 80 °C. The maximum daily average is 40 °C and the maximum yearly average is 30 °C. Daily variation of temperature can reach 25 °C and the lowest minimum is - 10 ° Cables considered in this specification shall be able to work without any problem with their rated load and in the worst climatic and atmospheric conditions that can occur in Baghdad.

- **Soil Thermal Conditions**

The three cables of one line shall be laid touching each other in trefoil formation in a prefabricated concrete trough at 1 meter depth in a soil having a mean thermal resistivity of 120 °C cm / w and a temperature of 35 °C at one meter under the ground level. To improve the current rating, special backfill material with a thermal resistivity of 120°C.cm /W (dry value) or better may be used

9.4 CABLES FEATURES

- **Synthetic Insulation Cables**

9.4..1 Conductor

The conductor shall have a circular cross section. It shall be made of aluminum wires , stranded in concentric or segmental layers , The conductor must comply , on any point, with IEC standards 228 ,28 and 111. Longitudinal water barrier with the conductor stands and shall be tested in accordance to latest IEC . recommendation NO. 60840.

9.4..2 Insulating Covering

9.4..2.1 Material

The covering shall be cross - linked polyethylene (XLPE) ,The insulation of the completed cable shall be free from any void larger than 0.025 mm any contaminant larger than 0.01mm in largest dimension or any translucent material that is larger than 0.5 mm in its radial vector projection.

The number of contaminants of sizes between (0.025-0.01)mm shall not exceed 15 per 15 cubic centimeters of insulation . In plant repairs of the insulation are prohibited unless specifically agreed to by the ETP Engineer.

9.4..2.2 Dimensions Features

1) Thickness of insulation

Nominal thickness of insulation must be 18 mm for XLPE .and minimum at any point must be not less than 16 mm , Inner and outer semi - conductor screen thickness are not included in these values .

2) Measurement of thickness of insulation

a) Sampling

Each cable length selected for the test shall be represented by two pieces of cable , taken one from Each end after having discarded , if necessary ,any Portion which may have suffered damage. If the average thickness measured or the lowest value Measured on one or the two pieces fails to meet the requirements specified in Sub - clause 1) two other pieces shall be checked , If both of the further pieces meet the specified requirements the cable is deemed to comply , but if either does not

meet the requirements the cable is deemed not to comply .

b) Procedure

The test procedure shall be in accordance with IEC publication n 540, previously document CEI 20 A (Central office) 45 .

c) Requirements

For each piece of core, the average values shall be Not less than the specified nominal thickness and The smallest value shall not fall below the specified

Nominal thickness by more than 0,1 mm + 10 % of the Specified nominal thickness.

As per (clause 10.6.2) of IEC 60840.

9.4..2.3 Mechanical, Physical and Chemical Features

Mechanical, physical and chemical features of insulation considered in the present edification must be at least equal to the values of table 1 or, if they are not given , to those of IEC 20 A (Central office) 51 and 20 A (Secretariat) 44 to be published as IEC 502 .2 .

The inspection of these features will be done according to IEC 540 [formerly document IEC 20 A (Central office) 45]

TABLE 1 - Test Procedure and Test Requirements for P.E Compounds and XLPE Compounds

1 Test Method	2 Test and procedure	3 Units	Insulation	
			PE	XLPE
C	Mechanical characteristics			
	Without aging :-			
	-tensile strength minimum	N/mm ²	125	15.0
	elongation at break minimum			
	-After aging in air oven :-	%	450/350 (1)	250
	-temperature (tolerance +2 c)	C	100	135
	-duration	Days	10	10
	elongation at break minimum		450/350 (1)	250
	-variation maximum (2)	%	+25	+25
	-Hot test: Degree of cross linking			
	-temperature (tolerance + 3 c)		(3)	200
	-time under load	C mm		15
	-mechanical stress	N/cm ²		20
-maximum elongation under load	%		175	
-maximum elongation after cooling	%		15	
D	Water absorption			
	Gravimetric method -Duration of immersion	days	14	14

	-Temperature (tolerance + 3 C) – - Maximum permissible variation of mass	C mg/cm ²	85 1	85 1(4)
P	Shrinkage test -Temperature (tolerance + 2C) -Duration -Maximum permissible shrinkage	C Hours %	100 1 4	130 1 4

(1) LDPE 450 % HDPE 350%

(2) variation difference between the median value of tensile strength find rlongjtion at break obtained after treatment and the median value obtained without treatment, expressed as a percentage of the latter.

(3) 115 C + 2C for Pewith density > 0.94

(4) 5instead of 1 for XLPE with a density > 1.02 .

9.4..3 Screens

9.4..3.1 Inner and outer semi - conducting screens .

These screens are obligatory on all cable considered in this specification They shall be continuous , have a constant average thickness ,have no asperity and keep in perfect contact with the insulation layer in normal operation conditions . They shall have no bad action on the conservation of cable elements at their contact and, especially not contain any injurious stuff that could diffuse into the insulation layer.

a) Inner semi - conducting screen .

This non - metallic screen consists in an extruded layer of a semi - conducting mixture Its thickness must not be less than 7% of the required average thickness of the insulation layer The ratio of extreme measured thickness must not be more than 2 .

b) Outer semi - conductor screen .

This non metallic screen consists in an extruded layer of a semi - conductor mixture , the thickness of which must not be less than 7% of the required average thickness of the insulation layer . Selection of test - pieces and checking of thickness shall be carried out according to IEC 540.

9.4..3.2 Metallic Screen and Metallic Sheath

Screen shall be consist of two layers from copper wire and the outer metallic sheath made from a continues lead pipe , these two sheaths must be to verify 40 KA short circuit current in (1second) , The nominal thickness of the lead sheath shall be so calculated as to make sure the transmission of a one -phase short circuit current in no case it will be less than the values given in table 2 as a function of the outer diameter of the cable before being covered with lead.

Features of the lead pipe shall comply with article 7 of NFC 32.050 standard . The measurement of the lead pipe thickness shall be carried out according to article 17 of NFC 32.050. The average thickness shall not be less than the nominal thickness; besides , the measured thickness at any point shall not be less than 95 % of the nominal thickness , as per (clause 10.7.1) IEC 60840.

TABLE 2 - MINIMUM THICKNESS OF THE LEAD PIPE

Outer diameter d before being covered with lead (mm)	minimum average thickness of the lead pipe (mm)
80 < d < 85	2.5
85 < d < 90	2.6
90 < d < 95	2.7
95 < d < 100	2.8
100 < d < 105	2.9
105 < d < 110	3.0

9.4.4 Outer Protection Sheath

The outer protection sheath consists in an extruded mixture of black HDPE the mechanical and physical features of which shall comply to features described in IEC 20 A (Central Office) 59 , to be published under IEC 502.2 or any convenient alternative .

- ST 1 , ST 2 for PVC .
- ST 3 , ST 7 for PE .

The nominal thickness of the outer protection sheath is given as a function of the outer diameter of the cable before being covered with the protection sheath , in table 3 . or any convenient alternative .

TABLE 3 - Nominal Thickness of The Outer Protection Sheath

Diameter D2 of cable before being Covered with the protection sheath (mm)	Nominal radial thickness outer protection sheath (mm)
74 < D2 < 78	3.6
78 < D2 < 82	3.7
82 < D2 < 86	3.8
D2 > 86	4

The measurement of the outer protection sheath shall be carried out according to IEC 540 published formally document IEC 20 A 5 (Central office 45).

- **Marking of Cables .**

Cables shall have ,on their whole length ,readable and durable indicating :

- Name of manufacturer.
- Year of manufacture.
- Area of conductor.
- Specified voltage of cable in kV.
- Type of cable.
- 'MOE'

The marks shall be visible without being necessary to open the lead sheath , and they shall be made as follows :-

9.4.1 Cables having polyvinyl chloride covering.

The marking is made by deep printing or relief printing on the polyvinyl chloride covering, on two diametrically opposed generative In this case , the marking shall include distinctive signs for the phase repairing .

9.4..2 Letter sizing

In both cases here above, marking can be discontinuous the space between the end of one print and the beginning of the following one shall not be longer than one meter . Height of letters and figures shall not be less than 4 mm.

- **Accessories**

- a. All necessary accessories for cable installation shall be very carefully designed and manufactured. Their constitutive elements shall be of the best quality .
- b. Insulators of terminal boxes shall be made of perfectly compact; homogeneous porcelain without any air bubbles or porosity. They shall be covered with brown enamel perfectly smooth, hard and continuous on the whole surfac . This enamel shall not be injured by long action of water, nitric acid or diluted alkalis and shall resist to changes of temperature.
- c. As a general rule ,insulators and terminal boxes shall comply respectively to fascicles C 64 080 of 8 June 1959 and C 64 050 of 4 June 1953 and additives n 1 of 10 December 1957 and n 2 of February 1963 of U.T.E .
- d. A complete set of tools & equipments for jointing the cables & accessories shall be supplied.
- e. A special program for training the purchasers staff to install and joint the 132kV cable and accessories must be included in the offer.

- **Shipment and Reels**

9.4..1 Packing, sealing and shipping.

- a. The cable shall be placed on the reels so that it will be protected from damage during shipment . Each end of the cable shall be firmly and properly secured to the reel. Care shall be taken to prevent looseness of reeled cable .
- b. There shall be no water and no corrosion in the completed cable when the reel is shipped .If the conductor shows evidence of slight corrosion and no pitting, then the manufacturer shall verify that the cable was dried prior to shipping. Each end of each length of cable shall be durably sealed before shipment to prevent entrance of moisture.
- c. Each length of cable listed on the purchaser's order or detail list shall be shipped on a separate reel , except where the purchaser specifies multiple or parallel cable assemblies.
- d. The reels shall be lagged or covered with suitable material to provide physical protection for the cables during roughly transit storage and handling operations.

9.4.4.2. - Reels.

- a. The minimum diameter of the drum of the shipping reel shall be not less than 1.8 meter.
- b. The inner or drum end of the cable, when allowed to project through the flange of the teel shall be protected to avoid damage to the cable seal.

9.4.4.3. - Marking on reels each reel shall be marked as follows: -

- a. with a durable label securely attached to a flange of the reel and plainly stating the destination , the purchase's order number, shipping length of cable on reel , number, type and size of conductors, cable configuration, type of insulation ,voltage rating ,and shall show identification the recorded shipping length of multiple cable assemblies shall be the measured length after assembly .The direction for rolling shall be indicated by an arrow .
- b. with a durable number on a flange of the reel either branded on the reel or stamped metal tags permanently attached to the reel.
- c. shipping reels shall be free of any information not pertaining to the order.

9.5 TESTS ON CABLES

- **General**

All test shall be carried out by the contractor at his own expense. The contractor shall supply specimens, testing apparatus and labor required for carrying out the prescribed tests. For the pressure test of high voltage cables at site, the contractor shall make available a suitable D.C. cable testing set. The test shall be carried out in the presence of the Inspector at the manufacturer's works, and of the Engineer at site.

The tender price shall include the cost of all tests specified. The purchaser may, however, relieve the contractor from carrying out certain type tests, provided the contractor produces Type Tests Certificate from a recognized testing authority acceptable to the Purchaser. In such case, the contract price will be reduced by amount equal to the costs of the type tests waived by the Purchaser. For this purpose Tenderer should quote separately the costs of the type tests specified.

All samples used for testing shall be at the contractor's expense and shall not affect the length of cable to be supplied under this contract. This also applies to joint boxes and other accessories.

Six copies of the records of all tests shall be furnished to the Engineer. The contract work will not be accepted by the Engineer until they have passed the prescribed tests and approved in writing by the Engineer.

The Contractor shall not be entitled to any payments whatsoever or any extension of time for completion because of tests, or failure of any tests or the rejection of any part of material or plant as a result of any tests or inspection.

- **Calibration**

An approved authority shall if required by the Engineer, calibrate all instruments use for testing purposes.

- **Test Conditions**

9.5..1 Frequency and waveform of power - frequency test voltages.

The frequency of alternating test voltages shall be not less than 49 Hz (c/s) and not more than 61 Hz (c/s). The waveform of such voltages shall be substantially sinusoidal.

9.5..2 Waveform of impulse test voltages .

The impulse wave shall have a front duration between 1 and 5 ms and a nominal time to half - value of 40 to 50 m s being further in accordance with I.E.C Publication 60, High - voltage test techniques .

9.5..3 Temperature.

Except where otherwise specified, tests shall be carried out with an ambient temperature between 15 and 25 °C In case the temperature of the conductor is specified, its value shall be obtained by producing a suitable electric current in the conductor.

- **Tests At Works**

9.5..1 Routine tests :

All lengths of cables shall be tested before dispatch according to the following :

9.5..1.1 Conductor Resistance Tests :-

The copper resistance of the conductors shall be measured by direct current at room temperature and corrected for temperature in accordance with I.E.C Publication 141-1 .The value thus obtained shall not be greater than the guaranteed values as per I.E.C publications 228 and 141-1

9.5..1.2 Capacitance Tests :

The electrostatic capacitance of each drum length of completed cable shall not be greater than the guaranteed values stated in the schedules

9.5..1.3 High Voltage Tests :-

Before inspection ,the Manufacturer will be allowed to test the testing installation by applying an alternative voltage of 190 KV between conductor and metallic screen during about 30 minutes . The high voltage test of each length of cable presented for inspection shall be carried out with an alternative voltage of 190 kv applied between the conductor and the metallic screen and maintained for 30 minutes .If a failure occurs on a length, either during the proceeding inspection or during inspection, both uninjured parts of the considered length will be presented by the manufacturer and shall be accepted by the ETP Engineer if they support, without any other failure, the test at 190 kV during a total duration of 30 minutes including the time they have been under voltage before the failure occurred . If the use of that cable requires an additional joint this joint shall be made up at the manufacturer's expense. If a second failure occurs on one of both parts, both parts shall be rejected. If the number of failures on the last 30 Kilometers of tested cable is greater than 5, ETP Engineer and the manufacturer shall look together after the causes of these failures and the ETP Engineer shall decide whether new testing procedure can be accepted.

9.5..1.4 Dielectric Power Factor / Voltage Test:-

Each drum length of completed 132kV cable shall be tested for power factor at normal frequency and at ambient temperature and at 0.5 EO, EO, 1.5 EO and 2EO.

PE, XLPE Cables :

The power factor of the insulation shall not exceed the guaranteed values stated in the schedules or the following values. PE : 0.0008 XLPE : 0.0030

9.5..2 Special Tests on Cables.

9.5..2.1 General

The tests specified in clause 5.4.2.2 to 5.4.2.4 inclusive shall be made on samples taken from cables manufactured for the contract (provided that the total length in the contract exceeds 4 km of cable) on the following basis :

Cable length		Number of samples
Above	Up to and including	
4	20	1
20	40	2
40	60	3

For the electrical tests, the piece of cable shall be erected with suitable terminations The manufacturer may , in the wishes ,carry out more than one of the special tests specified in Clauses 5.4.2.2. to 5.4.2.4 inclusive on one and the same piece of cable, the order in which the tests are performed being left to his discretion . However, if on a subsequent test the requirements are not fulfilled ,this test shall be repeated on a new piece of cable and the results of this latter test only shall be valid for the ultimate assessment of the results .

By agreement between the purchaser and the manufacturer ,any or all the tests prescribed in Clauses 5.4.2.2 . 5.4.2.3. and 5.4.2.4. may be omitted provided that the test or tests has or have previously been

made on pieces of cable taken from samples having similar construction to the cable included in the contract and the manufacturer produces a certificate to this effect. Similar construction means that the cable included in the contract and the cable covered by the test certificate have identical characteristics in respect of the rated voltage E_0 , the impulse with stand voltage EP, the maximum permissible conductor temperature in degrees Celsius for permanent operation under equivalent specified ambient and installation conditions the type and material of the metallic sheath details of the construction e.g. types of joint and sealing end and the insulation thickness of the cable and the maximum voltage gradient in the insulation at E_0 .

9.5..2.2 Power - Factor / Temperature Test.

This test shall be made on a piece of cable at least 20 m long. The Power - factor of the insulation shall be measured at voltages of $0.5 E_0, E_0, 1.5 E_0$ and $2 E_0$:

- a) at ambient temperature,
- b) after the cable has been slowly heated to a maximum temperature 5°C above the maximum permissible operating temperature of the conductor,
- c) immediately after cooling to ambient temperature. The cable shall be maintained at each temperature until a stable temperature distribution is achieved.

The test temperature shall be the temperature at the hottest point in The cable as determined from thermocouples placed at intervals along the increase in resistance of the conductor, making due allowance for the temperature difference between the thermocouples and the conductor. Throughout the tests the power factor shall not exceed :The following values at E_0 , for PE and XLPE cables : PE : 8.10^{-4} & XLPE : 40.10^{-4}

Variations of the losses angl tangent in the insulation ,when the temperature changes from ambient to maximum operation temperature shall not be more than : 2.10^{-4} for PE & 10.10^{-4} for XLPE

9.5..2.3 Dielectric Security Test

A piece of cable 25m in length excluding the terminals shall be subjected at ambient temperature to a power - frequency test voltage applied between conductor and screen The value of the test voltage shall be 210 kV and it shall be applied for 24 hours without the occurrence of a breakdown of the insulation .

9.5..2.4 Mechanical Test and Hot Impulse - Voltage Test

The test shall consist of a bending test, followed by an impulse voltage test of the behavior of the insulation and by a physical examination of the covering .

A - Bending test.

The bending test shall be made at a temperature between 10°C and 15°C ,unless otherwise agreed between the purchaser and the manufacturer ,on a piece of cable of sufficient length to provide one complete turn around the test cylinder.

The diameter of the test cylinder shall be $30 D$, where D is the overall diameter of the cable. The piece of cable shall be bent round the test cylinder at least one complete turn. It shall then be unwound and the process repeated in the opposite direction .This cycle of operations shall be carried out three times if the sheath is offload-alloy.

B- Impulse - Voltage test.

The piece of cable shall be heated slowly to a maximum conductor temperature not less than the maximum permissible operating temperature as declared and not greater than the maximum permissible operating temperature plus 5°C The maximum conductor temperature is understood to

be the temperature at the hottest point in the cable and it shall be determined from the increase in resistance of the conductor and from thermocouples placed at intervals along the cable making due allowance for the temperature difference between the thermocouples and the Conductor. The cable shall be maintained at this test temperature for at least 2 hours . The piece of cable shall then be subjected at the above temperature to 10 positive and 10 negative voltage impulses applied between conductor and screen ,the peak value being as specified below . The waveform of the impulse test voltages shall comply with sub - clause 9 . 5.3.2. A photographic record shall be made of the first and last impulse waveform of each polarity at the specified impulse level. During this test no breakdown of the insulation shall occur. The peak value of the impulse test voltage shall be $E_p=650$ kV after the impulse test ,the sample shall be subjected at ambient temperature for 15 minutes to a power - frequency high - voltage test. The value of the test voltage shall be 190 kV for PE or XLPE cable. No, breakdown of the insulation shall occur.

C – Examination

After the high - voltage test, a specimen about 1m in length ,taken from the middle of the piece of cable that has been tested ,shall be dismantled and examined .The metal sheath and protective coverings over the sheath shall not be seriously damaged .

9.5..2.5 No Moisture Propagation Test (for PE and XLPE Cables Only)

A piece of cable about 10 meters long in the middle of which a default (a hole of 2cm diameter between the outer sheath and the core) has been prepared is submitted to the following test: The sample is introduced into a pipe 10 meters long, through suitable watertight joints

The pipe is filled up with water, the temperature of which must not be less than 20 C. The water pressure is maintained at 3 bar all along the test After 100 hours, there must be no trace of humidity on the core at a distance greater than 50 cm from the hole.

9.5..2.6 Eld Projection Test (for PE and XLPE Cables Only)

1) Sample Void and Contaminant Determination and Conductor Shield and Insulation This shall be prepared as follows: Fifty millimeters of the sample shall be cut helical or in some other convenient manner to produce thin, cross sectional samples of the insulation and conductor shield. Wafers (or the turns of the helix) shall be approximately 0.075 mm thick (producing approximately 60 wafers) The cutting blade shall be sharp and shall produce a sample with uniform thickness and with very smooth cut surfaces .The sample shall be kept clean and shall be handled carefully to prevent scratching the cut surfaces .

2) The entire specimen shall be viewed transmitted light for general determination of freedom from voids , contaminants .and translucent materials in the insulation and between the insulation and conductor shield .

A- A contaminant is any solid or liquid material which is opaque or not homogeneous polyethylene cross linked polyethylene insulation excluding discolored .translucent material of less than 0.5 mm in its radial vector projection .

B- The entire area of 20 consecutive wafers (or equivalent turns of the helical sample) shall be examined with a minimum of 20power magnification .including any areas which appear suspect during the above examination by transmitted light.

C- A tabulation of numbers and size shall be made with a minimum of 20 power magnification of : - all void 0.025 mm in greatest dimension and larger .in cross linked polyethylene; and all contaminants 0.025 mm in greatest dimension and larger, in polyethylene and cross linked polyethylene; and - discolored .translucent material of more than 0.025 mm in its radial vector projection . This tabulation shall be recorded and reported.

D-The largest void and the largest contaminant shall be marked by encircling and must be

subsequently measured on a micrometer microscope.

E- The number of voids, contaminants and translucence per 15 cm³ of insulation shall be calculated from the tabulation. (The volume of the 20 wafers or equivalent turns may be determined by any convenient method) If the 20 wafers constitute less than 15 cm³ and if the void or contaminant count exceeds the allowable number ,then a sufficient number of wafers from the same sample shall be examined to total 15 cm³ of insulation .

3) The largest void, contaminant and translucent material marked on the sample shall be measured with a micrometer microscope using animism of 60-power magnification .The largest

dimension shall be measured only If voids contaminants or translucence exceed the dimensions shown in Table 2 the sample shall be considered to have failed to meet the test requirements .

Table 2

Voids mm		Contaminants, mm	
Cross linked		Cross linked	
polyethylene	polyethylene	polyethylene	Polyethylene
25	75	100	100

4) The contact area between the insulation and conductor shield or insulation shield on the 20 wafers or equivalent turns shall also be examined, using a minimum of 20 power magnification .The sample shall be considered to have failed to meet the test requirements if the contact surface between the conductor shield or the insulation shield and the insulation has projections or irregularities which extend more than 100 mm from the cylindrical suffice of the conductor shield.

5) In case of failure of the original sample (s) ,one sample from each of cable of every shipping reel shall be tested . In case of failure of one or both of the samples ,the cable on the shipping reel from which the sample (s) was taken shall be rejected .

9.6 TESTS ON ACCESSORIES

- General**

The test specified in clauses 6.2 to 6.3 inclusive shall be made on the following basis

Number of accessories	Number of Samples
3 to 50	1
51 to 100	2
101 to 150	3

The tests described in Clauses 76 and 77 shall be carried out for each particular design of joint or sealing end . Both tests shall be carried out on the same sample. (according to clauses 6.4 and 6.5 The cable length used for testing shall be a sample of the cable with which the accessories will be associated in the field installation .The test shall be considered valid both for the cable and the accessories , provided the cable sample has previously been subjected to the bending test described in Sub-Clause 18 .1 and the length of cable between the ends of adjacent accessories is not less than 5 m. These tests on the assembly consisting of cable and accessories shall be carried out under dry (ambient) conditions and for oil filled cable, the oil pressure shall be adjusted to the minimum value declared.

- Pressure tanks

9.6..1 Hydraulic test

A hydraulic pressure equal to 1.1 times the operating maximum static pressure of the tank shall be applied to all tanks before the outer protection has been applied . No leaks shall be visible after the pressure has been applied for 8 hours .

9.6..2 Pressure / Volume test

After the test described in Sub-Clause 6.2.1 has been completed. The pressure/volume characteristic of the tank shall be checked For the purpose of this test, the pressure tank is defined by a curve having as abscise the pressures in kg/ cm² gauge and as ordinates the volumes of oil trappable from the tank. Such a curve is valid at a given temperature (for instance 20 °C) and between two pressure limits (for instance between 0.3 and 1.8 kg/ cm² gauge) the test shall be carried out as follows:

The tank is filled so that the pressure is at the highest limit. Then, always operating at the given temperature, measured volumes of oil are successively tapped, and the corresponding pressure values noted until the lowest pressure limit is reached .The oil volumes so obtained shall not fall below 90 per cent of the nominal values represented by the D D characteristic curve of the type of tank being tested .

- Alarm Pressure Gauges

The tripping pressures of the electrical contact gauge shall be checked and shall not vary more than + 5 per cent from the nominal settings .

- Dielectric Security Test (All Kinds of Cable)

The test shall be made as specified in Clause 5.4.2.3. No. breakdown in any part of the test assembly or flashover of the sealing ends shall occur.

- Impulse Voltage Test (All Kinds of Cable)

The test shall be made as specified in Sub - Clause 5.4.2.4.B the temperature at the hottest point of the cable sample being controlled and not that of the accessory. No breakdown in any part of the test assembly or flashover of the sealing ends shall occur. Arcing horns or rings may be removed for the test .

9.7 TESTS AFTER INSTALLATION

- **General**

On completion of the contract, the complete installation shall be subjected to electrical tests described in clauses 28 to 32 inclusive.

- **High - Volt Age Test (All Kinds of Cable)**

After the system has been brought up to its design oil pressure ,the cable joints and sealing ends forming a complete circuit ,shall be tested with direct current and shall withstand a voltage equal to 310 kV applied between conductor and screen for a period of 15 minutes. Alternatively ,the test may be made with alternating current at a voltage of 135 kV applied for 15 minutes .

- **Conductor Resistance Test (for information only)**

W hen required by the purchaser, the conductor resistance shall be measured and corrected to 200 C

- **High Voltage Test of The Protection Covering (all kinds of cables)**

After laying the cable and partially back- filling the trench ,and before making the junctions , the protection covering shall be tested with direct current at a voltage of 20 kv between the metallic screen and the earth for a period of 5 minutes . This test shall be repeated after

the fitting up of accessories . For this purpose ,all earth connections of the metallic screen shall be made through unplayable links fitted in a cabinet. If a failure occurs during these tests , the contractor take care of putting the installation in good order , until the tests can be carried out satisfactorily . Later on ,periodic tests of the dielectric strength of the covering will be carried out with direct current at a voltage of 7kV.

9.8 TESTS CLASSIFICATION - QUALIFICATION - ACCEPTANCE

- Tests Classification

The above-described tests are classified as:

- Type tests: tests carried out on prototypes and heads of series. They may be partially or totally remade from time to time in order to check that the quality of fabrication is maintained.
- Series tests : tests systematically carried out on all lengths manufactured -Acceptance tests : contract tests witnessed by a representative of the Customer to check the quality of the supplied equipment

- Qualification

9.8..1 Qualification Tests

Qualification is obtained when the complete series of verifications and tests of table 7 have been carried out as type tests ,series tests and samples tests the necessary samples being taken from the same fabricated length of cable . Qualification tests can be carried out, totally or partially, according to the circumstances, in a laboratory approved by both parties .If some the qualification tests are carried out at the manufacturer's, they shall obligatorily be made in presence of a ETP representative. ETP can ask ,at their own ,expense ,that these tests which look as type tests be periodically re- made ,in order to make sure that the corresponding prescriptions are still fulfilled .

9.8..2 Sanctions

If any one of the qualification tests is not successful ,the type of equipment is not accepted for qualification ,or the qualification may be cancelled if it is a repetition of one of the type tests.

- Checking During Manufacture

This includes the verification of the components ,all checks the manufacturer thinks useful ,so as for each lot of fabrication ,all verifications and tests given in table 7 as being systematic .

- Acceptance

9.8..1 Acceptance Tests

The procedure of acceptance of a lot be shipped includes inspection of completed cables carrying out of tests given in table 7 as series tests and samples tests. It can also include repetition of some type tests in the conditions of clause 8.2 of the present specification .

9.8..2 Sanctions

Any lot of material ,the tests carried out for the acceptance of which are not satisfactory can be rejected . However ,when the results of tests on samples taken from material to be delivered ,are not satisfactory ,it is proceeded to a new inspection of the material in following conditions : all tests are repeated on a second series of samples the length of which is twice the length of the previous ones .The second series of samples is taken from other fabricated lengths of cable . If the results obtained on the second series of samples are satisfactory the lot of cable is accepted ,except the lengths of cable which did not give good results in the previous tests . If it is not so ,the whole lot of cable is rejected . The manufacturer has free disposal of rejected lengths ,but he engages himself not to deliver them to any department of the ETP.

Table 7 - Classification of Tests

Item no.	Description	Type of cable	Type tests	Series tests	Samples tests
1	Verification of the composition	All		X	
2	Core characteristics	All		X	
3	Geometrical characteristics -of insulation wall. -of semi conduction screens . -of metallic sheath.	All		X X X X	
4	Mechanical characteristics. of protection covering.	PE. XLPE		X(1)	X
5	Physical and chemical properties of insulation wall. -index of fluidity . - rate of reticulation -of protection covering. . -hot pressure test	PE XLPE All XLPE	X X		X X
6	Electrical tests on completed cable -verification of dielectric strength -measuring of tg δ function of voltage -bending test on mandrel -measuring of tg δ function of temp -impulse voltage withstand test	All	X X X		X X X
7	Electrical tests on cable and accessories -impulse voltage withstand test -power frequency voltage withstand test	All	X X		
8-	Humidity no propagation test	PE.XLPE			X
9-	Void and contaminant test	PE.XLPE	X		X

(1) - on ready to be shipped material

Schedule A - General Particulars And Guarantees of 132 kV Power Cable

Item no.	Particulars and grantees	Units	LDPE	HDPE	XLPE
1-	Section area of conductor	Sq.mm			
2-	Metal				
3-	External diameter of conductor	mm			
4-	Maximum resistance of conductor of completed cable at 20C(D.C. Resistance)	Ohms/km			
5-	Star reactance of 3 phase circuit a 150 H	Ohms/km			
6-	Capacitance between conductor and screen	F/km			
7-	Maximum charging current per 1000 m of completed cable at normal voltage frequency	Amps			
8-	Inner semi conducting sheath a) construction b) material c) thickness	mm			
9-	Minimum thickness of insulation for XLPE between inner and outer semi - conductor	mm			
10-	Outer simi conductor sheath a) construction b) material c) thickness	mm			
11-	Longitudinal water tight barrier between semi – conductor & copper wires - material - nominal thickness	mm			
12-	Metallic screen - material - nominal thickness - number of wires - total cross sectional area - arrangement	mm pcs mm ²			
13-	Equalizing tape - material - nominal thickness				

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Item no.	Particulars and grantees	Units	LDPE	HDPE	XLPE
14-	Longitudinal water tight barrier between Equalizing tape & lead sheath - material - nominal thickness	mm			
15-	Nominal thickness of lead sheath	mm			
16-	Diameter over lead sheath a) Maximum b) Minimum	mm mm			
17-	Composition of lead sheath (by weight) a) lead b) tin c) cadmium d) antimony	% % % %			
18-	External covering (HDPE) a) construction b) material c) thickness	mm			
19-	Overall cable diameter	mm			
20-	Weight per meter of completed cable	kg			
21-	Minimum radius of bend around which cable can be bent during installation	m			
22-	Nominal internal diameter of duct or pipe through which cable can be pulled	mm			
23-	a) Nominal drum length b) Drum dimensions (w × d) c) Nominal drum weight (gross)	m m kg			
24-	Maximum continuous current carrying capacity a) when laid direct in concrete trough with 1m to top of protective cover ground temp. 35 C. g-120 for one 3 phase circuit per trench . b) when drawn into pipes or ducts of length more than 15 mts for one 3- phase circuit c) when cleated to sealing end structure (ambient max . 50 C)	Amps Amps Amps			

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Item no.	Particulars and grantees	Units	LDPE	HDPE	XLPE
25-	Maximum continuous current carrying capacity a) when laid trefoil formation on concrete floor inside shed (max. ambient temperature) of 50C.	Amps			
26-	Assumed max. conductor temp. for a) cable laid direct in concrete trough b) cable draw into pipes or ducts c) cable laid on racks in air	0C 0C 0C			
27-	Maximum dielectric loss of completed cable when laid in concrete trough per 1000 mts at normal voltage and frequency and at max conductor temp (see item above)	kW			
28 -	Maximum power factor of charging kVA of completed cable when laid direct in the ground at normal voltage and frequency and conductor temperature of : a) 15C b) 30C c) 40 C d) 50 C e) 60 C f) 70 C g) 80 C h)Max .temp.	% % % % % % % %			
29-	Maximum power factor of charging kVA of completed cable at normal frequency and conductor temperature of 25 C & at: a) 50 % normal voltage b) 100 % normal voltage c) 150 % normal voltage d) 200 % normal voltage	% % % %			
30 -	Sheath loss of complete cable per 1000 m of 3 phase circuit at normal voltage & frequency & at max current rating when: a) laid direct in ground with current per phase as in item 22 (a) b) draw in to pipes or with current per phase as in item 22 (a)	kw			
31 -	Impulse puncture voltage a)positive 1/50 wave b)negative 1/50 wave	kv			

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Item no.	Particulars and grantees	Units	LDPE	HDPE	XLPE
32-	Maximum conductor temperature after passage of a current of 40, 000 Amps. For (1second) subsequent to continues full load current	°C			
33-	Maximum pressure for which cable is designed	kg/sq.cm			
34-	Maximum dielectric stress: a) at conductor b) at screen or sheath	kV/cm kV/cm			
35-	Total loss of completed cable per 1000 m of 3 phase circuit at normal voltage, frequency max. current rating.	KW			

Note: We have no objection to study any proposal submitted from the bidder for metallic screen to verify 40 kA / 1sec. short circuits current

SECTION 10: STANDARD SPECIFICATION FOR FIBER OPTIC CABLE AND TELECOMMUNICATION & SCADA SYSTEM

Standard Specification for Telecommunication

10.1 General

This Specification provides for the survey and verification of existing systems and equipment parameters, design, manufacture, testing in factory, supply, delivery, off-loading on site, erection, testing on site, training of Employer's staff (in the use and maintenance of), commissioning, setting to work and the remedying of all defects during the Defect Notification Period of the equipment detailed herein.

It shall be the responsibility of the Contractor to determine the parameters of the existing systems and equipment owned by the Employer and to ensure that new equipment supplied by the Contractor is fully compatible with such existing systems and equipment. It shall be the responsibility of the Contractor, assisted by the Employer, to demonstrate by means of tests at site that the Employer's existing equipment and any supplied by the Contractor perform satisfactorily together, subject to the proviso that any fault or failure of existing equipment shall be the responsibility of the Employer. It shall be the responsibility of the Contractor to furnish equipment, which shall meet in all respects the performance specified under the prevailing site conditions.

This Specification shall be read in conjunction with standard specifications for substations and or power stations available from Employer. Except where specified herein to the contrary or where the context indicates otherwise, the requirements of such specifications shall apply to this Scope of Work as if specified herein.

The Contractor shall agree with the Employer any specific operating parameters that need to align with the Employer's existing equipment and networks.

10.2 PDH/SDH (STM-1) OPTICAL FIBRE EQUIPMENT

- **General Requirements**

The digital multiplex equipment shall be universal, software-controlled, and provide various interface cards to connect tributary interfaces signals such as voice, teleprotection and data to aggregate interfaces. On aggregate level 2Mbit/s electrical and 8Mbit/s optical interfaces complying with ITU-T recommendations G.703 / G.704 and 2Mbit/s HDSL interfaces shall be available. In addition, optical STM-1 aggregate interfaces on 155Mbit/s shall be available. All modules shall form an integrated part of a 19" shelf. The multiplexer shall provide means to drop and insert individual 64 kbit/s signals and allocate them to determined time slots in the 2Mbit/s streams. Path protection on 64 kbit/s and 2Mbit/s shall be supported.

It shall be suitable for operation in a substation with harsh environment as is found in Iraq and with high electromagnetic interference, be highly reliable and provide secure communication for real time signals such as voice, SCADA, teleprotection and status/control signals. The equipment offered shall already be working successfully in telecommunication networks operated by power utilities. It shall comply with the latest ITU-T standards and be able to be interconnected with telecommunication equipment. Any equipment in the network shall be manageable from a control center and there shall be means to supervise external/existing equipment as well. As a minimum, modules for the following user signals shall be available as plug-in units for the digital multiplexer:

- Analogue subscriber interface: subscriber and exchange side
- 4-wire E&M voice interface
- G.703, 64kbit/s data Interface
- X.24/V.11 (RS-422), N x 64kbit/s data interface
- V.24/V.28 (RS-232), data interface
- V.35, N x 64kbit/s data interface
- Data interface V.36 (RS-449), N x 64kbit/s data interface (V.10)
- Alarm collection interface
- Teleprotection command interface.
- Optical protection relay interface

- Binary signal (status and control) interface
- 2Mbit/s electrical interface for unframed signals acc. to ITU-T G.703 and framed signals acc. G.703 and G.704.
- LAN interface 10BaseT Ethernet
- ISDN U interface

Additionally, the equipment shall provide the following aggregate interfaces:

- STM-1 (155 Mbit/s) optical 1+1 interface for medium and long distances, with automatic laser shut down.
- STM-1 (155 Mbit/s) optical add-drop interface for medium and long distances, with automatic laser shut down
- STM-1 (155 Mbit/s) electrical interface
- 34/45 electrical interface
- 8 Mbit/s optical interface
- Mbit/s HDSL interface

The equipment shall be equipped with a ringing generator for analogue subscriber interfaces.

- **General Conditions**

The same equipment shall be used as a terminal, for through connections (transit, repeater) and as add-drop multiplexer (ADM) with integrated optical line modules. First order multiplexing (2048 Mbit/s), second order multiplexing (8448 Mbit/s) and STM-1 multiplexer shall be integrated.

Conference for voice channels and point-multipoint function for data signals shall be possible. The equipment shall be of fully modular design, based on a single 19" shelf.

10.2..1 Channel Capacity: Digital Cross Connection

functions. The cross connect capacity should be in the form $n \times 2\text{Mbit/s}$ and should be **stated** by the bidder and non-blocking. For high-density applications the cross connect capacity shall be upgradeable up to $128 \times 2\text{Mbit/s}$.

It shall cross-connect 64kBit/s as well as 2Mbit/s (G.703 unframed and G.704 framed) and VC12 The bidder should stated cross connect capacity for high density application ..

10.2..2 Redundant Centralized Functions

The equipment shall be equipped with redundant circuits for all centralized functions.

10.2..3 Power Supply

The multiplex equipment shall operate at 48VDC +/- 15%.

Redundant power-supply shall be supported.

In addition it shall also be possible to use a redundant power source (Dual power feeder).

10.2..4 ITU Compliance

The Equipment shall comply to the latest ITU-T recommendations for the Plesiochronous and synchronous hierarchies, such as:

G.702-704, G.706, G.711-714, G.732, G.735-737, G.742, G.826, G.823, Q.552

10.2..5 Electromagnetic Compatibility and Safety Regulations

The equipment shall comply with the EN50022, EN 61000 series of documents, IEC 801-2, IEC 801-6 and shall be conformant with CE..

10.2..6 Ambient Conditions

Storage and transport: -40 ... +70°C; 98% (no condensation) Operation: -5 ... +50 °C, humidity of max. 95% (no condensation)

10.2..7 Mechanical Construction

The equipment shall be of robust design. All tributary and aggregate units shall be integrated in the same shelf. All connectors shall be accessible from the front.

10.2..8 Network Configuration/Management System

The equipment shall be software programmable, either by a local craft access terminal - preferably notebook - or a centralized Network Management System (NMS). Traffic through the multiplexer shall under no circumstances depend on the Network Management System; i.e. the multiplexer has to operate without being connected to any management system. The Network Management System shall be used to supervise the PDH and SDH.

10.2..9 1+1 Path Protection

The equipment shall provide means to protect 64kBit/s channels. The protection shall be end to end from one interface (telephone or data) to the other. It shall switch automatically from the main channel to the standby channel. It shall be configurable whether the system switches back to the main channel (reversible switching) or not (non-reversible). If a path has switched to its standby route because the main route is disturbed this shall be indicated with an alarm. The switching shall be done within the multiplexer without using the Network Management System.

10.2..10 1+1 Section protection

The equipment shall provide means to protect 8Mbit/s and 155 Mbit/s connections. It shall be possible to use two independent links: one as the main and the other as the standby. The system shall automatically switch to the standby connection and generate an alarm if the main connection is disturbed. The switching shall be done within the multiplexer without using the Network Management System.

10.2..11 Network Topology

It shall be possible to build point to point, linear, ring, T, and meshed networks.

10.2..12 Synchronization

The equipment shall be synchronisable with an external clock, with connected 2048 Mbit/s signals and/or with internal oscillator. The synchronization shall be configurable and it shall be possible to distribute the synchronization to other equipment as well. The system shall have means to switch to select the synchronization source as well as means to prevent the system from switching synchronization loops. The equipment shall be capable select the synchronization source by means of the SSM (Synchronization Status Messaging) feature according to ITU-T G.704 or priority based.

10.2..13 Alarms

Each module shall supervise its functions and shall have an alarm-indication LED on its front. All alarms shall be collected by the NMS. Each node shall be capable to collect up to 50 external alarms..

10.2..14 Test Loops

The equipment shall provide means to loop signals on 64kBit/s level as well as on 2Mbit/s level. It shall indicate an alarm if a loop is activated. It shall have the possibility to determine the time after which an activated loop is switched back.

10.2..15 Maintenance Facilities

Every Network Element shall have a built-in Signal Generator and Analyzer to analyze communication paths. It must be possible to cross connect the Generator and Analyzer to transmission channels and terminate the signal in other Network Elements. The configuration must be possible locally with the craft access terminal and remotely with the NMS or the craft access terminal.

It must be possible to loop-back signals locally and remotely using the craft access terminal or the NMS.

- **Requirements for Transport Level**

10.2..1 SDH Aggregate Units

The interface shall be designed for use on single mode non-zero dispersion shifted fiber (NZ-DSF) according to ITU-T G655 (at 1310nm ,1550nm and 1625nm). The Bidder should state the type of optical connectors .

The following main functions shall be supported :

- Termination of the OS-, RS-, MS- and VC-4 layer
- Extraction and insertion of the SOH communications information
- Through connections of VC-12 and VC-3

The following maintenance functions shall be supported :

- Status indications

- Loops

- Restart after ALS

- TTI monitoring

- BIP Error Insertion

The following SDH interfaces shall be available :

- STM-1 (155Mbit/s) optical 1-port interface

- STM-1 (155Mbit/s) optical 2-port interface

This interface shall provide Multiples Section Protection (MSP) :

- 1+1 Section Protection

- STM-1 (155Mbit/s) electrical 1-port interface

10.2..2 HDSL Trunk Units

2Mbit/s HDSL interface The HDSL interface shall provide means to interconnect the multiplexer over two pairs of copper wire up to a distance to be stated by the bidder and the type of modulations should be mentioned. It shall communicate either with another interface of the same type or with a remote desktop terminal.

- **2 Mbit/s HDSL Desktop Terminal**

This Terminal shall provide a HDSL interface to transmit 2Mbit/s over two pairs of copper over a distance up to 12 km. It shall be housed in a metallic indoor case. The following interfaces shall be available:

- G.703, 2Mbit/s, 75 ohm
- G.703, 2Mbit/s, 120 ohm
- X.21/V11, N x 64kBit/s (N = 1 .. 32)
- V.35, N x 64kBit/s (N = 1 .. 32)
- V.36 / RS449, N x 64kBit/s (N = 1 .. 32)
- LAN connection:

10BaseT Ethernet connection for e.g. router supporting

LAN protocols: IP, IPX; Routing Protocols: RIP; WAN protocols: HDLC, PPP, Frame Relay (including RFC 1490). It shall inter-operate with Cisco, W ellfleet, 3Com etc. and be manageable locally, remotely, and with Telnet and SNMP. Two such Desktop Terminals shall be connectable to provide a 2Mbit/s link over two pairs of copper.

10.2..1 HDSL Repeater

An HDSL repeater solution for distances longer than 12km shall be offered including a remote powering solution.

10.2..2 HDSL Line Protection

The HDSL equipment shall (where necessary) be protected against influences of induced voltages up to 10 kV.

- **Tributary Units**

10.2..1 Wire Interface (VF interface)

This interface shall provide multi voice channels with a bandwidth of 300 Hz ...3.4 kHz and 2 signaling channels (M => E, M" => E") per voice channel. Each interface shall be configurable to operate with or without CAS. The bist which will be used with CAS should be stated according to ITU recommendation . The level shall be software adjustable Modules where each interface can be individually configured with 1+1 path protection shall be available.

10.2..2 Analogue Subscriber Interface

The number of interface should be stated by the bidder. High-density subscribers can be provided with number of subscriber to be stated by the bidder. The ringing generator shall be integrated in the subscriber module interface. The ringer frequency shall be adjustable for 20Hz, 25Hz, and 50Hz.

The following main functions shall be supported:

- Downstream signaling
- Ringing
- Metering
- Polarity reversal
- Reduced battery
- No battery Upstream signaling
- On/off-hook
- Pulse and DTMF dialing
- Flash impulse
- Earth key General:
- Constant current line feeding
- Line test
- Permanent line checks
- CLIP (On-hook VF transmission)
- Metering after on-hook

10.2..3 Exchange Interface

This interface shall provide many interfaces to connect remotely connected analogue subscribers to an exchange. The number of interfaces should be specified by the bidder. It shall provide the following functions:

- pulse dialing
- tone dialing (DTMF)
- earth key function
- metering function(12 kHz or 16 kHz).
- flash impulse
- polarity reversal indication of busy lines

The following parameters shall be configurable by software:

- input voice level -5 to +4 dBr
- output voice level -7.5 to -1 dB
- metering pulse enable/disable signaling bit definition loop back of voice to the telephone

10.2..4 Party Line Telephone System (Engineering Order Wire)

An engineering order wire (EOW) facility shall be provided at each multiplexer. The EOW shall be configured as a party line and use in band DTMF signaling to call another EOW - Terminal.

The Terminal shall have an integrated DTMF decoder allowing to program a subscriber call number (..... digits), and group call numbers (..... digits each). The EOW functionality can also be realized by using Voice over IP (VoIP) routed over the management channel.

10.2..5 V. 24/V.28 RS232 Interface

It shall support the following bit rates:

- 0 to 0.3 kbit/s transp. (V.110)
- 0.6 to 38.4kbit/s synchronous / asynchronous (V.110).

Modules where each interface can be individually configured with 1+1 path protection shall be provided.

10.2..6 V.11/X.24 Interface

This interface shall comply to the ITU-T X.24 recommendation for signal definition and to V.11 for electrical characteristics.

It shall support the following bit rates:

- 48, 56, N x 64 kbit/s (N = 1 to 30) synchronous
- 0.6 to 38.4kbit/s synchronous / asynchronous (X.30)

Modules where each interface can be individually configured with 1+1 path protection shall be provided.

10.2..7 V.35 Interface

This interface shall comply with the ITU-T V.35 and V.110 recommendations.

It shall support the following bit rates:

48, 56, N x 64kbit/s (N = 1 to 30) synchronous

0.6 to 38.4kbit/s synchronous / asynchronous

Modules where each interface can be individually configured with 1+1 path protection shall be provided.

10.2..8 V.36 / RS 449 Interface

This interface shall comply with the ITU-T V.36 and V.110 recommendations.

It shall support the following bit rates:

48, 56, N x 64kbit/s (N = 1 to 30) synchronous

0.6 to 38.4kbit/s synchronous / asynchronous

Modules where each interface can be individually configured with 1+1 path protection shall be provided.

10.2..9 64 kbit/s Co-directional Interface

This interface shall comply with the ITU-T G.703 part 1.2.1 for co-directional data transfer. A module shall have at least 8 interfaces.

Modules where each interface can be individually configured with 1+1 path protection shall be provided.

10.2..10 LAN Interface

There shall be a 10BaseT interface available with Router Bridge and FRAD Function available. The following specification shall be covered:

Ethernet connection: 10BaseT

LAN protocols: IP, IPX

Routing Protocols: static IP route, OSPF2 V2

WAN protocols: PPP, Frame Relay (including RFC 1490)

The interface shall be manageable locally, remotely, with the management system of the platform.

The LAN interface shall support linear-, ring- and star-configurations.

The WAN side shall support link capacities n*64kBit/s and 2Mbit/s.

10.2..11 Alarm Interface

This interface shall provide means to collect various alarms, which will be displayed, on the Network Management System. It shall be used to manage non-PDH equipment with the

PDH Network Management System. It shall have at least 24 binary inputs and at least 4 outputs, which can be switched by the Network Management System.

It shall be possible to connect an input to an output so that if an alarm occurs, the output contact will be switched. It shall be possible to label an alarm. The label-text shall be read from the interface module so that it can be indicated on the Network Management System as well as on the local craft terminal.

10.2..12 Tele protection Interface

This interface shall provide a means to transmit four bi-directional command channels. The signals shall be adjustable from 24 to 250Vdc by means of software. All inputs and outputs shall be isolated and with EMC immunity for harsh environment. Security, Dependability and Transmission speed shall be selectable and programmable. It shall be able to drop and insert commands, transfer commands as a transit station and to have AND- and OR-connections between commands. The interface shall support T-nodes.

The teleprotection interface shall provide an integrated non volatile event-recorder which shall be synchronisable either internally or by GPS or a command counter which counts trip commands.

The teleprotection interface shall provide means for signal delay measurement.

1+1 protection must be available; the switching shall be done within less than 10ms. (possible time to be stated by the bidder)

The interface shall do automatic loop test as frequently as possible. Under no circumstances shall the interface cause trip-commands in case of power supply failure or when put in or out of service.

It shall be possible to synchronise all teleprotection interfaces with one GPS in one station.

The GPS time shall be distributed over the teleprotection channel.

10.2..13 Optical Protection Relays Interface

This interface shall have an optical port to connect protection relays for teleprotection to the multiplexer. It shall operate according IEC 60870-5-1, format class FT 1.2 on 1300nm using MCMI line coding.

10.2..14 Binary Contact Interface

This interface shall provide means to transmit binary signals.

The inputs and outputs shall be isolated.

The inputs shall be suitable for 24Vdc to 60Vdc.

Outputs shall be solid state relays.

The interface shall provide a 24Vdc short circuit proofed auxiliary power supply. It shall be able to drop and insert commands, transfer commands as a transit station and to have AND- and OR-connections between commands,.

The Teleprotection interface shall provide an integrated event recorder, which shall be synchronisable either internally or by GPS.

10.2..15 2 Mbit/s G.703 / G.704 Interface

This interface shall comply with the ITU-T G.703 and G.704 recommendations.

The interface module shall have at least four interfaces to be activated individually. It shall be possible to have 128 interface modules per multiplexer. In order to connect different equipment, the interfaces shall be available with the impedance of 120 ohms and 75 ohms.

The interface shall support CRC-4 multi-frame according to ITU-T G.704 (enabled and disabled by software).

The CAS signaling according to ITU-T G.704 table 9 shall be activated optionally.

The interface shall be able to extract the 2.048 MHz clock, which can be used to synchronize the multiplex equipment.

The interface module shall support 2Mbit/s loop-back of the incoming signal as well as the loop-back of the internal signals.

10.2..16 ISDN U Interface

There shall be ISDN U interfaces available for subscriber and exchange side. The interface shall be based on 2B1Q code and provide 8 ISDN U lines.

- **Optical Amplifier**

In case of long distance communication, which cannot be covered by standard a optical interface, an optical amplifier shall be applied.

- **Summary of Standards**

The Equipment shall comply with the latest ITU-T recommendations for the Plesiochronous and synchronous hierarchies.

The equipment shall be KEMA type tested.

In particular the mentioned recommendations shall be covered:

10.2..1 PDH Interfaces

The PDH interfaces shall conform to the following recommendations:

ITU

- ITU-T G.702: General aspects of digital transmission systems – Terminal equipment - Digital hierarchy bit rates
- ITU-T G.703: Digital transmission systems – Terminal equipment – General Physical/electrical characteristics of hierarchical digital interfaces
- ITU-T G.704: Digital transmission systems – Terminal equipment – General Synchronous frame structures used at 1544, 6312, 2048, 8448 and 44 736 kbit/s hierarchical levels
- ITU-T G.706: General aspects of digital transmission systems – Terminal equipment - Frame alignment and cyclic redundancy check (CRC) procedures relating to basic frame structures defined in recommendation G.704
- ITU-T G.711: Pulse code modulation (PCM) of voice frequencies
- ITU-T G.712: Transmission performance characteristics of pulse code modulation channels
- ITU-T G.732: General aspects of digital transmission systems – Terminal equipment - Characteristics of primary PCM multiplex equipment operating at 2048 kbit/s
- ITU-T G.735: Characteristics of primary multiplex equipment operating at 2048 kbit/s and offering synchronous digital access at 384 kbit/s and/or 64 kbit/s
- ITU-T G.736: General aspects of digital transmission - Characteristics of a synchronous digital multiplex equipment operating at 2048 kbit/s.
- ITU-T G.737: Characteristics of external access equipment operating at 2048 kbit/s and offering synchronous digital access at 384 kbit/s and/or 64 kbit/s
- ITU-T G.823: The control of jitter and wander within digital networks, which are based on the 2048 kbit/s hierarchy
- ITU-T G.826: Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate.

10.2..2 Architecture of Optical SDH interfaces

The architecture of optical SDH interfaces shall conform to the following recommendations:

ETS/EN

- ETS 300 147: Synchronous digital hierarchy multiplexing structure
- ETS 300 417: Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment
- ETS 300 417-1-1 / EN 300 417-1-1 V1.1.2: Generic Processes and Performance
- ETS 300 417-2-1 / EN 300 417-2-1 V1.1.2: SDH and PDH Physical Section Layer Functions
- ETS 300 417-3-1 / EN 300 417-3-1 V1.1.2 : STM-N Regenerator & Multiplex Section Layer Functions
- ETS 300 417-4-1 / EN 300 417-4-1 V1.1.2 : SDH Path Layer Functions

ITU

- ITU-T G.707: Network node interface for the synchronous - digital hierarchy
- ITU-T G.783: Characteristics of synchronous digital hierarchy (SDH): equipment functional blocks
- ITU-T G.803: Architecture of transport networks based on the synchronous digital hierarchy (SDH)
- ITU-T G.805: Generic functional architecture of transport networks
- ITU-T G.826: Error performance parameters and objectives for international, constant bit rate digital paths at or above the primary rate
- ITU-T G.841: Types and characteristics of synchronous digital hierarchy (SDH) network protection architectures
- ITU-T G.957: Optical interfaces for equipment and systems relating to the synchronous digital hierarchy

- ITU-T M.2101.1: Performance limits for bringing into service and maintenance of international SDH paths and multiplex section
- ITU-T T.50: International Reference Alphabet (IRA) - Information technology 7 bit coded character set for information interchange

10.2..3 Synchronization and Timing of Optical SDH Interfaces

The synchronization and timing of optical SDH interfaces shall conform to the following recommendations:

ETS/EN

- ETS 300 417-6-1 / EN 300 417-6-1 V1.1.2: Synchronisation Layer Functions
- ETS 300 462-1 / EN 300 462-1-1 V1.1.1: Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 1: Definitions and terminology for synchronization networks
- EN 300 462-4-1 V1.1.1: Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 4-1: Timing characteristics of slave clocks suitable for synchronization supply to Synchronous Digital Hierarchy (SDH) and Plesiochronous Digital Hierarchy (PDH) equipment
- ETS 300 462-5 / EN 300 462-5-1 V1.1.2: Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 5: Timing characteristics of slave clocks suitable for operation in Synchronous Digital Hierarchy (SDH) equipment

ITU

- -ITU-T G.813: Timing characteristics of synchronous digital hierarchy (SDH) equipment slave clocks (SEC)

- **Synchronization Equipment**

A master clock for the synchronization of the SDH equipment shall be provided. This shall be a Type XL-DC or similar. The supplier should be True Time or similar.

- **Test Equipment**

The following test equipment shall be provided:

10.2..1 Optical Power Meter

Optical Power Meter for 1300 nm and 1550 nm, handheld: OLP-6 or similar Suppliers: Acterna or similar

10.2..2 Digital Communication Analyzer

Digital Communication Analyzer: for signal analysis on 64kbit/s and 2Mbit/s level Suppliers: Acterna or similar

10.2..3 Optical Time Domain Reflectometer OTDR

Optical Time Domain Reflectometer Suppliers : Anritsu, Fujicura or similar

10.2..4 Test Equipment for Telprotection Module

Test equipment for Telprotection Module: Testset or similar Suppliers: Teleprotection module producer or similar

- **Abbreviations**

ADM	Add-drop multiplexed
ALS	Automatic Laser Shutdown
BIP	Bit Interleaved Parity
CAS	Channel Associated Signaling
CAP	Carrier-less Amplitude and Phase
CRC	Cyclic Redundancy Check
DTMF	Dual Tone Multi-Frequency

EN	European Norm
EOW	Engineering Order Wire
ETS	European Telecommunications Standards
GPS	Global
HDSL	High Density Subscriber Line
IEC	International Electrical Commission
ITU	International Telecommunication Union.
IP	Internet Protocol
ISDN	Integrated Services Digital Network
MCM	Multi Coded Mark Inversion
MS	Multiplex Section
NE	Network Element
NMS	Network Management System
LAN	Local Area Network
OS	Optical Section
OSPF	Open Shortest Path First
PDH	Plesiochronous Digital Hierarchy
PPP	Point-to-Point Protocol
RS	Regenerator Section
SDH	Synchronous Digital Hierarchy
SNMP	Simple Network Management Protocol
SOH	Section Overhead
STM	Synchronous Transport Module
TCP	Transmission Control Protocol
TTI	Trail Trace Identifier
VC	Virtual Container
VF	Voice Frequency.

Addendum A:

Data about offered integrated equipment to be filled in by the bidder.

Name of Manufacturer:

Model :

Type:

1.General		Required	Offered
Type of multiplexer		SDH: ADM	
Complying to ITU-T rec.		Yes	
Transmission Capacity	Mbit/s	STM-1: 155	
Access capacity on 64 kbit/s	channels	to be state by the bidder	
Access capacity on 2 Mbit/s	channels	Minimum 40	
Equipment used in substation environment		List of 10 reference substation projects	
Redundant central processor		Shall be available	
Digital cross connect function		Fully non-blocking	
The equipment is KEMA type tested		YES	
2. Teleprotection functionality:			
Integrated distance teleprotection functionality		YES	
Integrated optical teleprotection functionality			
Addressing system for commands		YES	
Loop test for delay time		YES	
Switch-over less than 10ms		YES	
3. Available AGGREGATES:			
Optical SDH aggregates (ITU-T G.957)		S-1.1, L-1.1, L-1.2	
4. Available TRUNK INTERFACES:			
Optical 8Mbit/s interface		Yes	
Electrical 34/35 Mbit/s interface		Yes	
HDB3, 2 Mbit/s interfaces per module	No.	Minimum 8	
Complying to ITU-T rec.		G.703, transparent G.704, selectable	
HDSL, 2Mbit/s interface: no of copper wires Capacity on 2Mbit/s or on 1Mbit/s Capacity selectable	No. ch ch / pair of wire	4 or 2 30 or 15 30 / 2 pairs 30 / 1 pair	
HDSL line codes CAP, PAM16, G.SHDSL		All codes available	
5. Available USER INTERFACES			
5.1 Voice interfaces for trunk lines:			
1 + 1 com path protection, available for all		Yes	
Analogue, 4wire with E&M: Input level	dBr	to be stated by the bidder according to standard recommendation international	
Output level			
Analogue, 2wire with E&M: Input level	dBr	+6.5 .. -12.5	
Output level		-1.0 .. -20	
Digital, 2Mbit/s CAS or PRI		Yes	

Contd.

		Required	Offered
5.2 Voice interfaces for remote subscriber:			
2wire, subscriber side	dBr	-5 .. +4 / -7.5 .. -1	
Minimal number of subscriber	No.	10	
2wire, PABX side	dBr	-5 .. +4 / -7.5 .. -3	
Minimal number of PABX	No.	10	
6. Integrated teleprotection			
6.1 Interface for Commands:			
Number of independent commands	No.	4	
Transmission time max.	ms	to be stated by the	
Signal voltage	V peak	250	
1 + 1 com path protection		Yes	
6.2 Interface(s) for Differential Protection:			
Electrical interface: G.703	kbit/s	64	
Optical Interface	kbit/s	to be stated by the	
7. Data: channels per module			
1 + 1 com path protection, available for all		Yes	
V.24/V.28 (RS-232): up to 38.4kbit/s	No.	to be stated by the	
V.11/X.24 (RS-422): 64kbit/s	No.	to be stated by the	
V.35: 64kbit/s	No.	to be stated by the	
V.36 (RS-449): 64kbit/s	No.	to be stated by the	
G.703: 64kbit/s	No.	to be stated by the	
Ethernet:: 10BaseT WAN capacity Protocols	No. Mbit/s	to be stated by the bidder Min: 2x 2Mbit/s Min.: IP	
Integrated Ethernet Hub 10/100 Base T	No.	Min. 5	
8. Integrated alarm gathering module:			
Number of external alarms per module	No.	Min. 20	
Auxiliary power supply for ext. contacts		Yes	
9. Configuration Management			
Type/Name of configuration tool			
For local / remote operation		Yes / yes	
Data communication network (DCN)		Ethernet / IP or Ethernet / OSI	
Integrated Management of Teleprotection Commands		Yes	

Contd.

		Required	Offered
10. Network Management System			
Type/Name of configuration tool			
For fault / configuration management		Yes / yes	
For local / remote operation		Yes / yes	
Data communication network (DCN)		Ethernet / IP or	
Graphical network representation		Yes	
Integrated Management of Teleprotection Commands		Yes	
Synchronization view option		Yes	
Networking Package option (end to end configuration)		Yes	
11. Technical Requirements			
11.1 Ambient Conditions:			
Storage: ETS 300 019-1-1, class 1.2	°C / % hum	-25 .. + 55 / class 1.2	
Transport: ETS 300 019-1-2, class 2.2	°C / % hum	-25 .. + 70 / class 2.2	
Operation: ETS 300 019-1-3, class 3.1E	°C / % hum	-5 .. +45 / class 3.1E	
11.2 Power Supply			
Operation	VDC	48 / 60 (-15/+20%)	
Fully redundant power supply		Yes	
Dual power feeder		Yes	
11.3 Optical amplifier			
Minimal Launched power (A)	dBm	to be stated by the	
Minimum sensitivity (B)	dBm	to be stated by the	
Available bit rates PDH: 8 and 34 Mbit/s, SDH: STM-1 (155 Mbit/s),STM-4 (622 Mbit/s)		All bit rates available	
Dispersion limits for STM-4 application (on SM Standard fibre G.654)	km	>250	
Optical connectors E2000		Yes	
Alarm output		Yes	
LAN management interface		Yes	

Bidder shall provide all necessary information which deemed to be necessary to complete the project in all respects.

10.3 UNDERGROUND OPTICAL FIBER CABLE SPECIFICATIONS

- **Specifications**

This Specification defines the requirements for the design, manufacture, supply of fiber optic underground fiber optic cables. (installation if required) .

10.3..1 Scope of work

The Contractor shall include design, manufacture, supply, including all the necessary fittings and optical joint enclosures, optical terminal boxes, splicing, and installation materials to complete the system. Details as below:

A.

1. The optical fibers shall be of single mode type and shall conform to IEC 60793-2-50-B4, IEC 60794 and ITU-T recommendation G.655 with transmission of information at all ITU-T recommended rates for PDH and SDH systems.
2. The fiber shall have triple operative windows, at 1310 nm, 1550 nm and 1625 nm wavelength.
3. Minimum of 24 fiber cores.
4. Optical fiber cable with loose tube construction.
5. Under all conditions, prior to and after installation, the maximum optical attenuation shall be:

At 1450 nm \leq 0.24 dB/Km

1550 nm \leq 0.20 dB/Km

1625 nm \leq 0.22 dB/km

Each individual fiber shall be colour coded for identification purposes, with details of the colour coding scheme adopted being provided in the Tender.

The fiber cables shall be able to withstand temperature cycling in the range -20°C to +80°C without changing the optical values during laying, installation, stocking and transportation.

B. Optical fiber approach cable with associated hardware suitable for direct burial.

C. Distribution patch panel for rack mounting, including patch cord for connecting OFAC to the optical line terminal equipment (OLTE).

The contractor shall provide Full details of the fiber optic cables, including:

1. Cable construction and materials, including the Mechanical Failure Load (MFL), Rated Tensile Strength (RTS) and Specified Maximum Working Tension (SMWT).
2. Installation methods and materials.
3. Jointing methods, materials and mounting arrangements.
4. Physical protection against the ingress and transmission of moisture.
5. Identification marking and fiber coding.

D. (if required) The Contractor shall ensure supervision by staff from the manufacturer, During installation of fiber optical cable and guidance at site to the contractor's and Employer's Engineer, and for the testing, commissioning and successfully putting into Operation of the fiber optical cable

system in totality.

E. Distribution patch panels used for termination of the OFAC and connection to the OLTE shall be Located in the existing telecom room.

F. Terminal equipment in each substation chosen as a node in an SDH network based on STM-1 or higher.

G. Necessary erection material for the equipment in the substation tools and Maintenance equipment for test and commission.

H. Training for the customer staff should be realized in numbers as shown in table and to comply with the different specification required i.e. training for Installation, splicing, using OTDRs and chromatic dispersion measurements, training for maintenance equipment. Training should be made in the manufacturing country.

witnessing of all the optical fiber cable and equipment Testing by customer staff should be made before shipment.

10.3..2 Underground Fiber Optic Cable

Underground fiber optic cable shall be installed to provide a fiber optic link between the substations as fiber optic cable link.

The cable is to be duct type with 24 fibers according to ITU-T G 655,

The cable is to have fiber reinforced plastic strength member, loose tubes filled with thixotropic jelly, PE fillers, glass or aramid yarn, peripheral strength member, petroleum jelly, polyester tape core wrapping, polyethylene overall sheathed. The cable design life is to no less than 25 years. The mechanical specification is to be according to:

- Tensile performance under load is to be according to ITU-L.14.
- Operating temperature : -20 to 80 ° C.
- Crush Resistance >2 KN/10 cm.
- Pulling resistance >2 KN.
- Impact resistance at MPT: 12 Newton meter.
- Minimum bending radius during installation: 15 times cable diameter.
- Minimum bending radius at zero tension: 10 times cable diameter
- Longitudinal water blocking (L-test): 1 m water deep for 3 m cable length for 24 hours.
- Packing length : 4 - 5 km.
-

The fibers of these cables are to be terminated in the communication room to rack mounted patch panels of size 144 for 132 kV S/Ss and 288 for 400 kV substations, the extra size is for future expansion.

Armouring shall be used for all direct buried cables or for cables requiring rodent protection. This shall comprise at least one layer of galvanized steel tape 0.2 mm thick, or steel laminated sheath applied directly to the cable core. All armouring shall be protected from corrosion and damage by a polyethylene sheath.

10.3..3 Optical Fibers:

- Total number of fibers : 24
- The fiber type is to be according ITU-T G 655, non-return to zero-dispersion shifted fiber NZ-DSF and according to IEC 60793-2-50.B4
- The project is to conform to the following items in G.655 :
 - Attenuation with detailed total attenuation due to fiber attenuation, splice loss and connector loss.
 - Chromatic dispersion equation at different wavelength with reference to 1550 nm dispersion.
 - Differential Group Delay (DGD) with reference to IEC.T R 61282-3.

- 10.3..3.1 Attenuation**
at :
1450 nm ≤ 0.24 dB/km
1550 nm ≤ 0.20 dB/km
1625 nm ≤ 0.22 dB/km
- 10.3..3.2 Chromatic Dispersion**
At 1530-1565 nm : 2.0 - 4.0 ps/nm.km.
To be according to A of G.655 recommendation.
- 10.3..3.3 Polarization Mode Dispersion:**
To be according to IEC 60794-3 and shall have a maximum value of ≤ 0.05 ps/√km
- 10.3..3.4 Induced Attenuation:**
For temperature between -60 °C to + 80 °C ≤ 0.05 dB/Km at 1550 and 1625 nm.
- 10.3..3.5 Coating Diameter: 250 ± 15 μm.**
- 10.3..3.6 Fiber carrying tube**
The fibers are to be inserted in loose buffer tubes filled with nonconductive homogenous gel which is to be stable even at 180 °C at short circuit current or lighting.
- 10.3..3.7 Measurements:**
Measurements of the fiber characteristics are to be according to IEC 60793-2-B4 which is applicable to NZ-DSF and to IEC-60793-1 with all characteristics are to be according to the parameters indicated in this standard and as follows:
- 1-20- Measurement fiber geometry.
 - 1-21- Measurement of coating geometry.
 - 1-22- Length measurement.
 - 1-30- Fiber proof test.
 - 1-31- Tensile strength test.
 - 1-32- Coating strip ability.
 - 1-33- Stress corrosion susceptibility.
 - 1-34- Fiber curl.
 - 1-40- Fiber attenuation.
 - 1-41- Fiber bandwidth.
 - 1-42/2007- Chromatic dispersion.
 - 1-43/2001- Numerical aperture.
 - 1-44/2001- Cut-off wavelength.
 - 1-45/2002- Mode field diameter.
 - 1-46/2001-Monitoring of changes in optical transmittance.
 - 1-47/2009- Micro-bending loss.
 - 1-48/2007- Polarization mode dispersion.
 - 1-49/2003- Differential mode delay.
 - 1-50/2001- Damp heat (steady state).
 - 1-51/2001- Dry heat.

1-52/2001- Change of temperature.

1-53/2001- Water immersion.

1-54/2003- Gamma irradiation.

10.3..4 Compliance with Standards

Underground Fiber Optic Cable manufacturing according to IEC60793/60794 & ITU-TG655, Other standard may also be acceptable provided that they recommend equal or higher standard Manufacturers shall give in their bids the copies of the standards and recommendations according to which they will manufacture & install their goods.

The optical fiber cable shall be manufactured, tested and commissioned in accordance with a quality assurance and quality control system in conformity with ISO certificates.

10.3..5 Technical Characteristics and Diagrams

The bidders shall give the following information in their bids, in addition to the information shown on the enclosed " List of Guaranteed technical characteristics " in metric system units .

a) Ultimate tensile strength and the method of determination.

b) Description , dimensions , drawings and weights of drums .

10.3..6

10.3..7 The ducts:

The ducts are to be Pliable Conduit tubes with outer diameter of 40 mm and of 3.5 mm wall thickness tested in accordance with EN 61386-1:2008 and EN 61386-24:2010:

- Inner diameter : 33 mm.
- The coefficient of friction of the inner surface is to be less than 0.1
- Maximum installation tension > 3.7kN
 - Compression. The product shall show no more that 15% deflection when subjected to a load no greater than 1700 Newton's in accordance with EN 61386-1:2008
 - Impact. The product shall withstand (no cracks or fractures) when subjected to a 15 Joule impac - 5 degrees centigrade in accordance with EN 61386-1:2008.
 - Tensile Strength. The product shall withstand a tensile load of 4.5kN for which the elongation shall be no greater than 5% in accordance with EN 61386-1:2008 -W hen using air pressure to blow in the cable during installation,
- the duct shall withstand a blow pressure no greater than 1500KPa (15Bar
- Length on a drum: 1750 m.
- Accessories to be delivered with these HDPE ducts are:
 - Joints with no cable inserted
 - Sealing plugs with cable inserted
 - Sealing plugs with no cable inserted
 - Maintenance joints with cable inserted.

10.3..8 Compressor Machines:

These machines are to self powered by a diesel generator and to include the followings: - Heavy duty air compressor tractor for cable placement within a range of 30 cubic meter per minute of air compression.

- Cable tractor self-loading by use of hydraulic lift system with a capacity of 1.5 MT to carry the cable drums.

- Coupler assembly vise for alignment of the conduit ends.
- Conduit conformance kit for testing the integrity of conduit sections, verify conduit air pressure which includes threaded adaptors, pressure gauges and hose clamps. We advice the contractor to have a look at Air-Trak Company products or any other similar company products.

10.3..9 Patch Panels

All substations are to be equipped with optical fiber patch panels, rack mounted, dust proof type. The type of connectors could be type LC. The connectors shall meet the following performance requirements which shall be repeatable up to 500 times.

- Insertion Loss no greater than 0.2dB
- Return loss greater than 50dB

For of 132kV substations, the size of the patch panels are to be of 144 fiber size and for 400kV substations are to be of 288 fiber size to take into account future expansions.

10.3..10 Test and splicing machine Equipments:

The test equipments to be supplied with OPGW and accessories are:

10.3..10.1 Splicing Machine:

The splicing machines require are to be suitable for NZ-DSF fibers with automatic alignment. The average loss of a splice at 1550 nm shall be less or equal to 0.04 dB.

It shall be supplied with following accessories:

Built in heat shrink oven, high precision fiber cleaver, 250 μm fiber holder, jacket remover, hard transit case, built in battery charger, built in AC adaptor, power cords, spare electrodes, cleaning tools, fiber protection sleeves.

10.3..10.2 OTDR:

It shall work on three wavelengths, 1310, 1550, 1625 nm with optical power output of 43,45,43 dBm respectively, with dynamic range of 250 km and 1 m resolution. It shall have the following facilities: splice loss report, passive optical network (PON) mode with ability to classify 1X32 splitter. Pulse width can be chosen from 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000 ns. Dead zone according to back-scattering of 8/6/6 m and according to Fresnel zone of 4/3/3 m of above wavelengths respectively.

10.3..10.3 Light or Laser Source:

Handheld laser source for quick measurement. To work at 1550 nm, with optical power of 1 dBm with built in battery, that can be connected to optical fiber NZ-DSF connector type LC or any one of the four types mentioned above.

10.3..10.4 Optical Power Meter:

To work at 1550 nm wavelength, can store the information in a built in memory of 4 MB, can be accessed through RJ-45 by a computer, with built in battery. Anritsu CMA50 or equivalent would meet our requirements.

10.3..10.5 Chromatic Dispersion

The type method to be used is to be one of the following three:

- Fiber Brag Grating (FBG).
- Virtual Image Phased Array (VIPA).
- Gires-Tournois Etalon (GTE).

It is left to the contractor to choose one of the three methods above based on technical reasons which must be given.

10.3..10.6 Tool Kit:

Fujikit-03 of Fujikura or equivalent.

10.3..11 TESTS

The standard to be used in tests and inspection shall be the same as the ones used in manufacturing process by the manufacturer who must inform ETP about which standards he would use before the order become effective.

A.Test Classification

Required tests include type tests, Sample test and Routine tests, as defined in subsequent paragraphs.

B.Test Methods

The supplier shall conform to international standards and methods for the tests which are not described in this specification

C.Factory Acceptance Tests

This test is to be done by MoE engineers who have been trained in the OPGW manufacturing plant given all facilities to conduct these tests .

These test are :

1. Type Test for Optical Fiber

Attenuation test according to IEC 60793-C1 and IEC 60793-C2 (Temperature, wavelength and bending).

2. Tensile Test

A sample of 80 m length of OPGW is to be subjected to 72% of its ultimate tensile strength (UTS) for attenuation measurement. Result: Maximum extra attenuation ≤ 0.02 dB/km at 1550 nm.

3. Crush Test

A sample of 80 m long to be subjected to load of 5 kN for 24 hours, then its attenuation is to be measured at 1550 nm. Result: No change.

4. Bending Test

A repeated bending loss is to be carried with a minimum radius specified in G-655 which should have no effect.

5. Lighting Test

A sample of 10 m sample which is to be subjected to DC lightning of 70-90 mm produced by 200-400 Ampere current with a duration of 250-500 ms causing a charge transfer of 100 Coulombs or more.

By measurement and monitoring of above effects, the result is to be based on the followings:

Maximum temperature of the optical fibers are to be less than 180° C.

Maximum extra attenuation after this effect is less than 0.04 dB.

Extra attenuation during the lightning is to be less than 0.2 dB.

Damage to the steel and aluminum wires is to be less than 15%.

6. Temperature cycling Test

A sample of 80 m of the cable is to be inserted in water with measurement of the attenuation at 65, 40, 20, 0 and 10° C. Result: No change.

7. Water penetration test

shall be carried out according to the IEC 794-1/E5.

8. Repeated bending test

shall be carried out according to the IEC 794-E6. No damage to fibers or optical unit shall occur.

9. High temp. stability of filling compound according to the EIA455-S1/A

Routine Test for optical fiber

- Mode field diameter test (acc. To IEC 793-1-C9A).
- Bandwidth test (acc. To IEC 793-1C4 and C5).
- Chromatic dispersion test (acc. To IEC 793-1-C5).
- Cutoff wavelength test (acc. To IEC 793-C7A).
- Refracted near field distribution & geometric tests (acc. To CCITT G 653).
- Core and cladding refraction index (indicate method of determination).
- Numerical aperture (NA) (indicate method of determination).

10.3..12 Packing & Shipment

Reels shall have a structure suitable for over seas transportation and handling. Also the reels shall be of heavy - duty construction suitable for use with tension stringing equipment. The woods used to cover the wires shall be made of a good quality wood. Wire ends shall be secured to the reels so that slippage does not occur at any time. Each reel shall be suitably labeled or marked to indicate the following information :-

- The name or symbol of the Manufacturer,
- the name of the buyer,
- order number.
- Year of manufacture.
- Net weight of the reel in kgs.
- Gross weight of the reel in kgs.
- Direction to unreel.
- Distention
- other necessary information if any.

The Underground Fiber Optic Cable Manufacturer shall take the necessary means so that the number of splices should be kept at minimum. The length of optical fiber cable should be (4 – 5) km in each reel. The cable ends are to be sealed with shrinkable plastic tubes.

Schedule of Technical Information

Table-1 : Fiber Optics Data of non zero dispersion shifted mode
To be filled by the manufacturer

Description	Required	Offered
1- Type		
2- Trade name		
3- National/International Standard No.		
4- Manufacturer	EUROPE, USA, JAPAN	
5- Attenuation		
5.1 Attenuation with bending at 1550& 1625		
5.2 Fiber cut-off wave length (λ_{cf})		
5.3 Cable cut-off wave length (λ_{cf})		
5.4 Mode field diameter		
6- Dispersion		
6-1 Zero Dispersion wave length(λ_0)		
6-2 Zero Dispersion slope(S_c)		
6-3 Total dispersion [ps/(nm*km)] At 1550 At 1625		
6-4 Over the range 1525 to 1575		
Dispersion calculation Dispersion : $D(\lambda)=S_0(\lambda-\lambda_0)$ [ps/(nm*km)] for 1500 $\leq\lambda\leq$ 1600nm		
7- Glass Geometry		
7-1 Cladding diameter		
7-2 Core-clad concentricity		
7-3 Cladding non circularity		
7-4 Primary Coating Diameter		
7-5 Coating concentricity		
8 – Environmental testing		
8.1 Temperature range		
8.2 Humidity cycling		
8.3 Water immersion		
8.4 Damp heat		
8.5 Heat Aging		
9- Mechanical		
9.1 Proof Test		
9.2 Tensile strength (Un-aged and aged)		
9.3 Static Fatigue (Un-aged and aged)		
9.4 Coating strip force (Un-aged and aged)		

Table-2 Fiber Optics cable

Item No.	Description	Required	Offered
1	Manufacture		
2	No. of tubes		
3	No. of fibers /tube		
4	Central Strength member diameter /mm		
5	Outer sheath diameter		
6	Cable diameter	10 – 14 mm	
7	Crush resistance	>2 KN/10 cm	
8	Impact resistance	12 Newton Meter	
9	Pulling resistance	>2 KN	
10	Minimum bending radius during installation	15 times cable diameter	
11	Minimum bending radius at zero tension	10 times cable diameter	
12	Operating temp	-20 to 80	
13	DURA LINE HDPE TYPE		
14	Outer/Inner Diameter	40\33 Thick=3.5mm	
15	Friction	<0.1	
16	Pressure	15 bar	
	Maximum installation tension	> 3.7 KN	

Table-3 Country of Origin Declaration Form

ITEM	DESCRIPTION	MANUFACTURER	PLACE OF FACTORY	PLACE OF TESTING
11	Optical fiber cable			
2	Optical Fiber wire	EUROPE , USA, JAPAN		
3	Multiplexer	EUROPE		
4	Test Equipment	EUROPE , USA, JAPAN		

10.4 TOOLS FOR LAYING AND INSTALLATION FIGGERS:

- Rope protection roller, galvanized



Duct dia.
150 mm

(Fig. 1)

- Glass fibre rod spooled on a galvanized vertical wheeled cage, complete of starting / ending junctions spinner and shackle.



(Fig. 2)

Length	Rod dia.	Cage dia.
120 m	11 mm	1000mm

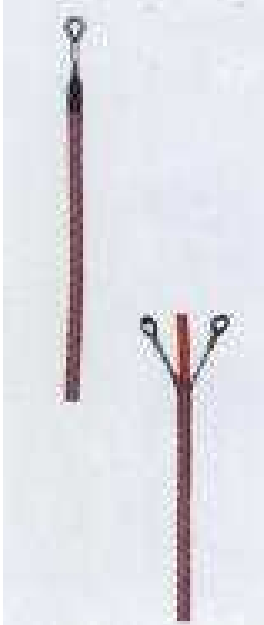
- STARTING ROLLER



(Fig. 3)

- **CABLE PULLING GRIPS MADE OF GALVANIZED STEEL WIRE, WITH 1 EYED THIMBLE AND PRESSED CLAMP, OPEN AT ONE END.**

Diameter	Length
100 – 120 mm	1500 mm
80 -- 100 mm	1500 mm



(Fig. 4)

- **CABLE PULLING GRIPS MADE OF GALVANIZED STEEL WIRE WITH 2 EYED THIMBLES AND PRESSED CLAMPS, OPEN TYPE, WITH TWO BINDING STRANDS FOR SUBSEQUENT IN-BRAIDING**



Diameter	Length
100 – 120 mm	1500 mm
80-100 mm	1500mm

(Fig. 5)

- **-CABLE ROLLER (STANDARD), GALVANIZED**

running in dust and water proofed bearings



Carrying load	max. Cable-Ø
250 kg	200 mm

(Fig.6)

- **-CABLE ROLLER (WIDE), GALVANIZED**



running in dust and water proofed bearings

Carrying load	max. Cable-Ø
250 kg	200 mm
250kg	280 mm

(Fig. 7)

- **CABLE ROLLER WITH GROUND PLATE (STANDARD), GALVANIZED**



Carrying load	max. Cable-Ø
250 kg	200 mm

(Fig. 8)

- **CORNER ROLLER WITH PLUG-IN HINGES (STANDARD), GALVANIZED**



Carrying load max. Cable-Ø
250 kg 200 mm

(Fig. 9)

- **CABLE GUIDE AND RUN-OFF FRAME, GALVANIZED**



Carrying load
200 kg

(Fig. 10)

- **HYDRAULIC LIFTING JACKS FOR CABLE DRUMS, GALVANIZED**

with plug-in cable drum claws, mobile version

Fig.: Hydr. lifting jacks and steel shaft with sliding bearings and fixing clamps



Drum dia	Carrying capacity per pair
900 – 3.200 mm	10 t
900 – 3.200 mm	20 t

(Fig. 11)

