



**National Electric Power Company (“NEPCO”)  
Amman - Jordan**

**Tender No. 2/2026**

**Procurement of Design, Engineering, Supply,  
Installation and Commissioning for the Following:**

- 1.1: New 0.5 km double circuit 400 kV OHTLs (Bundle Conductors), to connect AAWDCP Main S/S with the existing Aqaba - Ma'an 400kv OHTL.
- 1.2: New 12 km double circuit 132 kV OHTLs (Single Conductor) to connect AAWDCP Main S/S with BPS2.
- 1.3: New 66 km double circuit 132 kV OHTLs (Bundle Conductor) to connect AAWDCP Main S/S with Quiera PV S/S passing by BPS3 S/S.
- 1.4: New 20 km double circuit132 kV OHTLs (Bundle Conductor) to connect BPS4 S/S with existed Bayader – Queen Alia OHTL (2in/2out).



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# Volume I

## The Tender



**Invitation to bidders**  
**From**  
**National Electric Power Company (NEPCO)**

**For Tender No. 2/2026**

**Procurement of Design, Engineering, Supply, Installation and Commissioning for the Following:**

- **1.1: New 0.5 km double circuit 400 kV OHTLs (Bundle Conductors), to connect AAWDCP Main S/S with the existing Aqaba - Ma'an 400kv OHTL.**
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- **1.4: New 20 km double circuit132 kV OHTLs (Bundle Conductor) to connect BPS4 S/S with existed Bayader – Queen Alia OHTL (2in/2out).**



1. National Electric Power Company (NEPCO) intends to implement the subject Tender with the following Scope:

(1.1): Includes the design, Engineering, Supply, Installation and commissioning of new 400kV OHTL to Connect AAWDCP Main S/S with the existing Aqaba - Ma'an with an Appx. length of 0.5 km.

The Proposed OHTL shall have double circuit, three phases per circuit, with twin conductor per phase, two OPGW shield wires.

(1.2): Includes the design, Engineering, Supply, Installation and commissioning of new 132kV OHTL to Connect AAWDCP Main S/S with BPS2 with an Appx. length of 12 km.

The Proposed OHTL shall have double circuit, three phases per circuit, with single conductor per phase, one OPGW shield wires.

(1.3): Includes the design, Engineering, Supply, Installation and commissioning of new 132kV OHTL to Connect AAWDCP Main S/S with Quiera PV S/S Passing By BPS3 S/S, with an Appx. length of 66 km.

The Proposed OHTL shall have double circuit, three phases per circuit, with twin conductors per phase, one OPGW shield wires.

(1.4): Includes the design, Engineering, Supply, Installation and commissioning of new 132kV OHTL to Connect BPS4 S/S with existed Bayader – Queen Alia OHTL with an Appx. length of 20 km.

The Proposed OHTL shall have double circuit, three phases per circuit, with twin conductors per phase, one OPGW shield wires.

2. NEPCO invite sealed Tenders from eligible Bidders for Design, Engineering, Supply, Installation and Commissioning for aforementioned Transmission lines.

3. Interested eligible Bidders may obtain further information and inspect the Tender Document at the Procurement Department of:

National Electric Power Company (NEPCO)  
P.O. Box 2310.  
Amman 11181, Jordan.  
Telephone: +962-6-5858615  
Telefax: +962-6-5818336

4. One book of Tender Document comprises one copy of each of the following:

- **Vol. I      The Tender**
  - Invitation to bidders
    - i. Instructions to Bidders
    - ii. Tender Data
    - iii. Tender Form
- **Vol. II      The Contract**
  - i. Contract Agreement Form
  - ii. General Conditions of Contract
  - iii. Particular Conditions of Contract  
(- Works Procedures)
  - iv. Price Schedules
  - v. Performance security Form
  - vi. Bank security for Advance Payment
  - vii. Defects Liability security form
- **Vol. III      Scope of work and technical specification**
  - 1. Introduction
  - 2. Scope of work
  - 3. General requirements
  - 4. Design
  - 5. Materials
  - 6. Construction
  - 7. Inspection and testing
  - 8. Data schedule
  - 9. Document list

5. A complete Tender Document may be purchased by any interested eligible Tenderer on application to the mentioned address and upon payment of a nonrefundable fee the equivalent of (5,000) Jordanian Dinars.
6. The enclosed Tender Acknowledgement should be filled out and returned to NEPCO immediately after the purchasing of the Tender Document.
7. Tenders must be completed and delivered to the mentioned address in Jordan as detailed in the Instructions to Bidders in four separate envelopes, one for the technical offer, one for the financial offer, one for the Tender Security, and the last for the qualification and eligibility).



8. All Tenders must be accompanied by a Tender Security, which shall be submitted separately in an individual envelope either by the tenderer or by the representative on behalf of the tenderer in the condition that he is fully authorized by Power of Attorney letter from the tenderer in an amount as detailed in the Instructions to bidders in the form of a bank security issued directly by an approved bank located in Jordan, in the form provided in the Tender Documents.
9. Tenders must be received by the Employer not later than 2:00 P.M. Amman local time **on (30/03 /2026)** at the following address:

Secretary of the Tendering Committee  
Procurement Department of the  
National Electric Power Company (NEPCO)  
P.O. Box (2310)  
Amman 11181, Jordan

10. The completion time for Design, Engineering, Supply, Installation and Commissioning) of all supplies for this project shall be (See Table No. 1 – Time for Completion, Vol.II - iii Time Schedule, (1) Execution Programme, Vol.II - The Contract).

#### **The Tender scope comprises of:**

Towers: engineering, manufacturing, testing in the factory, packing, insurance (DAP) supply to the site unloaded.

Conductors, optical ground-wire, ground-wire, insulators, and all fittings, vibration, dampers, spacers and warning spheres are supplied by the contractor.

All materials need to be transported to the site; this activity includes unloading and temporary storage.

Surveys required for engineering works comprise the geodetic survey, geotechnical investigation, and report and survey of existing infrastructure and connection points, and gathering cadastral maps/plans from Municipalities, Greater Municipalities, Land Department, or any other concerned party that NEPCO finds necessary.

All design works comprising line design (route finalization, towers spotting, line profiles, and clearance reports, equipment utilization reports), will be done by the contractor.



Full design of towers and foundations shall be provided by the employer to the awarded contractor.

Some of the route corridor lands are in state ownership, Hence, the Contractor is expected to negotiate temporary access to work areas with private landowners. NEPCO may assist in this regard.

The Contractor will prepare for approval the plan of temporary access, storage yards, and site office locations.

All civil, construction, and line installation works comprising of: access roads, temporary yards and storages, site and work areas protection, foundations construction, towers assembly and erection, delivery and installation of all OHTL material and equipment. Commissioning and energizing works and services.

All of the above works must be completed in conformance with the Employer's Requirements (Volume III of this Tender Documentation Package) and generally in conformance with the Contract.

The bid price shall be based on preliminary quantities as provided in the bill of quantities incorporated into price sheets. Upon approval of the final design, the contractual price sheets will be amended with the revised quantities. The payments will be based on the bid unit prices, and actual (real) installed quantities.

This project is considered to be an EPC project, the contract is based on **FIDIC (Federation Internationale des Ingenieurs Conseils) Conditions of Contract for Plant and Design-Build (Yellow Book) First Edition 1999**. The scope shall include, design, engineering, procurement, supply, delivery, installation, construction, testing, commissioning, and handing over of the Works in a complete, safe, and fully operational condition.

The OHTL shall be built according to a so-called modern international design standard using European standards (EN 50341) and the latest IEC standards.

The time for Completion of the whole of the Facilities (Design, Engineering, Supply, Installation and Commissioning) of all supplies for this project shall be as per (Table No. 1 – Time for Completion, Vol.II - iii Time Schedule, (1) Execution Programme, Vol.II - The Contract).

**The bidders are invited for the whole project scope only (All Parts). bidders for a part of the scope will not be considered.**



Bidders can obtain the tender documents from the Employer NEPCO in electronic format (pdf) and Hardcopy. Specific files in other formats (like forms for securities or price sheets) will be provided upon request.

Bidders may obtain further information from NEPCO at the following address:

National Electric Power Company (NEPCO)  
Attention: Dr. Sufian M. AL-Bataineh  
Managing Director  
P.O. Box 2310, Amman 11181, Jordan  
Telephone: +962-6-5858615  
Telefax: +962-6-5818336  
Mail: info@nepco.com.jo

The tender must be accompanied by a Tender Security from a reputable bank acceptable to the Employer in the amount of ( 900,000 ) JOD .

The Bidders are allowed to enter into a joint venture, consortium, partnership, or other unincorporated groupings with a proposed partner company. The proposed partner company will be assessed against NEPCO prequalification criteria.

All joint ventures, consortia, partnerships, or other unincorporated groupings shall submit with the Tender a copy of the properly signed Agreement entered into between the partners.

After awarding, Bidders are required to enter into a joint venture or consortium or higher subcontractor (partnership) with a local contractor for the purposes of Article 16 of the Construction Contractors Organization Law in addition to the obligation to be a member in the Jordanian Construction Contractors Association and shall abide by all of local laws and regulations regarding hiring local employment.

A pre-bid meeting and a site visit shall be arranged with on a duly advised date. The site visit shall be arranged from NEPCO HQ offices to the proposed route location. Transportation will not be provided by the employer. Bidders are advised to bring their transportation units, and to be capable of working in difficult terrains.



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## **VOLUME I.i INSTRUCTIONS TO BIDDERS**

### **General**

#### **1. Scope**

1.1 The Employer, as defined in the Tender Data, invites Bidders for the design, engineering, procurement, supply, delivery, installation, construction, testing, commissioning, and handing over of the Works in a complete, safe, and fully operational condition of the Facilities outlined in the Schedule of Requirements and the Technical Specifications in accordance with the procedures, conditions and contract terms prescribed in these tender documents.

#### **2. Source of funds**

2.1 The Cost of the described works will be financed by NEPCO and/or from a loan.

#### **3. Eligibility and Qualifications**

3.1 This invitation to tender is open to all Tenderers from all countries and satisfies the requirements concerning experience for projects of this nature. The successful tenderer for the EPC work is obliged to register himself (the company) in Jordan Contractors Association, in Ministry of Public Works and Housing, CCD Trade, Jordan Engineers Association, and Ministry of Industry and Trade.

##### **3.2 Eligibility criteria**

The Tenderer has completed at least Four Contracts of 132 kV OHTL projects or above (Single Circuit or Double Circuit), and at least two of them should be outside his own country “except for the local tenderer (and that the main equipment manufacturer) and all the projects outside or inside his own country should be in successful commercial operation for at least one year in the last ten years.

3.3 A firm, its affiliates, or parent company that provides consulting services for a project cannot be a supplier of goods or works for such project, unless it can be demonstrated that there is not a significant degree of common ownership, influence, or control between the firm providing consulting services and the firm tendering for the supply of goods or works.

3.4 A Bidder may submit or participate in only one tender for each contract. Submission or participation by a Bidder in more than one tender for a

contract will result in the rejection of all tenders for that contract in which the party is involved. However, the same subcontractor may be included in more than one tender.

3.5 A Bidder shall not be eligible to participate where it has been determined to have engaged in Prohibited Practices described in subparagraph 34.

3.6 Documentary evidence from the end-users, consultant or representative, must be provided. End-user consultant or representative/ performance certificates shall conform to the following, otherwise; it may be rejected:

1. Certified and signed by the end user consultant or representative;
2. In English language, printed officially;
3. Translation shall be in English language printed officially and legalized by the appointed governmental authority in the end user country.
4. End-user consultant or representative certificate shall clearly indicate the following: name of customer/company and complete address where equipment is installed, date of issuance of certificate, date of put in operation, details related to Scope of Work, rating, capacity of related equipment.
5. If the tenderer provides original performance certificate, the certificate may be returned, if required by the Tenderer.
6. Failure to supply the required qualification documentation to the satisfaction of the Employer or any forged certificate or any dummy & unreal project found may result in rejection of the Tender.

3.7 Financial Situation and Performance for :

3.7.1 The Tenderer shall also demonstrate its financial capabilities, to the satisfaction of the Employer, that it has adequate sources of finance to meet the cash flow requirements on works currently in progress and for future contract commitments.

3.7.2 Documentary evidence of the Tenderer's qualification to perform the Contract and the Tenderer has the financial, technical and production capability necessary to perform the contract. In particular it is required that:

- ✓ **The financial statements of the bidders must achieve a good level of the financial ratios (liquidity, profitability, activity and operation, coverage) for the last 3 years and fill them in tables No 1 and 2 (as Forms attached). Tables 1 and 2 are included at the end of Volume II.**
- ✓ **Financial statements for the last 3 years to be provided, supported with certified independent public accountant's reports.**



#### **4. Cost of tendering**

4.1 The Bidder shall bear all costs associated with the preparation and submission of its tender, and the Employer will in no case be responsible or liable for these costs.

#### **5. Pre-tender meeting and site visit**

5.1 The Bidders or their local representative are advised to attend the pre-bid meeting and site visit. The dates will be duly advised.

5.2 The Bidder shall visit and examine the site and surroundings where the Facilities are to be installed and obtain for itself on its own responsibility all information that may be necessary for preparing the tender and entering into a contract for supply and installation of the Facilities. The costs of visiting the site shall be at the Bidder's own expense.

5.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such inspection, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the Employer, its personnel and agents from and against all liability in respect thereof and neither the Employer, its personnel or agents will be responsible for death or personal injury, loss of or damage to property and any other loss, damage, costs, and expenses incurred as a result of the inspection.

### **Tender Documents**

#### **6. Contents of tender documents**

6.1 The tender documents comprise the documents listed below, other documentation or drawings specified in the Tender Data, and addenda issued in accordance with paragraph 8.

- **Vol. I**      **The Tender**
  - Invitation to bidders
  - i. Instructions to Bidders
  - ii. Tender Data
  - iii. Tender Form

- **Vol. II**      **The Contract**
  - i. Contract Agreement Form
  - ii. General Conditions of Contract
  - iii. Particular Conditions of Contract



- (- Works Procedures)
- iv. Price Schedules
- v. Performance security Form
- vi. Bank security for Advance Payment
- vii. Defects Liability security form

- **Vol. III Scope of work and technical specification**

1. Introduction
2. Scope of work
3. General requirements
4. Design
5. Materials
6. Construction
7. Inspection and testing
8. Data schedule 132 kV
9. Document list

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

## **7. Clarification of tender documents**

7.1 A prospective Bidder requiring any clarification on any aspect of the tender documents may notify the Employer in writing (or by email and fax) at the Employer's mailing address indicated in the Tender Data. All requests for clarification must be received by the Employer no later than fifteen (15) days prior to the deadline for the tenders' submission. The Employer will respond in writing to such requests for clarification of the tender documents which it receives. Copies of the Employer's response (including a description of the inquiry but without identifying its source) will be sent to all prospective Bidders that have received the tender documents.

## **8. Amendment of tender documents**

- 8.1 At any time prior to the deadline for submission of tenders, the Employer may amend the tender documents by issuing addenda.
- 8.2 All addendum thus issued shall be part of the tender documents and shall be communicated in writing by email or by fax to all prospective Bidders



that have received the tender documents. Prospective Bidders shall immediately acknowledge receipt of any addendum by email or fax to the Employer and it will be assumed that the information contained therein will be/have been taken into account by the Bidder in its tender.

8.3 To give prospective Bidders reasonable time in which to take the amendment into account in preparing their tender, the Employer may, at its discretion, extend the deadline for the submission of tenders, as provided for in paragraph 17.2.

## **Preparation of Tenders**

### **9. Language of tender**

9.1 The tender and all documents and correspondence relating to the tender shall be in the language of the tender specified in the Tender Data. Any printed literature furnished by the Bidder may be written in another language so long as such literature is accompanied by an accurate translation of its pertinent passages in the language of the tender, in which case, for purposes of interpretation of the tender, the translation shall govern.

## **10. Documents comprising the tender**

10.1 Tender documents shall be divided into four (4) separately sealed envelopes:

- **Tender Security Envelope** - containing element (d)
- **Technical Envelope** - containing all remaining elements of the Tender listed below
- **Financial Envelope** - containing elements (a), (b) and (c) listed below
- **Qualification and Eligible Envelope** -containing elements a

A tender submitted in accordance with these Instructions to Bidders shall comprise the following:

- (a) **Tender Form** (in the format indicated in Volume I.iii) duly completed in the manner and detail indicated therein and signed by the Bidder;
- (b) Attach. 1. **Price Schedules** (in the format indicated in Volume II. iv) duly completed by the Bidder in the manner and detail indicated therein and following the requirements of paragraphs 11 and 12;
- (c) Attach. 2. **Power of Attorney** duly authorized by a public notary, indicating that the person(s) signing the tender have the authority to sign the tender and thus that the tender is binding upon the Bidder;



(d) Attach. 3. **Tender Security**, furnished in accordance with paragraph 14;

(e) Attach .4. **Company charter and registration documents**

(f) Attach. 5. **Conformity of the Facilities** - documentary evidence establishing that the facilities to be supplied by the Bidder in its tender, or in any alternative tender (if permitted) conform to the tender documents. Details of the documents required are specified in the Tender Data;

(g) Attach. 6. **Subcontractors and Material Suppliers (Manufacturers) Proposed by the Bidder** - the Bidder shall include details of all major items of supply or services that it proposes to purchase or subcontract, giving details of the proposed subcontractors for each of these items. Bidders are free to list more than one subcontractor and manufacturers against each item of the Facilities.

The Bidder shall have been duly authorized by the manufacturer or producer of all subcontracted plant, equipment or components to supply and install.

The Bidder shall be responsible for ensuring that any subcontractor proposed complies with the requirements of paragraph 3, and that any plant, equipment or services to be provided comply with the tender documents.

The Employer reserves the right to delete any proposed subcontractor from the list prior to the award of the contract and, after discussion between the Employer and the Contractor; the subcontractors approved for each item shall be identified in an attachment to the Contract Agreement.

(h) Attach. 7. **Deviations** - pursuant to paragraph 11.2, any deviations to the tender document requirements shall be listed only in Attach. 7. The Bidder shall also furnish the additional cost or savings associated with each deviation. The attention of the Bidder is drawn to the provisions of paragraph 23.4 regarding the rejection of tenders that are not substantially responsive to the requirements of the tender documents. The Employer reserves the right to accept or reject any deviation.



(j) Attach. 8. **Other documentation and information** which may be specified in the Tender Data.

(k) Attach 9. **Financial Capabilities** of the bidders.

10.2 In addition to paragraph 10.1 above, tenders submitted by a joint venture or consortium of two or more firms shall comply with the following requirements:

- (i) The tender shall be signed so as to be legally binding on all member firms of the joint venture or consortium;
- (ii) One of the member firms of the joint venture or consortium, responsible for following up the procurement process procedures and performing a key component of the contract, shall be nominated as being in charge; this authorization shall be evidenced by submitting with the tender a power of attorney signed by legally authorized signatories of all member firms of the joint venture or consortium;
- (iii) The member firm of the joint venture or consortium in charge shall be authorized to incur liabilities and receive instructions for and on behalf of any and all member firms of the joint venture or consortium, and the entire execution of the contract, including payment, shall be done exclusively with the member firm in charge; All payments shall be made on a single account.
- (iv) All member firms of the joint venture shall be liable jointly and severally for the execution of the contract in accordance with the contract terms;
- (v) The offer shall clearly define the respective roles and responsibilities of each member.
- (vi) A copy of the duly certified agreement entered into by the member firms of the joint venture or consortium shall be submitted with the tender, or alternatively a Letter of Intent to execute a Joint Venture Agreement, in the event of a successful bid the agreement shall be signed by all members, duly authorized and submitted before awarding.

If a member of the joint venture or consortium withdraw from the joint venture or consortium after being qualified and before awarding, his offer shall be rejected.

In order for a joint venture or consortium to qualify, each of its member firms or combination of member firms must meet the minimum criteria listed for an individual Bidder for the component of the contract they are designated to perform. Failure to comply with this requirement will result in rejection of the tender of the joint venture or consortium.

The leader of the partnership shall have project management experience on the similar Projects the Employer reserves the right to accept or reject the joint venture or consortium qualifications depending of the provided documentation. In case of the Joint Venture, Consortium or Partnership Agreement only one tender security shall be provided for the total amount. A firm can be a member in only one joint venture or consortium; tenders submitted by joint ventures or consortia including the same member firm will be rejected. The Tenderer shall fill the letter of tender (in case of Joint Venture / Consortium or Partnership Agreement each member shall comply with the requirements). The Tenderer shall fill the Integrity Form in case of Joint Venture/Consortium or Partnership Agreement each member shall comply with the requirements. The tenderer shall fill the Historical Contract Non-Performance, Pending Litigation and Litigation History Form in case of Joint Venture/Consortium or Partnership Agreement each member shall comply with the requirements.

Tenderer shall confirm non-performance of a contract did not occur as a result of contractor's default over the last 5 years, where; nonperformance, as decided by the Employer, shall include all contracts where (a) nonperformance was not challenged by the contractor, including through referral to the dispute resolution mechanism under the respective contract, and (b) contracts that were so challenged but fully settled against the contractor. Nonperformance shall not include contracts where Employers decision was overruled by the dispute resolution mechanism.

Nonperformance must be based on all information on fully settled disputes or litigation, i.e. dispute or litigation that has been resolved in accordance with the dispute resolution mechanism under the respective contract and where all appeal instances available to the applicant have been exhausted.

Tenderer shall confirm that it has not been under suspension based on execution of a Bid Securing Declaration by the Employer. Tenderer's financial position and prospective long-term profitability still sound according to the criteria mentioned below and assuming that all pending litigation will be resolved against the Tenderer.

Tenderer shall confirm that no consistent history of court/arbitral award decisions against the Tenderer over the last five years.

**Quality & HSE requirements (in case of Joint Venture/Consortium each member shall comply with the requirements).**

The Tenderer shall submit with its Tender, the following documents:

- Quality Management System UNI EN ISO9001 Certificate
- Environmental Management System ISO 14001 Certificate
- Health & Safety BS OHSAS 18001 Certificate Or ISO 45001

Failure to provide the required qualification documentation and meet the above-mentioned criteria to the satisfaction of NEPCO or any forged certificate or any dummy unreal project found will result in rejection of the offer.

## **11.Tender prices**

11.1 Unless specified otherwise in the Tender Data and/or the Technical Specifications, Bidders shall quote for the entire Facilities on a “single responsibility” basis such that the total tender price covers all obligations of the contractor pursuant to or to be reasonably inferred from the tender documents in respect of the design, manufacture all materials, including procurement and subcontracting (if any), delivery, construction, installation and completion of the Facilities. This includes all responsibilities of the Contractor for testing, pre-commissioning and commissioning of the Facilities and, where so required by the tender documents, the obtaining of all permits, approvals and licenses, etc., operation, maintenance and training services and such other items and services as may be specified in the tender documents, all in accordance with the requirements of the Conditions of Contract.

11.2 Bidders are required to submit a tender fully compliant with the commercial, contractual and technical requirements specified in the tender documents and to quote the price covering all commercial, contractual and technical obligations outlined in the tender documents. If a Bidder wishes to offer a deviation to the tender document requirements, such deviation shall be listed in Attachment 7 of its tender. The Bidder shall also provide the additional price or saving associated with such deviation. The Employer reserves the right to accept or reject any deviation.

11.3 Bidders shall give a breakdown of the prices in the manner and detail called for in the Price Schedules.

11.4 In the Price Schedules, Bidders shall provide the required details and a breakdown of their prices as follows:

(a) Plant and Equipment to be supplied from abroad, installation and other services provided for all labor, contractor's Equipment, temporary works, materials, consumables and all matters and things of whichever nature, including operations and maintenance services, the provision of operations and maintenance manuals, training, etc., where identified in the tender documents as necessary for the proper execution of the installation and other services shall be quoted on a DAP basis. The DAP shall be governed by the rules prescribed in the latest Incoterms,



published by the international chamber of commerce,  
Paris.

(b) Recommended spare parts shall be quoted separately as specified and in accordance with the origin of the spare parts.

**11.5 Customs and import duties:**

- a) Custom fees and Sales tax:
  - i) Custom fees and Sales Tax related to the shipped materials shall be borne by the Employer and to be paid by the Contractor and will be reimbursed by Employer upon submitting substantiating documents. (DAP price will not include custom fees & sales tax).
  - ii) Sales Tax related to the locally purchased materials, goods or services shall be borne by the Contractor.
  - iii) Customs Duty Guarantees shall be responsibility of the Contractor.
- b) The Contractor shall be solely responsible to investigate and conform to all requirements of all announcements which have been or are being issued by the governmental authorities in Jordan in this respect.
- c) Temporary entry shall be permitted for vehicles and equipments of special type and which are required for the execution of the Works only. Such entry will be strictly according to the laws and regulations prevailing in Jordan. A customs Guarantee is required to be submitted by the Contractor in favor of the Ministry of Finance and Customs to secure the accrued fees and duties payable on the temporarily entered equipment and materials. This Bond will be returned upon the re-export from Jordan of such equipment and the recommendation of the Employer.
- d) Temporary entry will not be permitted for automobiles, trucks, tools, office and residential equipment and supplies, furniture, prefabricated offices and houses, caravans, all types of



hangars, timber, lumber and ply-woods, steel stanchions and laboratory instruments. Customs duties and other charges and dues shall be paid for by the Contractor, the cost of which shall be deemed to be included in the Contract Price. It shall be solely the Contractor's duty to determine the effect of such laws and regulations on the performance of his work.

- e) The Contractor will not be entitled to any extra compensation on the grounds of ignorance regarding the application of such taxes, duties, fees, etc. which will be deemed to have been included in the Contract Price.
- f) It shall be the contractor's duty to determine the effect of such laws and regulations on the performance of his work.  
The contractor will not be entitled to any extra compensation on the grounds of ignorance regarding the application of such taxes, duties, fees, etc. which will be deemed to have been included in the contract price.
- g) The Contractor shall furnish the Ministry of Finance and Customs a Bank Guarantee for securing the customs duties and charges in case of the use of tax-free tools, materials or equipment for purposes other than those for which exemption is granted.  
This requirement may be enforced for each and every shipment and must be in force from the time the goods leave the port of entry until the Employer/Engineer certifies the expiry of their use on site.
- h) In general, locally manufactured goods incorporated in the Works will not be exempted from Jordanian taxes. Fuel oils, coal, lubricating oils, greases and any type of oil are not exempted from Jordanian taxes.
- i) No import license fee is payable for goods which are exempted from customs duties, but the Contractor shall arrange for the issue of all import licenses and clearance permits which may be required for each and every shipment.



j) Stamps Fees:

Revenue Stamp duty and award fees are payable on Jordanian Contracts according to Jordanian laws. It is the Contractors responsibility to purchase legal stamps to the requisite amount depending on the Contract Value.

k) The Contractor shall acquaint himself with the provision of the Jordanian Prime Ministry Announcement No.44 for the Year 1988 and shall comply with its content. In addition, the Contractor should also acquaint himself with the Jordanian prime Ministry Directives Nos. 9, 20 and 24 for the Year 1986 and 1995 regarding representation in Jordan and the utilization of local entrepreneurs.

l) Consignee Name

All material shall be with the following consignee name taking into consideration what is mentioned at section 5:

CONTRACTOR NAME / PROJECT NAME (NEPCO)

m) Shipping marks of all material:

- The Hashemite Kingdom of Jordan.
- National electric Power Company.
- Contract No.
- Material Name.
- Quantity.
- Net Weight.
- Gross Weight.
- Actual length.

n) The Contractor shall bear all expenses including shipping costs, landing charges, and other costs incurred in the importation and subsequent exportation of constructional plant, materials and other things required in the execution of the Contract. Storage and portage fees are to be paid by the Contractor for materials kept in yard, warehouses or stores belonging to Government authorities.

o) Materials surplus to requirements on completion of the Works, any surplus materials (not scrap) may be disposed of in one of the following manners:

- Sell to the Employer at an agreed price and delivery to Employer's stores.
- Export from Jordan.

- Sell locally after all Customs and Import Duties have been paid according to Jordanian Laws.
- p) The Contractor shall be responsible for providing Bank Guarantees prior to release of goods from the port of entry. The Bank Guarantees for taxes and duties shall be based on the requirements of the Laws of Jordan.
- q) The Bank Guarantee will be released upon submittal of receiving and damage reports authenticated by the Employer/Engineer certifying that the goods have been received and erected at the site.

#### 11.6 Metal Price Adjustment for conductors & OPGW

The final Contract price will be based on the LME standard cash Bid price of Aluminum and Closing Price for Steel Rebar FOB Turkey (Month 1 – Contract) one day after letter of acceptance as follows:

**Basic price of Aluminum:** 3192 US Dollar per metric ton.

**Basic price of Steel Rebar FOB Turkey:** 560 US Dollar per metric ton.

**Contract price = Offer price + Adjustable price**

$$C = A + B$$

**Where** **C = Contract Price/km**

**A = Offer price/km**

**B = B1 + B2**

**B1 = (LME Price of AL – 3192) \* W<sub>Al</sub> / 1000**

**B2 = (LME Price of ST – 560) \* W<sub>st</sub> / 1000**

**Where**

- LME Price of Al = LME Aluminum rate at time of settlement Per Ton (i.e. one day after Letter of Acceptance date)
- LME Price of St = LME steel Rebar rate at time of settlement Per Ton (i.e. one day after Letter of Acceptance date)
- **W<sub>Al</sub> = Total weight of Aluminum in kg/km**
- **W<sub>st</sub> = Total weight of Steel in kg/km**

After the metal prices have been adjusted as described above, for final price shall be further adjusted in proportion to the difference in metal weights if the actual weights as determined from the sample tests on the finished Conductors & OPGW are less than the minimum weights as stated in the Tender, The reduction shall then be made on



the base of (Al, St) weight difference in total quantity and prices based on LME price one day after Letter of Acceptance.

In determining the weights during sample tests, the average weights of the samples shall represent the total quantity of the materials supplied.

**11.7** Unless specified otherwise in the Tender Data, prices quoted by the Bidder shall be fixed for the time period during which the contract is performed and shall not be subject to variation for any reason. A tender submitted with an adjustable price quotation which is not consistent with this paragraph shall be treated as non-responsive and rejected.

## **12. Tender currencies**

**12.1** Unless specified otherwise in the Tender Data, prices shall be quoted in the following currencies:

- a) For Plant and Equipment covered under paragraph 11.4 (a) to be supplied from abroad, the prices shall be quoted in American dollars (USD).
- b) Local transportation, storage, assembly, civil works, installation and erection and other local costs shall be quoted in either USD and/or local currency (JOD), depending upon the currency in which the costs are to be incurred and in accordance with the provisions of paragraph 12.1(a)

## **13. Tender validity period**

**13.1** Tenders shall remain valid for the period specified in the Tender Data after the closing date for the receipt of tenders, pursuant to paragraph 17.1. A tender valid for a shorter period shall be rejected by the Employer as being non-responsive and rejected.

**13.2** In exceptional circumstances, the Employer may solicit the Bidder's consent to an extension of the tender validity period. The request and responses thereto shall be made in writing or by fax. If a Bidder agrees to extend the period of validity, the Tender Security shall also be extended accordingly. A Bidder may refuse the request without forfeiting its Tender Security and in this case his Tender Security shall be returned to him. A Bidder granting the request will not be required nor permitted to modify its tender, except as provided in paragraph 13.3.

**13.3** Where the tender is for a fixed price contract (not subject to price adjustment), if the tender validity period is extended, the amounts payable in both local and foreign currencies to the Bidder selected for award shall be increased by applying the factors specified in the Tender



Data to both the local and the foreign currency component of the payments, respectively, for the period of delay beyond the expiration of the initial tender validity up to the time of notification of award. Tender evaluation will be based on the tender prices without considering the above adjustment.

## **14. Tender Security**

- 14.1 The Bidder shall furnish, as part of its tender, a Tender Security in the amount stipulated in the Tender Data, in the currency of the tender, or in the equivalent amount in a freely convertible currency.
- 14.2 The Tender Security shall, at the Bidder's option, be in the form of a certified check or a bank guarantee from a reputable bank located in the Employer's country. The format of the bank guarantee shall be in accordance with the form of Tender Security included in the tender documents; other formats may be permitted, subject to the prior approval of the Employer. Tender Security shall remain valid for a period of twenty-eight (28) days following the last day of the original tender validity period, and following the last day of any extension of the tender validity period pursuant to paragraph 13.2.
- 14.3 Any tender not accompanied by an acceptable Tender Security shall be treated as non-responsive and rejected. The Tender Security of a joint venture or consortium must be in the name of all member firms of the joint venture or consortium submitting the tender.
- 14.4 The Tender Securities of unsuccessful Bidders will be returned as promptly as possible, but not later than twenty-eight (28) days after the last day of the tender validity period.
- 14.5 The Tender Security of the successful Bidder will be returned when the Bidder has signed the Contract Agreement, and has furnished the required Performance security.
- 14.6 The Tender Security may be forfeited:
  - (a) if the Bidder,
    - i. withdraws its tender during the period of tender validity, or modifies it after the closing date; or
    - ii. refuses to accept the corrections of computational errors in its tender price, pursuant to paragraph. 23.2; or
    - iii. invalidates its tender pursuant to paragraph 21.2; or
    - iv. Submits false or fraudulent information or documents for the purpose of participating in the tender.



(b) in the case of a successful Bidder, if the Bidder fails

- i. to sign the contract in accordance with paragraph 31; or
- ii. to furnish Performance security in accordance with paragraph 32.

## **15. Format and signing of tender**

15.1 The Bidder shall prepare an original and the number of copies/sets of the tender specified in the Tender Data, clearly marking each one as “ORIGINAL TENDER”, “COPY NO. 1”, “COPY NO. 2”, etc., as appropriate. In the event of any discrepancy between the original and any copy, the original shall govern.

15.2 The original and all copies of the tender, each consisting of the documents listed in paragraph 10.1, shall be typed or written in indelible ink and shall be signed by the Bidder or person(s) duly authorized to act on behalf of the Bidder. The latter authorization shall be evidenced by written power of attorney accompanying the tender and submitted pursuant to paragraph 10.1. All pages of the tender, except for un-amended printed literature, shall be initialed by the person or persons signing the tender.

15.3 Any interlineation, erasures or overwriting shall only be valid if they are initialed by the person or persons signing the tender.

## **Submission of Tenders**

### **16. Sealing and marking of tenders**

16.1 The Tender shall be divided into **4 envelopes**:

- **Tender Security Envelope**
- **Financial Envelope**
- **Technical Envelope**
- **Qualification and Eligibility Envelope**

Financial, tender security, technical, and qualification &eligibility envelopes , as described in paragraph 10.1. Each set of Four sub-envelopes shall be sealed in one overall envelope (package) appropriately marked: ORIGINAL, COPY No. 1, COPY No. 2 etc. These envelopes shall then be sealed in an outer envelope (tender package).

16.2 The inner and outer envelopes shall be sealed and:

- addressed to the Employer with the address set forth in the Tender Data; and
- bear the identification specified in the Tender Data.



16.3 The inner envelopes shall also indicate the name and address of the Bidder so that the tender can be returned unopened in case it is withdrawn or declared “late”.

16.4 If the outer envelope is not sealed and marked as required by paragraph 16.2 above, the Employer will assume no responsibility for the misplacement or premature opening of the tender. If the outer envelope discloses the Bidder’s identity, the Employer will not guarantee the anonymity of the tender submission, but this disclosure will not constitute grounds for rejection of the tender.

## **17. Deadline for submission of tenders**

17.1 Tenders must be received by the Employer at the address specified in paragraph 16.2(a), no later than ( ) at **14:00** Amman local time.

17.2 The Employer may extend this deadline for submission of tenders by amending the tender documents in accordance with paragraph 8, in which case all rights and obligations of the Employer and Bidders previously subject to the deadline will thereafter be subject to the deadline as extended.

## **18. Late tenders**

18.1 Any tender received by the Employer after the tender submission deadline will be rejected and returned unopened to the Bidder.

## **19. Modification and withdrawal of tenders**

19.1 The Bidders may withdraw or modify their offers by submitting signed and sealed written request deposited in the tenders’ box before the deadline for the submittal of the offers, and the offers may not be returned after the written request except in the opening session.

19.2 Modifications of a tender shall be prepared, sealed, marked and dispatched as follows:

(a) The Bidder shall provide an original and the number of copies specified in paragraph 15.1 of any modifications to its tender, clearly identified as such, in two inner envelopes, duly marking the envelopes as “TENDER MODIFICATIONS - ORIGINAL” and “TENDER MODIFICATIONS - COPIES”. The inner



envelopes shall be sealed in an outer envelope, which shall be duly marked as “TENDER MODIFICATIONS”.

(b) Other provisions concerning the numbers, marking, and dispatch of tender modifications shall be in accordance with paragraph 16.

19.3 A Bidder wishing to withdraw its tender shall notify the Employer in writing prior to the tender submission deadline. A withdrawal notice may also be sent by fax, but it must be followed by a signed confirmation copy, postmarked no later than the tender submission deadline. The notice of withdrawal shall:

(a) be addressed to the Employer at the address specified in paragraph 16.2(a); and  
(b) bear the contract name and the words “TENDER WITHDRAWAL NOTICE”. Tender withdrawal notices received after the tender submission deadline will be ignored, and the submitted tender will be deemed to be a validly submitted tender.

19.4 No tender may be modified or withdrawn in the interval between the deadline for submission of tenders and the expiration of the tender validity period specified in paragraph 13.1. Withdrawal of a tender during this interval may result in the Bidder’s forfeiture of its Tender Security, pursuant to paragraph 14.6.

## **Tender Opening and Evaluation**

### **20. Opening of tenders by Employer**

20.1 (If Any) The Employer will open commercial envelopes of technically qualified tender (accomplished qualification & eligibility criteria) in the presence of Bidders’ representatives who choose to attend the opening at the time, on the date and at the location that will be duly provided. The Bidders’ representatives who are present shall sign a register evidencing their attendance. Online opening might be applied.

20.2 The Bidder’s names, tender modifications or withdrawals, tender prices, discounts, alternative tender (if any), the presence or absence of required Tender Security and other such details as the Employer, at its discretion, may consider appropriate, will be announced at tender opening. No tender will be rejected at tender opening except for late tenders, which will be returned unopened to the Bidders, pursuant to paragraph 18.1.

20.3 Tender discounts or modifications furnished pursuant to paragraph 19 that are not opened, read out and recorded at tender opening will not be considered for tender evaluation. Withdrawn tenders will be returned unopened to the Bidders.



20.4 The Employer will prepare minutes of the tender opening, including the information disclosed to those present in accordance with paragraph 20.2.

20.5 Any discount shall be included in the financial envelop. Value of the discount (if any) shall be clearly mentioned in the cover letter of the financial offer which is included in the financial envelop.

## **21. Contacting the Employer**

21.1 Subject to paragraph 22, no Bidder shall contact the Employer on any matter relating to its tender, from the time of tender opening to the time the contract is awarded.

21.2 Any effort by a Bidder to influence the Employer's tender evaluation or award decision, including the offering or giving of bribes, gifts or other inducement, may result in the invalidation of its tender and the forfeiture of its Tender Security, pursuant to paragraph 14.6.

## **22. Clarification of tenders**

22.1 To assist in the examination, evaluation and comparison of tenders, the Employer may, at its discretion, ask a Bidder for a clarification of its tender. Such clarification may be requested at any stage up to award of the contract. Requests for clarification and the responses thereto shall be in writing or by email or fax, and no change in the price or substance of the tender shall be sought, offered or permitted except as required to confirm the correction of computational errors discovered by the Employer in the examination of the tenders in accordance with paragraph 23.2.

## **23. Preliminary examination of tenders**

23.1 The Employer will examine the tenders to determine whether they are complete, whether any computational errors have been made, whether required Tender Securities have been furnished, whether the documents have been properly signed, and whether the tenders are generally in order.

23.2 The Employer may waive any minor informality, non-conformity or irregularity in a tender that does not constitute a material deviation, and



that does not prejudice or affect the relative ranking of any Bidder as a result of the detailed evaluation pursuant to paragraphs 25 and 26.

23.3 Prior to the detailed evaluation pursuant to paragraphs 25 and 26, the Employer will determine whether each tender is of acceptable quality, is complete and is substantially responsive to the tender documents. For purposes of this determination, a substantially responsive tender is one that conforms to all terms, conditions and specifications of the tender documents without material deviations, objections or reservations. A material deviation, objection or reservation is one (i) that affects in any substantial way the scope, quality or performance of the contract; (ii) that limits in any substantial way, inconsistent with the tender documents, the Employer's rights or the successful Bidder's obligations under the contract; or (iii) whose rectification would unfairly affect the competitive position of other Bidders who are presenting substantially responsive tenders.

23.4 In particular, deviations from, objections to or reservations about critical provisions, such as those concerning Tender Security, Governing Law, Taxes and Duties, Defect Liability, Functional Guarantees, Patent and Indemnity, Limitation of Liability, and related requirements as set forth in the Tender Data, will be treated as non-responsive. The Employer's determination of the responsiveness of a tender is to be based on the contents of the tender itself without recourse to extrinsic evidence.

23.5 If a tender is not substantially responsive, it will be rejected by the Employer and may not subsequently be made responsive by the Bidder by correction of the non-conforming deviation, objection or reservation.

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

- (a) Where there are errors between the total of the amounts given under the column for the price breakdown and the amount given under the Total Price, the former shall prevail and the latter will be corrected accordingly;
- (b) If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected accordingly;

- (c) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and
- (d) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.
- (e) If the Tenderer has not priced one or more of the items, these unquoted items shall be considered included in the total price.

If a Tenderer does not accept the correction of errors, its Tender shall be declared non-responsive and rejected and its tender security shall be forfeited.

## **24. Conversion to single currency**

24.1 To facilitate evaluation and comparison of tenders, the Employer will convert all tender prices expressed in various currencies into a single common currency as specified in the Tender Data.

## **25. Technical evaluation**

25.1 The Employer will carry out a detailed technical evaluation of the qualified tenders not previously rejected as being substantially non-responsive in order to determine whether the technical aspects of such tenders are in accordance with the requirements set forth in the tender documents. In carrying out such technical evaluation, the Employer will examine and compare the technical aspects of the tenders based on the information supplied by the Bidders, taking into account the following factors:

- (a) overall completeness and compliance with the Technical Specifications and Drawings; deviations from the Technical Specifications as identified by the Bidder in its tender and those deviations not so identified; suitability of the Facilities offered in relation to the environmental and climatic conditions prevailing at the site; and quality, function and operation of any process control concept included in the tender. The tender that does not meet minimum acceptable

standards of completeness, consistency and detail will be rejected as non-responsive;

- (b) achievement by the Facilities of specified performance criteria;
- (c) type, quantity and long-term availability of mandatory and recommended spare parts and maintenance services; and
- (d) any other relevant factors listed in the Tender Data.

25.2 Where alternative technical solutions have been permitted and offered by the Bidder, the Employer will make a similar evaluation of the alternatives. Where alternatives have not been permitted but have been offered, they shall be ignored.

## **26. Commercial evaluation**

26.1 Comparisons between tenders shall be based on the clause No 39 of instruction to bidders' price of Plant and Equipment as stated in paragraph 25.1 (d). The Employer's evaluation will also include the costs resulting from application of the evaluation factors pursuant to paragraph 26.2.

26.2 The Employer's evaluation of a tender will take into account, in addition to the tender prices indicated in the Price Schedules, additional evaluation factors as may be specified in the Tender Data.

26.3 Any adjustments in price which result from the application of the above evaluation factors shall be added, for purposes of comparative evaluation only, to arrive at the "Evaluated Tender Price". Tender prices quoted by Bidders shall remain unaltered.

## **27. Post-qualification**

27.1 In the absence of prequalification, the Employer will determine to its satisfaction whether the Bidder selected as having submitted the lowest evaluated responsive tender meets the minimum qualifying criteria specified in paragraph 3.2 and is otherwise qualified to perform the contract satisfactorily.

27.2 The determination will take into account the Bidder's financial, technical, and production capabilities, particularly its contract work in process, future commitments, and current litigations. These matters will be assessed based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder in its tender, as well as such other information as the Employer deems necessary and appropriate.



27.3 An affirmative determination will be a prerequisite for award of the contract to the Bidder. A negative determination will result in rejection of the Bidder's tender, in which event the Employer will proceed to the next lowest evaluated tender to make a similar determination of that Bidder's capabilities to perform satisfactorily.

27.4 The capabilities of the vendors and subcontractors proposed in the tender to be used by the lowest evaluated Bidder will also be evaluated. Their participation should be confirmed with a letter of intent or similar documentary evidence. Should a vendor or subcontractor be determined to be unacceptable, the tender will not be rejected, but the Bidder will be required to substitute an acceptable vendor or subcontractor without any change to the tender price.

## **28. Employer's right to accept any tender and to reject any or all tenders**

28.1 The Employer reserves the right to accept any tender or reject any or all tenders, and to annul the tender process and reject all tenders at any time prior to award of contract, without thereby incurring any liability to any Bidder or any obligation as specified at the Governmental procurement bylaw no 8 of 2022.

## **Award of Contract**

### **29. Award criteria**

29.1 Subject to paragraph 28, the Employer will award the contract to the successful Bidder whose tender has been determined to be substantially responsive and which has been determined as the lowest evaluated tender, provided further that the Bidder is determined to be qualified to perform the contract satisfactorily.

29.2 The Employer reserves the right to accept any of the deviations submitted in accordance with paragraph 10.1(h) by the winning Bidder at a price shown for the deviation in the tender.

29.3 The employer has the right to award each Lot/Lots of the tender to same or different contractors without thereby incurring any liability to any Bidder or any obligation as specified at the Governmental procurement bylaw no 8 of 2022.



### **30. Notification of award**

30.1 The Employer will notify the successful Bidder in writing by registered letter or by fax or any other proper way, that its tender has been accepted. The notification of award will constitute the formation of the contract.

30.2 As soon as the successful Bidder has furnished the Performance security pursuant to paragraph 32, the Employer will promptly notify each unsuccessful Bidder and will discharge their Tender Securities, pursuant to paragraph 14.4.

30.3 Commencement date:  
Not less than 7 days after the notification of award, the Employer will send the letter of acceptance to the contractor, which consider the commencement date. Commencement date shall be considered after 10 Days from the date of the Letter of acceptance.

### **31. Signing of Contract Agreement**

31.1 At the same time as the Employer notifies the successful Bidder that its tender has been accepted, the Employer will send the Bidder the Contract Agreement provided in the tender documents, incorporating all terms and conditions agreed between the parties.

31.2 Within twenty-eight (28) days of receipt of the Contract Agreement, the successful Bidder shall sign and date the Contract Agreement and return it to the Employer.

### **32. Performance security**

32.1 Within twenty-eight (28) days of receipt of the notification of award, the successful Bidder shall furnish the Performance security in accordance with the Conditions of Contract, and in the form provided in **VOLUME II.v** of the tender documents or in another form acceptable to the Employer.

32.2 Failure of the successful Bidder to comply with the requirements of paragraphs 31 or 32.1 shall constitute sufficient grounds for the annulment of the award and forfeiture of the Tender Security, in which event the Employer may make the award to the next lowest evaluated Bidder or invite new bidders.



### **33. Dispute Resolution**

33.1 Any dispute which is not settled amicably shall be referred for final decision to the courts of the Hashemite Kingdom of Jordan.

### **34. Prohibited Practices**

34.1 The Employer requires that Bidders, suppliers, sub-suppliers, contractors, subcontractors, consultants and sub-consultants, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, the Employer:

- (a) defines, for the purposes of this provision, Prohibited Practices as one or more of the following:
  - (i) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party.
  - (ii) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation.
  - (iii) "coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party.
  - (iv) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party; and
  - (v) "theft" means the misappropriation of property belonging to another party.
- (b) will reject a proposal for award if it determines that a Bidder, supplier, sub supplier, contractor, subcontractor, concessionaire, consultant or sub consultant recommended for award has engaged in Prohibited Practices in competing for the contract in question.

### **35. Local registration**

35.1 Bidders (**foreign contractors**) from outside of Jordan shall be registered with all concerned parties, which according to NEPCO present understanding included the Ministry of Industry and Trade CCD, Jordan Engineering Association, Jordan Contractors Association and Housing and Public Ministry.

No interim payment certificate will be released before registration.



### **36. Hiring of Locals**

36.1 The awarded contractor shall hire local Engineers, Technicians, and Workers, and the prices shall be quoted as per the quantities in the price schedules.

36.2 The Contractor shall abide by all laws and regulations of the Hashemite Kingdom of Jordan, including and not limited to the laws and regulations of the ministry of public work and housing and the ministry of labor.

36.3 The contractor shall comply with the requirements of the article No 16 of the Construction Contractors Association Law and Regulation No 131 of 2016 for the mandatory hiring of local employment and all other related.

36.4 In case of the contractor did not hire the required number of local employees for the full project duration as per the tender documents, the employer has the right to deduct double the amount intitled by the contractor for this period of time.

### **37. Compliant procedure**

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

### **38. Variance with Governmental procurement bylaw no. 8 of 2022**

38.1 In the event of there being any inconsistency between the provisions of this Instructions to Person Tendering, Conditions of Contract and the Governmental procurement bylaw no. 8 of 2022, the provisions of the public procurement regulations no. 8 of 2022 shall prevail and shall be considered as incorporated in the Contract.

### **39. Contract Incoterms**

39.1 For the execution of this contract, the chosen incoterm is DAP for the project site and for NEPCO stores – Jordan, “Incoterms 2020”.

39.2 Due to conditions of this contract and the employer requirements, the following alternations are required into “DAP rule articles – Incoterms 2020” as follows:-

1. Article no. B7-b as follows:



The seller must carry out and pay for all formalities required by the country of import, such as:

- Import Licenses; and,
- Security clearance for import; and,
- Pre-shipment inspection; and,
- Any other official authorization.

And for avoiding any doubt, the following points as a result of alternation must be taken into consideration:

- An effect into article No. B3-a, where no responsibility will be taken by the Employer since the article B7-b become contractor's responsibility.
- The contractor must take all clearance process with all requirements in the country of import.
- Bill of Lading document must be issued by the order of contractor as a Consignee Party, and then mentioned the name of Employer and tender number and description in any other party.

2. Article No. B9-d as follows:

The seller must pay: duties, taxes, and any other cost related to import clearance under B7 (b).

Taking into consideration that materials, equipment and supplies, which are to be incorporated in works and which will become the property of the Employer are exempted from customs duties and sales tax, but in case of non-exemption, contractor shall pay these customs duties and sales tax for offshore shipping and it shall be subject to claim, employer will reimburse the contractor upon submitting payment request (claim) attached with duly supporting documents, therefore contractor's tender price must be exclusive of these custom duties and sales tax.

#### **40. Invoicing :**

You shall commit with issuance all of your invoices through the Jordanian National Electronic Invoicing System.

## VOLUME I.ii

### TENDER DATA

The following tender-specific data for the facilities to be procured shall amend and/or supplement the Instructions' to Bidders. Whenever there is a conflict, the provisions herein shall prevail over those in the Instructions to Bidders

#### **Instructions to Bidders**

##### **para. ref.**

##### **para. 1.1: Name of Employer**

National Electric Power Company ("NEPCO"), Amman, Jordan acting as Project Executing Agency ("PEA") or the legal successor in title.

##### **para. 3.1: Eligibility**

The Employer permits firms and individuals from all countries to offer goods, works and services for the project. Any conditions for participation shall be limited to those that are essential to ensure the firm's capability to fulfill the Contract in question.

##### **para. 3.2: Qualifying requirement**

In addition to documents outlined in tender documents, Bidders shall, as part of their tender, submit the following documentary evidence:

(a) List of key personnel:

- (i.) The updated list of the key personnel (Project Manager, Site Manager, various disciplines engineers etc.) to be engaged, followed by CVs in standardized format;
- (ii.) Additional key personnel as mentioned in the table below. Relevant information in the relevant form about a main candidate and an alternate, followed by CVs:

#### **Personnel Capabilities**

<b>Position</b>	<b>Total experience (years)</b>	<b>In similar countries (years)</b>	<b>In similar position (years)</b>
OHL Project Manager	20	5	15
Site Manager	15	5	10
OHL Line and structural design engineer	15	5	10
OHL electric design engineer	15	5	10
Procurement manager	10	5	5
Quality Manager	10	5	5
Safety Engineer	10	5	5



**para. 5.1: Pre-tender meeting or site visit**

A pre-tender meeting will be held to answer any questions on the tender documents of the Bidders at NEPCO office in Amman. The Pre-bid meeting and the site visit shall be held from NEPCO Offices to the route location. The date shall be duly advised.

All expenses related to the attendance of this meeting and the route inspection will be to the Bidder's account.

Evidence shall be given along with the tender to have attended this meeting.

An early indication of the issues to be raised and addressed during the pre-tender meeting would be appreciated. Bidders are therefore requested, as far as possible, to submit any questions and/or concerns in writing or by fax, to reach the Employer not later than one week before the meeting.

Minutes of the meeting, including the text of the questions raised and the responses given, together with any responses prepared after the meeting, will be transmitted without delay to all purchasers of the tender documents.

**para. 6.1: Other documents comprising the tender documents**

Replace the text of paragraph 6.1 with the following:

The tender documents comprise the documents listed below, and should be read in conjunction with any Addenda issued in accordance with para.8:

**Volume I, The Tender**

Invitation for Tenders

i. Instructions to Bidders

ii. Tender Data

iii. Letter of Tender

iv. Tender Security Form

v. Manufacturer's Authorization Form

vi. List of Non-material deviations

vii. n/a

viii. Covenant of Integrity

ix. List of suppliers/subcontractors

x. Personnel schedule/Work team schedule

xi. Equipment Capability

xii. Declaration of Undertaking

xiii. Letter of Acceptance

xiv. Tentative Time Schedule



## **Volume II, The Contract**

- i. Contract Agreement
- ii. General Conditions of Contract
- iii. Particular Conditions of Contract
- Addenda nos.
- Terms and Procedures of Payment
- Insurance Requirements
- Time Schedule (approved)
- List of Subcontractors and Suppliers/Manufacturer
- Scope of Works and Supply by the Employer
- List of Documents for Approval or Review
- Functional Guarantee
- iv. Price Schedules
- v. Form of Performance security
- vi. Form of Advance Payment security

## **Volume III, Scope of work and technical specification**

1. Introduction
2. Scope of work
3. General requirements
4. Design
5. Materials
6. Construction
7. Inspection and testing
8. Data schedule 132kV
9. Document list

### **para. 7.1: Employer's mailing address**

**National Electric Power Company (NEPCO)**  
P.O. Box 2310.  
Amman 11181, Jordan  
Attention: Dr. Sufian M. AL-Bataineh, Managing Director  
Tel.: +962-6-5858615.  
Fax.: +962-6-5818336.  
Mail: [info@nepco.com.jo](mailto:info@nepco.com.jo)

All requests for clarification of the tender documents must be received by the Employer no later than twenty-one (21) days prior to the deadline for submission of tenders.



The Employer will respond in writing to such requests for clarification at the latest ten (10) days prior to the tender deadline. Copies of the Employer's response (including a description of the enquiry but without identifying its source) will be sent to all Bidders that have purchased the tender documents and have informed the Employer that they intend to submit a tender.

Requests for clarifications submitted by e-mail shall be done in the form of a letter, signed and scanned.

Requests for clarifications shall be done in the form of a table, consecutively numbered with reference to the relevant section of the Tender Documents. For easier processing, any requested clarification shall be submitted also by e-mail in WORD.

**para. 9.1: Language of tender**

The tender and all documents and correspondence relating to the tender exchanged by the Bidder and the Employer shall be provided in the **English** language.

**para. 10.1: Documents comprising the tender**

Replace the text of paragraph 10.1 with the following:

Tender documents shall be divided into four (4) separately sealed envelopes :

- Tender Security Envelope - containing an attachment (2).
- Technical Envelope - containing attachments (1), (4), (14), (17), (18), and all remaining attachments listed below.
- Financial Envelope - containing attachments (1), and (5).
- Qualification and Eligibility Envelope- containing attachments (4),(6),(14),(17),and (18).

**a)** Letter of Tender with their attachment in the format indicated in Volume I.iii, completed in the manner and details indicated therein and signed by the Bidder (in case that the Bidder is a Joint Venture, Consortium or another kind of unincorporated Partnership, signed so as to be legally binding on all partners or parties to the partnership).

**b) Attach. 1. Power of Attorney** duly certified by a Notary Public, indicating that the person(s) signing the tender have the authority to sign in the name of and on behalf of the Bidder or the Joint Venture, Consortium or Partnership established by the Bidders;



- c) Attach. 2. Tender Security** furnished in accordance with paragraph 14;
- d) Attach. 3. Site visit certificate** as issued during the site visit by the Employer/Engineer (Not Mandatory).
- e) Attach. 4. The Joint Venture, Consortium, or Partnership Agreement** signed by all partners and complying with the minimum requirements given in para. 3.5. In addition, a joint venture or consortium of two or more firms shall also comply with the para. 10.2.
- f) Attach. 5. Price Schedules** in the format indicated in Volume II.iv, completed in the manner and detail indicated therein and in accordance with paragraphs 11 and 12. The filled in Price Schedules shall be provided in paper format as well as in MS Excel format on a Compact Disc. If there is a discrepancy between the tendered prices given in the MS Excel format and those shown on the paper format the latter shall prevail. Failure to comply with this requirement will be treated as non-responsiveness and will lead to the rejection of the respective tender.

**Prices shall be stated in whole numbers of JD and USD.**

**By filling out the Excel Sheets, the option “Precision as displayed” shall be activated in order to avoid arithmetical errors.**

- g) Attach. 6. N/A**
- h) Attach. 7. List of Non-material deviations** according to Volume I.vi. The List of Deviations has to be attached even in case of no deviations and shall mention the remark “no deviations” and be signed. The Bidder shall also provide the additional costs or saving, associated with each of these deviations. The Employer reserves the right to accept or reject any deviations.
- i) Attach. 8. Time Schedule** in MS Project or similar software utilizing critical path method covering all works necessary for this tender indication but not limited to the following essential activities: Mobilization, survey & data collection, periods of

design, manufacture, factory testing, delivery & transport, civil work, outage times, erection and test on completion, commissioning incl. trial operation in compliance with the overall project completion time.

The Time Schedule shall clearly state the completion date for this project, time for review, approval and consent required from parties. Potential parallel work on several sections should be clearly visible. The foreseen sequence of works, e.g. considering sections in mountain regions as well as the local weather conditions must be considered. The Tentative Time Schedule attached has been compiled to assist Bidders in assessing the programming requirements and phasing of the project implementation works (Vol.I.xiv.).

**j) Attach. 9. Organization chart of the Contractor** showing the position of the Contractor's Representative/Project Manager, Resident Project Manager, Site Supervisor, Site Managers, OHL Design Engineer, Surveyor, Soil Mechanic Expert, Commissioning Engineer etc. (refer also para 3.2 above) and other key personnel participating in the project as well as the main communication lines (home office as well as site office personnel). Organization of multiple work teams for the individual sections should be visible.

**k) Attach. 10. A time and personnel schedule** for the whole duration of this project for engineering, *construction, erection, commissioning* indicating:

- position and name of the personnel
- total no. of expatriate and local personnel
- time of min. stay on site for local and expatriate personnel incl. proposed key personnel (refer to para. 3.2 above)
- qualification and experience of expatriates and local personnel;

**l) Attach. 11. A work team schedule** (in form of a histogram) showing the intended deployment of project staff on site during the construction phase e.g. line survey, profile and tower spotting, soil investigation, access roads, tower foundation, tower erection, stringing, tests on completion and commissioning.

The work team schedule has to mention the number of work teams (multiple work teams are necessary when working in



parallel), their task, number & qualification of personnel, transportation of work groups etc.

**m) Attach. 12. A construction/erection equipment/tool schedule** showing the intended deployment main machinery, main equipment and main tools during the duration of the project e.g. vehicles, cranes, graders, dozers, lorries, bucket trucks, mixers, stringing equipment (minimum two, suitable for triple conductor pulling and sagging and for OPGW/Earth Wires). The Bidder has to also consider in this schedule the equipment set out as minimum requirement during the prequalification. The number of equipment, technical data, and year of production of the respective machinery have to be provided as per attached Form.

**n) Attach. 14. List of Subcontractors and Manufacturer's** (see Vol. I ix.). The Bidder shall include details of all major items of supply all Material or services that he proposes purchasing or subcontracting, giving details of the proposed subcontractor/supplier for each of these items. Bidders are free to list up to three subcontractors/suppliers against each item of the facilities. The participation of the subcontractor/supplier shall be confirmed by the manufacturers' authorization (Volume I.v.). Authorizations for factories belonging to the Bidder are not required, however, is to be clearly indicated in the relevant list of suppliers. To substantiate the subcontractors/suppliers experience, the Bidder shall submit reference lists for the last 10 years, at least 3 duly authenticated user's certificates in 3 different countries, for Material these 3 certificates has to insure operating period at least 2 years in the last 10 years, taking over certificates, Type Test Reports of manufacturers' equipment issued by an authorized and certified testing laboratory and other relevant documents.

The Bidder shall be fully responsible to get approval by the Employer / Engineer for any subcontractor/manufacturer to be involved in the Contract realization and that any plant, equipment or services to be provided by the contractor comply with the Tender Documents, prequalification requirements prior to conclusion of the Contract.

**o) Attach. 15. Method statements** for all major activities shall be provided by the Contractor describing how the works are



intended to be performed, safety measures to be taken, equipment to be used, ...etc, presented in the manner and details indicated in Volume III. Organization of multiple work teams for the individual sections must be described in detail. The foreseen sequence of works, e.g. considering sections in mountain regions as well as the local weather conditions must be described in detail.

**p) Attach. 17 Declaration of Undertaking**

**q) Attach. 18** Certification of ISO 9001, 14001, OHSAS 18001 or ISO 45001 or equivalent and description of the Quality Assurance System

**r) Attach. 19.** Fully completed Technical Data Sheets, the filled in Technical Data Sheets (Volume III.) shall be provided in paper format as well as in MS Word format on a Compact Disc. If there is a discrepancy between the tendered data given in the MS Word format and those shown on the paper format the latter shall prevail;

**s) Attach. 20.** A detailed description of the equipment's and its components' essential technical and performance characteristics, including up-to-date brochures and catalogues of offered equipment, type test reports issued by an authorized and certified testing laboratory, certified in accordance with the IEC standards or equivalent, drawings etc. shall be provided.

**t) Attach. 21.** Draft-Drawings (preliminary layout of towers, foundation, earthing system etc.) presented in the manner and details indicated in Volume III.

**u) Attach. 22.** Commentary on the Employer's Technical Specifications and adequate evidence demonstrating the substantial responsiveness of the facilities to those specifications. Bidders shall note that the standards for skill, materials and equipment designated by the Employer in the tender documents are intended to be descriptive (establishing standards of quality and performance) only and not restrictive. A Bidder may substitute alternative standards, brand names and/or catalogue numbers in its tender, provided that it demonstrates to the Employer's satisfaction that the substitutions are substantial, equivalent or superior to those designated in the Technical Specifications (Vol. III).

**The documents shall be strictly provided in the above order.**



**para. 10.3: Alternative tenders**

Alternative Tenders are not permitted.

**para. 11.6: Tender prices**

The Tender shall be based on an (EPC basis covering the complete scope of the works) price with fixed unit rates. The quoted unit prices shall be fixed for the time period during which the contract is performed and shall not be subject to variation for any reason. Any quantities which may be set out in a Schedule or in the description of the scope of supply are **estimated** quantities and are not to be taken as the actual and correct quantities of the Works which the Contractor is required to execute on (EPC basis covering the complete scope of the works ) to fulfill the purpose of the Works.

The quantities in price sheets shall be amended upon finalization of the design by the Contractor and approval by the Engineer.

The Works shall be paid by fixed tender unit prices and actual quantities installed. Further explanation is provided in Vol. II. iv – Price Schedules.

**para. 12.1: Tender currencies**

The prices shall be quoted as per price schedules.

**para. 13.1: Period of tender validity**

The tender validity period shall be 180 days.

**para. 13.3: Extension of tender validity period**

Not Applicable.

**para. 14.1: Tender Security**

Bidder shall furnish, as part of his Tender, a Tender Security in the form of a bank guarantee issued by a reputable bank located in the employer country, in the amount of (900,000) JOD

**para. 15.1: Number of copies of tender**

In addition to the original the number of copies is: two (2), clearly marked “ORIGINAL” and “COPY 1”, “COPY 2”, etc.

The original and two (2) copies shall be delivered to the Employer:

**The Secretary of Tendering Committee**  
**Procurement Department**  
National Electric Power Company (NEPCO).  
P.O. Box (2310).



Amman 11181-Jordan.

The original and each copy shall be accompanied by a CD containing the complete tender documents as a soft copy.

Additionally, all Price Schedules and Data Sheets shall be initialed by the person or persons signing the tender and stamped.

Non-compliance with this requirement will be considered as non-responsiveness.

**para. 16.2(a): Address of Employer**

National Electric Power Company (NEPCO).  
P.O. Box (2310).  
Amman 11181, Jordan.

**para. 16.2(b): The tender envelopes shall bear following identification:**

a) Addressed to:

The Secretary of Tendering Committee  
National Electric Power Company (NEPCO)  
P.O. Box (2310).  
Amman 11181, Jordan.

b) (Tender title):

Tender no. 2/2026 for the Procurement of Design, Engineering, Supply, Installation and Commissioning for the Following:

- **1.1: New 0.5 km double circuit 400 kV OHTLs (Bundle Conductors), to connect AAWDCP Main S/S with the existing Aqaba - Ma'an 400kv OHTL.**
- **1.2: New 12 km double circuit 132 kV OHTLs (Single Conductor) to connect AAWDCP Main S/S with BPS2.**
- **1.3: New 66 km double circuit 132 kV OHTLs (Bundle Conductor) to connect AAWDCP Main S/S with Quiera PV S/S passing by BPS3 S/S.**
- **1.4: New 20 km double circuit132 kV OHTLs (Bundle Conductor) to connect BPS4 S/S with existed Bayader – Queen Alia OHTL ( 2in/2out).**



c) The words  
“DO NOT OPEN BEFORE 14:00 PM local time  
on 30/03/2026.

**para. 17.1: Deadline for submission of Tenders**

Tenders must be delivered to the addresses given in para. 16.2 (a) above at or before 14:00 p.m. local time, on ( **30/03 /2026**).

Any tender received by the Employer after the tender submission deadline will be rejected.

The Tenders to be delivered to the employer shall be received not later than one day after the deadline for submission of tenders. However, decisive for a timely submission is the receipt of the tender by the Employer.

**para. 20.1: Opening of tenders by Employer**

The Tender Security envelope shall be opened immediately. Technical envelopes (with valid tender security) will be evaluated for technical content and conformance, or as the employer finds suitable.

The Commercial envelopes (of technically responsive tenders) will be opened after completion of the technical evaluation process. Unopened Commercial envelopes will be returned closed to the bidders.

The qualified technically Bidders may be invited to the opening of the commercial envelopes at:

**The Secretary of Tendering Committee  
National Electric Power Company (NEPCO).  
Amman 11181  
Jordan.**

**para. 23.5: Preliminary Examination of tenders**

*para 23.5 shall be read as follow:*

Additionally, deviations from, objections to or reservations about critical provisions, such Performance security, Power of Attorney, Change to General Conditions of the Contract, Price Adjustments, Changes to the Terms of Payment, Time for Completion will be treated as non-responsive.



Bidders must offer the complete scope of supply and works. Tendering only for parts for the project will be considered as a material deviation to the Tender Documents and result in the rejection of the tender. The Employer's determination of the responsiveness of a Tender is to be based on the contents of the tender itself.

**para. 24.1: Conversion to common currency**

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

**paras 25.1(d): Tender evaluation factors and 26.2:**

**Technical evaluation**

In addition to the criteria listed in ITB 25.1 (a) - (c) the following factor shall apply:

(d) All key data required proposed by the Bidder recorded in the technical schedules and have to be guaranteed by the Bidder will be evaluated.

**Commercial Evaluation**

Any adjustment in price that results from the procedures outlined below shall be added, for purpose of comparative evaluation only, to arrive at an "Evaluated Tender Price". Tender prices quoted by Bidders shall remain unaltered.

a) the cost of all quantifiable non-material deviations and omissions from the contractual and commercial conditions and the Technical Specifications as identified by the Bidder in its tender, and other deviations and omissions not so identified;

**Pursuant to the above, the following evaluation methods will be followed:**

**(a) Contractual, commercial and non-material technical deviations:**

The evaluation shall be based on the evaluated cost for fulfilling the contract in compliance with all commercial, contractual and technical requirements set forth in this tender document. In arriving at the evaluated cost, the price



associated with non- material deviations proposed by the Bidder will be used, if applicable. If such a price is not given, the Employer will make its own assessment of the cost of such a deviation for the purpose of ensuring a fair comparison of tenders.

**(b) Performance of the Facilities:**

Bidders shall state the guaranteed performance or efficiency in response to the technical specifications and associated Technical Data Sheets. Tenders offering plant and equipment with a performance of less than the specified minimum performance will be rejected.

**(c) Time for completion:**

The works under this contract shall be completed, commissioned and tested (excluding trial operation) No credit will be given for earlier completion.

The attached Tentative Time Schedule has been compiled to assist Bidders in assessing the programming requirements and phasing of the works.

Prevailing weather conditions at the Site as well as work in mountain areas shall also be taken into account in the Bidders Work Program as well as duration of inland transports from the harbor to the Site.

**(d) Recommended Spare Parts**

The price of recommended spare parts quoted in Price Schedule No. IV shall not be considered for evaluation.

**Commercial Evaluation**

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

- a) Where there are errors between the total of the amounts given under the column for the price breakdown and the amount given under the Total Price, the former shall prevail and the latter will be corrected accordingly;
- b) If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of



the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected accordingly;

- c) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and
- d) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.
- e) If the Tenderer has not priced one or more of the items, these unquoted items shall be considered included in the total price.

If a Tenderer does not accept the correction of errors, its Tender shall be declared non-responsive and rejected and its tender security shall be forfeited.



## VOLUME I.iii

### LETTER OF TENDER

Date: .....

Loan/Credit No.: .....

IFT No.: .....

Name of Contract: .....

To: *(Name and Address of Employer)*

Ladies and/or Gentlemen,

Having examined the tender documents, including Addenda Nos. *(insert numbers)*, receipt of which is hereby acknowledged, we, the undersigned, offer to design, manufacture, test, deliver, install, pre-commission and commission the Facilities under the above-named Contract in full conformity with the said tender documents for the sum of:

.....(USD)  
.....(JOD)

We undertake, if our tender is accepted, to commence the Facilities, and to achieve Completion within the times stated in the tender documents.

If our tender is accepted, we undertake to provide an advance payment Guarantee and a performance Guarantee in the form and amounts, and within the times specified in the tender documents.

We agree to abide by this tender for a period of \_\_\_\_\_ *(number)* days from the date set for submission of tenders as stipulated in the tender documents, and it shall remain binding upon us and may be accepted by you at any time prior to the expiration of that period.



Until a formal Contract Agreement is prepared and executed between us, this tender, together with your written acceptance thereof and your notification of award, shall constitute a binding contract between us.

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

Dated this ..... day of .....2026

.....  
(signature)

In the capacity of

.....  
(position)

Duly authorized to sign this tender for and on behalf of

.....  
(name of Bidder)

*Note: Have to be signed and to be attached together with the Letter of Tender.  
Changes, Modifications are not permitted.*

Initials                    of                    signatory                    of                    Tender  
.....



## APPENDIX TO TENDER

The items below are amending the Sub-Clauses of the FIDIC (Federation Internationale des Ingenieurs Conseils) Conditions of Contract for **Plant and Design-Build** (YELLOW BOOK) FIRST EDITION 1999 form the General Conditions of Contract stated in Volume II.

Item	Sub-Clause	Entry
Employer's name and address	1.1.2.2 & 1.3	National Electric Power Company (NEPCO). P.O. Box (2310). Amman 11181-Jordan. Tel.: +962 6 585 8615 <a href="http://www.nepco.com.jo">www.nepco.com.jo</a>
Contractor's name and address	1.1.2.3 & 1.3	TBA
Engineer's name and address	1.1.2.4 & 1.3	(OHTL Projects Department) within the Employer's organization, and /or the Consultant who may be appointed by the Employer
Time for Completion of the Works	1.1.3.3 & 8.2	The time for completion shall be (12 months) for part 1.1 ,(16 months) for part 1.2 ,(24 months) for part 1.3 and (20 months) for part 1.4 (See Table No. 1 – Time for Completion, VOLUME II.iii Time Schedule, (1) EXECUTION PROGRAMME, Volume.II, The Contract). from the date of commencement, plus four (4) weeks trial operation after completion date which are not included in the project execution time.
Defects Notification Period	1.1.3.7	365 calendar days, calculated from the date



		on which the Works are completed, as stated in the Taking-Over Certificate signed by the Employer.
Communications	1.3	All communication shall be in writing and in English language. For further details please refer to Vol.III Employers' Requirements, Project Description and Procedures.
Governing Law and Ruling Language	1.4	Law of Hashemite Kingdom of Jordan; English
Amount of Performance security	4.2	15 % of the Accepted Contract Amount, in the currencies and proportions in which the Contract Price is payable.
Period for notifying unforeseeable errors, faults and defects in the Employer's Requirements	5.1	30 days
Normal working hours	6.5	7:30 – 16:00, Sunday - Thursday
Delay damages of the Works	8.7 & 14.15 (b)	0.5% of the Accepted Contract (portion/section) Amount per week in the currency and proportions in which the Contract Price is payable.
Maximum amount of Delay damages	8.7	10% of the Accepted Contract (portion/section) Amount
Adjustment for changes in costs	13.8	Not Applicable
Total Advance Payment	14.2	- (10%) of Materials supply Price (DAP Price). -(10%) of Installation &Commissioning Price



		(Foreign and Local Currency).
Start repayment of advance payment	14.2 (a)	With first Interim Payment Certificate
Limit of retention money	14.3	As per terms of payments
Payment of Retention Money	14.9	As per terms of payments
Currencies of payment	14.15	Jordan Dinar (JOD) and US Dollar (USD)
Insurance against injury to Persons and Damage to Property	18.3	not less than 1.5% of total contract amount.
Periods for submission of insurance: • evidence that the insurances required by Contractor have been effected, • copies of the policies, and • for each insurance, evidence of paying the premium.	18.1	Within (10 days) from the date of commencement.
Appointment (if not agreed) to be made by	20.3	The President of FIDIC or a person appointed by the President



## **VOLUME I.iv**

### **NATIONAL ELECTRIC POWER COMPANY (NEPCO)** **Tender no. 2/2026**

**TENDER SECURITY FORM NO.\_\_\_\_\_**

**M/S., NATIONAL ELECTRIC POWER COMPANY (NEPCO)**  
**AMMAN – JORDAN**

At the request of ..... Bank (The Foreign Bank) and on behalf of M/S.....(The Contractor's Name and Address), We ..... (The Local Bank) issue in your favor our irrevocable and unconditional Tender Security No..... for contract No. **2/2026** in the amount of ( ) ..... (in words) In this connection we..... (local bank) hereby consider ourselves responsible for the unconditional payment to you or your authorized representatives of the above sum on your first written demand in whole or in part notwithstanding any objections on the part of the above named contractor and without any need for notarial warning or judicial proceedings.

This bond remains valid from the date of issuance till its expiry date on ..... unless it is extended or renewed upon the Employer's request.

**BANK (LOCAL BANK)**



## VOLUME I.v

### MANUFACTURER'S AUTHORISATION FORM

(date)

TO: (*Name of the Employer*)

WHEREAS [*name of the Manufacturer*] who are established and reputable manufacturers of [*name and/or description of the goods*] having factories at [*address of factory*] do hereby authorize [*name and address of Agent*] to submit a tender, and subsequently negotiate and sign the Contract with you for the above goods manufactured by us.

We hereby extend our full guarantee and warranty as per the General Conditions of Contract for the goods offered for supply by the above firm in response to this Invitation for Tenders.

.....  
(*signature for and on behalf of Manufacturer*)

***This letter of authority should be on the letterhead of the Manufacturer and should be signed by a person competent and having the power of attorney to bind the Manufacturer. It should be included by the Bidder in its tender.***

## VOLUME I.vi

## LIST OF NON-MATERIAL DEVIATIONS

It shall be assumed that the Bidder is meeting the Technical Specification and Contract Clauses in all respects, other than those listed below.

Any deviation from the Tender requirements shall be specifically listed in the form enclosed herein. By this form, the Bidder confirms that the offer submitted fully complies with the requirements of the Tender Documents except for the deviations listed. If Bidder fails to provide subject form as requested herein, it technical offer shall be deemed as provided fully in accordance with Tender requirements. No deviations, except those specified in the subject form and accepted by NEPCO during Technical Evaluation, shall be allowed in the case of Contract award.

Non-material deviations mentioned in the text or drawings forming part of the tender, but not contained in this list, will be considered as nil and void and the respective works will be treated as fully in line with the requirements of these Tender Documents.

Bidder is obliged to provide list of deviations, if any, ONLY in the attached form, duly signed and stamped by the Bidder authorized representative and in the name of the Tenderer. Deviations specified in any other form, manufacturer's notes and comments shall not be considered.

For each of the deviations listed, the Bidder shall provide the following information: precise reference to the corresponding Tender requirement and description of deviation clearly stating the reasons for proposing such deviation. List of deviations has to be attached even in case of no deviations and shall mention the remark "no deviations" and be signed. The Bidder shall also provide the additional costs or saving, associated with each of these deviations. The Employer reserves the right to accept or reject deviations.



## **VOLUME I.vii**

### **Compliance with Prequalification Criteria**

**NOT APPLICABLE**



## **VOLUME I.viii**

### **COVENANT OF INTEGRITY (to the Promoter from the Contractor to be attached to its Tender and qualification envelope)**

"We declare and covenant that neither we nor anyone, including any of our directors, employees or agents, acting on our behalf with due authority or with our knowledge or consent, or facilitated by us, has engaged, or will engage, in any Prohibited Practice (as defined below) in connection with the tendering process or in the execution or supply of any works, goods or services for [specify the contract or tender invitation] (the "Contract") and covenant to so inform you if any instance of any such Prohibited Practice shall come to the attention of any person in our organization having responsibility for ensuring compliance with this Covenant.

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

If (i) we have been, or any such director, employee or agent acting as aforesaid has been, convicted in any court of any offence involving a Prohibited Practice in connection with any tendering process or provision of works, goods or services during the five years immediately preceding the date of this Covenant, or (ii) any such director, employee or agent has been dismissed or has resigned from any employment on the grounds of being implicated in any Prohibited Practice, we give details of that conviction, dismissal or resignation below, together with details of the measures that we have taken, or shall take, to ensure that neither this company nor any of our directors, employees or agents commits any Prohibited Practice in connection with the Contract [give details if necessary].

In the event that we are awarded the Contract, we grant the Project Owner and auditors appointed by either of them, as well as any authority having competence under Jordan law, the right of inspection of our records.

We accept to preserve these records generally in accordance with applicable law but in any case, for at least six years from the date of substantial performance of the Contract."



For the purpose of this Covenant,

- **“Corrupt Practice”** means the offering, giving or promising of any improper advantage to influence the action of a Public Official, or the threatening of injury to his person, employment, property, rights or reputation, in connection with any procurement process or in the execution of any contract in order that any person may obtain or retain business improperly or obtain any other improper advantage in the conduct of business.
- **“Fraudulent Practice”** means a dishonest statement or act of concealment which is intended to, or tends to, influence improperly the procurement process or the execution of a contract to the detriment of the Project Owner, or is designed to establish tender prices at non-competitive levels and to deprive the Project Owner of the benefits of fair and open competition, and includes collusive practices (whether before or after tender submission) among Bidders or between a Bidder and a consultant or a representative of the Project Owner.
- **“Project Owner”** means the person designated as such in the tender documents or the Contract.
- **“Public Official”** means any person holding a legislative, administrative, managerial, political or judicial post in any country, or exercising any public function in any country; or a director or employee of a public authority or of a legal person controlled by a public authority of any country; or a director or official of a public international organization.
- **“Prohibited Practice”** means an act that is a Corrupt Practice or a Fraudulent Practice.

Signed	Signed
Name	Name
For and on behalf of (name of partner)	For and on behalf of (name of partner)



## VOLUME I.ix

### List of Suppliers/Manufacturers

The below list shall be filled out by the Bidder, and the relevant reference list as well as authorization form added. The name of the proposed manufacturer shall be provided, terms like “or equivalent” or “or similar” will be considered as nil and void. Further main equipment shall be added by the Bidder. Bidders are free to list up to three subcontractors per item.

Item of Supply	Name of Supplier / Manufacturer	Country of origin of equipment	Reference list added [Yes/No]	Authorization form added [Yes/No]	Type test added [Yes/No]
<b>OHL equipment</b>					
Towers					
Earthing Material					
Insulators					
OPGW					
Conductors					
Fittings					



## VOLUME I.ix

### List of Sub-contractors

The below list shall be filled out by the Bidders and the relevant reference list as well as authorization form added. Subcontractors for other tasks, if any, shall be added by the Bidder. Bidders are free to list up to three subcontractors per item.

Item of Work	Name of Subcontractor	Country of Origin	Assigned element of work	Approximate value	Reference list added [Yes/No]	Authorization form added [Yes/No]	List of machinery added [Yes/No]	Other information added [Yes/No]
<b>Civil works</b>								
<b>Erection works</b>								
<b>Others</b>								

The Bidder shall enter in this Schedule a list of sections and approximate value of the work for which he proposes to use Sub-Contractors, together with the names, places of business and countries of the proposed Sub-Contractors. Notwithstanding such information, the Bidder, if awarded the Contract, shall remain entirely and solely responsible for the satisfactory completion of the Works.

Date \_\_\_\_\_ Signature(s) \_\_\_\_\_ Stamp \_\_\_\_\_

# **VOLUME I.x**

## **Time and Personnel Schedule**

<sup>1)</sup> CV's for key personnel and expatriate personnel must be attached.

*2) For key personnel only*



## Personnel Capabilities

---

Name of Bidder

---

*For specific positions **essential** to contract implementation, Bidders should provide the names of at least two candidates qualified to meet the specified requirements stated for each position. The data on their experience should be supplied in separate sheets using one Form for each candidate.*

1.	Title of position
	Name of prime candidate
	Name of alternate candidate
2.	Title of position
	Name of prime candidate
	Name of alternate candidate
3.	Title of position
	Name of prime candidate
	Name of alternate candidate
4.	Title of position
	Name of prime candidate
	Name of alternate candidate



## Candidate Summary

Name of Applicant

Position	Candidate <input type="checkbox"/> Prime <input type="checkbox"/> Alternate	
<i>Candidate information</i>	1. Name of candidate	2. Date of birth
	3. Professional qualifications	
<i>Present employment</i>	4. Name of employer	
	Address of employer	
	Telephone	Contact (manager / personnel officer)
	Fax	Telex
	Job title of candidate	Years with present Employer

*Summarize professional experience over the last 20 years, in reverse chronological order. Indicate particular technical and managerial experience relevant to the Project.*

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

**VOLUME I.xi**  
**Equipment Capabilities**

**Name of Applicant**

*The Applicant shall provide adequate information to demonstrate that it has the capability to meet the requirements for all items of equipment listed in the Prequalification Data. A separate Form (6) shall be prepared for each item of equipment listed in the Prequalification Data, or for alternative equipment proposed by the Applicant.*

<b>Item of equipment</b>		
<i>Equipment information</i>	1. Name of manufacturer	2. Model and power rating
	3. Capacity	4. Year of manufacture
<i>Current status</i>	5. Current location	
	6. Details of current commitments	
<i>Source</i>	7. 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 Applicant or partner.*

<i>Owner</i>	8. Name of owner	
	9. Address of owner	
	Telephone	Contact name and title
	Fax	Telex
<i>Agreements</i>	Details of rental / lease / manufacture agreements specific to the Project	



## VOLUME I.xii

### LETTER OF Acceptance

(*date*)

TO: (*Name of successful Bidder*)

(*Address of successful Bidder*)

This is to notify you that your tender dated (*enter date*) for the execution of the (*name of the contract as given in the Tender Data*) for the Contract Price of (*amount in numbers and words, and name of currency/currencies*) or equivalent thereof, as corrected and modified in accordance with the Instructions to *Bidders*, is hereby accepted by our Agency.

You are hereby required:

- (a) to submit the performance security (*specify as provided in the tender documents*)
- (b) sign the attached Contract Agreement and return (*specify as provided in the tender documents*); and
- (c) to commence performance of the said contract in accordance with the Contract Documents.

Authorized Signature.....

Name and Title of Signatory.....

Name of Agency.....

Attachment: Contract Document

***This Letter of Acceptance should be on the letterhead of the Employer and should be signed by a person competent and having power of attorney to bind the Employer. If the Employer intends to accept any alternatives offered by the successful Bidder, this should be stated.***



## **VOLUME I.xiii**

### **DECLARATION OF UNDERTAKING**

We underscore the importance of a free, fair and competitive procurement process that precludes abusive practices. In this respect we have neither offered nor granted directly or indirectly any inadmissible advantages to any public servant or other person nor accepted such advantages in connection with our bid, nor will we offer or grant or accept any such incentives or conditions in the presence procurement process or, in the event that we are awarded the contract, in the subsequent execution of the contract. We also declare that no conflict of interest exists in the meaning of the kind described in the pertinent Guidelines.

We also underscore the importance of adhering to minimum social standards (“Core Labor Standards”) in the implementation of the project. We undertake to comply with the Core Labor Standard ratified by the country of Jordan.

We will inform our staff about their respective obligations and about their obligation to fulfill this declaration of undertaking and to obey the laws of the country of Jordan.

We acknowledge that, in the event that our company (or a member of the consortium) is added to a list of sanctions that is legally binding for the client, the client is entitled to exclude our company/the consortium from the procurement procedure and, if the contract is awarded to our company/ the consortium, to terminate the contract immediately if the statements made in the Declaration of Undertaking were objectively false or the reason for exclusion occurs after the Declaration of Undertaking has been issued.

.....  
Place, date

.....  
Bidder



## **VOLUME I.xiv**

### **TENTATIVE TIME SCHEDULE**



Table No.1

**Bidder Financial data for financial capability determination**

**Company Name...**

**Tender No**

**Currency...**

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

**Instructions:**

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

Table No.2

Bidder Financial analysis ratios for financial capability determination

Company Name...

Tender No

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

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

Any Wrong calculation is subject to correction.



## Volume II

## The Contract



## Volume II.i

### CONTRACT AGREEMENT

**This Agreement** made the \_\_\_\_\_ day of \_\_\_\_\_ 2026  
between

National Electric Power Company (NEPCO)  
P.O. Box (2310)  
Amman 11181, Jordan

(hereinafter called "the Employer") of the one part,  
and

---

---

---

---

(hereinafter called "the Contractor") of the other part.

**Whereas** the Employer desires that the Works known as **Contract no. 2/2026** should be executed by the Contractor, and has accepted a Tender by the Contractor for the execution and completion of these Works and the remedying of any defects therein,

**The Employer and the Contractor agree** as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement:
  - a. The Contract Agreement
  - b. MoM of Contract Clarifications
  - c. Letter of Acceptance.
  - d. Letter of Tender
  - e. Particular Conditions of Contract incl. Addenda
  - f. General Conditions of Contract
  - g. Clarification to Tender Documents and Addenda
  - h. Employer's Requirements
  - i. The Schedules
  - j. Clarification to Contractor's Proposal
  - k. Contractor's Proposal



3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to design, execute and complete the Works and remedy any defects therein, in conformity with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor, in consideration of the execution and completion of the Works and the remedying of defects therein the amount of:

*USD Portion of Contract Price* (in words: ..... ) USD  
and *JOD Portion of Contract Price* (in words: ..... ) JOD

Or such other sum may become payable under the provisions of the Contract at times and in the manner prescribed by the Contract.

**In Witness** whereof the parties hereto have caused this Agreement to be executed the day and year first before written in accordance with their respective laws.

SIGNED by: \_\_\_\_\_

for and on behalf of the Employer

in the presence of

SIGNED by: \_\_\_\_\_

for and on behalf of the Contractor

in the presence of

Witness: \_\_\_\_\_

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

Address: \_\_\_\_\_

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

Witness: \_\_\_\_\_

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

Address: \_\_\_\_\_

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

**Appendices:**

Appendix MoM of Contract Clarification Meeting



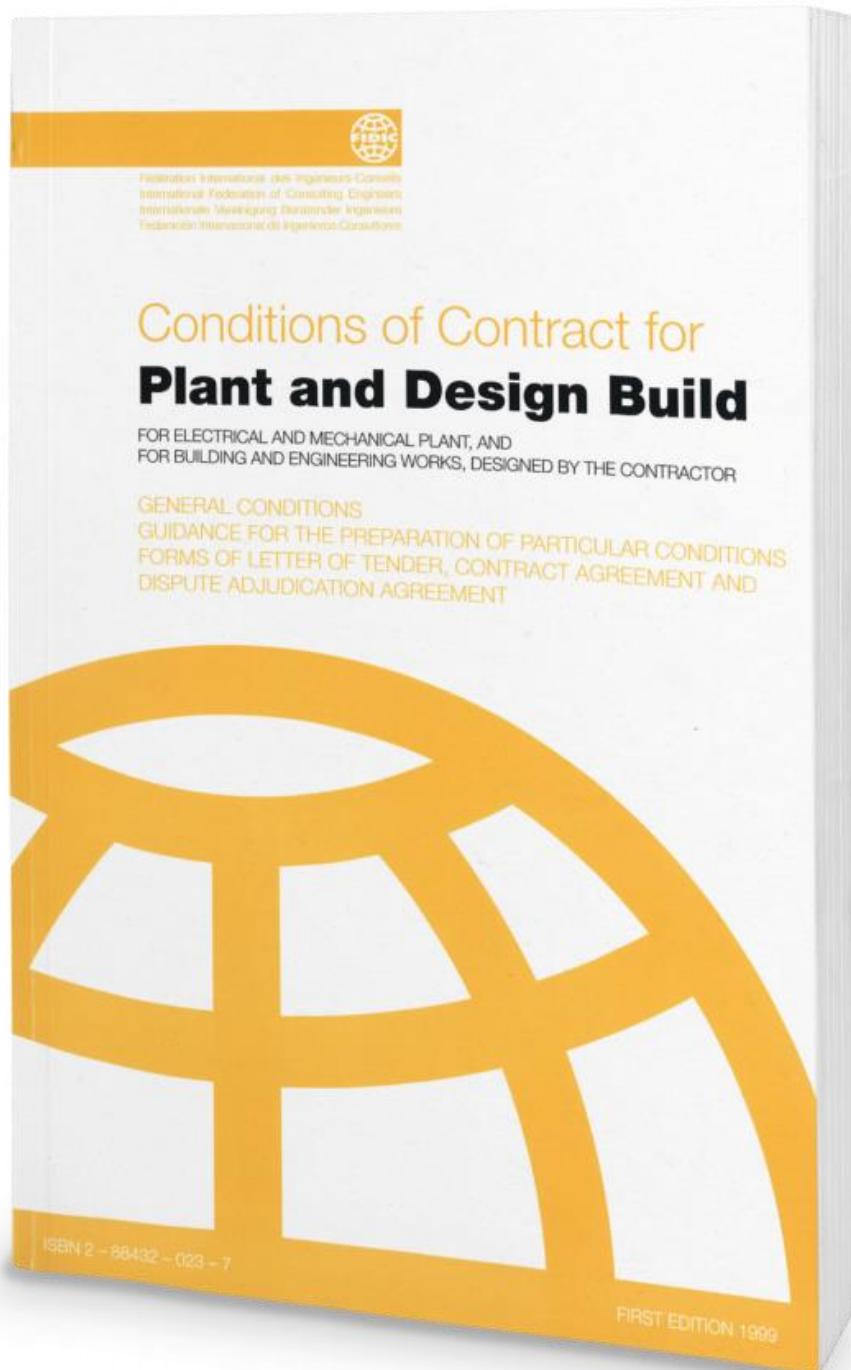
## VOLUME II.ii

### GENERAL CONDITIONS OF CONTRACT

The General Conditions of Contract shall be as per FIDIC (Federation Internationale des Ingenieurs-Conseils) Conditions of Contract for **Plant and Design-Build** (Yellow Book), First Edition, 1999:

1. General Provisions
2. The Employer
3. The Employer's Administration
4. The Contractor
5. Design
6. Staff and Labor
7. Plant, Materials and Workmanship
8. Commencement, Delays and Suspension
9. Tests on Completion
10. Employer's Taking Over
11. Defects Liability
12. Tests after Completion
13. Variations and Adjustments
14. Contract Price and Payment
15. Termination by Employer
16. Suspension and Termination by Contractor
17. Risk and Responsibility
18. Insurance
19. Force Majeure
20. Claims, Disputes, and Arbitration

The Conditions of Contract for **Plant and Design-Build**, YELLOW BOOK, First Edition 1999, is subjected to copyright and may not be reproduced without the permission of FIDIC.





## VOLUME II.iii

### PARTICULAR CONDITIONS OF CONTRACT

The Conditions of Contract comprise the “General Conditions”, which form part of the “Conditions of Contract for **Plant and Design-Build**, First Edition, 1999, published by the Fédération Internationale des Ingénieurs-Conseils (FIDIC), and the following “Particular Conditions”, which include amendments and additions to such General Conditions.

Where reference is made to any Clause or Sub-Clause, this shall mean, unless specifically stated otherwise, a Clause or Sub-Clause in the General Conditions of contract, but with the amendments or additions given in these Particular Conditions.

In case of any difference between the General Conditions of Contract and the Particular Conditions, the Particular Conditions shall govern.



## PARTICULAR CONDITIONS OF CONTRACT

The following Particular Conditions of Contract (PCC) shall supplement the General Conditions of Contract (GC). Whenever there is a conflict, the provisions herein shall prevail over those in the GC. The corresponding clause number of the GC is indicated in parentheses.

### Clause 1 General (Sub-Clause 1.1) Definitions

#### 1.1.2.2 At clause 1.1, insert:

National Electric Power Company (NEPCO)  
P.O. Box (2310)  
Amman 11181-Jordan  
Tel.: +962 6 585 8615  
www.nepco.com.jo

#### 1.1.2.3 At Sub-Clause 1.1.2.3, insert:

The Contractor is: t.b.d.

#### 1.1.2.4 At Sub-Clause 1.1.2.4, insert:

The Engineer is:(OHTL Projects Department) within the Employer's organization ,and /or the Consultant who may be appointed by the Employer

#### 1.1.2.5 At Sub-Clause 1.1.2.5, insert:

Contractor's Representative is:  
t.b.d

#### 1.1.3.10 Add Sub-Clause 1.1.3.10:

“FAT” means Factory Acceptance Tests of the equipment (s)

#### 1.1.5.6 Clause 1.1.5.6 delete and replace by:

“Section” means a part of the Works specified in the VOLUME II.iii Execution Programme.

#### 1.1.6.2 “Country” means Jordan

#### 1.1.6.5 “Laws” means all national (or state) legislation, statutes, ordinances and other laws and regulations obligatory and final decisions, rules, or other acts of the competent state bodies of Jordan and by-laws of any legally constituted public authority.

#### 1.1.6.10 Add as new Sub-Clause 1.1.6.10 Design:

“Design” means the basic and detailed engineering, preparation of drawings, calculations, patterns, models, tests, operation and maintenance manuals and any other technical documentation required for the execution of the Works and to be supplied by the Contractor.

### Sub-Clause 1.2 Interpretation

#### At the end of Sub-Clause 1.2, insert:

Under these Conditions, provisions including the expression “Cost plus reasonable profit” defines this profit to be one twentieth (5%) of this Costs.

### Sub-clause 1.4 Law and Language Amend

#### as follows:

All the documentation, correspondence, communication and all the documents to be prepared and submitted under the Contract shall be in English and the Contract will be constituted and interpreted in English.

The applicable Law is the Law of Hashemite Kingdom of Jordan.



### **Sub-Clause 1.5 Priority of Documents Delete and Replace by:**

The documents forming the Contract are to be taken as mutually explanatory of one another. For the purpose of interpretation, the priority of the documents shall be in accordance with the following sequence:

- a. The Contract Agreement
- b. MoM of Contract Clarifications if any
- c. The Letter of Acceptance
- d. Letter of Tender
- e. Particular Conditions of Contract incl. Addenda
- f. General Conditions of Contract
- g. Clarification to Tender Documents and Addenda
- h. Employer's Requirements
- i. the Schedules
- j. Clarification to Contractor's Proposal
- k. Contractor's Proposal

Anything mentioned in the Employers' Requirements and not shown on the Drawings or shown on the Drawings and not mentioned in the Employers' Requirements shall be of like effect as if shown or mentioned in both. In case of any difference between scaled dimensions and figures on the Drawings, the figures shall prevail.

If any ambiguity or discrepancy is found in the documents, the Engineer shall issue any necessary clarification or instruction.

### **Sub-Clause 1.6 Contract Agreement**

#### **Replace in the last sentence:**

The word "Employer" shall be replaced by "Contractor".

### **Sub-Clause 1.8 Care and Supply of Documents**

#### **Delete and replace second sentence by:**

The Contractor shall supply to the Employer and to the Engineer the number of copies as defined in the "Project Description and Procedures".

### **Sub-Clause 1.9 Errors in the Employer's Requirements**

Last part of the first paragraph

*"..., the Contractor shall give notice to the Engineer and ..."*

shall be replaced by

*"..., the Contractor shall give notice to the Employer and the Engineer ..."*

In the last paragraph:

*"After receiving this notice, the Engineer shall proceed ..."*

shall be replaced by

*"After receiving this notice, the Employer and the Engineer shall proceed ..."*

### **Sub-Clause 1.12 Confidential Details**

#### **At the end of the Sub-Clause 1.12, add:**

The Contractor shall treat the details of the Contract as private and confidential, except to the extent necessary to carry out obligations under it or to comply with applicable Laws. The Contractor shall not publish, permit to be published, or disclose any particular of the Works in any trade or technical paper or elsewhere without the previous consent in writing of the Employer.



#### **Sub-clause 1.13 Compliance with laws**

**At the end of Sub-clause 1.13, add:**

c) The Contractor shall submit, in good time, the details of Goods to the Employer and the Contractor shall obtain all import permits or licenses required for these goods.

### **Clause 2 The Employer**

#### **Sub-clause 2.1 Right of Access to the Site**

**After the first paragraph of Sub-clause 2.1, add:**

Permanent permission to enter and possession of the new tower locations and permanent access roads will be provided with the construction permission.

Agreements with the concerned landowners to obtain temporary permission to access the sites fall within the responsibility of the Contractor. As per sub-clause 4.13, the Contractor shall bear all related costs.

However, construction works at the Site will only be possible after provision of the line design and granting of permit for construction by the relevant local authorities. The Contractor must consider this requirement within his work programme.

“The grant of possession of the Site by the Employer, and any permission to enter and carry out the Works, is provided solely for the purpose of allowing the Contractor to commence the Works. Such possession shall not relieve the Contractor of his full responsibility to obtain all necessary site access permits, approvals from landowners and/or relevant authorities, whether temporary or otherwise. The Contractor must consider this requirement within his work program. Any delay or additional costs arising from the Contractor’s failure to obtain such permits and approvals shall be entirely borne by the Contractor.”

#### **Sub-clause 2.2 Permits, Licences or Approvals**

**Add the following Sub-clause:**

c) The Contractor shall obtain, at his own cost, work permits from the appropriate Jordanian authorities to enable any foreign personnel employed by him to work in Jordan. The Contractor shall be responsible for all formalities in connection with passports, visas, police permits and for customs duties and other import charges for personal goods of foreign personnel employed by him on the Contract. However, the Employer will, if required, assist the Contractor in obtaining visas and work permits to the extent of writing letters to the concerned authority confirming the status of the Contractor.

#### **Sub-clause 2.4 Employer’s Financial Arrangements**

**Delete complete clause**

### **Clause 3 The Engineer**



### **Sub-clause 3.1 Engineer's Duties and Authority**

#### **At the end of Sub-clause 3.1, add:**

The Engineer shall reach specific agreement with the Employer before taking action under the following Sub-clauses of these Conditions:

- a) approving the sub-letting of any part of the Works under Sub-Clause 4.4 (Subcontractors)
- b) certifying additional cost determined under Sub-Clause 4.12 (Unforeseeable Physical Conditions)
- c) determining an extension of time under Sub-Clause 8.4 (Extension of Time for Completion)
- d) issuing a Variation under Clause 13 (Variations and Adjustments).

Notwithstanding the responsibility of the Employer as set out above, if, in the opinion of the Engineer, an emergency occurs affecting the safety of life or of the Works or of adjoining property, he may, without relieving the Contractor of any of his duties and responsibilities under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. The Contractor shall forthwith comply, despite the absence of approval of the Employer, with any such instruction of the Engineer.

### **Clause 4 The Contractor**

#### **Sub-Clause 4.1 Contractor's obligations**

##### **After the first paragraph of Sub-Clause 4.1, insert:**

The drawings and documents included in the Employer's Requirements are intended to be descriptive of the character of the Works and used in conjunction with the requirements of the Employer's Requirements and shall in no way limit the responsibility of the Contractor to design and supply all plant equipment, materials and services necessary to provide for a complete and functional complex which fits for the intended purpose. The Contractor has to perform the basic and detail design for the Over Head Transmission Line (OHTL) according to the Jordan legislation.

The Contractor shall bear full design responsibility and fitness for purpose obligations, the Employer's review shall not relieve the Contractor of its liabilities

#### **At the end of Sub-clause 4.1, add:**

The Contractor shall be responsible for:

- a) Alcoholic liquor or drugs: The Contractor shall not, otherwise than in accordance with the Statutes, Ordinances and the Government Regulations or Orders for the time being in force, import, sell, given, barter or otherwise dispose of any alcoholic liquor or drugs or permit or suffer any such importation, safe, gift, barter or disposal by his subcontractors agents or employees.
- b) Arms and ammunition: The Contractor shall not give, barter or otherwise dispose of to any persons any arms or ammunitions of any kind or permit or suffer the same as aforesaid.
- c) Festivals and religious customs: The Contractor shall in all dealings with labour in his employment, have due regard to all recognized festivals, days of rest and religious or other customs.
- d) Epidemics: In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Government of the local medical or sanitary authorities for the purpose of dealing with and overcoming the same.

- e) Disorderly conduct: The Contractor shall at all times take all reasonable precautions to prevent any unlawful riotous or disorderly conduct by or amongst his employees and for the preservation of peace and protection of persons and property in the neighborhood of the Works against the same. The Contractor shall not interfere with any members of any authorized Police Force who shall have free and undisputed access at all times to any part of the Works in the execution of their duties.
- f) Other conditions: The Contractor shall be responsible for keeping discipline on the Site and shall obey all police, health and municipal regulations and all other regulations which may from time to time require his observance and he shall instruct his agents, subcontractors and other employees to obey such regulations.
- g) Report on accidents: The Contractor shall provide the Engineer with a written notice within twenty-four (24) hours of any accident occurrence at or about the Site or in connection with the execution of the Works. The contractor shall also report such accident to the competent authority whenever the Law requires such report.
- h) Observance by subcontractor: The Contractor shall be responsible for observance by his subcontractors of the foreign provisions.
- i) safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations.
- j) The Contractor shall comply with the provisions of the Labour Law of 1996 and relevant occupational health and safety legislation and regulations in force in Jordan and all other laws related to safety and health at work.
- k) The Contractor shall abide by the general safety conditions (for people and equipment) followed by the National Electric Power Company
- l) The Contractor shall coordinate with the National Electric Power Company's Substations Departments regarding work within the electrified areas. The assigned Contractor shall comply with the entry and exit procedures for persons and equipment and shall comply with the general safety procedures applied in the company.

All duties and taxes levied to the Contractor, its Subcontractors or their employees as per the Governing Law in respect with the Contract performance on the territory of Jordan, including those due and/or payable in respect with Contractor's or its Subcontractor's employees and/or personnel shall be borne by the Contractor. It is the Contractor's obligation to issue the documents under this Contract in compliance with the Governing Tax Law including VAT Act.

Furthermore, Contractors from outside of Jordan shall be registered with the Ministry of Industry and Trade CCD, Jordan Engineering Association and Jordan Contractors Association.

#### **Sub-Clause 4.2 Performance Security**

Delete and Replace by:

4.2.1 Before signing the contract and within 28 days from Letter of Acceptance, the Contractor shall furnish at his cost an irrevocable and unconditional bond titled Performance Guarantee equal 15% of the total contract price issued by local bank in the Employer country accepted by the Employer in the form given and in the same contract currency, and contractor required to extend the validity of the Tender Security until the Performance Guarantee has been established and accepted by Employer.

4.2.2 The Performance Guarantee shall be valid and enforceable until:

- a. Issuing of Taking Over Certificate, and

- b. Contractor is executed and completed the works and remedying all pending items and fully finalized all contractual terms, and
- c. Clearing of all Employer's Claims, and
- d. Submitting of Defect Liability Guarantee related to any remedy required by the Employer for defect may occurred within the defect notification period/s, such guarantee shall equal 5% of Contract Price according to the form given issued by local bank in the Employer country and in the same contract currency and it shall be valid 21 days after issuing of Performance certificate, Failure by the contractor to remedy a default within 42 days after receiving the Employer's notice, then the Employer is entitled to forfeiture the Defect Liability guarantee or prorated.
- e. Failure to comply with the above items from a-d, then the Employer is entitled to forfeiture the performance guarantee or prorated.

4.2.3 Failure to comply with the requirements of submitting performance guarantee or shall constitute sufficient grounds for the annulment of the award and forfeiture of the tender security, in which event the Employer may make the award to the next lowest evaluated Tenderer or call for new tenders.

4.2.4 If any variation order has been issued to increase the contract price during the contract duration, the contractor must increase the Performance Guarantee accordingly.

#### **Sub-Clause 4.3 Contractor's Representative**

##### **First sentence in the second paragraph shall be replaced by:**

Unless the Contractor's Representative is named in the Contract, the Contractor shall, prior to the Commencement date, submit to the Employer and to the Engineer for consent the name and particulars of the person the Contractor proposes to appoint as Contractor's Representative.

##### **Third paragraph shall be replaced by:**

The Contractor shall not, without the prior consent of the Employer and the Engineer, revoke the appointment of the Contractor's Representative or appoint a replacement.

##### **Second sentence in the fourth paragraph shall be replaced by:**

If the Contractor's Representative is to be temporarily absent from the Site during the execution of the Works, a suitable replacement person shall be appointed, subject to the Employer's and the Engineer's prior consent, and the Employer and the Engineer shall be notified accordingly.

##### **Second sentence in the sixth paragraph shall be replaced by:**

Any delegation or revocation shall not take effect until the Employer and the Engineer have received prior notice signed by the Contractor's Representative, naming the person and specifying the powers, functions and authority being delegated or revoked.

##### **At the end of Sub-clause 4.3, add:**

The Site Managers shall be fluent English language. If the Site Managers are not fluent in English language, the Contractor shall make a competent Interpreter available during all working hours.

#### **Sub-Clause 4.4 Subcontractors**



**At the end of the paragraph a), add:**

The list of the Subcontractors accepted by the Employer (Volume II. List of Subcontractors and Suppliers/Manufacturers) is part of the Contract. Such acceptance by the Employer for any Subcontractor does not release the Contractor from any of his obligations and responsibilities under the Contract.

**At the end of the paragraph b), add:**

In case that the Contractor intends to modify the list of the Subcontractors, he shall submit this modification early enough for approval by the Employer, so not to obstacle the Works progress.

In case the Employer has objections to any new proposed Subcontractor the Contractor should propose another Subcontractor. Such approval by the Employer for any new Subcontractor does not release the Contractor from any of his obligations and responsibilities under the Contract.

**At the end of Sub-clause 4.4, add:**

All correspondence from any Subcontractor to the Engineer / Employer shall be submitted only through the Contractor. Correspondence by the Subcontractor directly sent to the Engineer / Employer will not be acknowledged.

Subcontracting of any works is only permitted in case the Contractor can prove that experienced supervisors from his own company supervise the work of the subcontractor. The Contractor's supervisors shall be specialized for the relevant works to be performed by the subcontractor and are available at any time during subcontractor's execution of the works. If the subcontractor fails to execute the works in accordance with the requirements of the Contract and the related terms and regulations, the Contractor shall provide his own personnel without delay.

**Sub-Clause 4.8 Safety Procedures**

**Add the following Sub-Clause:**

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

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

The Contractor shall be responsible for indemnification, which may arise from any claims, judicial acts, damages or disturbances, and for any cost or expenses, resulting or related to damages or disturbances.



#### **Sub-Clause 4.9 Quality Assurance**

**Insert at the end of Sub-Clause 4.9 the following:**

The Contractor shall be certified as per ISO 9000 series.

The quality plan drafted by the Contractor shall be a project-related plan, developed specifically for this project. This will not be the quality handbook used by the Contractor, but will relate to it. In this project - related quality plant, the Contractor should describe how he himself intends to check the activities for the works. In this plan the following should be included as a minimum (ref. ISO- 9001):

- the project organization of the Contractor
- qualifications and expertise
- checking documents
- testing procedure in the factory and on site
- trial operation
- elimination of defects and corrective measures
- documentation of quality
- internal quality audits

#### **Sub-Clause 4.15 Access Route**

**At the end of Sub-Clause 4.15, add:**

The Contractor shall be responsible for receipt, if necessary, of licenses from the relevant authorities for the transport of the equipment and of the Contractor's equipment to the site. The Employer shall make all in time efforts to assist the Contractor receiving these licenses, if the Contractor wants to. The Contractor shall keep the Employer harmless of any claims regarding damages of roads, bridges and other road facilities that may be caused during transportation of the equipment and of the Contractor's equipment to the Site.

#### **Sub-Clause 4.16 Transport of Goods**

The title of this sub-clause is amended to read "Transport of Goods and Personnel".  
Add the following Sub-clauses at the beginning:

\* The Contractor and his Subcontractors, suppliers and manufacturers shall give priority to Arab shipping companies and their subsidiaries for shipment of goods, materials and plant for the Contract, provided such companies ships call at the port of export.

\*Priority shall be given to the Royal Jordanian Airlines (Alia) for items, which are to be transported by airfreight, and for the carriage of personnel.



### **Sub-Clause 4.18 Protection of the Environment**

**At the end of Sub-Clause 4.18, add:**

The Contractor shall comply with all applicable national, provincial and local environmental laws and regulations.

The Contractor shall (a) establish an operational system for managing environmental impacts, (b) carry out all of the monitoring mitigation measures (c) allocate the budget required to ensure that such measures are carried out. The Contractor shall submit semi-annual reports on the carrying out of such measures to the Employer.

The contractor shall maintain an OHS management system appropriate to the size and nature of its business and in line with good international practice such as ILO OSH 2001 Guidelines or OHSAS 18001 or ISO 45001. The management system shall include appropriate incentive and penalty schemes to promote good OHS practices.

Contractor must submit the HSE Plan and Method Statements for review and approval, covering all required works.

The HSE Plan must cover at least the following titles:

- ✓ **A. Construction Environmental and Social Management Plan (C-ESMP).**  
The Construction Environmental and Social Management Plans (C-ESMP) shall identify all environmental and social issues specific and relevant to the works and shall provide information explaining how they will be managed. The C-ESMP shall include details of the environmental and social management system, including the plans to manage and monitor environmental and social impacts associated with all construction work carried out by the Contractor and its Subcontractors. As a minimum the C-ESMP shall cover the following areas, risks and issues:
  - ✓ · Environmental and social policy/statement;
  - ✓ · Response to the legal framework and the Requirements;
  - ✓ · Environmental and social organisation chart, including roles and responsibilities;
  - ✓ · Monitoring, reporting, inspections, audits, incidents and non-conformities;
  - ✓ · Management process description, as well as any changes thereof;
  - ✓ · Pollution prevention and control (including hazardous materials, noise and vibration, air pollution, effluent management and surface run-off, as appropriate);
  - ✓ · Emergency preparedness and response;
  - ✓ · Waste management;
  - ✓ · Ecological management;
  - ✓ · Cultural heritage management
  - ✓ · Land management and reinstatement, including topsoil management and infrastructure and service management;
  - ✓ · Stakeholder engagement
  - ✓ · Spoil disposal;
  - ✓ · Construction camp (layout and management plan);
  - ✓ · Interaction with local communities
- ✓ **B. Health and Safety ,**As a minimum the Occupational and Community Health and Safety Plan (OCHSP) shall cover the following areas, risks and issues:
  - ✓ · Health and safety policy/statement; · Response to the legal and the Requirements;
  - ✓ · Health and safety organisational chart, including roles and responsibilities;
  - ✓ · Information and training ;
  - ✓ · Communication;
  - ✓ · Monitoring, inspections, audits, and non-conformities;
  - ✓ · Accident and incident investigation and reporting;
  - ✓ · Arrangements for controlling significant risks associated with the work including, but not limited to: a) Working at heights; b) Lifting operations; c) Traffic

management – inside and outside the Site; d) Ground disturbance and excavations; e) Working with and around live electrical conductors;

- ✓ · Security management, including interaction with local communities;
- ✓ · Workers accommodation;
- ✓ · Emergency arrangements and emergency response;
- ✓ · First aid

C. Labour Management ,the contractor shall provide a Labour Management Plan (LMP), which outlines the methods to management and monitoring labour and working conditions, including workforce welfare and employee relations. As a minimum the LMP will cover the following areas, risks and issues: · A named manager with defined responsibility for labour issues, including those in relation to subcontractors and labour agencies;

- ✓ human resources policy;
- ✓ · An equal opportunities policy/statement, including equal remuneration for men and women for work of equal value, as well as prohibition of sexual harassment, exploitation or abuse, gender based violence;
- ✓ · Procedures for enhancing staff skills, including regular, documented training with clear objectives;
- ✓ A confidential worker grievance and dispute resolution process; · Policies in respect of the recruitment and treatment of migrant workers, if any
- ✓ Performance review for labour issues in co-operation with other stakeholders.

D. Environmental and Social Action Plan (ESAP)

The contractor shall list all ESAP measures

E. ESHS Resources

The contractor shall list Health and Safety, Environment and Social Managers, Advisors,

Officers, or Supervisors, as well as Stakeholder Relations Managers and Community Liaison

Officers and provide the brief description of the resources and logistic arrangements to enable their work.]

F. ESHS and Labour Reporting

The contractor shall describe reporting procedure for all incidents, non-conformities and non-compliances in respect of the C-ESMP, OCHSP and LMP. This shall describe the mechanism, frequency, timing and lines of reporting for all incidents, non-conformities and non-compliances.

Projects are required to comply, at a minimum, with:

- national labour, social security and occupational health and safety laws, and
- the principles and standards embodied in the ILO conventions 2 related to:
  - a) the abolition of child labour
  - b) the elimination of forced labour
  - c) the elimination of discrimination related to employment
  - d) the freedom of association and collective bargaining

The Contractor shall also fully comply with the requirements set out in Volume III Section scope of works and technical requirements or elsewhere in the Contract Documents.

#### **Sub-Clause 4.21 Progress Reports**

**Change title of Sub-Clause 4.21 into:**

**Progress Reports and Progress Meetings**

**Replace the first sentence of the first paragraph by:**



Monthly progress reports shall be prepared by the Contractor and submitted to the Employer and to the Engineer (as mentioned in Vol. III) latest at the fifth working day of the month following the reporting period.

**At the end of sub-item (a), add:**

The time schedule shall show the “frozen” columns compared with the “actual” columns. Planned and actual disbursement schedule for the project (S-graph).

**Add as sub-point (i):** detailed cash flow estimate of all payments to which the Contractor will be entitled under the Contract;

**Add as sub-point (j):**

records as per sub-clause 6.10

**Add at the end of the Sub-Clause the following:**

**Coordination and design meetings**

During execution of the Contract, the Employer may call for coordination and design meetings, either at the Employer's head office, the office of the Engineer, the site, or the office of the Contractor, as deemed necessary.

The object of these meetings is to coordinate the progress of work and its control, discuss approval procedures and technical details and to discuss all other matters pertinent to the Contract in order to achieve smooth and undisturbed progress of work as well as expeditious delivery of supplies. Representatives of each SubContractor shall be present at these meetings if requested.

**Progress meetings on site**

During erection on the Site and tests of completion, daily or weekly and monthly progress meetings shall be conducted at the Site as directed by the Employer or the Engineer. These meetings are to discuss and review in detail the latest progress of works at the Site.

In order to assist the Employer or the Engineer in his review during the progress meeting of the work done, the Contractor shall provide; at least one (1) day in advance of each meeting, the Employer or the Engineer with a detailed schedule of specific items of works that have been performed, with a comparison of the actual and planned schedule.

If any work or part of works is delayed, the reasons for the delay shall be explained and proposals for how to expedite the delayed part of Works shall be submitted (see also Clause 8 (Commencement, Delays and Suspension))

Further details are stated in Volume III.1 Projects Procedures.

**At the end of Sub-clause 4.21, add:** Besides the items listed above, the provisions set out in the Employer's Requirements shall be considered.



#### **Clause 4.23 Contractor's Operations on Site**

##### **At the end of Clause 4.23, delete the following:**

However, the Contractor may retain on Site, during the Defects Notification Period, such Goods as are required for the Contractor to fulfill the obligations under the Contract.

##### **At the end of Clause 4.23, to be added:**

If all these items have not been removed within 28 days after the issue of Taking Over Certificate, the Employer may sell or otherwise dispose of any remaining items. The Employer shall be entitled to be paid the costs incurred in connection with, or attributable to, such sale or disposal and restoring the Site.

Any balance of the money from the sale shall be paid to the Contractor. If this money is less than the Employer's costs, the Contractor shall pay the outstanding balance to the Employer.

#### **Clause 5 Design**

##### **Sub-Clause 5.2 Contractor's Documents**

##### **At the end of the first paragraph of Sub-Clause 5.2, add:**

The documentation provided during the Contract implementation has to consider the requirements as set out in the Employers' Requirements and shall be submitted to the Engineer for review and/or approval. Within one month after the commencement date the Contractor shall submit to the Engineer for approval the project implementation work programme (time schedule) and sub-suppliers and sub-contractors. Detail design erection works shall be checked and stamped by the Engineer. All documents necessary for the licensing of the Plant and equipment coming from abroad shall be provided in the English language.

##### **At the end of the second paragraph of Sub-clause 5.2, add:**

An electronic version of the documents shall be provided to the Engineer, as also laid down in the Project Descriptions and Procedure. One copy of the certified Drawings, Specifications and other information including the latest revision thereof shall be kept by the Contractor on the Site and the same shall at all reasonable times be available for inspection and use by the Engineer / Employer or by any other person authorized in writing by the Engineer / Employer.

##### **Replace first sentence of fourth paragraph of Sub-Clause 5.2, by:**

The review period shall not exceed 28 days, calculated from the date on which the Engineer receives a Contractor's Document and Contractor's notice.

##### **Sub-Clause 5.6 As Built Documents**

##### **Insert at the end of Sub-Clause 5.6 the following:**

The number of copies and date of submission of the As built Documentation is given in the Employers' Requirements (V. III)

##### **Sub-Clause 5.7 Operation and Maintenance Manuals**

##### **Substitute the complete text with the following:**

The Contractor shall supply to the Engineer provisional operation and maintenance manuals in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair the plant, in accordance with the requirements of Contracts Specifications.

The Works shall not be considered to be completed for the purposes of taking over under Sub-clause 10.1 (Taking Over of the Works and Sections) until the Engineer has received final operating and maintenance manuals in such detail, and any other manuals specified in the Employers Requirements for these purposes. The number of copies and date of submission of the As built Documentation is given the Employers' Requirements (V. III)

#### **Clause Staff and Labor**



**Sub-Clause 6.2 Rates of Wages and Conditions of Labor**

**At the end of Sub-clause 6.2, add:**

The Contractor shall keep proper wage books and times sheets and other proper account books and shall on request of the Engineer, produce for his inspection the above-mentioned documents and books, showing the wages paid, and the hours worked by the Contractor's employees.

**Sub-Clause 6.4 Labor Laws**

**At the end of Sub-clause 6.4, add:**

The contractor shall comply with all governing law. The Contractor shall be responsible on his account for payment of all taxes and other levies for the persons employed by him for execution of the Contract, in accordance with governing law.

The Contractor shall provide equal wages and benefits to men and women for work of equal value or type and shall use their best efforts to employ women and local people negatively affected by, or living in the vicinity of, the project.

The Contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The Contractor shall base the employment relationship upon equal opportunity and for treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline.

The Contractor shall provide equal wages and benefits to men and women for work of equal value or type.

**Sub-Clause 6.5 Working Hours**

**Add the following:**

- d) The Engineer may, after consulting with the Employer and the Contractor, direct that work shall be done at other times if this has become necessary for the completion of the Works within the Time for Completion and this is due to default of the Contractor.

**Sub-Clause 6.7 Health and Safety (HSE)**

**Insert at the end of Sub-Clause 6.7 the following:**

Further requirements are laid down in Vol. III.

**Sub-Clause 6.9 Contractor's Personnel**

**At the end of Sub-clause 6.9, add:**

Any person so removed from the work shall be replaced at the Contractor's expense as soon as possible by a competent substitute approved by the Engineer. The Contractor shall not be entitled to any extension of time for completion by reason of such personnel exchange.

Any person who has been removed as a result of the Engineer's order cannot be employed again in any occupation relating to the works under this Contract unless the Engineer authorities to do so in writing.

**Clause 7 Plant, Material and Workmanship**

#### **Sub-Clause 7.4 Testing**

##### **At the end of Sub-clause 7.4, add:**

The testing should be performed in compliance with Volume III.

The Contractor shall give notice to the Employer for the place and period of performance of the planned FAT at least 28 days in advance and at least 7 days in advance for the planned tests of the equipment and/or works that are performed at Site. The Employer keeps his right to be present at all kinds of tests.

The Contractor should also submit together with the notice the approved full description of the procedures and methods of performing the tests. Such a description should also contain the type of equipment to be used for such an activity. The number and date of submission should be as given in Vol.III, Project Procedures).

If the tests are unreasonably delayed by the Contractor, the Employer may, with notice to the Contractor, request such tests to be performed within 21 days after the date of the notice. The Contractor may then perform the tests within the specified period, with a notice to the Employer.

#### **Clause 8 Commencement, Delays, and Suspension**

##### **Sub-Clause 8.1 Commencement of Work**

##### **Replace the whole paragraph of Sub-Clause 8.1 by:**

The Engineer shall give the Contractor not less than 7 days' notice of the Commencement Date. Unless otherwise stated in the Particular Conditions, the Commencement date shall be considered after 10 Days from the date of the Letter of Acceptance.

The Contractor shall commence the design and execution of the Works as soon as is reasonably practicable after the receipt of Letter of Acceptance and shall then proceed with the Works with due expedition and without delay.

##### **Sub-Clause 8.3 Programme**

##### **After first sentence of first paragraph, add:**

The approved Execution time programme in form of bar chart will be frozen and taken as basis for works progress review. Further requirements are laid down in the Volume III

##### **Replace item (a) with the following:**

(a) the order in which the Contractor intends to carry out the Works, including the anticipated timing of each stage of design, Contractor's Documents, procurement, manufacture, inspection, delivery to Site, construction, erection, testing, commissioning and trial operation. The sequence of works, e.g. considering sections in mountain regions as well as the local weather conditions must be considered.

##### **After second sentence of first paragraph, add:**

This revised programme shall show the "frozen" columns compared with the "actual" columns. After contract signature the Contractor shall monthly update the schedule submitted with his Tender completed with required outages considering the Employer's need assuring a safe and continuous operation of the plant. If not otherwise agreed the Contractor shall apply for outages three weeks in advance. However, a tentative outage schedule shall be included to the progress reports.

The Contractor shall prepare and submit a detailed programme for the Works, clearly showing the critical path with zero float, for the purpose of evaluating and approving any extension of time (if any), facilitate monitoring and assessment of delays.



### **Sub-Clause 8.7**

#### **Delay Damages**

After first paragraph insert:

Delay Damages sum for each Section shall equal Section value multiplied by 0.5% for every week elapsed between the relevant Time for Completion and the date stated in Taking Over Certificate; in the currency and proportions in which the Contract value is payable;

Maximum sum of Delay Damages for each Section shall equal the Section value multiplied by 10% in the currency and proportions in which the Contract value is payable.

### **Clause 10 Employer's Taking Over**

#### **Sub-Clause 10.1**

##### **Taking over of the Works and sections**

**After second paragraph of Sub-Clause 10.1, insert:**

Before the Taking-Over Certificate will be issued, the necessary protocol according to the Jordan Regulations and Laws shall be signed

##### **Last paragraph of Sub-clause 10.1:**

Shall be deleted.

### **Clause 11 Defects Liability**

#### **Sub-clause 11.3**

##### **Extension of Defects Notification Period**

**After the first paragraph of Sub-Clause 11.3, add:**

In case of any defects or damages found during the Defects Notification Period, the reasonable time for remedying of the defects or damages will be given in the Employer's notice. The necessary period of remedying of the defects or damages will be added to the Defects Notification Period for the damaged as well as for other affected equipment. The Contractor shall extend the validity of Performance Security accordingly.

#### **Sub-clause 11.4 Failure to Remedy Defects**

In the first line replace the words "a reasonable time" by "28 days".

### **Clause 13 Variations and Adjustments**

#### **Sub-Clause 13.4**

##### **Payment in Applicable Currencies:**

**At the end of Sub-Clause 13.4, add:**

Except for the following, payment shall be made in US Dollar and Jordanian Dinars, as defined in VOLUME II.iv – Schedule of Prices.

(i) VAT for Plant, Equipment, Material, Works, Supplies or Services supplied from within the Employer's country shall be paid in local currency (JOD) at the National Bank of Jordan's exchange rate valid on the date of the invoice.

#### **Sub-Clause 13.5 Provisional Sum**

Not Applicable. Delete entire sub-clause 13.5.

#### **Sub-Clause 13.8 Adjustments for changes in Cost**

Delete entire sub-clause 13.8, adjustments for changes in cost will not apply.

### **Clause 14 Contract Price and Payment**

#### **Sub-Clause 14.1**

##### **The Contract Price**

**Replace Sub-Clause 14. 1, item a) with the following:**

a) the project will be executed on (EPC basis covering the complete scope of the works ). Unit Prices quoted are fixed and firm prices up to the date of issuing of the Performance Certificate. Items, which will be paid "at actual" (based on unit rates as per Volume II.iv Price Schedules) are defined in Volume II.iv. Price Schedules which includes also further requirements to be considered.

**Add as new item e) the following:**



e) Prices for recommended spare parts, recommended equipment, tools and instruments for maintenance shall be fixed up to twelve months after contract commencement date.

**Sub-Clause 14.2 Advance payment**

**Add after the second sentence of the first paragraph the following:**

The Contractor shall submit the Advance payment security/Advance Payment Invoice within twenty-eight (28) days from the Letter of Acceptance

The Advance Payment security shall be a bank guarantee from a reputable bank in the form mentioned in the Contract and shall be issued by bank acceptable to the Employer.

**Sub-Clause 14.4 Schedule for Payments**

**Delete the whole Sub-Clause 14.4 and replace by:**

The installments/conditions in which the Contract Price shall be paid are stated in VOLUME II. iii, Terms and Procedures of Payment , VOLUME II.iv, Price Schedules , which forms part of the Contract.

**Application for payments**

Contractor may submit maximum three (3) Invoices per Month, one for foreign currency portion and two for local currency portion unless otherwise confirmed by the Engineer.

**Application for Payment on Erection and Construction Works**

A report on progress or completion of all Works on Site giving evidence that the conditions of Sub-Clause 14.3 have been fulfilled shall be provided, certified by the Employer and Engineer.

**Sub-Clause 14.5 Plant and Materials intended for the works**

**Delete the whole Sub-Clause 14.5 and replace by:**

The Employer shall pay to the Contractor the relevant Plant and Materials intended for the Works in accordance with the prices mentioned in the Price Schedule and the Schedule of Payments and under the condition that Plant and Materials have been delivered to and properly stored on the Site, are protected against loss, damage or deterioration and appear to be in accordance with the Contract.

**Sub-Clause 14.6 Issue of Interim Payment Certificates**

**At the end of Sub-clause 14.6, add:**

The Engineer may, if in his opinion it is necessary or desirable, order in writing that any additional or substituted work shall be executed on a time and material basis. The Contractor shall then be paid for such work under the conditions set out in the Volume II.iv schedule of prices

The Contractor shall furnish to the Engineer such receipts or other vouchers as may be necessary to prove the amounts paid and before ordering materials shall submit to the Engineer quotations for the same for his approval.

In respect of all work executed on a time and material basis the Contractor shall during the continuance of such work delivered each day to the Engineer's Representative a detailed list in duplicate of the names, occupation and time of all workmen employed on such work and a statement also in duplicate showing the description and quantity of all materials and Contractor's equipment used thereof or therefore. One copy of each list and statement will, if correct or when agreed, be

signed by the Engineer's Representative and returned to the Contractor. At the end of each month the Contractor shall deliver to the Engineer's Representative a priced statement of the labor, material and Contractor's equipment used and the Contractor shall not be entitled to any payment unless such lists and statements have been fully and punctually rendered. Provided always that if the Engineer shall consider that for any reason the sending of such list or statement by the Contractor in accordance with the foregoing provision was impracticable he shall nevertheless be entitled to authorize payment for such work or at such value therefore as shall in his opinion be fair and reasonable.

**Sub-Clause 14.8 Delayed Payment**

The following sentence replaces the second and third paragraph in GCC:  
The financial charges due to delayed payment shall be calculated at the annual rate as follows:

- Local Currency (JOD): Overnight Main Interest Rate issued by Central Bank of Jordan + 2%,
- Foreign Currency: three-month U.S. dollar LIBOR rate + 2%

**Sub-Clause 14.9 Payment of Retention Money**

Replace the words "first half of the Retention Money" in the first paragraph by "the first part of the Retention Money".

Replace the words "the second half" in the second paragraph by "the second part".

Replace the words "of either half" in the third paragraph by "of either part".

**Clause 16 Suspension and Termination by Contractor**

**Sub-Clause 16.2 Termination by Contractor**

Sub-item (a) is deleted.

**Clause 18 Insurance**

**Sub-Clause 18.1 General Requirements for Insurances**

The Contractor shall comprehensively insure all the works, plant, materials, contractor's documents, the costs of demolition, removal of debris, and professional fees and profit.

The Contractor shall effect and maintain all the insurances required by him with an insurer and in terms approved by the Employer, and for the duration of the Contractor's obligations under this Contract. In each insurance, the Contractor shall be named jointly with the Employer, in addition to himself, as the insured. The Contractor shall be responsible to see that all of his Subcontractors are named as insured parties in the Contractor's policy.

The Contractor shall within the respective periods stated in the Appendix to Tender (calculated from the Commencement Date), submit to the Employer:

- evidence that the insurances required by him have been effected,
- copies of the policies, and
- for each insurance, evidence of paying the premium.

The Policies shall contain a provision that coverage will not be cancelled or materially changed without Forty-Five (45) days written notice to the Employer. The Employer shall have the full right of negotiating coverage with the insurance company and shall be entitled for requesting any extension of the insurance policy to cover the execution of the work. Any agreement reached between the Employer and the insurance company shall be considered as binding to the Contractor.

Prior to moving his equipment onto the site or beginning any operations at the site, the Contractor shall have provided to the Engineer at the site copies of the approved certificates.



The Contractor's insurance for Transport, Erection, and the Defects liability period shall be placed with a licensed insurance company in Jordan.

The Contractor and his Subcontractors shall deal only with local Insurance companies and their affiliates and subsidiaries in insuring equipment/material, plant, personal property and personnel.

Further Insurance requirements are specified in **Insurance**.

**Sub-Clause 18.2 Insurance for Work and Contractor's Equipment**

**At the end of sub-clause 18.2, add:**

Further Insurance requirements are specified in VOLUME II.iii.

In case of discrepancies between the GC, PCC and requirements as per Volume II.iii Insurance, a final determination of the requirements will be provided by the Employer.

**Sub-Clause 18.3 Insurance against injury to Persons and Damage to Property**

**The first paragraph to be replaced by:**

The Contractor as per Governing law shall effect and maintain the professional indemnity insurance which shall cover the risk of its and its Subcontractor's (if any) professional negligence liability for any loss, damage, death or bodily injury which may occur to any physical property (except things insured under Sub-clause 18.2) or to any person (except persons insured under Sub-clause 18.4) in the design and construction of the works in the limit amount not less than 5 (five) million EUR per each event.

This insurance shall be in full force and effect per each year during the performance of the Contract until the issue of the Performance Certificate. The Contractor undertakes to notify the Employer promptly of any difficulty in extending, renewing or reinstating this insurance.

**item (b) to be replaced by:**

Shall be in the name of the Contactor and the Employer as party insured.

**To be added at the end of this sub-clause:**

- Insured liability limit per event: the Contract Price. When the event causing insurance payments has been occurred, the Contractor shall recover the balance up to the amount of insured liability limit.
- Deductible limits: no more than 5% of the amount for each event.
- Validity: from the Commencement Date of the contract until the issue of the Performance Certificate.

**Clause 20 Claims, Disputes and Arbitration**

**Sub-Clause 20.1 Contractor's Claims**

**Insert at the end of the first paragraph:**

The notice shall make reference to this sub-clause 20.1. The notice shall be in writing (fax or letter but shall not be part of another document, e.g. progress reports) and shall be delivered by hand (against receipt) or submitted by fax. A notice not fulfilling these conditions will be considered as failure to give notice of a claim.

**Sub-Clause 20.2**

**Appointment of the Dispute Adjudication Board**

Delete entire sub-clause 20.2

**Sub-Clause 20.3**

**Failure to Agree Dispute Adjudication Board**

Delete entire sub-clause 20.3

**Sub-Clause 20.4**

**Obtaining Dispute Adjudication Board's Decision**

Delete entire sub-clause 20.4



**Sub-Clause 20.5**

**Amicable Settlement**

Delete entire sub-clause 20.5

**Sub-Clause 20.6**

**Arbitration**

Delete entire Sub-Clause 20.6 and replace with the following:

Any dispute which is not settled amicably shall be referred for final decision to the courts of the Hashemite Kingdom of Jordan.

**Sub-Clause 20.7**

**Failure to Comply with Dispute Adjudication Board's Decision**

Delete entire sub-clause 20.7

**Sub-Clause 20.8**

**Expiry of Dispute Adjudication Board's Appointment**

Delete entire sub-clause 20.8

## VOLUME II.iii

### Terms and Procedures of Payment

#### 1. INTRODUCTION

In accordance with the provisions of GCC 14 and PCC 14 (Contract Price and Payment), the Employer shall pay the Contractor as per the following terms of payment, based on the price breakdown given in the Price Schedules. Payments will be made in the currencies stated in PCC 13.4 of the Contract. Applications for payment in respect of part deliveries may be made by the Contractor as work proceeds.

Within thirty (30) days from the Commencement Date, the Contractor will submit proposal for delivery stages in order to enable the Employer to make the payments, as follows:

- Delivery dates and respective amount for Procurement and Installation from each contractual item to be delivered from abroad;
- Delivery dates and respective amount for Procurement and Installation from each contractual item to be delivered from within the Employer's country.

#### 2. TERMS OF PAYMENT:

For Any Method of Payment, all bank charges, Commissions, and expenses inside or outside Jordan are to be borne by the contractor.

The Terms of payment to the contractor shall be as follows:

##### 2.1. Materials Supply (Procurement, Mandatory Spare Parts, Special Equipment & Tools):

The payment of the Materials Supply supplied from abroad or from within the Employer country shall be made to the contractor upon application as below:

- **Ten per cent (10%) of Materials supply Price (DAP Price )** as advance payment within 42 days after issuing the Letter of Acceptance or within 21 days after receiving the following documents whichever is later, against submitting of:
  1. **Interim payment certificate** issued and signed by the Employer upon receiving Contractor's Statement accompanied with supporting documents as mentioned below from (2-4):

2. **Accepted advance payment Security** for the same value and same currency, valid until issuance of taking over Certificate, such guarantee may be progressively reduced by the amount repaid by the Contractor as indicated in the Payment Certificates.
3. **Accepted Performance Security** as specified in the contract.
4. **Commercial invoice** in the correct amount in two originals plus four copies.

- **Fifty per cent (50%)** of supplied material as interim payment for shipment of plant and/or material, within fifty-six (56) days upon receiving Contractor's STATEMENT accompanied with supporting Shipping documents as Follow:
  1. **Interim payment certificate** issued and signed by the Employer upon receiving Contractor's Statement accompanied with supporting shipping documents as mentioned below from 2 to 8:
  2. **Commercial invoice** in two originals and three copies, showing commodity description, quantity, unit price, total price and basis of delivery, reference to items as per Schedule of Prices, in case of material supplied from abroad.
  3. **Bill of lading** - one negotiable plus three non-negotiable, in case of material supplied from within the Employer's country, just the **Delivery Note** in one original plus three copies are requested in this item.
  4. **Packing list** in one original plus three copies.
  5. **Certificate of origin** in one original plus three copies, in case of material supplied from abroad.
  6. **Marine insurance certificate** in one original plus three copies issued from Local Jordanian insurance Co.
  7. **Certificate of successfully Completed Factory Acceptance Test (FAT)** countersigned by Employer's inspection Engineer.
  8. **Other documents** required by the formalities of the loan agreement, if any.

## **2.2. Installation & Commissioning for Foreign & Local Currency Portion:**

Payment for both foreign & local currency portion will be made as follows:

- **Ten per cent (10%) of Installation & Commissioning Price (Foreign and Local Currency)** as advance payment within 42 days after issuing the Letter of Acceptance or within 21 days after receiving the following documents whichever is later, against submitting of:
  5. **Interim payment certificate** issued and signed by the Employer upon receiving Contractor's Statement accompanied with supporting documents as mentioned below from (2-4):
  6. **Accepted advance payment Security** for the same value and same currency, valid until issuance of taking over Certificate, such guarantee may be progressively reduced by the amount repaid by the Contractor as indicated in the Payment Certificates.
  7. **Accepted Performance Security** as specified in the contract.
  8. **Commercial invoice** in the correct amount in two originals plus four copies.
- **Seventy per cent (70%) of the Installation & Commissioning value** as interim payment proportional to the progress of works at site, within fifty-six (56) days upon receiving Contractor's STATEMENT accompanied with the Following supporting documents:
  1. **Interim payment certificate** issued and signed by the Employer upon receiving Contractor's Statement accompanied with supporting documents as mentioned below from 2 to 3:
  2. **Proportional progress Report** issued and signed by the contractor and countersigned by the Employer.
  3. **Commercial invoice** in the correct value.

### **2.3. FAT and/or Training and/or Type Test:**

Payment for FAT and/or Training and/or Type Test for both Local and Foreign Currency Portion will be made as follows

- **Eighty per cent (80%)** of FAT and/or Training and/or Type Test within fifty-six (56) days upon receiving Contractor's STATEMENT accompanied with the Following supporting documents:
  1. **Interim payment certificate** issued and signed by the Employer upon receiving Contractor's Statement

accompanied with supporting documents as mentioned below from 2 to 3:

2. **Commercial invoice** in the correct amount.
3. **FAT and /or Training and/or Type Test Report** issued and signed by the Employer as evidence that the FAT and/or Training and/or Type Test has been done according to the Employer's instructions.

#### **2.4. Hiring of Local Employment:**

Payment for Hiring Local Employment in both Local and Foreign Currency Portion will be made as follows:

- **Eighty per cent (80%)** of Hiring Locals prices within fifty-six (56) days upon receiving Contractor's **STATEMENT** accompanied with the Following supporting documents:
  1. **Interim payment certificate** issued and signed by the Employer upon receiving Contractor's Statement accompanied with supporting documents as mentioned below from 2 to 4:
  2. **Commercial invoice** in the correct amount.
  3. **Copies of ID's or Passports of Employed Personnel**
  4. **Social Security Record for Employees** issued and signed (or Stamped) by the Social Security Cooperation as evidence that the employees have received their salaries.

#### **2.5. Release of Retentions:**

- **Twenty per cent (20%) of the Materials Supply (DAP value)** shipped from both abroad and from within the Employer country against the following:
  1. **Material Receiving Report** issued and signed by the Employer as evidence that the material and/or equipment have been received at site or Employer warehouse in satisfactory conditions.
  2. **Interim payment certificate** issued and signed by the Employer.
  3. **Contractor's application** (payment request) in the correct value.

- **Ten per cent (10%) of the Total Contract Value** to be paid upon issuance of taking over certificate and submitting of the following:
  1. **Interim payment certificate** issued and signed by the Employer.
  2. **Contractor's application** (payment request) in the correct value.
- **Five (5%) per cent of the Total Contract Value** will be paid against the following:
  1. **Interim payment certificate** issued and signed by the Employer upon receiving the following supporting documents from 2 to 3:
  2. **Contractor's application** (payment request) in the correct value.
  3. **Finalising Pending Items Report** approved by Employer of the respective Section of the works.
- **Last Five (5%) per cent of the Total Contract Value** will be paid against receipt of contractor's application for performance certificate payment (invoice) supplemented with the following documents:
  1. **Interim payment certificate** issued and signed by the Engineer upon receiving the following supporting documents from 2 to 9:
  2. **Contractor's application** (payment request) in the correct value.
  3. **Performance Certificate** issued by Employer for the respective section of the work.
  4. **Release Certificate** from Social Security Corporation.
  5. **Release Certificate** from Tax authorities.
  6. **Release of lien**, The Contractor and all Subcontractors performing work at the Site must sign the release of liens.
  7. **Release Certificate** from customs department.
  8. **Release Certificate** from the ministry of labour.
  9. **Release Certificate** from the ministry of labour regarding foreign subcontractors, if any.
  10. **Release Certificate from Jordanian Construction Contractors Association.**
  11. **Release Certificate from Jordanian Engineers association.**



The above Terms of Payment shall be applied to any variation orders issued by the Employer.

## **OTHER CONDITIONS**

1. Any expenses associated with the payment in foreign currency shall be borne by the Employer in Jordan and by the Contractor outside Jordan.
2. Any expenses associated with the payment in local currency shall be borne by the Employer for his bank and by the Contractor for his bank.

## **PAYMENT PROCEDURES**

The procedures to be followed in applying for certification and making payments shall be as mentioned in the Particular Condition of Contract (PCC), Sub-Clause 14.4.

## VOLUME II.iii

### PROHIBITED PAYMENTS

The Contractor is herein notified that he or his agents are not entitled to give any prohibited payments in any manner or any time to any of the Employer's personnel, and if so, they shall declare these payments officially.

Meanwhile the contractor will submit evidences of all the payments regarding this contract, released by him to his agents ... etc.

#### **Other Payments**

1. Contractor has fully disclosed in the declaration for other payments attached to this contract and all direct or indirect commissions, consulting fees, agent fees, tenders fees or other payments, or inducements or the giving of anything of value (collectively, "third payments") to third parties other than any Government person (a "third party"), including without limitation a detailed description of the basis therefore, made or to be made, directly or indirectly, by or on behalf of contractor, its subcontractors and its or their employees, agents or representatives, in connection with the solicitation, bidding, negotiation, award or performance of this contract; and hereby covenants and agrees promptly to disclose to the first party (The Employer) in writing the existence of any Third party payments including without limitation, a detailed description of the basis therefore. Upon the earliest to occur of contractor making or being obligated to make, any such Third-party payment.
  
2. In the event of any violation or breach of the provisions of paragraph 1 of this Clause, the first party (The Employer) at its sole option and discretion shall take all or any of the following actions:
  - a) terminate the contract and / or
  - b) deduct from all or any payments due to contractor under this contract an amount equal to two times the amount of any Third-party payments and / or
  - c) demand that contractor pay forthwith to the first party (The Employer), which demand that contractor hereby irrevocably agrees to honor, an amount equal to two times the amount of any Third party payments, it being the intention, subject to paragraph D below, that the aggregate of all amounts to which the first party (The Employer), is entitled under paragraph B shall not exceed the amount which is two times the amount of all Third party payments.

3. Contractor agrees that provisions substantially similar (but in no event less restrictive) to paragraph 1 and 2 above shall be incorporated by contractor in all agreements with contractor, sub-contractor, Suppliers or contractor arising out of or relating to this contract, and shall also expressly provide that same may, at the first party (The Employer), sole discretion, be enforced directly by the first party (The Employer), contractor further agrees promptly to supply to the first party (The Employer), true and complete copies of such agreements together with evidence of their inclusion in such agreements, forthwith upon the entering into by contractor of such agreements,
4. Nothing in this Section shall expressly or impliedly make lawful or permissible any Third-party payments that are otherwise prohibited under applicable law or regulations. The rights and remedies of the first party (The Employer), under this Clause are in addition to and not in derogation of any other rights the first party (The Employer), may have under applicable law or regulations.
5. This Clause shall survive the termination of this contract.

### **Prohibited Payments**

1. The contractor hereby presents and warrants to the first party (The Employer), in the attached declaration for prohibited payments that no direct or indirect commissions, consulting fees, Contracts fees of other payments, and no inducements or the giving of anything of value, have been made or promised to be made, directly or indirectly, by or on behalf of the contractor, its Sub-contractors and its or their employees, agents or representatives, to the first party (The Employer), (collectively, “prohibited payments”), including without limitation any official employee, agent or representative (whether or not acting in an official capacity) of the first party (The Employer), (A Government person”), in connection with the solicitation, bidding negotiation, award or performance of this contract; and hereby covenants and agrees that no prohibited payment shall be made or promised to be made, directly or indirectly, by or on behalf of contractor, its Sub- contractors and its or their employees, agents or representatives, to any Government person in connection with the amendment, modification, renewal, extension or performance of this contract.

2. In the event of any violation or breach of the provisions of paragraph 1 of



this Clause, the first party (The Employer), at its sole option and discretion shall take all or any of the following actions

- a) terminate the contract, and / or
- b) deduct from all or any payments due to contractor under this contract an amount equal to two times the amount of any prohibited payment: and / or
- c) demand that contractor pay forthwith to the first party (The Employer), which demand contractor hereby irrevocably agrees to honor, an amount equal to two times the of any prohibited payment, it being the intention, subject to paragraph D below, that the aggregate of all amounts to which

the first party (The Employer), is entitled under paragraph B shall not exceed the amount which is two times the amount of all prohibited payments.

3. Contractor agrees that provisions substantially similar (but in no event less restrictive) to paragraphs 1 and 2 above shall be incorporated by contractor in all agreements with contractor's Sub- Contractors, suppliers or contractors arising out of or relating to this contract, and which provisions shall also expressly provide that the same may, at the first party's (the Employer's) sole discretion be enforced directly by the first party (The Employer), contractor further agrees promptly to supply to the first party (The Employer), true and complete copies of such agreements together with evidence of their inclusion in such agreements, forthwith upon the entering into by contractor such agreements.
4. The rights and remedies of the first party (The Employer), under this Clause are in addition to and not in derogation of any other rights the first party (The Employer) may have under applicable law or regulations.
5. This Clause shall survive the termination of this contract.



## **VOLUME II.iii**

### **Insurance Requirements**

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## **1. GENERAL REQUIREMENTS**

The Contractor shall comprehensively insure all the works, Plant, Materials, Contractor's documents, the costs of demolition, removal of debris and professional fees and profit.

The Contractor shall effect and maintain all the insurances required by him with an insurer and in terms approved by the Employer, and for the duration of the Contractor's obligations under this Contract. In each insurance the Contractor shall be named jointly with the Employer, in addition to himself, as the insured. The Contractor shall be responsible to see that all of his Subcontractors are named as insured parties in the Contractor's.

The Contractor shall within the respective periods stated in the Appendix to Tender (calculated from the Commencement Date), submit to the Employer:

- evidence that the insurances required by him have been effected,
- copies of the policies, and
- for each insurance, evidence of paying the premium.

The Policies shall contain a provision that coverage will not be cancelled or materially changed without Forty-Five (45) days written notice to the Employer. The Employer shall have the full right of negotiating coverage with the insurance company and shall be entitled for requesting any extension of the insurance policy to cover the execution of the work. Any agreement reached between the Employer and the insurance company shall be considered as binding to the Contractor.

Prior to moving his equipment onto the site or beginning any operations at the site, the Contractor shall have provided to the Engineer at the site copies of the approved certificates.

The Contractor's insurance for Transport, Erection, and the Defects liability period shall be placed with a licensed insurance company in Jordan.

The Contractor and his Subcontractors shall deal only with local Insurance companies and their affiliates and subsidiaries in insuring equipment/material, plant, personal property and personnel.

## **2. TRANSPORT "ALL RISKS" INSURANCE**

All equipment and material during transportation from places of manufacture up to the relevant places of destination for the installation as well as intermediate storage shall be covered by insurance against risks, according to institute Cargo Clauses (All risks) including war risk, fire, flood, loss in transit, riots, strikes, civil commotion, theft, pilferage, vandalism. Loss and/or damage caused by sea, fresh water and rainwater, condensation, hooks, mud, oil, fire, ordinary breakage, bending, denting, twisting, and rusting howsoever caused.

The coverage shall be made for one hundred and twenty percent (120%) of the DAP part of the Contract value of the equipment and material to be supplied.

The insurance shall cover all risks from the factory to the site (warehouse to warehouse). All insurance policies for individual consignment shall be valid for ninety (90) days after the delivery of material by the Contractor at the site thus enabling a thorough check for loss and damage.

All formalities in connection with the processing of insurance claims shall be solely the responsibility of the Contractor. The Contractor shall collect payments for replacements for damage/lost material or equipment from the insurance company.

Order for replacement for material and equipment reported to be lost or damaged shall be processed on a priority basis without awaiting settlement of insurance claims.

All monies received under any such policy shall be applied towards the replacement or repair of the works lost, damaged or destroyed but this provision shall not affect the Contractors liabilities under the Contract.

## **3. ERECTION "ALL RISKS" INSURANCE**

The insurance shall cover:

- All supplies and services under the Contract to one hundred and twenty percent (120%) of the full Contract value from delivery of materials and equipment to the site for the whole of the works and during defects liability period until releasing the Contractor of any obligations.
- The existing property at the site, which belong to the Employer or held in care, custody, or control by him, the coverage shall be for its replacement value according to the Employer estimation.

The coverage of this insurance shall be against all risks, with deductible limits not exceeding those stated in the Appendix. The insurance shall be established through an Employer approved insurance company licensed in Jordan in the joint names of the Employer, the Contractor and Subcontractors and shall be payable

in a free convertible currency. The insurance coverage between the "transport" and the "erection" all risks insurances shall be without any interruption. All monies received under any such insurance shall be applied in or towards the replacement and repair of the work destroyed or damaged. The Employer/ Engineer shall decide the method of execution of repairs. The validity of these policies shall be up to the releasing the Contractor from any obligations.

#### **4. THIRD PARTY, PUBLIC LIABILITY AND PROPERTY DAMAGE INSURANCE**

The Contractor shall, in the joint names of the Contractor, the Employer and Subcontractors insure through an Employer approved insurance company licensed in Jordan against all damage or injury occurring during execution of the Contract to any person or any property (other than property forming part of the Works including the existing property of the Employer referring to in Sub- Clause 18.3/b) due to or arising out of the execution of the work. Such insurance shall be effected in terms approved by the Employer (which approval shall not be unreasonably withheld) and for at least the amount of 1,500,000.00 (One million five hundred thousand) Jordanian Dinars per single claim and in aggregate.

The Employer shall have the right at any time to require insurance coverage limits greater than that specified above. In such event, an additional premium payable solely as a result of such increase in insurance will be added to the Contract Price.

#### **5. ACCIDENT OR INJURY TO WORKMEN**

The Employer will not be liable for any damages or compensation payable at law in respect or in consequence of any accident or injury to any workman or other person in the employment of the Contractor or any Subcontractor and the Contractor shall indemnify any hold harmless the Employer against all claims, demands, proceedings, costs, charges and expenses whatsoever in relation thereto.

##### **Insurance Against Accident etc. to Workmen**

Before commencing the execution of the Works on the site, the Contractor shall insure against his responsibilities towards his employees with an insurance company licensed in Jordan and approved by the Employer and shall continue such insurance for the entire time that any persons are employed by him or his Subcontractors on the Work, and shall, when required, provide the Engineer with such policies of insurance and the receipt for payment of the current premiums.

The Contractor shall present to the Employer satisfactory evidence that he has complied with the statutory obligations for workmen's compensation under the labor and social security laws of Jordan.

The contractor shall maintain insurance against any loss or damage arising during the Defects Liability Period to insure the Contractor's liability for making good any loss or damage to the work while the Contractor is on site.

## **6. CONTRACTOR'S EQUIPMENT**

The Contractor shall insure the Contractor's equipment for its full replacement value whilst in transit to the site, from the commencement of loading until completion of unloading at the site, while on the site and until unloading at its return destination against all loss or damage caused by any of the Contractor's Risk".

## **7. REMEDY ON THE CONTRACTOR'S FAILURE TO INSURE**

If the Contractor fails to effect and keep in force the insurance required thereof or any other insurance which may be required to be effected under the terms of the Contract, then the Employer without any obligations to the Contractor, may effect and keep in force any such insurance at the Contractor's expense and pay such premium or premiums as may be necessary for that purpose and from time to time deduct the amount so paid by the Employer, plus an additional ten per cent (10%) to cover administrative costs, from any monies which are due or may become due to the Contractor, or recover the same as a debt due from the performance security without notarial warning or judicial proceedings.

## **8. INSURANCES TO BE TAKEN OUT BY THE CONTRACTOR**

In accordance with the provisions of GCC Clause 18, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, such approval not to be unreasonably withheld.

### **a) Cargo Insurance**

Covering loss or damage occurring while in transit from the supplier's or manufacturer's works or stores until arrival at the Site, to the Facilities (including spare parts therefore) and to the construction equipment to be provided by the Contractor or its Subcontractors.

Amount: 110% of the Contract price for the Plant and Equipment shipped  
Deductible limits: 1% of the value of shipment

Parties insured: Contractor plus Employer as co-insured

From: Contractor's or Subcontractor's works

To: Arrival at the Site

**b) Installation All Risks Insurance**

This insurance shall be all Risks Insurance covering physical loss of or damage to the Works, Plant, Materials and Contractor's documents for which the Contractor and/or the Subcontractors (if any) are liable, occurring from the Commencement Date to the issue of the Taking-Over Certificate and for the loss or damage caused by the Contractor and/or Subcontractors in the course of any other operations (including Defects liability Period) with an extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring until the date of issue of the Performance Certificate.

Amount: The insuring party shall insure the Works, Plant, Materials and Contractor's Documents for not less than 110 % of the Contract amount.

Deductible limits: No more than 1% of the Contract Amount

Parties insured: Contractor, Subcontractor plus Employer as co-insured for each event

From: Commencement Date

To: End of Defect Liability Period

**c) Third Party Liability Insurance**

Covering bodily injury or death suffered by third parties (including the Employer's personnel) and loss of or damage to property occurring in connection with the supply and installation of the Facilities.

Amount: 1,500,000 JOD E.E.L and in aggregate per each event  
Deductible limits: 1% max. from the insurance amount.

Parties insured: Contractor plus Subcontractor as co-insured

From: Commencement Date

To: Issue of Performance Certificate

**d) Automobile Liability Insurance**

Covering use of all vehicles used by the Contractor or its Subcontractors (whether or not owned by them) in connection with the supply and installation of the Facilities. Comprehensive insurance in accordance with statutory requirements.

**e) Workers' Compensation**

In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

**f) Employer's Liability**

In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

**g) Other Insurances:**

The Contractor is also required to take out and maintain at its own cost the following insurances:

**I. Details: Debris Removal**

Amount: USD 500,000

Deductible limits: USD 2,000

Parties insured: Contractor, Subcontractor(s) plus Employer as co-insured for each event from: Commencement Date To: Issue of Performance Certificate

**II. Details: Existing Property**

Amount: USD 250,000

Deductible limits: USD 1,000

Parties insured: Contractor, Subcontractor(s) plus Employer as co-insured for each event from: Commencement Date To: Issue of Performance Certificate

The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Clause 18, except for the Third-Party Liability, Workers' Compensation and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Clause 18, except for the Cargo, Workers' Compensation and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insured for losses or claims arising out of the performance of the Contract shall be waived under such policies.

The Employer shall at its expense take out and maintain in effect during the performance of the Contract the following insurances:

**9. INSURANCES TO BE TAKEN OUT BY THE EMPLOYER**

Not Applicable.



## **VOLUME II.iii**

### **Time Schedule**

#### **1. EXECUTION PROGRAMME**

The Bidder shall prepare his detailed Execution Programme in accordance with the Conditions of Contract. The Bidder may propose a shorter time for completion based on a detailed Execution (Time) Programme, which then shall become part of the Contract.

The Tenderer's Execution Programme shall clearly show all major and important activities and milestones related to the project implementation, such as but not limited to site mobilization, surveys, investigation, design, review and approval period, manufacture, factory testing, delivery, civil work, erection and commissioning. Prevailing weather conditions and mountains regions at the site shall also be taken into account.

Initially for tender purposes, the various time periods, programme, histogram, S-curve, etc. shall be indicated in terms of weeks from the Commandment Date.

#### **1.1. Definition of the Section**

For definition of the Section, please refer to the Particular Conditions of the Contract, Clause 1.1.5.6.

Generally, Time for Completion for each Section is specified based on the requirement for completion of the respective part of the Works.

The Bidder shall note that contractual certificates (like Taking Over Certificate, Performance Certificate) shall be applied and issued per Section.

#### **1.2. Sequence of the Project Certificates**

The Bidder shall consider the following sequence of the project certificates in order to prepare the Execution Programme.

<b>Certificate</b>	<b>Event</b>	<b>Applicable</b>
Commencement Date	As per Sub-Clause 8.1 of PCC	Per Contract
Taking Over Certificate (TOC)	Actual Completion Date	per Section
Performance Certificate (PC)	After Defects Notification Period	per Section
Delay Damages	- 0.5% of Section Value per week of Delay - maximum 10% of Section Value	Per Section



### **1.3. Execution Programme**

The Execution Programme shall be in the form of a bar chart showing the sequence and duration of major activities. The Execution Programme shall show the phasing of all the work defined in VOLUME III - Scope of Works and Technical Requirements and shall be prepared based on the following:

**1.3.1. Commencement Date: 10 Days from the date of the Letter of Acceptance**

**1.3.3. Time for Completion As per Table No. 1 below**

### **1.4. Progress S-Curve**

The planned progress S-curve related to the Execution Programme shall include the planned percentage progress to be achieved during each week of the Contract.

### **1.5. Method Statement**

The Bidder shall provide a detailed method statement of executing the work in accordance with the Execution Programme. The Method Statement shall comprise at least the following:

- 1.5.1. Description of the methodology intended to be applied in case of Award. The description shall include the scope of the maximum number of LOTs the Tender proposed to be able to carry out.
- 1.5.2. Bar charts, level 1 and level 2, indicating the proposed timing. Bar charts shall be provided for each Section.
- 1.5.3. S-Curve, for each Section, based on the bar chart.
- 1.5.4. Man-power histogram.
- 1.5.5. Any other material to demonstrate Tenderer's ability to carry out selected scope.

**Table No. 1 – Time for Completion**

Section of Work	Time of Completion (Months) from the commencement date
<ul style="list-style-type: none"> <li><b>1.1: New 0.5 km double circuit 400 kV OHTLs (Bundle Conductors), to connect AAWDCP Main S/S with the existing Aqaba - Ma'an 400kv OHTL.</b></li> </ul>	<p><b>12 Months</b> <b>(Excluding trial operation of 4-weeks)</b></p>
<ul style="list-style-type: none"> <li><b>1.2: New 12 km double circuit 132 kV OHTLs (Single Conductor) to connect AAWDCP Main S/S with BPS2.</b></li> </ul>	<p><b>16 Months</b> <b>(Excluding trial operation of 4-weeks)</b></p>
<ul style="list-style-type: none"> <li><b>1.3: New 66 km double circuit 132 kV OHTLs (Bundle Conductor) to connect AAWDCP Main S/S with Quiera PV S/S passing by BPS3 S/S.</b></li> </ul>	<p><b>24 Months</b> <b>(Excluding trial operation of 4-weeks)</b></p>
<ul style="list-style-type: none"> <li><b>1.4: New 20 km double circuit 132 kV OHTLs (Bundle Conductor) to connect BPS4 S/S with existed Bayader – Queen Alia OHTL ( 2in/2out).</b></li> </ul>	<p><b>20 Months</b> <b>(Excluding trial operation of 4-weeks)</b></p>

## **VOLUME II.iii**

### **List of Subcontractors and Suppliers/Manufacturers**

#### **Part 1 Nominated Subcontractors and Suppliers/Manufacturers**

No subcontractors/manufacturers are nominated by the Employer.

#### **Part 2 Approved Subcontractors and Suppliers/Manufacturers**

The following subcontractors are approved for carrying out the item of the Facilities indicated. Where more than one subcontractor and suppliers/manufacturers is listed, the Contractor is free to choose between them, but it must notify the Employer of its choice in good time prior to appointing any selected subcontractor and suppliers/manufacturers. In accordance with GCC Sub-Clause 4.4, the Contractor is free to submit proposals for subcontractors and suppliers/manufacturers for additional items from time to time. No subcontracts shall be placed with any such subcontractors for additional items until they have been approved in writing by the Employer and their names have been added to this list of approved subcontractors.

Item of Facilities	Approved Subcontractors/Suppliers	Nationality
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## **VOLUME II.iii**

### **Scope of Works and Supply by the Employer**

The following personnel, facilities, works and supplies will be provided /supplied by the Employer, and the provisions of GC Clauses 6,7 shall apply as appropriate.

#### **- None**

All personnel, facilities, works and supplies mentioned above will be provided by the Employer in good time so as not to delay the performance of the Contractor, in accordance with the approved Time Schedule and Programme of Performance pursuant to GC Sub-Clause 8.3 (Programme).

Unless otherwise indicated, all personnel, facilities, works and supplies will be provided free of charge to the Contractor.



## **VOLUME II.iii**

### **List of Documents for Approval or Review**

Pursuant to GC Sub-Clause 5, the Contractor shall prepare, or cause its Subcontractor to prepare, and present to the Project Manager in accordance with the requirements of GC Sub-Clause 8.3 (Programme ), the following documents for

#### **A. Approval**

- 1.
- 2.
- 3.

#### **B. Review**

- 1.
- 2.
- 3.

## **VOLUME II. iv**

### **PRICE SCHEDULES (preamble)**

#### **General**

1. The price schedules are divided into separate schedules as follows:

Schedule No. I: Plant, and Mandatory Spare Parts Supplied from Abroad.

Schedule No. II: Plant, and Mandatory Spare Parts Supplied from Within the Employer's Country.

Schedule No. III: Design Services.

Schedule No. IV: Training and Other Services.

Schedule No. V: Hiring of Local Employment.

Schedule No. VI: Recommended Spare parts.

Schedule No. VII: Day Rates.

Schedule No. VIII: Grand Summary.

2. The Schedules may not give a full description of the Plant and Equipment to be supplied and the services to be performed under each item. However, Bidders shall be deemed to have read the Employer's Requirements and other sections of the tender documents and to have 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 include for the full scope as aforesaid, including overheads and profit.
3. If Bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with the Instructions to Bidders in the tender documents prior to submitting their tender.

#### **Pricing**

4. Prices shall be entered in indelible ink, and any alterations necessary due to errors etc. shall be initialed by the Bidder. As specified in the Tender Data, unit prices shall be fixed and firm for the duration of the Contract.

The project will be executed on an (EPC basis covering the complete scope of the works), All Unit prices quoted are fixed and firm prices.

Any quantities which may be set out in a Schedule or in the description of the scope of supply are estimated quantities and are not to be taken as the actual and correct quantities of the Works which the Contractor is required to execute on an (EPC basis covering the complete scope of the works) to fulfill the purpose of the Works. Exceptions, which will be paid "**at actual**" (based on unit rates as per Price Schedules) based on the quoted unit prices, are as follows:

Tower foundations  
Towers (per type and body extension)  
Leg extensions  
Tower earthing  
Permanent access roads  
Conductors  
Insulators  
OPGW

5. Tender prices shall be quoted in the manner indicated and, in the currencies, specified in the Instructions to Bidders (ITB) in the tender documents.

For each item Bidders shall complete each appropriate column in the respective Schedules, giving the price breakdown as indicated in the Schedules.

Prices given in the Schedules for each item shall be for the scope covered by that item as detailed in the Technical Specifications, Drawings or elsewhere in the tender documents.

6. Where there are discrepancies between the total of the amounts in the column for the price breakdown and the amount in the column for the total price, the former shall prevail and the latter will be corrected accordingly.

Where there are discrepancies between the total of the amounts of Schedules I to V and the amount given in Schedule VIII (Grand Summary), the former shall prevail and the latter will be corrected accordingly.

Where there are discrepancies between amounts stated in figures and amounts stated in words, the amounts stated in words shall prevail.

7. Recommended spare parts shall be quoted separately (Schedule VI) as specified in either subparagraph (a) or (b) above in accordance with the origin of the spare parts.

8. Payments will be made to the Contractor in the currency or currencies indicated under each respective item.

9. Items left blank will be deemed to have been included in prices for other items. The total for each schedule and the total of the Grand Summary shall be deemed to be the total price for executing the Facilities and sections thereof in complete accordance with the Contract, whether or not each individual item has been priced.

10. When requested by the Employer for the purposes of making payments or part payments, calculating 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.

### **Handling of Price Schedules**

In the Schedules, bidders shall give the required details and a breakdown of their prices as follows:

#### **Price Schedules No. 1: Plant, and Mandatory Spare Parts Supplied from Abroad**

The price of the plant shall be quoted on DAP-named place of destination basis as specified in the Tender Documents.

#### **Price Schedules No. 2: Plant, and Mandatory Spare Parts Supplied from within the Employer's Country**

(a) Plant to be supplied from abroad (Schedule No. 1):

The price of the plant shall be quoted on DAP-named place of destination basis as specified in the Tender Documents.

(b) Plant manufactured within the Employer's country (Schedule No. 2):

- (i) The price of the plant shall be quoted on an EXW Incoterm basis (such as ex-works," "ex-factory," "ex- warehouse" or "off-the-shelf," as applicable),
- (ii) Sales tax and all other taxes payable in the Employer's country on the plant if the contract is awarded to the Bidder, and
- (iii) The total price for the item.

#### **Price Schedules No. 3: Design Services.**

#### **Price Schedules No. 4: Training and Other Services.**

Training Services shall be quoted separately (Schedule No. 4) and shall include rates or prices for local transportation to named place of final destination as **specified in the Tender Documents**, insurance and other services incidental to delivery of the plant, all labor, contractor's equipment, temporary works, materials, consumables and all matters and things of whatsoever nature, including operations and maintenance services, the provision of operations and maintenance manuals, training, etc., where identified in the Bidding Document, as necessary for the proper execution of the installation and other services, including all taxes, duties, levies and charges payable in the Employer's country as of twenty-eight



## **VOLUME II.v**

### **PERFORMANCE SECURITY**

#### ***SECURITY NO.***

***M/S., NATIONAL ELECTRIC POWER COMPANY (NEPCO)  
Amman – Jordan***

(Contract No. ) :

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

In this connection we.... (**local bank**) hereby consider ourselves responsible for the unconditional payment to you or your authorized representatives of the above sum on your first written demand in whole or in part notwithstanding any objections on the part of the above named contractor and without any need for notarial warning or judicial proceedings.

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

**Bank (Local Bank)**



## **VOLUME II.Vi** **ADVANCE PAYMENT SECURITY**

### ***SECURITY NO.***

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

***Amman – Jordan***

(Contract No. ):

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

In this connection we ... (**Local bank**) hereby consider ourselves responsible for the unconditional payment to you or your authorized representatives of the above sum on your first Written demand in whole or in part notwithstanding any objections on the part of the above named contractor and without any need for notarial warning or judicial proceedings.

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

**Bank (Local Bank)**



## VOLUME II.Vii

### **DEFECT LIABILITY SECURITY**

#### ***SECURITY NO.***

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

***Amman – Jordan***

(Contract No. ):

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

In this connection we ... (**Local bank**) hereby consider ourselves responsible for the unconditional payment to you or your authorized representatives of the above sum on your first Written demand in whole or in part notwithstanding any objections on the part of the above-named contractor and without any need for notarial warning or judicial proceedings.

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

Bank (Local Bank)



Volume III

**SCOPE OF WORK**  
**AND**  
**TECHNICAL SPECIFICATION**



**NATIONAL ELECTRIC POWER COMPANY (NEPCO)**  
**TENDER NO.2/2026**  
**Terms of Reference**

**SCOPE OF WORK**  
**AND**  
**TECHNICAL SPECIFICATION**

**INTRODUCTION**

**1.1 General**

The contract scope includes design, engineering, manufacturing, testing in the factory, packing, insurance (DAP) supply to Aqaba Docks as well as transport all materials including Conductors, OPGW Earthwire, Insulators and all fittings from the docks of Aqaba to site, and transport of all scrap materials (e.g. Empty Drums, dismantled material ....etc) to the employer store which will be specified by the employer (Amman South, karak store and Zarqa Store), unloading, temporary storage, installation and commissioning, energizing works and services complete in each respect at EPC basis of 132 & 400 kV Overhead Transmission Lines, as detailed and specified in the Employer's Requirements.

The proposed transmission lines go for **NEW OHTLs TO CONNECT:**

**1.1 AAWDCP Main S/S with the existing Aqaba - Ma'an 400kv OHTL.** having length of about (0.5) km.

,

**1.2 AAWDCP Main S/S with BPS2.** having length of about (12) km.

,

**1.3 AAWDCP Main S/S with Qwera PV S/S passing by BPS3 S/S.** having length of about (66) km.

**AND**

**1.4 BPS4 S/S with existed Bayader – Queen Alia OHTL.** having length of about (20) km.



The Project includes the following main infrastructures:

The construction of a new double circuit overhead line to connect:

**1.1: New 0.5 km double circuit 400 kV OHTLs (Bundle Conductors), to connect AAWDCP Main S/S with the existing Aqaba - Ma'an 400kv OHTL.**

,

**1.2: New 12 km double circuit 132 kV OHTLs (Single Conductor) to connect AAWDCP Main S/S with BPS2.**

,

**1.3: New 66 km double circuit 132 kV OHTLs (Bundle Conductor) to connect AAWDCP Main S/S with Qwera PV S/S passing by BPS3 S/S(2in/2out).**

**AND**

**1.4 New 20 km double circuit 132 kV OHTLs (Bundle Conductor) to connect BPS4 S/S with existed Bayader – Queen Alia OHTL ( 2in/2out).**

The above Projects will be implemented through EPC works for new 132 & 400 kV OHTLs Contract, including steelworks, conductors, insulators, clamps, civil works and construction for **NEW KV OHTLs AS DESCRIBED ABOVE.**

This Technical Specification covers the EPC works related to 132 & 400 kV line Contract.

The scope of work detailed here represent the main items of project to be provided and works to be carried out under this Contract, but the Contractor is required to ascertain by themselves whether any additional works are necessary to leave the transmission line complete and in full working order upon completion of the contract in accordance with the Specifications and Tender Drawings.

Implemenataion of the mitigation report result from ESIA study, the ESIA is under progress and is doing by consultant , so the contractor shall applied all the mitigations will be resulted as output of the ESIA study.

Any such additional plant or works, including all extensions and modifications to existing equipment necessary are deemed to be included in the prices quoted in the Schedules. To complete each item of plant and equipment detailed in this Schedule all necessary cabling, cable boxes, earthing works, terminal boards, protective relays, panels for control equipment, supporting steelwork, panel wiring, fuse links, interlocking gear, motors, auxiliary contacts, holding down bolts, screen guards, labels, auxiliary and control cables and all necessary miscellaneous items whether specified in detail or not shall be provided.

The Contractor shall design, execute and complete the Works in accordance with the Contract, and shall remedy any defects in the Works. When completed, the Works shall be fit for the purposes for which the Works are intended as defined in the Contract.

The Contractor shall provide the Plant and Contractor's Documents specified in the Contract, and all Contractor's Personnel, Goods, consumables and other things and services, whether of a temporary or permanent nature, required in and for this design, execution, completion and remedying of defects.

The Works shall include any work which is necessary to satisfy the Employer's Requirements, or is implied by the Contract, and all works which (although not mentioned in the Contract) are necessary for stability or for the completion, or safe and proper operation, of the Works.

## 1.2 Project description

### 1.2.1 New 400 kV line

The following New 400 kV OHTLs:

**New 0.5 km double circuit 400 kV OHTLs (Bundle Conductors), to connect AAWDCP Main S/S with the existing Aqaba - Ma'an 400kv OHTL.** Which is double circuit, three phases with bundle conductor, ACSR/ACS type, two OPGW shieldwires.

New 400 kV overhead transmission line has the following main characteristics: double circuit, three phases with bundle conductor/Phase, ACSR/ACS type, two OPGW shieldwires.

- ✓ **An additional cross arms might be used at both terminal towers in order to achieve clearances, and shall be responsible of the contractor to manufacture the said crossarms .**
- ✓ **Designs and drawings for Towers and Foundations to be used shall be provided by the employer to the awarded contractor.**
- ✓ **Contractor has to design foundation for hard rock soil type based to be compliance with tower design**

The main System Data are indicated in Data Schedule.

The Contractor shall perform on EPC basis the design, engineering, material procurement, quality management, fabrication, factory inspection and testing, transport and delivery of all material to work-site, installation, construction, site inspection, testing and commissioning, and perform all associated works and services until final handing over of line work in a satisfactory condition to the Employer, as specified in the Scope of Work and Technical Specification.

The Works are being tendered on an EPC/ with fixed unit rates. The Contractor is advised to carefully comprehend his contractual obligations under the provisions of the contract and fully understand the proposed Scope of Works. The provided Price Sheet and schedules in the Tender Documents are for guidance only; and it is the CONTRACTOR'S responsibility to check the correctness of the quantities inserted against each item in the quantities' column of the Bill of Quantities/Price Sheet, in addition to completeness and comprehension of the items. Missed items or incorrectly inserted quantities shall be the sole responsibility of the CONTRACTOR.

### **1.2.2 New 132 kV line**

The following New 132 kV OHTLs:

- **New 12 km double circuit 132 kV OHTLs to connect AAWDCP Main S/S with BPS2** which is double circuit, three phases with **single** conductor per phase, AAAC yew type, one OPGW shield wires.
- ✓ **All Designs and drawings for Towers and Foundations to be used shall be provided by the employer to the awarded contractor .**

- **New 66 km double circuit 132 kV OHTLs (Bundle Conductor) to connect AAWDCP Main S/S with Qwera PV S/S passing by BPS3 S/S.** which is double circuit, three phases with **bundle** conductor per phase, AAAC yew type, one OPGW shield wires.
  - ✓ **All Designs and drawings for Towers and available Foundations (normal & soft rock) to be used shall be provided by the employer to the awarded contractor**
  - ✓ **Contractor has to design foundation of poor soil type and hard rock type to complied with tower design .**
  
- **New 20 km double circuit 132 kV OHTLs (Bundle Conductor) to connect BPS4 S/S with existed Bayader – Queen Alia OHTL ( 2in/2out).** which is double circuit, three phases with **bundle** conductor per phase, AAAC yew type, one OPGW shield wires, **including tower dismantling if required.**
  - ✓ **All Designs and drawings for Towers and available Foundations (normal & soft rock) to be used shall be provided by the employer to the awarded contractor.**
  - ✓ **Contractor has to design foundation of poor soil type and hard rock type to complied with tower design.**

The main System Data are indicated in Data Schedule.

The Contractor shall perform on EPC basis the design, engineering, material procurement, quality management, fabrication, factory inspection and testing, transport and delivery of all material to work-site, installation, construction, site inspection, testing and commissioning, and perform all associated works and services until final handing over of line work in a satisfactory condition to the Employer, as specified in the Scope of Work and Technical Specification.

The implementation phase is expected to be completed **(See Table No. 1 – Time for Completion, VOLUME II.iii Time Schedule, (1) EXECUTION PROGRAMME,**

## Volume II The Contract). after Contract award.

The Works are being tendered on an EPC basis. The Contractor is advised to carefully comprehend his contractual obligations under the provisions of the contract and fully understand the proposed Scope of Works. The provided Price Sheet and schedules in the Tender Documents are for guidance only; and it is the CONTRACTOR'S responsibility to check the correctness of the quantities inserted against each item in the quantities' column of the Bill of Quantities/Price Sheet, in addition to completeness and comprehension of the items. Missed items or incorrectly inserted quantities shall be the sole responsibility of the CONTRACTOR.

### 1.3 Abbreviations

Abbreviation	Full Description
AAAC	All Aluminium Alloy Conductor
ACI	American Concrete Institute
ACSR	Aluminium Conductor Steel Reinforced
ACSR/ACS	Aluminium Conductor Aluminium Clad Steel Reinforced
AGS	Armour Grip Suspension
AISC	American Institute of Steel Construction
ANSI	American National Standard Institute
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
Abbreviation	Full Description
CAD	Computer Aided Design
CEN	European Normalization Committee
CENELEC	European Normalization Committee For Electrotechnical Standardization
DDP	Delivered Duty Paid
DAP	Delivered At Place
EN	European Standard
FAT	Factory Acceptance Test
FIDIC	International Federation of Consulting Engineers

FOC	Fiber Optic Cable
IEC	International Electric Commission
KCMIL	Kilo Circular Mils
LSTK	Lump Sum Turnkey
NEPCO /Employer	National Electric Power Company
NFOC	Non Metallic Fiber Optic Cable
OGW	Conventional Overhead Ground Wire
O/H	Overhead
OHTL	Overhead Transmission Line
OPGW	Optical Ground Wire
P. I.	Point of Intersection
PTS	PROJECT Technical Specification
RIV	Radio Influence Voltage
ROW	Right of Way
S/S	Substation
SWL	Safety Working Load
TK	Turnkey
T/L	Transmission Line
UG	Underground
UTS	Ultimate Tensile Strength

### 1.3 Line route

In Annex 1 the general map showing the preliminary line route for the NEW OHTLs.

The routes lengths mentioned in the Tender Documents is **approximate** and could be changed in accordance with the project needs and Contractor's design; the Contractor shall not be entitled to ask for any claims including additional cost, and/or time extensions against this.

### 1.4 Ambient condition

Minimum and maximum recorded temperatures are -5°C and 45°C for areas, on which the line is routed. Elevations above 700 m are classified "ice area", but, for the purposes of support design, ice loading is to be assumed throughout the whole length of the line. Relative humidity varies between approximately 30% in the afternoon and 140% in the morning over the year.

Annual average rainfall is approximately 40 cm.

The average number of thunderstorm days per year is about 15.

Prevailing wind:

- Summer  
Average daily approximately 5-8 meters/sec.
- Winter  
Average afternoon wind between 10-13 meters/sec.; during morning generally light and variable wind. Gust speeds up to 33.5 meters/sec.

The main data for line design are shown in Data Schedule.

Restricted areas:

The Contractor shall acquaint himself of any restricted areas within the project's site (Military areas, airports...etc.) and shall take into consideration all necessary arrangements to guarantee delivering and completing the Works smoothly and timely, all necessary arrangements including access to any location within the site is the Contractor's sole responsibility.

The Contractor needs to get access permissions from related Authorities where needed, any delay in the obtaining any permissions shall be the Contractor's full responsibility, this shall be considered in the Contractor's construction methodology and execution plan.

## SCOPE OF WORK

- The following activities are included in this Scope of Work:

a) **Construction stage**

- Mobilization
- Installation of site offices for Contractor construction activities and Employer representatives
- Final line route definition
- Detailed survey
- Plan & Profile and tower spotting
- Structure staking and diagonal sections relief
- Construction of access roads, maintenance roads and tower pads
- Local soil-investigation and foundation type selection
- Resistivity measurements at tower location
- Final staking chart, complete of all line components
- Design and manufacture of all line materials, with relevant testing and inspection at Manufacturer's factory, supply, insurance, packing for export shipment, transport to Aqaba docks.

- Transportation and delivery of all materials to the work-site from the docks of Aqaba
- Construction and testing of tower foundations
- Erection of the lattice steel tower
- Installation of insulators and associated hardware
- Installation of conductors and OPGW, including vibration dampers, spacer dampers and accessories
- Installation and connection of joint boxes and associated hardware
- Installation and testing of towers earthing system
- Testing and commissioning
- Demobilization and cleanup
- Supply and deliveries of spare materials
- Transportation of the excess materials (dismantled material, empty drums..etc) back to the employers store (Amman South and Zarqa stores)

**b) Operation stage**

- Maintenance for a period (Defect Notification Period) of 12 calendar months of the complete transmission line.
- Training of the Employer staff

### **Interfaces with Substation Contractor**

The OHTL Contractor shall:

- Define with Substation Contractor, during base design stage of the Project, all data concerning final location and design data of Gantry.
- Connect the OPGW between terminal tower and gantry top; supply and install the OPGW down leads on gantry, to be jointed (by others) to the underground fiber optical cable between gantry and terminal inside the substation.
- Connect the conductors to the gantries and supply and install the OHTL insulators, idler jumper insulators, compression dead-end, T-Tap connectors, sufficient length of jumper conductors and all necessary hardware/fittings, except the termination hardware at substation, which has to be provided by the Substation Contractor.
- Connect the earthing of proposed dead-end tower (last OHTL tower before the gantry) to the grounding grid/ of the Substation.
- Coordinate all work activities regarding line testing and commissioning with the Substation Contractor and the Employer.

## Scheduling

Within the documents to be delivered in the Bid, the Bidder shall include the preliminary project Time Schedule, with clear indication of periods foreseen for design, material construction and completion, in bar-chart form.

The Contractor shall, within one months from the commencement date, provide the Employer with the following documents:

- Overall contract activities schedule
- Drawing list
- Material procurement list and schedule - Sub-supplier list and references.

The Contractor shall provide for all parts of the work to be completed in every respect for commercial operation to the requirements of the Employer; notwithstanding that any details, accessories, etc., required for the complete installation and satisfactory operation of the plant are not specifically mentioned in this Specification, such details are to be considered as included in the Contract Price.

## General requirements

### 3.1 Site services

#### a) Living accommodation

The Contractor is to make his own arrangements with regard to accommodation for his expatriate staff and locally recruited labor during the Contract period.

All dwellings and buildings, existing or erected for the purpose by the Contractor, shall comply with local regulations in regard to construction, water supply and sanitation and other requirements. Temporary construction camps are to be provided with proper sanitation and other necessary facilities. All accommodation shall be removed by the Contractor when no longer required and before the granting of the final Certificate. After the removal of accommodation, the ground shall be left in a clean and tidy condition.

#### b) Office accommodation

The Contractor shall provide such temporary buildings as may be necessary for office accommodation for his site staff during the erection of the Works and the cost of these shall be deemed to be included in the Contract Price.

He shall also provide two separate rooms for the Employer, complete with furnishings, which shall also be included in the Contract Price.

c) Storage Facilities

The Contractor must make his own arrangements for storage areas and camp sites. The Contractor shall, in all cases, obtain the approval of the Employer to the places along the route of the line, where he intends to distribute line materials. In no case will this be outside the authorized area, unless special arrangements are made with the owners of adjacent property, at the Contractor's own expense.

d) Electricity and Water Supply

In view of the area, over which the Contract will be carried out, the Employer will not be able to assist the Contractor in any specific arrangement for provision of the above items. The Contractor must therefore make his own arrangements in this respect.

e) Lifting Facilities

The Contractor shall make his own arrangements regarding lifting facilities required for transport and handling.

f) Medical Facilities

These will not be provided by the Employer and the Contractor will be required to make his own arrangements, where these services may be required for his expatriate or locally engaged staff.

The Contractor must ensure that comprehensive first aid kits are carried by each site gang and in each personal carrying vehicle. Such kits are to be replenished and renewed at frequent intervals. Due to large distance from some parts of the line to towns and villages, where medical assistance may be provided, it is strongly recommended that in summer months snake bite serum be carried by site gangs.

### **3.2 Access to the line**

The final route shall be determined by the Contractor and submitted to the Employer for approval. Access and maintenance roads maps shall also be submitted to the Employer. Access roads interconnect the existing infrastructure to the line and are well surfaced. The Transmission Line route does not necessarily follow surfaced roads and the Contractor must use what access is available and make what additional arrangements he requires for access construction, at his own expense.

The port of entry into Jordan is Aqaba, hence conveyance to site will be by road.

### **3.3 Safety of personnel**

In relation to HSE Contractor is obliged to adhere at all times and situations to Jordanian law and approved HSE procedures. Contractor is obliged to submit for review and approval HSE Manual and Method Statements covering all required Works. Any fines, stoppages due to non-compliances, delays and rectifications required due to

Contractor not following approved procedures or Jordanian law will be at Contractor's cost only.

### **3.4 Statutory regulations**

The works and all plant, equipment and materials forming part of this Contract are to comply in all respects with any relevant Jordanian Statutory Regulations, By-Laws and orders currently in force.

### **3.5 Language**

The English language shall be used in all documents contained in the Bid and in all correspondence between the Contractor and the Employer. Whenever anything is required under the terms of the Contract to be written, marked, printed or engraved, the English language is to be used, except where otherwise provided in this Specification.

### **3.6 Correspondence**

All correspondence on matters arising out of the Contract shall be addressed by the Contractor to the Employer in triplicate.

The Contractor must bear all costs and expenses in delivering correspondence, drawing or samples to the offices of the Employer.

### **3.7 Unit of measurement**

In all correspondence, in all technical schedules and in all drawings, metric units of measurement shall be used. (S.I. System International).

Angular measurement shall be in degrees, with 90 degrees comprising the right angle.

### **3.8 Design and fabrication**

Each of the several parts of the plant shall be of such construction and design as to give long and continuous service with high economy and low maintenance costs.

All workmanship is to be of the highest class throughout and the design dimensions and materials of all parts are to be such that the stresses to which they are subjected shall not render them liable to distortion or damage under the most severe conditions encountered in service. Welding, filling, plugging or cutting of defective parts will not be permitted without the permission in writing of the Employer.

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

The detailed design shall be such as to facilitate inspection, cleaning and repairs and simplicity of operation and maintenance. All apparatus shall be designed to ensure satisfactory operation under the various atmospheric conditions prevailing in the different areas, where the line is to be built and under such variations of load and voltage as may occur under the working conditions of the system. The design of all line supports and fittings shall be such as to minimize the risk of damage in service of any part of the line. The design shall incorporate any reasonable precaution and provision for the safety of those concerned in the maintenance of the Contract works and all associated works supplied and executed under other Contracts.

All corresponding parts shall be made to gauge, shall be interchangeable wherever possible throughout the Contract works and are to be such as will facilitate the fitting of replacement parts.

All tower designs shall incorporate facilities for hot line working equipment. The equipment itself is not required under the terms of this Contract, but the Contractor will show, by means of approved drawings, how particular pieces of the equipment can be used for hot working.

### **3.9 Type tests and Factory Acceptance Tests (FAT)**

The Employer representative has the right to inspect materials and equipment, and witness type test and FAT of plant and equipment included in this Contract. The Employer will witness all type tests. The acceptance test will be either witnessed or waived by written notice of the Employer.

### **3.10 Spare material**

A list of spare material is included in Price Schedule, detailing the spares holdings required by the Employer. The local transport shall be at stores nominated by the Employer. Wherever possible, the material should be handed over to the Employer as soon as it arrives on site and shall be checked at presence of the Employer's representative. The Contractor shall obtain a receipt for material at the time of delivery to the Employer's stores.

Any spare material so ordered is to be strictly interchangeable with the parts, which it is intended to replace, packed or treated in such a manner as to be suitable for storage in the climate at the site for an indefinite period and each part is to be clearly marked for identification purposes, outside the package, where applicable. Spare support material is to be delivered in sets for each individual type of support. The spare material delivery will not be deemed to be complete until packaged material has been opened by the Contractor, the contents checked by a representative, or assembled into units at the Employer's option. In the case of steel tower material, the Employer may require the check erection on the ground of components, to ensure later satisfactory erection when used by the Employer. Schedules of spare materials in triplicate shall be handed over to the Employer, arranged for the easy identifications and checking of material at the handover. Prior to the handing over date for Contract spares, the Contractor shall be responsible for all security arrangements and the safe custody of the spare materials.

### **3.11 Transport to site of offshore material**

The Contractor shall transport all offshore materials necessary for the overhead line at the docks of Aqaba Port, and from Aqaba Port to the site.

The Contractor shall bear all expenses in connection with the port due and transport to site of all plant, materials and equipment needed for the purpose of the Contract including warehouse rent, handling and other charges, which may occur.

The Contractor is to observe any regulations, which limit loads on roads and bridges, over which material may be conveyed.

The handling, loading, transport and storage of any plant supplied shall be entirely at the Contractor's risk.

Nevertheless the Contractor is to arrange for the protection, to the satisfaction of the Employer, of all materials against corrosion, theft and mechanical damage during handling, loading, transport, storage and erection at the Site.

To avoid delays in the removal of material from the docks it is absolutely essential for the Contractor to have an Agent or Representative at the port as and when required. Unloading from the lighter to the Quay is limited to a maximum lift of 10 tons, by means of a mobile crane.

For special heavy loads a "Z" craft is available in the Harbour on to which a heavy trailer can be maneuvered from a special base constructed for this purpose.

Trailers with a loading capacity of up to 40 tons are available in Jordan and therefore the limit of weight, which can be handled, depends entirely on the capacity of the ship's derricks. Transport from the port is normally by road.

### **3.12 Erection and checking at site**

All work at the site is to be carried out in such a manner as not to obstruct the operation of any other Contractor on the Site or the operation of electrical equipment.

The carrying out of all work included in the Contract is to be supervised by a sufficient number of qualified representatives of the Contractor and full facilities and assistance are to be afforded by the Contractor for the Engineer to check the Works.

The Contractor is to obtain from the Employer details of the parts which he wishes to inspect, but such inspection shall in no way exonerate the Contractor from any of his obligations.

The Contractor shall keep the site, on which he erects or stores plant, reasonably clean, removing all waste material resulting from the works as it accumulates and as reasonably directed. On completion of the works the Site shall be left clean and tidy to the satisfaction of the Employer.

Any damage done to buildings, structures and plant or property belonging to the Employer shall be made good at the Contractor's expense.

The Contractor shall be responsible for satisfying himself as to the correctness of the electrical and mechanical connections to all plant supplied under the Contract, before such plant is brought into commission. The maximum safety shall be observed.

Reasonable measures shall be taken to afford adequate protection against materials falling from a higher level on to personnel below.

**3.13 Maintenance**  
The Contractor is to guarantee the efficient and good working of the plant supplied by the Contractor under the Contract for a period of one year from the date on which the Employer takes over the plant.

The Contractor shall also guarantee that the erection methods he employs will not impair the quality of the materials supplied by the Employer. This guarantee shall also be effective for a period of one year from the date on which the Employer takes over the plant.

### **3.14 Contractor's Employees**

The Contractor is to fulfill all his obligations in respect of accommodation, feeding and medical for all personnel in his employ, as necessary to ensure satisfactory execution of the Contract. He is also to comply with the requirements of all relevant Jordanian Statutory Employment Regulations.

The Contractor is to be responsible for the behavior on site of all personnel employed by him.

If, in the opinion of the Employer, any employee of the Contractor or his sub-Contractors who consistently displays unsatisfactory behavior or who refuses

to comply with the reasonable requests of the Employer must be removed from site forthwith.

The Contractor's Engineers must be appropriately qualified and experienced and must speak read and write English proficiently.

Before being allowed to travel to site the curricula vitae of the engineers and senior site staff the Contractor proposes to use at site must be approved by the Employer.

### **3.15 Contractor's responsibilities**

Unless stated specifically to the contrary in the Bid with full supporting explanations, the Contractor will be deemed to have concurred as a practical Manufacturer with the design and layout of the works as being sufficient to ensure reliability and safety in operation, freedom from undue stresses and satisfactory performance in all other essentials as a working plant.

The Contract is to include the whole of the works, which are described or implied by the Contract document. All matters omitted from the Contract document, which may be inferred to be obviously necessary for the efficiency, stability and completion of the works, shall be deemed to be included in the Contract Price.

Works shown on the drawings and not mentioned or described in the Specification and works described in the Specification and not shown on the drawings will nevertheless be held to be included in this Contract and their execution is to be covered by the Contract Price in the same manner as if they had been expressly shown on the drawings and described in the Specification.

The Employer will set out terminal and angle tower positions from which the Contractor on his own responsibility is to duly set out all other works, but under the direction and to the satisfaction of the Employer and according to the drawings supplied or approved by the Employer ,and the Contractor is also to find all labour, stakes ,instruments and other things and do all other things necessary for the use of the Employer for checking such setting out and also for the periodical measurement of works executed and materials supplied.

The Contractor's representative on the Site or his nominated deputy is to be given full responsibility to enter into negotiations regarding points arising out of erection, so that the work may be expedited with as few delays as possible. Unless otherwise specified, the Contractor is to supply the whole of the labour and erection equipment required for the completion of the Works.

No claim whatever will be considered for changes in the process between those shown on the Bid drawings and those finally required for construction purposes.

### **3.16 Planning documents and dates for completion**

The dates of readiness for inspection and testing delivery and completion of the Contract works shall be shown in the Bid Time Schedule and include out the dates by which the Contractor shall require access to the site.

The power given to the Employer to vary any of the work shall include the power to vary from time to time the dates stated in Schedule, for the execution of the works detailed in the Schedules, or part thereof.

Any costs occasioned by such variation shall be certified by the Employer and added to or deducted from the Contract Price as the case may require.

Within one month of acceptance of the Bid, the Contractor shall forward to the Employer four copies of a proposed program, detailing the activities relating to the plant manufacture, delivery and erection for the complete Contract works for comment and approval as regards its logic, detail and time scale. Copies of the approved diagram as required by the Employer, shall be provided by the Contractor.

The program shall indicate the various phases of work for all items of the Contract from the commencement of the Contract to its final completion, i.e. design, ordering of materials, manufacture, delivery, erection and commissioning.

If, at any time during the execution of the Contract, it is found necessary to modify the approved program, the Contractor shall inform the Employer and submit a modified program for approval. Such approval shall not be taken as reason of any amendment of the completion date as stated in the Schedule.

### **3.17 Contractor's plant of equipment**

At the conclusion of the Contract, should it be desired to retain possession of all or any of the Contractor's plant or equipment the Employer shall be at liberty to do so upon paying for the same such price.

## 3.18 Documents

### 3.18.1 General

The required documents for Bid stage and Construction stage are listed in the annexed Schedules. General requirements are indicated in the following paragraphs.

### 3.18.2 Bid stage technical documents

The Bidder shall declare the compliance to the specifications. Any deviation shall be clearly shown with reference to the related specifications clause.

Any additional or alternative offer shall be in separate Bid, in addition to their offers and such offers must meet the intention of the specification as regards factors of safety, quality and the design data set out. The additional offer must be accompanied by a tabulated statement, showing clearly and in order of the relevant clauses, any departure from the specification.

The bidder shall fill up all Technical Date Schedule, Material Data Schedule and Price schedule. Furthermore the bidder shall supply all documents required in the bidder document list.

Notwithstanding any description, drawings or illustrations, which may be submitted with the Bid, all details, other than those shown in the additional offer tabulated statement, will be deemed to be in accordance with the specification and the standard specifications and code referred to therein.

No departures from the specification, excepting those shown in the tabulated statement and approved by the Employer, are to be made without the written approval of the Employer.

Drawings need have leading dimensions. All tower type drawings shall have outlines with provisional dimensions and clearance diagrams for still air and swing of insulators and jumpers called for in this Specification.

The conductor and OPGW tension charts are to show final sags and tensions for a range of equivalent spans between those approximately 50 % higher and lower than the basic spans selected, in still air at maximum temperature, everyday and minimum temperature, and the tension at minimum temperature, under full wind ice loading.

The successful Bidder will be required, at the time of the Contract award, to supply additional copies of such drawings submitted with his Bid, as may be

selected by the Employer. These drawings, together with copies of the drawings originally issued with the Bid documents, will then be bound up either in the Contract document or in a separate folder.

### **3.18.3 Construction stage technical documents**

All drawings shall conform to the following:

- All drawings are to be prepared on the international sizes as described in BS EN ISO 5457. They are to be of 'A' series.  
The use of sheets larger than A0 shall be avoided.
- The Employer title block must be added to all drawings produced for the Contract. The block may be reduced in size, depending on sheet size.  
The Employer drawing number must appear in bottom right hand corner of drawing.  
The drawings must also include the Contractor's title block adjacent to Employer title block as shown.
- Each drawing to have its own individual number. For schedules, a drawing number to be given and then sheet 1 of X sheets.
- All descriptive information must be entered in Employer title block. All drawings must contain Employer drawing numbers as so described and issued by the Employer.
- The title block should contain the following:
  1. Name of subject i.e. 132 kV Overhead Transmission Lines
  2. Nature of drawing i.e. site layout, outline, shop drawing
  3. Dimensions to be in mm or m
  4. Scale i.e. 1:5, 1:1000
  5. Contract No.
  6. Employer drawing numbers allocated by the Employer
  7. Rev. to contain latest revision number
  8. Graphical bar scales where required
  9. Any other information or notes & title.
- Scales shall be in multiples of 1:5, 1:10.
- All information to be stenciled on drawing, block capital letters should be used throughout. No freehand printing on drawing except for revision or Hold cloud.
  1. Revisions must be lettered and indicated in block provided, all revisions to be checked and approved by the Employer.

2. Revisions must be lettered and highlighted by penciling cloud around the part revised previous cloud revisions must be removed so as to avoid confusion.
3. Vague descriptions of revisions such as 'general revisions' or 'revised details' should be avoided, descriptions should be specific.  
No matter how small the revision is it should be recorded.
- Notes, reference drawings and legends should be recorded on drawing.
- In key plans, North arrow shall be shown.

- To allow for the fact that drawings will be increased or reduced, the following stencil and pen size must be used in accordance to:

Main Headings i.e. Plan, elevation, notes, ref., drawings	Stencil mm	Pen mm
Intermediate Headings i.e. Section A-A, detail 5 and within title block	8	0.8
Descriptive Notes/Dimensions Main outlines i.e. Shuttering outlines, L.L.D.S. Mechanical Outlines	5	0.5
Dimension Lines		0.7/0.5
Maximum Sizes	3	0.3
Minimum Sizes	8	0.8

- Example of drawing title blocks and titles should be submitted to the Employer for approval before commencement of drawings.
- On completion of Contract, the final drawings submitted to the Employer are to be marked "as Built", dated and signed. The drawings must be accompanied by a complete drawing schedule, listing all the drawings in the order of the Employer Numbers. The drawing schedule should be in the region of A3 or A4 size.

It is to be understood, however, that approval of any drawing will not exonerate the Contractor from any responsibility in connection with the work.

### 3.18.4 Sub-contracted work

- As soon as possible after the placing of the Contract, the Contractor shall obtain the Employer's approval to the local sub-Contracts he proposes to enter into for the execution of the Contract.

Delay on the part of the Contractor in obtaining such approval will not be accepted as a valid reason for claiming an extension of the Contract period.

- Four copies of all orders for sub-Contracted, materials and equipment (except as detailed below) shall be submitted to the Employer for approval at the time any such order is placed.

Such approval when given in all cases shall be subject to satisfactory operation of the Contract equipment in service, and will in no way relieve or minimize the Contractor's responsibilities or obligations under this Contract.

- Sub-orders shall be endorsed as follows:
  - Name of Purchaser
  - Contract reference number
  - The instruction:  
"Subject to inspection by the Employer".
- Orders or requisitions placed by one works or another work of the same Contractor shall be treated as suborders and subject to the requirements stated above.

### 3.18.5 Progress report and meeting

At monthly intervals after approval of the program chart, the Contractor is to submit to the Employer written detailed Progress reports (in triplicate) of an approved form, indicating the stage reached in the design ,ordering of material ,manufacture, delivery and erection of all components of plant. These reports are to be forwarded promptly so that on receipt by the Employer the information contained therein is not more than seven days out of date. There shall be a meeting between the Contractor and the Employer at the Employer's offices within one month of the date of award of the Contract to the Contractor.

During the progress of the work, the Contractor shall provide a reasonable number of photographs of an approved type at the direction of the Employer. These photographs will be required to supplement the Progress Reports and Records where necessary, also to show any unusual form of construction or foundation work. Up to three prints of photographs so ordered shall be handed over to the Employer without delay.

If during execution of the Contract the Employer considers the progress position of any section of the work to be unsatisfactory, he will be at liberty to call such

meetings, in his Amman Office or at Site, as he deems to be necessary. If required by the Employer, a responsible representative from the Contractor's works is to attend such meetings.

Access to the Contractor's and sub-Contractor's works is to be granted to the Employer at all reasonable times for the purpose of ascertaining progress.

### **3.18.6 Operating and maintenance instructions**

The Contractor shall submit to the Employer for approval fully detailed operating and maintenance instructions.

They are to be as simple and clear as possible, fully illustrated with part number for ordering replacement.

Two copies are required for use by the Employer for review in advance, and 6 copies are to be reproduced as a book or books of approximately A4 size and bound into strong black durable imitation leather covers inscribed with gold letters upon the generally in the form of the title page to this documents except that the reference to specifications, conditions of Contract, Drawings, etc., will be replaced by "Operating and maintenance instructions". The finished books are to be handed to the Employer not later than one month before the Taking Over Certificate is issued.

Details on stringing jointing and sagging shall be delivered in advance to the Employer before starting of the related activities.

### **3.18.7 Training of Employer's personnel**

- Offshore Training of (10) Employer's personnel for (2) weeks shall be quoted. The Bidder shall submit a tentative offshore training program. The training shall be performed in English language and will include all specific matters concerning the project, related to foundation and tower design, insulation coordination, tower spotting and the use of PLS TOWER software and PLS CADD (profiling/tower spotting) software. The Contractor shall provide comprehensive training documents. The Contractor shall provide for each Employer staff, the following:

1. One economy class returns air ticket.
2. Visa expenses, airport taxes and other incidental travel expenses as required.
3. Hotel accommodation including full board.
4. Local transportation.

- Local Training of the Employer's personnel.

During the implementation of the Contract, the Contractor may be required to employ a number of trainees relating to the works, which are being carried out. These trainees will be appointed by the Employer, who

will be responsible for their payment and transportation. The Contractor shall allocate to the trainees any particular job as may be directed by the Employer. If the Contractor is dissatisfied with the behavior of any of the trainees, he will report to the Employer who will take any action he may consider necessary. No extra payment will be given to the Contractor for local training.

### **3.18.8 Standards**

Wherever possible materials used will be to the appropriate Standards of the International Electrotechnical Commission (IEC) or other appropriate internationally recognized Standards best suited to conditions prevailing and Quality Assurance arrangements shall conform to the appropriate sections of EN ISO 9001.

The particular reference Standard for each type of material are indicated in the Data Schedule.

If other Standards are proposed by the Bidder, he will give full particulars of the same with name, number and year of adoption. A copy of each such standard shall be submitted together with its English translation. All discrepancies between such standards and the standards specified shall be clearly indicated by the Bidder. All Standard shall be in last version.

## **DESIGN**

### **4.1 Design data**

Reference is made to Data Schedules. Here below the particular technical requirements for each activity concerning line and line component design.

### **4.2 Wind and ice loads**

The loads are related to wind, ice and temperature given in Data Schedule combined in loading assumptions defined for conductor and OPGW mechanical calculation, and tower and foundation design, as well as all line components.

#### **4.3 Conductor and OPGW sag/tension calculation**

The sag/tension charts are to show final sags and tension for a range of equivalent spans between these approximately 50 % higher and lower than the basic span selected, in the following cases:

- Every day temperature no wind
- Maximum temperature no wind
- Minimum temperature no wind
- Max wind pressure at minimum temperature
- Ice, normal wind pressure at minimum temperature
- Ice, no wind at minimum temperature
- Reduced wind with minimum temperature
- 40°C temperature no wind

The assumed minimum, every-day, and maximum temperatures of conductors are stated in Data Schedule.

The conductors shall be erected with such sags that at everyday temperature in still air the final tensions shall provide a factor of safety on the ultimate tensile strength of the conductor of not less than that stated in Data Schedule.

The term "Final tension" shall mean the tension existing in a line conductor, for any given condition of loading, after sufficient period in service to allow for "bedding down" stretch and creep to take place. For purposes of calculated creep allowances this should be taken as ten years from erection.

For determining sags, the "equivalent span" method is to be used, in which the tension in any section length is that which would apply to a single span equal to the square root of the figure arrived at by dividing the sum of the cubes of the individual span lengths, in the section considered, by their sum.

The calculated tensions at the time of initial erection shall be increased by an approved amount (long term creep) to allow for settling of the conductors. Other means may be adopted, subject to the approval of the Employer.

The OPGW sag in EDS conditions shall be less than 90% of the phase conductor sag.

At the yearly average temperature, with no wind, the final horizontal tension/stress shall not exceed 20% of the calculated breaking load/ stress or of the minimum guaranteed breaking load/ stress indicated by the manufacturer.

#### **4.4 Survey and tower spotting**

##### **4.4.1 Activities and documents**

During the progress of the work, the Contractor shall record on approved documents and maps of approved scale such particulars as will allow an accurate reference to be made afterwards in case of any faults or projected modifications to the line. The maps and/or profile sheets shall show the exact position of every support with approved reference marks so that, in conjunction with the staking charts, the types of structures foundations, insulators, position of tension joints, etc., and number of circuits can be ascertained quickly. The maps shall be supplemented, or profiles marked, by sketches where necessary, to delineate boundary positions of towers which cannot be clearly indicated on the maps. The data included on the maps, profile sketches and line schedules shall be to the approval of the Employer, to whom facilities shall be given for examining such records during the progress of the work.

The line survey shall be performed by qualified and experienced surveyors. Not less than 15 days prior to the commencement of the survey works, the Contractor shall submit qualification records of the proposed personnel, the work program and a list of survey equipment for approval by the Engineer.

The documents above shall be based on survey data, resulting from the sequence of the following activities:

- The Contractor shall submit in two months time from the commencement date the land maps of scale 1:10000 or 1:2500 or as available at the department of lands or the municipalities, with line routes in order to enable the Employer to get the necessary right of way approvals.
- The angle point locations shall be numbered and identified with topographic coordinates in the global positioning system (GPS) or in local network.  
The line route shall take care of environmental conditions, obstacles, construction and maintenance problems, parallelism with existing infrastructures (telecommunication system, pipe lines, rail ways, Transmission lines, underground cable) and of electromagnetic impact in populated area.
- Detailed survey along the line route  
The survey data shall be delivered in digital file for central line profile and two parallel lines at **20 m** distance for **132 kV** & at **45 m** distance for **400 kV** Further data on line corridor shall be given in digital or manual format, concerning obstacles (lines, construction, river, roads, railways, forest, access, swam bay area's etc.) and type of soil (vegetables, forbidden areas etc.).

For crossed transmission lines the locations of tower adjacent to the route central line and all data concerning the crossed span shall be recorded.

- Plan and profile – To be issued in AutoCAD format

The plan and profile shall represent all information in scale 1:2000 (horizontal dimensions), 1:500 (vertical dimensions) issued on profile sheets not exceeding 1000 mm in length.

On continuation sheet a minimum margin of 50 mm shall be allowed. At the bottom a route maps showing all details shall be drawn, within a distance of 30 m on each side of the route center-line. Adjacent towers of crossed line and other data shall be shown.

The profiles of central axis and two parallel lines at 15 m distance both sides shall be represented.

- Tower spotting – To be issued in AutoCAD format

On the plan and profile, optimized tower distribution shall be carried out, by specialized computer program PLS CAD. The backup file shall be given to the Employer. The result will show type and height of towers, lower conductor and OPGW catenaries at max temperature and at minimum temperature, clearance template, ruling span length and single span lengths.

At each tower location and span, the following check shall be made:

- Compliance with tower rating according Data Schedule.
- Compliance of calculated swing angle of suspension insulator set with limits defined in Data Schedules
- Compliance with external clearances specified in Data Schedule.

- Preliminary staking chart

Table shall be provided, showing all data necessary for tower pegging activity (spans, tower type and height).

- Tower pegging

At each tower location, the surveyor shall install a central peg, check the feasibility, survey the diagonal profiles for leg extension if required.

Foundation and earthing type selection, based on soil type (strength and resistivity) may be postponed, but is necessary for final staking chart.

- Final staking chart

All information concerning spans, towers and accessories shall be tabled in staking charts. The foundation types and earthing arrangement may be listed in separate sheet.

The staking chart shall be the base for material procurements; the bill of material (components) annexed to the staking chart is required.

- **Stringing chart**

In case of difficult terrain orography and presence of obstacles, detailed analysis of the tensioned section may be required, to control the interference of conductors with soil and obstacles, for a given location of tension equipment.

- **Sagging chart**

The sagging chart of each section between tension towers shall be issued, with sag/tension values before and after clamping, and clipping offset. Long time creep shall be proposed and justified (by calculation, references or supplier documents) as temperature gap or equivalent, and the conductor will be overstressed accordingly. The data shall be given for conductor actual temperature range between min and max with 5°C step.

In addition to the data specified above the Contractor is to provide complete list of materials to be supplied for the line, as soon as the final quantities are known.

It will be the Contractor's responsibility that the final tower positions within the line sections will be correctly aligned, that the spans and relative levels of all proposed tower center pegs correspond with the profile, that the ground line is such that clearances to conductors are maintained in accordance with the profile drawings. Due precautions shall be taken in the last mentioned operation to ensure that wind- and weight-span limitations (maximum or minimum) are not infringed.

In the event of the Contractor discovering any apparent discrepancy in the information provided to him under this clause, he shall immediately inform the Engineer of this matter and the Engineer will instruct the Contractor to make adjustments or to remedy the defect.

If no such discrepancy is reported to the Engineer and inadequate clearances or unacceptable tower loadings become apparent at a later date, the Contractor shall rectify matters forthwith at his own expense and by means approved by the Employer. Payment for survey work performed by the Contractor will be included in the Contract lump sum price.

#### 4.4.2 Additional requirements

The profile drawings shall include the following:

continuous longitudinal chainage for each section, ground line salient levels, ground line, ground clearance line, line of lowest conductor at maximum sag, indication of side slopes (below the outer conductor phases, due account being taken of swing of conductor under wind loading), where appropriate, side slope which could affect clearance of conductor to vertical or other steep slopes, buildings, streams and rivers, roads and railways, power and telecommunication lines crossed or to be crossed or to be deviated, sections unsuitable for support positions, vegetation, and any other features affecting the line construction.

In addition to any other factors affecting the location of suspension towers, wherever possible the following conditions shall be observed:

- The longest span length in any section shall be less than the equivalent span of that section multiplied by 1.5.
- The shortest span length in any section shall be more than the equivalent span of that section multiplied 0.4.
- The maximum ratio of adjacent span lengths shall not be more than 1:2.5
- The equivalent span for any 10 consecutive spans in a section shall not deviate from the equivalent span of the complete section by  $\pm 10\%$ .
- Line section between two tension towers shall not exceed 3 km.
- The tower spotting shall optimize the tower rating performance, with special attention to wind span, to minimize the number of towers.
- Tower stubs and templates shall be available early on site so that foundation work can proceed without delay.

Tower height shall be clearly and accurately shown with setting level of each type and extension of tower and the height of the conductor attachment points. 30 cm margin on clearance to ground shall be maintained.

## 4.5 Towers

### 4.5.1 Form of construction

All towers shall be lattice steel, self-supporting towers, double circuit, single conductor for 132kV and bundle conductor for 400kV.

Towers Characteristics, arrangements, and design specifications provided in this chapter shall apply unless Towers Designs were provided by the employer.

In the same circuit, the middle phase conductors shall be offset beyond the bottom phase conductors in that circuit by at least **1.5 meters** for **132 kV** and **2.5 meters** for **400 kV**, in still air. The bottom phase conductor shall be offset beyond the top phase conductor in the same circuit by at least **0.6 meters** for **132 kV** and **1 meter** for **400 kV**.

In **132 kV** lines, towers shall be designed for one OPGW earthwires; the angle of shade protection of the OPGW earthwire to the top conductor shall be maximum **30 degrees** to vertical at the tower.

In **400 kV**, towers shall be designed for two OPGW earthwires, each one located above the top insulator set attachment point of each circuit, but offset from the tower center line by at least **2 meters** less than the top insulator attachment point, and the angle of shade protection of the OPGW earthwire to the top conductor shall be maximum **20 degrees** to vertical at the tower.

The standard  $\pm 0$  height guarantees the specified clearances to normal ground in still air at maximum temperature in average span length.

Different heights, from  $-3$  m reduction to  $+12$  m body extension to the standard height, shall be provided, to be used in tower spotting, in step of  $3$  m; for tower 4DTu, different body extensions shall be designed: from  $-2$  m reduction to  $+4$  m extension .

Interchangeable leg extensions from -2 m to +3 m, for adaptation only to sloped ground, shall be provided. The legs shall be interchangeable for all tower heights. The design shall take into account the max difference in level between the four legs.

**Tower and foundation design ( drawing for manufacturing and construction ) shall be provided by the employer.**

#### **4.5.2 Tower types**

##### **4.5.2.1 132 kV lines**

- Designation
  - Suspension tower : DL &2DL
  - 0-10 deg tension and heavy suspension : D1 &2D1
  - 10-30 deg tension tower : D3&2D3
  - 30-60 deg tension tower : D6 &2D6
  - 60-90 deg tension and terminal tower : D9/DT &2DT/D9
  - Special tower for under-crossing : DTU &2DTU

The DL&2DL type and D1&2D1 type in heavy suspension configuration are equipped with suspension insulator strings; all other types with tension insulator strings.

##### **4.5.2.2 400 kV lines.**

- Designation
  - Suspension tower : 4DL
  - 0-10 deg tension and heavy suspension : 4D1
  - 10-30 deg tension tower : 4D3
  - 30-60 deg tension tower : 4D6
  - 60-90 deg tension and terminal tower : 4D9/4DT
  - Special tower for under-crossing : 4DTu

The 4DL type and 4D1 type in heavy suspension configuration are equipped with suspension insulator strings; all other types with tension insulator strings.

### 4.5.3 Tower rating

#### 4.5.3.1 132 kV lines

The following table shows the design spans and line angle for each tower type :

Tower type		basic span	Line angle	Wind span		Max weight span		Min weight span	Max single span
				Normal	Broken	Normal	Broken		
		m	deg	M	M	m	m	m	m
DL &2DL	Susp.	335	0	410	310	670	505	>60% wind span	505
			2	340	260				
D21 &2D1	Tens.	335	0-10	410	310	1010	750	-200	650
	Heavy Susp.	335	0	650	490	1010	750	>60% wind span	650
	Sectio n	335	0	410	310	1220	750	-610	650
D3&2D3	Tens.	335	10-30	410	310	1010	750	-200	505
D6&2D6	Tens.	335	30-60	410	310	1010	750	-200	505
D9/DT &2D9/ 2DT	Tens.	335	60-90	410	310	1010	750	-200	505
	Term.	335	45 line side 45 gantry side	410	0	700	0	-200	505
DTU &2DTU	Tens. & Term.	150	0-5° Entry angle	300	210	650	490	-100	200

with the following notes:

- The term wind span shall mean half the sum of adjacent horizontal span lengths supported by any one tower; in angle tower it is shown in combination with max line angle. For lower angles, it may be adjusted maintaining the transverse load within the design limit.
- The term weight span shall mean the equivalent length of the weight of conductor supported at any one tower at minimum temperature in still air.

At suspension positions, the minimum weight span of conductor shall not be less than 60% of the wind span of conductor.

- special consideration shall be given to the vertical loading on towers , where the gradient between adjacent support points exceeds 15 degrees to the horizontal.
- All terminal towers shall be designed for four slack spans of OPGW earthwires connected to two substation gantries.
- All tension towers shall be verified as section towers at max line angle.
- The D1 is a tower that can be used as tension and heavy suspension tower. The internal clearance shall be verified for both configurations.
- DTU is a special tower used only in special condition to under-crossing transmission lines or other obstacles. The use of this tower shall be approved by the Client and the Contractor shall submit crossing detailed, special tower configuration and clearances.

#### 4.5.3.2 400 kV lines.

The following table shows the design spans and line angle for each tower type:

Tower type		basic span	Line angle	Wind span		Max weight span		Min weight span	Max single span
				Normal	Broke n	Normal	Broke n		
		m	deg	m	m	m	m	M	M
4DL	Susp.	410	0	450	340	820	615	>60% wind span	900
			2	355	270				
4D1	Tens.	410	0-10	450	340	1230	900	-300	900
	Heavy Susp.	410	0	850	640	1230	900	>60% wind span	900
	Section	410	0	450	340	1450	900		
4D3	Tens.	410	10-30	450	340	1230	900	-300	900
4D6	Tens.	410	30-60	450	340	1230	900	-300	900
4D9/ 4DT	Tens.	410	60-90	450	340	1230	900	-300	900
	Term.	410	45 line side 45 gantry side	400	0	900	0	-300	900
4DTu	Tens.& Term.	150	0-5° Entry angle	300	210	650	490	-100	200

with the following notes:

- The term wind span shall mean half the sum of adjacent horizontal span lengths supported by any one tower; in angle tower it is shown in combination with max line angle. For lower angles, it may be adjusted maintaining the transverse load within the design limit.
- The term weight span shall mean the equivalent length of the weight of conductor supported at any one tower at minimum temperature in still air.  
At suspension positions, the minimum weight span of conductor shall not be less than 60% of the wind span of conductor.
- special consideration shall be given to the vertical loading on towers , where the gradient between adjacent support points exceeds 15 degrees to the horizontal.
- All terminal towers shall be designed for four slack spans of OPGW earthwires connected to two substation gantries.
- All tension towers shall be verified as section towers at max line angle.
- The 4D1 is a tower that can be used as tension and heavy suspension tower. The internal clearance shall be verified for both configurations.
- 4DTU is a special tower used only in special condition to under-crossing transmission lines or other obstacles. The use of this tower shall be approved by the Client and the Contractor shall submit crossing detailed, special tower configuration and clearances.

Typical example is annexed.

## 4.6 Internal clearance for 132 kV & 400 kV.

### 4.6.1 132 kV lines.

For all towers the clearances from conductors, jumper loops and all live metals to steelwork shall not be less than those specified in Data Schedule. The drop angle to be considered for phase conductor in clearance check is:

- Suspension tower: from  $0^\circ$  to  $15^\circ$
- Tension tower: from  $-10^\circ$  to  $15^\circ$

The shielding angle of OPGW on outer phase conductor shall not be more than that specified in Data Schedule.

For angle structures, carrying deviation angles up to 10 degrees, crossarms shall be so proportioned that live metal clearances are maintained under all conditions without the use of jumper suspension insulators. Jumper suspension insulators may be used, where required, in higher line angles.

The length of angle tower crossarms shall be such as will ensure that the distances between conductors of two circuits at straight-line towers, are maintained in a plane normal to the conductors for average line angle (p.e. 20° in D3 tower).

The minimum vertical clearance between OPGW and phase for tension towers shall not be less than that for suspension towers.

The minimum distance between phases shall be not less than:

$$\text{Vertical configuration: } 0.75\sqrt{f+l} + 0.75 \cdot 1.4 \text{ (m)}$$

$$\text{Horizontal configuration: } 0.62\sqrt{f+l} + 0.75 \cdot 1.4 \text{ (m)}$$

where: f(m) phase sag at 40°C temperature in max geometrical span length  
l(m) suspension string length (suspension tower)

The minimum distance between OPGW and top phase shall be not less than:

$$\text{Vertical configuration: } 0.75\sqrt{f} + 0.75 \cdot 1.2 \text{ (m)}$$

$$\text{Horizontal configuration: } 0.62\sqrt{f} + 0.75 \cdot 1.2 \text{ (m)}$$

where: f(m) phase sag at 40°C temperature in max geometrical span length.

#### 4.6.2 400 kV lines.

For all towers the clearances from conductors, jumper loops and all live metals to steelwork shall not be less than those specified in Data Schedule. The drop angle to be considered for phase conductor in clearance check is:

- Suspension tower: from 0° to 15°

- **Tension tower:** from  $-10^\circ$  to  $15^\circ$

The shielding angle of OPGW on outer phase conductor shall not be more than that specified in Data Schedule.

For angle structures, carrying deviation angles up to 10 degrees, crossarms shall be so proportioned that live metal clearances are maintained under all conditions without the use of jumper suspension insulators. Jumper suspension insulators may be used, where required, in higher line angles.

The length of angle tower crossarms shall be such as will ensure that the distances between conductors of two circuits at straight-line towers, are maintained in a plane normal to the conductors for average line angle (p.e.  $20^\circ$  in 4D3 tower).

The minimum vertical clearance between OPGW and phase for tension towers shall not be less than that for suspension towers (except for tower 4DTu). The minimum distance between phases shall be not less than:

$$\text{Vertical configuration: } 0.75\sqrt{f+1} + 0.75 \cdot 3.2 \text{ (m)}$$

$$\text{Horizontal configuration: } 0.62\sqrt{f+l} + 0.75 \cdot 3.2 \text{ (m)}$$

where:  $f(m)$  phase sag at  $40^\circ\text{C}$  temperature in max geometrical span length       $l(m)$  suspension string length (suspension tower)

The minimum distance between OPGW and top phase shall be not less than:

$$\text{Vertical configuration: } 0.75\sqrt{f} + 0.75 \cdot 2.8 \text{ (m)}$$

$$\text{Horizontal configuration: } 0.62\sqrt{f} + 0.75 \cdot 2.8 \text{ (m)}$$

where:  $f(m)$  phase sag at  $40^\circ\text{C}$  temperature in max geometrical span length

#### 4.7 External clearance

The clearance between the line conductors and the ground in still air under the maximum specified temperature final tension and the ground or between the

ice covered line conductors, at the minimum specified temperature final tension, shall not be less than the figure stated in the Data Schedule.

The clearance under all specified conditions between any part of any fences, walls, buildings or other structures, on which a man may stand or against which a ladder may be placed, and the nearest line conductor shall be as per Data Schedule.

#### **4.7.1 Load cases**

##### **4.7.1.1 132 kV lines.**

The assumed maximum simultaneous working loads shall be combined with safety factors specified in Data Schedule.

The following load cases shall be considered:

- Normal condition
  - Max wind
  - Normal wind with ice
- Security condition
  - Broken wire
  - Unbalanced ice / Anticascade (only for tension towers)
- Safety condition
  - Maintenance

###### **4.7.1.1.1 Suspension tower**

###### **A ) Max wind**

- Condition: Max wind, minimum temperature
- Vertical loads
  - Weight of insulators, fittings and accessories.
  - Weight of conductor and OPGW in minimum and maximum weight span. - Weight of tower
- Transversal loads
  - Max wind pressure load, as per Data Schedule, acting on conductor, OPGW, insulator set and tower.

- Angle component load due to tension of conductors and OPGW, calculated with the worst ruling span at condition case.
- Longitudinal loads
  - No unbalanced loads are foreseen in phase conductors.
  - In OPGW, unbalanced load due to 15% of maximum tension, calculated at condition case, shall be applied at right angle to the plane of crossarm.

## **B) Normal wind with ice**

- Condition: Normal wind, ice thickness, minimum temperature
- Vertical loads
  - Weight of insulators, fittings and accessories.
  - Weight of conductor and OPGW, covered with a thickness of ice, as per Data Schedule in minimum and maximum span.
  - Weight of tower
- Transversal loads
  - Normal wind pressure load acting on insulator sets, tower and conductor and OPGW covered with a thickness of ice as per Data Schedule.
  - Angle component load due to tension of conductors and OPGW calculated with the worst ruling span at condition case.
- Longitudinal loads
  - In phase conductors, no unbalanced loads are foreseen.
  - In OPGW, unbalanced load due to 15% of maximum tension, calculated at condition case, shall be applied at right angle to the plane of crossarm.

## **C) Broken wire**

- Condition: Max wind or Normal wind with ice, minimum temperature. Breakage of complete one phase or one OPGW.
- Vertical loads
  - Weight load of insulators, fittings and accessories.

- Weight of conductor and OPGW in minimum and maximum weight span.
- Broken wires: the weight span shall be reduced as per Data Schedule.
- Weight of tower
- Transversal loads
  - Normal wind pressure load as per Data Schedule, acting on conductor, OPGW, insulator set and tower.
  - Angle component load due to tension of conductors and OPGW calculated with the worst ruling span at condition case.
  - Broken wires: the wind span shall be reduced as per Data Schedule and the line angle component shall be considered acting only on one tower side.
- Longitudinal loads
  - Broken wires unbalanced load shall be applied. For the broken phase, a reduction of 30% of the tension is allowed. No reduction for broken OPGW is allowed.
  - In unbroken OPGW, unbalanced load due to 15% of maximum tension calculated at condition case shall be applied at right angle to the plane of crossarm.

## D) Maintenance

- Condition: No wind, minimum temperature.
- Vertical loads
  - Weight load of insulators, fittings and accessories.
  - 1.5 times weight of conductor and OPGW in maximum weight span.
  - Weight of equipment and lineman: 500 daN.
  - Weight of tower
- Transversal loads
  - Angle component load due to tension of conductors and OPGW, calculated with the worst ruling span at condition case.
- Longitudinal loads
  - Unbalanced load on all conductors and OPGW simultaneously, due to fixing of the wires to the ground with a maximum angle of 15° to the horizontal.

#### 4.7.1.1.2 Tension tower and terminal

##### A) Max wind

- Condition: Max wind, minimum temperature
- Vertical loads
  - Weight load of insulators, fittings and accessories.
  - Weight of conductor and OPGW in minimum and maximum weight span. - Weight of tower
- Transversal loads
  - Max wind pressure load as per Data Schedule acting on conductor, OPGW, insulator set and tower.
  - Angle component load due to tension of conductors and OPGW calculated with the worst ruling span at condition case.
- Longitudinal loads
  - Unbalanced load due to 15% (100% for terminal tower) of maximum tension calculated at condition case. The load shall be applied at right angle to the plane of crossarm.

##### B) Normal wind with ice

- Condition
  - Normal wind, ice thickness, minimum temperature
- Vertical loads
  - Weight of insulators, fittings and accessories.
  - Weight of conductor and OPGW covered with a thickness of ice as per Data Schedule in minimum and maximum span.
  - Weight of tower
- Transversal loads
  - Normal wind pressure load acting on insulators, tower, conductors and OPGW covered with a thickness of ice as per Data Schedule.
  - Angle component load due to tension of conductors and OPGW, calculated with the worst ruling span at condition case.

- Longitudinal loads
  - Unbalanced load due to 15% (100% for terminal tower) of maximum tension calculated at condition case. The load shall be applied at right angle to the plane of crossarm.

### C) Broken wire

- Condition: Max wind or Normal wind with ice, minimum temperature. Broken of complete two phases or complete one phase and one OPGW.(MAX Torsion)
- Vertical loads
  - Weight of insulators, fittings and accessories.
  - Weight of conductor and OPGW in minimum and maximum weight span.
  - The weight span of the broken wires shall be reduced as per Data Schedule. - Weight of tower.
- Transversal loads
  - Max wind pressure load as per Data Schedule acting on conductor, OPGW, insulator set and tower.
  - Angle component load due to tension of conductors and OPGW, calculated with the worst ruling span at condition case. Broken wires: the wind span shall be reduced as per Data Schedule and the line angle component shall be considered acting only on one tower side
- Longitudinal loads
  - Intact wire: unbalanced load due to 15% (100% for terminal tower) of maximum tension calculated at condition case.
  - Broken wire: full tension applied on broken wire (no tension for terminal tower). The breaks shall be considered in two different configurations: same direction (max moment) or opposite direction (max torsional).

### D) Unbalanced ice / Anticascade

- Condition: no wind, ice thickness, minimum temperature. Presence of ice on one span and no ice on adjacent one.
- Vertical loads
  - Weight of insulators, fittings and accessories.
  - Weight of conductor and OPGW covered with a thickness of ice as per Data Schedule in minimum and maximum span.
  - Weight of tower

- Transversal loads
  - Angle components load due to tension of conductors and OPGW, calculated with the worst ruling span at condition case.
- Longitudinal loads
  - Unbalanced load on all conductor and OPGW simultaneously, due to the presence of ice on one span and no ice on adjacent one, in the worst case of adjacent ruling span difference. No reduction for conductor and OPGW is allowed.

## E) Maintenance

- Condition: No wind, minimum temperature.
- Vertical loads
  - Weight of insulators, fittings and accessories.
  - Double weight of conductor and OPGW in maximum weight span.
  - Weight of equipment and lineman: 500 daN.
  - Weight of tower.
- Transversal loads
  - Angle component load due to tension of conductors and OPGW calculated with the worst ruling span at condition case.
- Longitudinal loads
  - Unbalanced load on all conductors and OPGW simultaneously, due to fixing of the wires to the ground with a maximum angle of 30° to the horizontal.

### 4.7.1.2 400 kV lines.

The assumed maximum simultaneous working loads shall be combined with safety factors specified in Data Schedule.

The following load cases shall be considered:

- Normal condition
  - Max wind
  - Normal wind with ice
- Security condition
  - Broken wire

- Unbalanced ice / Anticascade (only for tension towers)
- Safety condition
  - Maintenance

#### **4.7.1.2.1 Suspension tower**

##### **A) Max wind**

- Condition: Max wind, minimum temperature
- Vertical loads
  - Weight of insulators, fittings and accessories.
  - Weight of conductor and OPGW in minimum and maximum weight span.
  - Weight of tower
- Transversal loads
  - Max wind pressure load, as per Data Schedule, acting on conductor, OPGW, insulator set and tower.
  - Angle component load due to tension of conductors and OPGW, calculated with the worst ruling span at condition case.
- Longitudinal loads
  - No unbalance loads are foreseen in phase conductors.
  - In OPGW, unbalanced load due to 15% of maximum tension, calculated at condition case, shall be applied at right angle to the plane of crossarm.

##### **B) Normal wind with ice**

- Condition: Normal wind, ice thickness, minimum temperature
- Vertical loads
  - Weight of insulators, fittings and accessories.
  - Weight of conductor and OPGW, covered with a thickness of ice, as per Data Schedule in minimum and maximum span.
  - Weight of tower
- Transversal loads
  - Normal wind pressure load acting on insulator sets, tower and conductor and OPGW covered with a thickness of ice as per Data Schedule.
  - Angle component load due to tension of conductors and OPGW calculated with the worst ruling span at condition case.
- Longitudinal loads

- In phase conductors, no unbalanced loads are foreseen.
- In OPGW, unbalanced load due to 15% of maximum tension, calculated at condition case, shall be applied at right angle to the plane of crossarm.

### C) Broken wire

- Condition: Max wind or Normal wind with ice, minimum temperature. Breakage of one phase or one OPGW.
- Vertical loads
  - Weight load of insulators, fittings and accessories.
  - Weight of conductor and OPGW in minimum and maximum weight span.
  - Broken wires: the weight span shall be reduced as per Data Schedule.
  - Weight of tower
- Transversal loads
  - Normal wind pressure load as per Data Schedule, acting on conductor, OPGW, insulator set and tower.
  - Angle component load due to tension of conductors and OPGW calculated with the worst ruling span at condition case.
  - Broken wires: the wind span shall be reduced as per Data Schedule and the line angle component shall be considered acting only on one tower side.
- Longitudinal loads
  - Broken wires unbalanced load shall be applied. For the broken phase, a reduction of 30% of the tension is allowed. No reduction for broken OPGW is allowed.
  - In unbroken OPGW, unbalanced load due to 15% of maximum tension calculated at condition case shall be applied at right angle to the plane of crossarm.

### D) Maintenance

- Condition: No wind, minimum temperature.
- Vertical loads
  - Weight load of insulators, fittings and accessories.
  - 1.5 times weight of conductor and OPGW in maximum weight span.
  - Weight of equipment and lineman: 500 daN.
  - Weight of tower

- Transversal loads
  - Angle component load due to tension of conductors and OPGW, calculated with the worst ruling span at condition case.
- Longitudinal loads
  - Unbalanced load on all conductors and OPGW simultaneously, due to fixing of the wires to the ground with a maximum angle of 15° to the horizontal.

#### **4.7.1.2.2 Tension tower and terminal**

##### **A) Max wind**

- Condition: Max wind, minimum temperature
- Vertical loads
  - Weight load of insulators, fittings and accessories.
  - Weight of conductor and OPGW in minimum and maximum weight span. - Weight of tower
- Transversal loads
  - Max wind pressure load as per Data Schedule acting on conductor, OPGW, insulator set and tower.
  - Angle component load due to tension of conductors and OPGW calculated with the worst ruling span at condition case.
- Longitudinal loads
  - Unbalanced load due to 15% (100% for terminal tower) of maximum tension calculated at condition case. The load shall be applied at right angle to the plane of crossarm.

##### **B) Normal wind with ice**

- Condition
  - Normal wind, ice thickness, minimum temperature
- Vertical loads
  - Weight of insulators, fittings and accessories.

- Weight of conductor and OPGW covered with a thickness of ice as per Data Schedule in minimum and maximum span.
- Weight of tower

- Transversal loads
  - Normal wind pressure load acting on insulators, tower, conductors and OPGW covered with a thickness of ice as per Data Schedule.
  - Angle component load due to tension of conductors and OPGW, calculated with the worst ruling span at condition case.

- Longitudinal loads
  - Unbalanced load due to 15% (100% for terminal tower) of maximum tension calculated at condition case. The load shall be applied at right angle to the plane of crossarm.

**C) Broken wire**

- Condition: Max wind or Normal wind with ice, minimum temperature. Broken of two phases or one phase and one OPGW.(MAX Torsion)
  
- Vertical loads
  - Weight of insulators, fittings and accessories.
  - Weight of conductor and OPGW in minimum and maximum weight span.
  - The weight span of the broken wires shall be reduced as per Data Schedule. - Weight of tower.
  
- Transversal loads
  - Max wind pressure load as per Data Schedule acting on conductor, OPGW, insulator set and tower.
  - Angle component load due to tension of conductors and OPGW, calculated with the worst ruling span at condition case. Broken wires: the wind span shall be reduced as per Data Schedule and the line angle component shall be considered acting only on one tower side
  
- Longitudinal loads
  - Intact wire: unbalanced load due to 15% (100% for terminal tower) of maximum tension calculated at condition case.
  - Broken wire: full tension applied on broken wire (no tension for terminal tower). The breaks shall be considered in two different configurations: same direction (max moment) or opposite direction (max torsional).

#### **D) Unbalanced ice / Anticascade**

- Condition: no wind, ice thickness, minimum temperature. Presence of ice on one span and no ice on adjacent one.
- Vertical loads
  - Weight of insulators, fittings and accessories.
  - Weight of conductor and OPGW covered with a thickness of ice as per Data Schedule in minimum and maximum span.
  - Weight of tower
- Transversal loads
  - Angle components load due to tension of conductors and OPGW, calculated with the worst ruling span at condition case.
- Longitudinal loads
  - Unbalanced load on all conductor and OPGW simultaneously, due to the presence of ice on one span and no ice on adjacent one, in the worst case of adjacent ruling span difference. No reduction for conductor and OPGW is allowed.

#### **E) Maintenance • Condition: No wind, minimum temperature.**

- Vertical loads
  - Weight of insulators, fittings and accessories.
  - Double weight of conductor and OPGW in maximum weight span.
  - Weight of equipment and lineman: 500 daN. - Weight of tower.
- Transversal loads
  - Angle component load due to tension of conductors and OPGW calculated with the worst ruling span at condition case.
- Longitudinal loads
  - Unbalanced load on all conductors and OPGW simultaneously, due to fixing of the wires to the ground with a maximum angle of 30° to the horizontal.

#### **4.7.2 Factor of safety of Towers**

Each type of suspension, tension and terminal tower shall be designed so that no failure or permanent distortion shall occur, when tested in all cases with working forces and safety factor as per Data Schedule.

#### **4.7.3 Design and detailing of towers**

The tower design shall comply with the following requirements:

- **Compression members**

The ultimate stress in members subject to compression loads shall not exceed a figure obtained from an approved formula to be entered in Data Schedule by Bidders. This formula is to be based on the elastic limit of the material.

- **Tension members**

Stresses in members subject to tensile loads will be calculated from the least area of the members at any section after deducting the area of any holes at that section. In case of a single angle with one flange only drilled, the net area of the member shall be appropriately reduced due to non-uniform stress distribution. The permissible ultimate tensile stress will be not greater than the yield stress for that grade of steel.

- **Redundant members**

Redundant members which support leg members or other members shall be capable of resisting a minimum load of 2.5% of the actual load in that leg member or that other member respectively, whichever is the greater.

- **Minimum allowable material thickness**

In considering the risk of damage during transport and assembly and of damage after erection, the material thickness for supporting structures will not be less than those given in the Data Schedule.

- **Maximum slenderness ratios**

The ratio between unsupported length of a member and the relevant radius of gyration,  $L/r$ , shall not exceed the ones given in Data Schedule.

- **Stub**

The design of stub shall be in accordance with ASCE10-97 or equivalent Standard. The loads shall be transferred to the foundation by cleats only, no adhesion is allowed. The hole for earthing system shall be provided. The stub shall fully galvanized.

- Bolts, bolted joints and permissible bolt stresses Bolted joints shall have one quality bolt only.

Each tower shall use max two diameter bolts, minimum 16 mm.

Permissible ultimate stresses for different bolt qualities and different base material are given in the following table:

Permissible ultimate stresses				
Quality acc. to ISO	Ultimate tensile stress	Tension and bending yield point	Shearing	Bearing
	N/mm <sup>2</sup>	N/mm <sup>2</sup>	N/mm <sup>2</sup>	N/mm <sup>2</sup>
5.6	500	300	310	540
6.8*	600	480	372	720
8.8	800	640	496	1152

\*For bolt 6.8 the allowed minimum required percent elongation after fracture is 17%.

The bearing ultimate stress cannot exceed 1.5 Fu, where Fu is ultimate tensile strength of the connected material.

Bolts subjected to combined tension and shearing shall be designed for the following conditions:

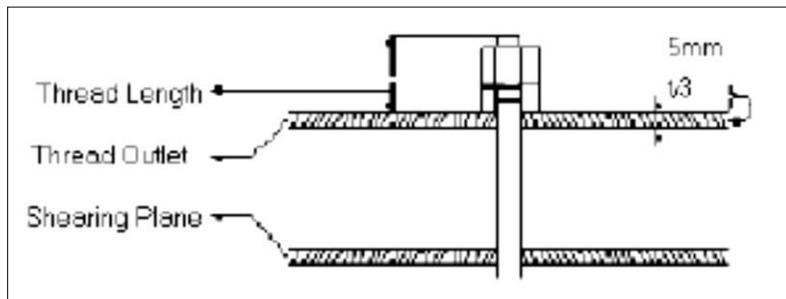
- Neither the actual tension stress nor the actual shearing stress shall exceed the permissible ultimate stresses given above.

b) 
$$\frac{(d)^2}{(du)} + \frac{(t)^2}{(tu)} \leq 1.15$$
 where: d = actual tension stress  
 t = actual shearing stress du = permissible ultimate tension stress  
 tu = permissible ultimate shearing stress

#### 4.7.4 Tower details

- The tower details shall be shown in shop and erection drawings, carried out according the practice and Standard, avoiding eccentricities or misalignment, which may induce unexpected internal stress.
- Bolts shall be dimensioned so that the thread of any bolt (except step bolts) shall not form part of the shearing plane between steel members.

Where step bolts are incorporated in a structural joint, they shall be ignored in the calculation of the strength of the joint (the step bolt hole shall be considered in determination of the net member area). The thread shall terminate under the washer or in some other way outside the stressed material. It is accepted that the thread run-out may terminate up to 5 mm into the material, but not more than a third of the material thickness, see Figure below.



Bolts shall be of such a length that the nut after tightening can be well secured by punching of the exposed thread if required.

Bolt tightening torque shall be such that any zinc accumulations or burrs are leveled and the joint fully closed. Bolt tightening torques shall be approved by the Employer, with reference to tower erection specifications.

The thread profiles shall be according to ISO or similar approved standard.

The minimum distances in connection details shall be as follows:

- From hole center to sheared edge  $1.5 \times$  bolt dia.
- From hole center to rolled edge  $1.3 \times$  bolt dia.
- Between holes center  $3 \times$  bolt dia.

The bolt-hole diameter after galvanizing shall not be greater than the bolt diameter plus 1.5 mm up to 20 mm diameter, 2.0 mm for larger diameter.

## 4.8 Tower accessories and support details

### 4.8.1 Anti-climbing guards and climbing steps

Each tower shall be fitted with an approved anti-climbing device with gates generally as indicated on drawing and which shall provide climbing facilities for use by authorized personnel.

All the angles used in the anti-climbing device should be made of galvanized steel to stand the man weight 100 dn x 1.5.

The barbed wire should consist of at least three strands or the overall diameter should be at least 9 mm.

The height of the anti-climbing device may be either adjustable or on members forming an integral part of the tower designed within the limits of 5 m and 6 m from the ground on the normal height tower. Where the support or tower is erected on sloping ground the height should be measured from the foot of the support where the ground is highest.

#### **4.8.2 Danger, circuit number, aerial plates and phase plates**

Two danger plates are to be provided and fixed in approved positions on all structures. Danger plates shall be red with a white background. The tower number plates will be attached to the danger plates.

Phase plates of approved types colored red, yellow and blue to indicate the line phases shall be provided and fixed in approved positions on each structure. Two circuit identification plates will be provided for each circuit.

These plates will show two colors approved by the Employer for each circuit and will be fixed at approved positions.

An aerial plate for each fourth tower shall be provided as approved by the Employer. All plates shall be of anti-corrosive material. If enameled iron plates are used, the whole surface of each plate including the back and edges shall be properly covered and resistant to corrosion. On all plates the colors shall be permanent and free from fading. With enameled plates, washers of approved material shall be provided back and front of the securing bolts or screws.

Lettering and size and location of plates shall be to the Employer's requirements, and generally as indicated on drawing attached to the end of these documents. All plates shall have thickness not less than 2 mm.

#### **4.8.3 Conductor and OPGW support attachments**

The phase conductor insulator set shall be connected to a single hole of suspension and tension tower.

All suspension towers shall be provided for suspension and tension set for OPGW, to allow down lead to joint box.

In all suspension and tension attachment points, additional maintenance holes shall be provided.

### **4.9 Foundations**

The types of soils and foundations are defined in Data Schedule as follows:

- **Normal Foundation**

This type of foundation shall be suitable for normal soil, occurring generally for the full foundation depth.

- **Soft Rock Foundation**

This type of foundation shall be suitable , when soft rock occurs at depth of less than 1 m. The soft rock encountered may be of a homogeneous limestone nature or of a harder limestone, but being fissured and stratified.

The soft rock foundation shall be suitable for both conditions.

- **Hard Rock Foundation**

This type of foundation shall be suitable, when hard rock is encountered within 1 meter of the surface of the ground.

- **Poor Soil Foundation**

This type of foundation shall be suitable for poor soil having an ultimate bearing capacity of  $2 \text{ kg/cm}^2$  (approx.  $200 \text{ kN/m}^2$ ). The foundations will be concrete block type with extended pad as necessary.

For Bid and supply purposes, the design of foundations shall follow the specification and assumptions set out below and given in Data Schedule.

In case of very poor soil or special case new foundation (p.e. raft or pile foundation) approved by the Employer shall be provided.

Ultimate foundation loadings per leg shall be calculated as follows:

- **Suspension towers**

- Compression - Compression load due to overturning force +1/4 applied vertical loads +1/4 tower weight) x factor of safety x overload factor.
- Uplift - Uplift load due to overturning force -1/4 x 1/3 max. applied vertical loads -1/4 tower weight) x factor of safety x overload factor.

- **Tension towers**

As above, but, in uplift case, the effect of negative weight span shall be considered. In computing ultimate bearing stresses, the weight of concrete in foundations shall be multiplied by the relevant factor of safety.

The ultimate loads transmitted by the tower (including factor of safety) shall be multiplied by overload factor defined in Data Schedule.

Foundations are to comply with requirements as follows:

#### **A. Pad and chimney**

The foundation base shall be centered on the tower leg direction.

The frustum angle of soil, resisting the uplift load as defined in Data Schedule, depends on construction type. The preference is given to undercut or other approved method, allowing upward bearing of the pad against undisturbed soil for a minimum width of 250 mm all round. Alternatively, the concrete pad shall be cast to the edge of the excavation for a minimum of 250 mm in order to gain assistance by adhesion to the original ground. No extra payment shall be made where the Contractor makes oversize excavation. Proposals shall be submitted with the Bid.

In cases where the concrete block is cast in contact with the edge of the excavation for at least 250 mm the earth frustum assumed to resist uplift shall be considered to start from the bottom of the vertical edges of the block. Otherwise, the frustum shall be assumed to start from the top of the block edges. Allowance shall be made for loss of uplift resistance due to overlap of frusta where necessary.

The slope of all concrete pyramid top faces unless reinforced shall not be less than 45 degrees to the horizontal.

### **B. Hard rock foundations**

Where foundations are installed in suitable hard rock, the depth of the stub leg grouted or concreted into the rock is in no case to be less than 0.9 m. The upper part of the stub is to be encased in concrete to a height of 150 mm above ground level. To ensure adequate uplift resistance a sufficient number of reinforcing bars shall be grouted into the rock, using an expanding grout for a minimum depth of 1.2 m from the base of the excavation. The reinforcing bars are to be tied together within the block. Bidders should assume the ultimate adhesion value between expanding grout and bed rock to be 0.39 N/mm<sup>2</sup>.

Such foundations are to be approved by the Employer before the erection of the support or the stub leg proceeds. When formulating rates for supports plus foundations, it should be assumed that good rock occurs at a maximum depth of 1 m below ground level. At depths greater than 1 m to rock, No extra excavation will be paid for excavation through any material.

### **C. Auger foundations**

The foundation resistance shall be based on:

- Uplift : concrete/soil friction and foundation dead weight
- Compression : concrete/soil friction and point bearing capacity

## **D. Concrete design**

The concrete characteristics strength shall not less than **24.0 N/mm<sup>2</sup>** for **132 kV** & **35.0 N/mm<sup>2</sup>** for **400 kV**

The reinforcing bars yield stress shall not be less than 350 N/mm<sup>2</sup>.

Concrete design shall comply with ACI 318 / Eurocode 2 or equivalent Standard. A net concrete cover of at least 50 mm is to be provided over any part of the steelwork below ground and extended above ground for a minimum distance of 300 mm. The maximum allowable bearing pressures, lateral pressures, the adhesion value between concrete and steel and the assumed weight of earth shall be as specified in Data Schedule. The stub leg shall not be of less thickness than the main tower leg and cleats shall be attached at the base to transfer the full leg load to the concrete. Accepted calculation method is given in ASCE 10.

## **4.10 Earthing system**

The electrical resistance to earth of all structures shall be measured in an approved manner with approved instruments and will not be more than 10 Ohms.

The standard configuration foresees a galvanized steel rod, at least 2.5m long, installed under each leg foundation and connected to the stub by a galvanized steel tape. An additional attachment point, coming outside from concrete and connected to the stub shall be provided for counterpoise connection, where necessary.

In this case the counterpoise shall consist of two pieces 60 m long of steel tape, connected to the required support in an approved manner. The steel tape shall be 40 mm x 4 mm galvanized steel.

The earth counterpoise is to be buried not less than 800 mm in the ground and bolted joints shall be protected by Denso paste and tape or other approved compound. The two counterpoise legs shall run one in each direction underneath the line where possible. Rates are to be entered for counterpoise length variation.

If necessary additional counterpoise length shall be added to achieve the specified resistance.

All structures shall be provided with means for connecting an additional earthing device, as required by the Employer.

Holes are to be left in all four legs of lattice tower structures to take 14 mm bolt for earth lead connection.

The terminal towers earthing system shall be connected to substation earthing system.

## **4.11 Insulator and fittings**

### **4.11.1 General**

The following support arrangements and fittings are to be foreseen and designed:

#### **A. Phase conductor at tower**

- I simple suspension set
- I double suspension set: to be used at railway or highway crossing or in special heavy suspension tower
- Single tension set, standard or reversed (if any)
- Double tension set: to be used at railway or highway crossing or in special span

Note: The reversed tension sets are required in case of upward disposition in EDS condition.

#### **B. Phase conductor in span**

- Compression joint
- Repair sleeve
- Stockbridge damper

#### **C. OPGW at tower**

- Suspension set
- Tension set for bypass or down leads to joint box

#### **D. OPGW in span**

- Repair sleeve preformed type
- Stockbridge damper

#### **E. Aircraft warning**

Due to the possible activity of aircraft in the vicinity of certain parts of the transmission line, it will be necessary to paint some tower parts with obstruction markings and to fasten warning spheres to OPGW earthwires. The Bidder is to enter rates against appropriate items in Price Schedule for the above and he will be advised early in the Contract of actual requirements. The sphere shall be installed with preformed armour rods.

The Bidder shall provide assembly drawings; the Contractor shall provide assembly and detailed drawing of each components.

All sets shall be connected to the tower with single attachment.

The design of the sets shall take into account:

- Loads applied with appropriate safety factors, referred to UTS. The tension set shall have UTS not lower than the conductor phase or OPGW
- Clearances and tower top geometry according to Data Schedule
- Required creepage length
- Electrical performances as per relevant Data Schedules
- The fittings designer shall be responsible of compatibility with insulator, conductor, OPGW, armour rods and damping devices.

The Contractor shall be responsible of compatibility of attachment points of the structure and fittings, checking the size and possible interferences, and shall define the boundaries.

It is preferred that fittings supply is independent of structure supply.

All fittings shall be designed to facilitate hot line maintenance with appropriate tools.

#### **4.11.2 Insulators**

The insulator shall be Composite type, fiberglass rod with silicone rubber sheds. The Supplier of composite insulator shall demonstrate his long experience, based on supply references.

#### **4.11.3 Fittings**

All fittings shall be designed for the required strength (UTS) and all sets shall have three-dimensional articulation, with contact surfaces between components adequate to maintain good electrical performance. Adequate bearing area between fittings shall be provided and “point and line” contacts shall be avoided.

All insulator sets, including their clamps and fittings, shall be free from corona discharges. The freedom corona shall be proven by type test in the laboratories. The minimum extinction corona voltage is specified in Data Schedules.

All insulator sets must be equipped with arcing devices, rings or horns fulfilling simultaneous the functions of corona shield, voltage distribution and protection of insulators and conductors when flashover occurs. The arcing fittings shall be made of hot dip galvanized steel; they must have the capability to withstand the fault current specified in Data Schedules and shall be designed so that, in case of a flashover, the arc will be led to the end. They may reach a final temperature not exceeding 600°C during the short circuit. The function of arcing-protection must not be greatly altered by the power arc. As corona shield devices, the guard rings shall be designed to ensure a corona-free insulator set line end as

well as a radio and television noises as low as possible. The radio interference (RI) performance of the insulator sets have to be proven by type test in the workshop or laboratories. As potential distribution devices, the arcing horns and guard rings must be designed for an optimized potential distribution along the insulator sets. The highest value resulting for any one insulator unit within the insulator string shall not exceed the rated withstand voltage of the corresponding insulator unit and test assumptions.

Special attention has to be considered to ensure that, in case of breakage of an insulator string from a multiple string set, the remaining strings shall withstand the resulting static and dynamic stress by applying the specified safety factors.

Characteristics of the main fittings are as follows:

a) Suspension clamps

The suspension clamps shall be suitable for conductor with armour rods, for OPGW with protective neoprene and armour rods and free to pivot in the vertical plane about a horizontal axis passing through and transverse to the center line conductor. The connection to string shall permit to pivot in the other horizontal axis.

It shall permit the complete conductor to slip before failure, after the specified percentage of UTS of relevant conductor (between 15 and 20%), and the outermost point of clamping pressure shall not be less than two conductor diameters inside the outermost point of contact between the conductor and its supporting groove (conductor being assumed horizontal). The supporting groove beyond the latter point shall be curved in the vertical plane to a min radius of 150 mm.

The grooves shall be bell-mouthed at each end to a min. radius of 25 mm for a distance of 12.5 mm unless otherwise approved. All surfaces shall be smooth.

The connection U bolts (if any) shall have nut on the upper part.

Any vertical separation of clamps components caused by conductor movements must be prevented by suitable connecting device.

b) Tension clamps and joints

Tension clamps and joints shall be of compression type.

The electrical conductivity of clamps and joints shall not be less than that of a piece of conductor/earthwire of the same length.

Clamps and joints shall withstand 95% of the conductor UTS. Hole for filler compound shall be provided in conductor joints if required by Project Specifications.

c) Arcing horns and rings

The insulator sets shall be equipped with: horns at tower side, ring at conductor side. The Contractor will take care of possible effect of the aeolian vibrations of the conductor.

The suspension string horn, conductor side, will withstand an ultimate weight 100 kg on tip. The rings 150 kg.

d) Sag adjusters

Tension insulator set shall incorporate devices for adjusting the sag of individual conductor. Unless otherwise specified, the range of adjustment shall not less than 75 mm and shall be fitted to the live end. Continuous adjusting turnbuckle can be proposed, subject to approval.

e) Extension links

Extension links may be required, tower side, to avoid interference between insulators and structure, which may occur in angle towers or particular crossarm geometry.

f) Shieldwire connections

In all cases, the OPGW shall be directly earthed to the tower by short piece of wire connected to the main OPGW and tower by parallel groove and single groove clamp.

g) Repair sleeves and joints for phase conductor

Repair sleeves and joints shall be of compression type.

h) Counterweights

To guarantee the required electrical distance to the structure in swinging condition, the suspension insulator set can be equipped with counterweights, directly connected to suspension clamps, subject to approval.

## 4.12 Vibration damping system

### 4.12.1 General

Conductors and OPGW are excited to vibration by laminar wind flows which may lead to damage by failures of individual strands and, eventually, of the

whole conductor. In this respect, to protect the conductors, vibration systems of stockbridge dampers are specified.

The Contractor will guarantee, by means of corresponding calculations i.e. Damping Efficiencies Studies that the bending stress of the conductor and OPGW protected by stockbridge dampers will be restricted to maximum  $\pm 150$  micro strain, for all frequencies up to  $f=1489/d$  [hz] where d is the conductor diameter in mm and the expected life of the conductors and OPGWs is at least 50 years.

The calculations shall cover the range of wind velocities inducing aeolian vibrations and associated vibration frequencies, for typical conductor and OPGW tensions and for the range of span lengths, as appropriate. All data for the calculations shall be performed under the responsibility of the Contractor and shall be subject for approval of the Employer.

#### **4.12.2 Vibration damper for conductors and OPGW**

Vibration dampers of stockbridge type shall be tested in accordance with EN 61897 (IE 61897).

- At conductor suspension and tension points.
- At OPGW suspension and tension points.

The number of dampers at each end of conductor or OPGW shall not be less than: - 1 damper for span lengths up to 400 m  
- 2 dampers for span lengths greater than 400 m.

Dampers may be required at warning sphere location on the OPGW, if any.

Spacer-dampers for twin conductors shall be installed in accordance with the recommendations of the damper study and the manufacturer's recommendation. They shall be efficaciously distributed along the spans at unequal intervals, but at minimum 2 m away from any mid span joint, repair sleeve or any other fitting attachment to the conductor.

Contractor shall submit the characteristics, location and determination of number of dampers to be used for conductors and ground wire for the range of spans, both for suspension and for tension points. The dampers shall be in line with the recommendations issued by CIGRE, in relation with the curve



parameter (Electra No.198 / October 2001 "Safe design with respect to aeolian vibrations

#### **4.13 Copyright of support designs**

The Contractor will assign to the Employer, free of charge, sole rights to use, in whatever manner the Employer requires, the technical documents design and fabrication of all materials, which are submitted by the Contractor and approved by the Employer. Assignment of such will be construed as to allow the Employer to use and/or amend the designs or information contained therein for any future project not mentioned in this document, which he may consider appropriate, without reference or payment of any kind whether to the Contractor or his design or fabrication organization.

Similarly by assigning to the Employer, the rights mentioned, the Contractor and his design and fabrication organization are relieved of all obligations and responsibilities for future projects in which the designs or information contained therein are utilized by the Employer.

To this end, the Contractor will furnish the following master drawings:

- Outline drawings of towers and extensions in pdf and dwg format.
- Loading diagrams and stress analysis for each type of tower and extension. Backup file of PLS tower format shall be given.
- Fabrication drawings of each tower type and extension in pdf and dwg format.
- Erection drawings of each tower type and extension in pdf and dwg format.
- Shop bills of each basic tower type and each extension.
- Arrangement and details of all insulator sets and fittings.
- Plan & profile in dwg and PLS CADD format.
- Foundation design report and construction drawings in file and dwg format.

The Contractor shall also furnish a statement in an approved form to the effect that he assigns the above-mentioned rights to the Employer. The Contractor will be expected to demonstrate, if required, that he has the authority to assign such rights.

The drawings and statement referred to above shall be handed over to the Employer for approval before the issue of the Final Certificate.



## MATERIALS

### 5.1 General

The following paragraphs include general requirements for the fabrication and supply of the OHTL materials. Reference is made to:

- Data Schedules with material characteristic.
- Document Lists with required documents as follows:
  - Documents to be attached to the Bid
  - Documents for approval
  - Final documents (as built, inspection report etc.)
- Test and Inspection paragraph:
  - Type Test (confirming the design)
  - Factory Acceptance Test (material ready)

All materials shall comply the Project Specifications, the Technical Data Schedules and the International Standard.

The Suppliers shall not commence any fabrication before approval of drawings and type tests.

Any deviation must be evidenced in the Required Documents attached to the Bid. All documents shall be issued in the English language.

The Suppliers shall furnish detailed QA/QC procedures and the Contractor shall be responsible for performing all tests and inspections required, as well as the rating test in fabrication process.

### 5.2 Phase conductor Features

#### 5.2.1 For 132 kV OHTLs.

The new 132 KV OHTLs are equipped with 6 phases, each one with single **OR** bundle conductor as described previously for each ohtl separately AAAC/YEW type All Aluminium Alloy Conductor with characteristics given in Data Schedule, and shall be manufactured and supplied by primary factory, in compliance with best practice as follows.

The manufacturer has to provide evidence about his long term experience with the manufacturing of AAAC/YEW type All Aluminum Alloy Conductor with characteristics given in Data Schedule.

A minimum of 10 years of experience is required AAAC/YEW type All Aluminium Alloy Conductor with characteristics given in Data Schedule reference list with the supply references of the past 5 years must be provided containing customers (with evidence), countries where installed, quantities and voltage level.

The conductor shall be made of heat treated Aluminium Magnesium Silicon alloy wires having the mechanical and electrical proprieties specified in IEC 61089 or such other equivalent standard as may be approved by the Employer to be used mainly for overhead transmission line.

The conductors shall be manufactured to ensure long service and low maintenance costs. They shall be suitable in every respect for continuous operation at nominal parameters, as well as in transient operating conditions. Special attention shall be paid to the conductor stranding process, to ensure the necessary tightness between different layers in order to avoid slippage or relative movement of strands or birdcage formation during stringing.

Joints of individual aluminium alloy wires of the conductors are not permitted in the respective outermost layers.

In the inner aluminium alloy wire layer of phase conductor, joints are permitted before stranding. Such joints (welds) shall be made by cold-pressure or electrical butt-welding. Joints made in individual aluminium alloy wires by resistance butt-welding shall not be permitted.

When it becomes necessary to weld the aluminum alloy, the welding shall be done in the aluminum wire rod before it is drawn so that the welds shall be indistinguishable in the finished wire.

Welds shall not be made in the aluminum alloy wires, except when the wire breaks during stranding and, in these cases, the drum number and notice of existence of the weld shall be communicated. In addition, the drum outside shall be marked with a letter "W".

The aluminum of the AAAC shall be of the highest purity commercially obtainable, which shall not be less than 99.5 per cent. The Supplier shall submit certificates of analysis giving the percentage and nature of aluminum impurities. The outermost aluminum layer shall be stranded with a right hand lay.

The stranding of all layers shall be in one production project.

### **5.2.2 For 400 kV OHTL.**

The line is equipped with 6 phases, each twin bundle conductor ACSR/ACS type Aluminium Conductor Aluminum Clad Steel Reinforced with characteristics given in Data Schedule, and shall be manufactured and supplied by primary factory, in compliance with best practice as follows.

The manufacturer has to provide evidence about his long term experience with the manufacturing of ACSR/ACS type Aluminium Conductor Aluminum Clad Steel

Reinforced with characteristics given in Data Schedule.

A minimum of 10 years of experience is required. ACSR/ACS type Aluminium Conductor Aluminum Clad Steel Reinforced with characteristics given in Data Schedule reference list with the supply references of the past 5 years must be provided containing customers (with evidence), countries where installed, quantities and voltage level.

The conductor shall be made of heat treated Aluminium Magnesium Silicon alloy wires having the mechanical and electrical proprieties specified in BSI Bs EN 50183 or such other equivalent standard as may be approved by the Employer to be used mainly for overhead transmission line.

The conductors shall be manufactured to ensure long service and low maintenance costs. They shall be suitable in every respect for continuous operation at nominal parameters, as well as in transient operating conditions. Special attention shall be paid to the conductor stranding process, to ensure the necessary tightness between different layers in order to avoid slippage or relative movement of strands or birdcage formation during stringing.

Joints of individual aluminium alloy wires of the conductors are not permitted in the respective outermost layers.

In the inner aluminium alloy wire layer of phase conductor, joints are permitted before stranding. Such joints (welds) shall be made by cold-pressure or electrical butt-welding. Joints made in individual aluminium alloy wires by resistance bull-welding shall not be permitted.

When it becomes necessary to weld the aluminum, the welding shall be done in the aluminum wire rod before it is drawn so that the welds shall be indistinguishable in the finished wire.

Welds shall not be made in the aluminum wires, except when the wire breaks during stranding and, in these cases, the drum number and notice of existence of the weld shall be communicated. In addition, the drum outside shall be marked with a letter "W". No joint are permitted in ACS wires.

The aluminum of the ACSR shall be of the highest purity commercially obtainable, which shall not be less than 99.5 per cent. The Supplier shall submit certificates of analysis giving the percentage and nature of aluminum impurities.

The outermost aluminum layer shall be stranded with a right hand lay.

### **5.2.3 Stranding, finishing and cleaning**

#### **a) Stranding**

The make-up and lay of the wire shall be such as to produce a conductor essentially free from a tendency to untwist or spring apart when cut. The aluminum alloy wires shall be so formed that the aluminum alloy wires can be readily regrouped and easily held in place with one hand to allow the splicing sleeve to be slipped over the aluminum alloy wires at the cut end of the conductor

#### **b) Finishing**

The external form and surface shall be uniformly cylindrical upon completion or manufacture and shall remain so when erected in place on the line.

The permissible reduction, from the unstressed circumference to the circumference when the conductor is subject to a tension equal to 30 per cent of its specified UTS, shall not be greater than two (2) per cent.

The surface of the conductor shall be free from points, sharp edges, abrasion, or other departures from smoothness or uniformity of contour.

The conductor shall be capable of withstanding the normal handling necessary for manufacture and erection, such as reeling, unreeling and pulling through stringing sheaves under sufficient tension to keep the conductor off the ground, etc., without being deformed from a cylindrical form.

#### **c) Cleaning**

The conductor shall be free from excessive amounts of die grease, metal particles and dirt. The Supplier shall describe in complete detail the method,

which he proposes to use in normal production to clean the conductor. The effectiveness of the cleaning process shall be subject to verification.

#### **5.2.4 Creep characteristics of conductor**

The Supplier shall furnish data of long time creep curves for the conductor.

#### **5.2.5 Drums**

##### **a) Length of drum**

The recommended nominal length of each piece of conductor on each drum shall be as indicated in the Data Schedule.

Each drum must be marked in group of 6 drums.

For example:

Drum No 1/1 ÷ 1/6

2/1 ÷ 2/6

##### **b) Drum details**

- All drums shall be fitted with steel hubs having a minimum inside diameter of 80 mm. The ratio of the diameter of the inside barrel to the diameter of the flange must not be less than 0.48.
- The timber to be used shall be new, dry, properly seasoned and suitably treated to stand changes in temperature and humidity without deterioration or shrinking.
- The timber shall be sufficiently hard and compact to hold the nails and must be treated with fungicidal and germicidal termite and white and proof preservative prior to painting.
- All drums shall be painted inside and outside with aluminium paint.
- Nails shall be fitted with proper care to avoid any contact with the conductor. Nailing shall be executed from the inside toward the outside. The nail heads shall be embedded into the flange for approximately 7 mm.
- Before punching nails into the timber, they should be wetted with ammonia to facilitate the gripping.
- The threaded spindle should be bolted in such a way that the washers are embedded into the flanges a few millimeters.
- Moreover the spindles nuts shall be properly locked to avoid their loosening as a consequence of expansion and subsequent timber shrinkage due to thermal effects and/or humidity. The threaded end of spindle shall not protrude above the nut by more than one thread.

- The nuts shall always be locked by riveting the threaded end.
- The flanges shall be fitted with reinforcing steel nuts bushing.
- The inner wrapping of the drum shall be made with a double layer of waterproof paper.
- The conductor shall be tied at the beginning of the last outer turn back to one flange with a suitable string and the outer end stapled to the other flange to avoid the conductor moving from the correct position.
- Any impregnated part of protective covering of the drum next to the phase conductor shall show no chemical aggressivity against the conductor.
- A piece of conductor 45 cm long shall be left sticking out of the flange hole.
- The extreme end of the conductor shall be tied, then 25 cm left free and then the remaining 15 to 20 cm shall be tied and taped and covered with cloth (no jute allowed).
- The untied section shall be bent as much as possible towards the center of the drum and nailed.
- Four binding stables enough to withstand transport stresses shall be used; the two outside must clamp the whole conductor, whilst the two inside are fixed through the conductor in order to prevent its sliding.
- Each drum shall be protected by wooden lagging on the circumference, with a thickness of at least 40 mm.
- A layer of waterproof paper around the conductor is required under the lagging.

### 5.2.6 Marking

The following information shall be marked with paint on the drums and clearly indicated on at least one metal tag firmly attached to the drum:

- Supplier's name or trade mark
- Supplier's plant location
- Drum number
- Date of manufacturing
- Destination
- Size
- Stranding
- Actual length
- Gross weight and tare weight
- Contract number

An arrow, showing the direction in which the drum must be rolled, shall be marked on each side of the drum, at the position of the outer end of placed conductor.

### **5.2.7 Type Tests**

The type test shall be performed by third party in accordance to EN 50182, EN 50183 and IEC61395.

Type test certificate may be accepted, provided that tested conductor structure corresponds to the offered one. The submitted type test certificate shall not be older than 10 years, The breaking load test for complete conductor is required even the type test is accepted

### **5.2.8 Acceptance Tests**

The acceptance test shall be performed in accordance to EN 50182 and EN 50183 . As a minimum, the following tests shall be carried out:

- Aluminium alloy wires:
  - Appearance
  - Diameter
  - Conductivity
  - Tensile breaking strength - Wrapping
  
- Complete conductor:
  - Appearance and finish
  - Constancy of shape
  - Overall diameter
  - Stranding and lay ratio
  - Quantity of wire
  - Weight
  - Dc resistance
  - Breaking load test

All metallic materials used in the manufacture of conductors shall be covered by test certificates stating their mechanical and chemical properties to prove compliance with this technical requirements and EN or IEC as appropriate.

After the arrival of the conductors at site, they will be inspected and shall pass to the satisfaction of the Employer/Engineer such of the tests set out above or the Standardization Rules as he may deem necessary to satisfy themselves that the conductors supplied conform to the Technical Specification, including Guaranteed Performances and Characteristics.

### **5.3 OPGW – Optical ground wire and joints box Features**

The line is equipped with one OPGW for 132kV line and two OPGW for 132kV Line, whose mechanical and optical characteristics are given in Data Schedule.

The manufacturer has to provide evidence about his long term experience with the manufacturing of OPGW.

A minimum of 10 years of experience is required. OPGW reference list with the supply references of the past 5 years must be provided containing customers (with evidence), countries where installed, quantities and voltage level.

The Bidder shall deliver the cross section drawing showing type of core and external wire layers. The OPGW shall be supplied by referenced primary factory and according to best practice. Beyond the requirements already given for conductor, the following additional ones are given.

#### **5.3.1 Design and fabrication**

The OPGW shall be earthed to the tower steel work at each tower (at joint box locations both sections of the OPGW shall be earthed). Approved clamps and bonding leads shall be used for earth connections.

The OPGW shall be supplied with approved end seals (waterproof), which shall not be removed until immediately prior to optical jointing.

The OPGW shall be designed to withstand short circuit currents without degradation of the optical attenuation of the fibers or mechanical damage to the ground wire strands.

The optical fiber shall be designed to prevent mechanical and optical degradation after thirty years of intermittent exposure to saline (marine), desert and polluted weather.

The mechanical calculation of the OPGW shall be made with the same loading conditions given in schedules and shall be based on Contractor information, namely:

- Mechanical characteristic, as per Data Schedule
- Max allowed tensions in various conditions (recommended by Supplier)
- Long term creep value

OPGW shall consist of at least two layers of wires, either aluminium clad steel strands or aluminium alloy, all surrounding an optical fiber communication cable enclosed in an aluminium alloy tube or other approved tool. The OPGW shall comply with the requirements of IEC 60793 AND 60794 or other equivalent International Standard. Contractor is required to submit with his Bid a record of previous service experience with the offered OPGW.

The wires shall be of uniform circular section, smooth and free from surface imperfections.

The diameter of the wires shall not vary more than 2 percent from the standard figures. The wires shall be pre-formed so that they remain inert when the conductor is cut. The lay of the outer layer shall be right-hand. There shall be no joints in individual wires in a reel length unless specifically approved.

OPGW shall be capable of carrying a lightning stroke current effect on the optical characteristic and electro mechanical characteristics.

The cable design shall be such that any heating due to lightning strikes or short-circuit fault current shall be confined as much as possible to the outer layers of the OPGW earth conductor and shall not affect the characteristics of the optical fibers or cause any permanent deterioration of the data transmission characteristics.

Fibers shall be laid loose and equally distributed into buffer tubes of stainless steel or aluminium tubes. The buffer tubes and the compound shall be suitable to withstand the above-mentioned temperatures. The compound shall not corrode the fiber or cause it to swell. The fibers shall be grouped and laid in a way allowing the adaptation to the overall cable elongation.

The Optical fiber shall be of ultra-pure fused silica glass coated with UV-cured acrylate suitable to withstand temperature of about 80°C (continuous) and up to 200°C under short circuit current.

The Contractor shall submit supporting documents comparing test conditions and measurement results.

The fibers in each tube shall be color coded in accordance with the Standards.

In any offered OPGW design, the reserve length of fiber against the linear length of OPGW shall be such that, when the OPGW is subjected to 100% of its UTS, the optic fibers will remain intact.

Contractor shall deliver the recommended procedures for OPGW stringing and sagging.

### **5.3.2 Delivery lengths**

OPGW cables shall be delivered in lengths, determined by the Contractor, taking into account sag and down-leads to joints, as no in span joints are allowed. The length of each drum shall be established according to tower spotting and joint box location; it shall not be less than 5000 m. A thermal pad shall be placed on the outer coils of the drum and thermal protection shall be at least equivalent to that obtained with an aluminum sheet covered by 10 mm thickness of expanded polyethylene.

After factory inspection, the inner end of the cable shall be fitted with a suitable cap to ensure water tightness. The outer end shall be fitted with a watertight head compatible with cable pulling.

The same precautions as for the line conductor shall be taken for earthwire and OPGW with regard to reels, packing and shipment.

### **5.3.3 Joint boxes**

The individual lengths of OPGW will be jointed at convenient tension or suspension tower locations, on the tower structures by means of connecting joints.

In case there is a tension tower between two adjacent OPGW joints, the Contractor shall provide suitable attachment fittings to by-pass the tower without any additional joint.

At the substation gantries, a connection between the OPGW and the optical fiber underground cable (UG-FOC) leading to the control room, shall be realized by means of joints (by other).

The joints shall be located in a suitable box and the OPGW and underground cable access to the enclosure should be via entry ports in the base, properly sealed to prevent moisture ingress. Same joint enclosures shall be suitable for jointing two OPGW sections or OPGW with UG-FOC by substitution of appropriate glands in entry ports.

As a rule, the joints or joint enclosures connecting the OPGW delivered lengths shall be installed immediately above the anti-climbing device, where a covered waterproof working platform can be accommodated. The Contractor shall

present in his offer by means of detailed description and drawings, the OPGW/OPGW jointing procedure and devices and is responsible for the operational continuity of the OPGW system considering that the interface point between line and substation is the OPGW/UG-FOC joint on substation gantry installed by substation Contractor; in any case coordination of the two Contractors shall be required.

Preparation and cleaning of the tube and fiber ends shall be done using tools and methods recommended by the Supplier of OPGW. Fusion splicing shall be carried out by trained personnel of Contractor or Supplier. Optical losses shall average at no more than 0.1 dB per splice and no single splice loss shall exceed 0.3 dB. Each splice shall have a spare length of fiber of approximately 1 m or more, to be supported within the joint box by suitable clips or restraints. It shall be possible to remove and replace the splice in the support device without risk of damage to the splice or fiber. The joint requirements are here below summarized.

#### The Contractor:

- Shall provide detailed information on mechanical and optical aspects for all joints, splices and end sealing arrangement for the individual parts and/or complete system, guarantying the quality and performance of all joints shall be consistent with achieving the mechanical requirements over its design life.
- Shall describe in detail the proposed method of jointing the optical fiber both during installation.
- Shall provide detailed drawings showing the location of all joints. Each joint shall be uniquely numbered.
- Shall monitor the optical performance of each joint using an Optical Time Domain Reflectometer. Upon completion of jointing and prior to sealing the joint box, a measurement of the total fiber attenuation shall be made. If the total fiber loss is projected to exceed the designed installation loss, then the joint shall be broken and re-joined until the specified performance is achieved.
- Assure that any fiber bends necessary shall not affect the physical properties of the fiber and shall not shorten its life span.
- Fusion splicing without any sharp edges or protrusion which may damage the optical fiber.

The fiber optic conductors or cables down-leads (to joint box) shall be supported on and electrically bonded to the structure by means of cleats at 1000□1500 mm centers on vertical members and 600 mm centers on horizontal

members. The cleats shall be designed so that no damage during installation is caused to the galvanized surface of the steelwork.

A suitable length of optical conductor or cable, minimum 3.5 m, is to be coiled and supported on the structure as specified before entering the joint box.

The joint boxes shall consist of an external steel or die cast aluminum housing and provide protection to IEC60529 IP447, and an internal die cast aluminum or high impact plastic ABS box to IEC60529 IP5. The external housing shall be designed to that rain water is directed away from the door, and there shall be no water ingress when the door is opened. The door of the box shall be fitted with captive hinges and shall be fastened shut by screw fixings. A hasp shall be provided on the door capable of taking a 10mm padlock. The bottom of the box shall be fitted with two gland plates, each gland plate shall have two entry points. The gland plate shall be interchangeable, one style shall be used for fiber optic earthwire (OPGW), the other for underground fiber optic cable (UG-FOC). The joint box shall be supplied complete with all fittings to secure and seal the cable in the gland plates or blank the unused spigots.

Junction box technology shall ensure only bottom cable entry, quick removal of box cover giving access to fiber splices, repair of fiber splicing at least three times during Transmission Line's working life, accordingly sufficient fiber length should be left loose inside the box. All jointing materials, sufficient for all splices (equal to 1.2 times the number of fibers), including the splicing sleeves, heat shrinking protective tubes, splice holder and cable holder should be provided inside the box.

All required materials for fixing the optical conductor or cable and for the installation of the joint boxes shall be supplied by the Contractor at their costs.

### **5.3.4 Type Tests**

The type test shall be performed by third party in accordance to IEC 60794-1-1, IEC 60794-2, IEC 60794-4, and EN50182.

Type test certificate may be accepted provided that tested conductor structure corresponds to the offered one. The submitted type test certificate shall not be older than 10 years.

### **5.3.5 Acceptance Tests**

The acceptance test shall be performed in accordance to EN 50182 and IEC 60794-1-1, IEC 60794-2, IEC 60794-4.

## **5.4 Lattice towers**

### **5.4.1 Material**

Steel for towers and bolts shall comply with international Standards such as ASTM, EN, BS or equivalent national Standards and shall only be manufactured and rolled in approved mills.

In order to reduce the risk of material confusion, only two grades will be permitted. Suitable classes are a low yield steel (yield point 275 N/mm<sup>2</sup>) and a high yield steel (yield point 355 N/mm<sup>2</sup>).

High yield steel shall have a resistance to brittle fracture at least equal to EN 355JR. High yield steel shall, prior to fabrication, be marked distinctively by a blue water paint stripe along the entire length or some other approved method of marking.

Before welding of members is carried out, the Contractor must submit a chemical analysis of the material to the Employer for his approval. Welded member shall have brittle fracture according to EN 355JO.

In case of there is steel sub supplier ( sub-contractors for steel suppliers) , all of prequalified conditions for prime contractor were mentioned in Tender, will be applied to qualify the sub-contractor, therefore all required qualifications documents need to be submitted, otherwise will not be qualified .

### **5.4.2 Fabrication**

- Workmanship**

Workmanship shall be first class. All pieces must be straight and free from lamination flaws and other defects. All clipping, back-cuts, grindings, bends, holes, etc. must be true to detailed drawings and free of burrs.

All identical pieces bearing the same erection number must be exactly interchangeable with each other and interchangeable in their relative position in all parts of the tower, where they are installed.

Means shall be provided to enable the Employer to carry out such checking of members as he may consider necessary.

Built-up sections, when finished, shall be true and free from all kinks, twists and open joints and the materials shall not be strained in any way. In order to check the workmanship, not less than 1 per cent, of the members corresponding to each type or support or crossarms shall be selected at random and assembled to form complete latticed supports or crossarms in the presence of the Employer at the manufacturer's works.

If the towers are fabricated or galvanized by sub-Contractors, the Contractor shall, if required by the Employer, provide a resident inspector at the works of each subContractor during the time that the bulk of the steelwork is being fabricated or galvanized.

- **Shearing and cutting**

Material may be sheared to length, but the ends, unless otherwise noted, must be square with the length and free of burrs, so that difficulty of assembly, caused by interference of end section with other members at the time of assembling the steel tower, may not occur.

The use of a burning torch is permissible for cutting members, providing all irregular edges are trimmed smoothly before galvanizing. Stresses shall not be transmitted into the metal through a burned surface. The material adjacent to a burned surface for a distance equal to the thickness of the material shall not be considered a part of the net section for tension members. The use of a burning torch for cutting bolt holes will not be allowed.

- **Punching and drilling**

Holes are to be realized with racks and jigs employed to ensure accuracy throughout. The punches and dies for this work must be maintained sufficiently sharp, so as to produce clean round holes normal to the plane of material, free of burrs, folds, depressed or upset edges.

Holes can be punched up to a thickness < 16 mm; holes must be drilled or subpunched and reamed in a mild steel over 19 mm thick, in high-strength structural steel over 16 mm thick and in tension only members. Maximum allowed subpunching diameter: 3 mm lower than the nominal diameter of the hole.

Any holes adjacent to a bend line or near the weld with the "cut and weld" or "cut open and weld-insert plate" technique must be drilled and must be positioned so that at least 12 mm of the parent metal exists between the edge of the hole and the weld line.

Holes in bent members, which may be affected by the bending operation, shall be laid out and punched or drilled after bending. Holes which are elongated or otherwise distorted by bending will not be accepted.

The diameter of bolt hole shall not exceed 1.5 mm plus the bolt diameter for bolt  $\phi < 20$  mm, 2.0 mm above.

- **Bending**

All bending shall be done hot; cold bending can be accepted for small sections with bending up to  $4^\circ$  in high strength steel, up to  $8^\circ$  in mild steel.

Members bent shall be heated in a non-oxidizing flame over a sufficient area to prevent excessive deformation; a member bent in error with respect to the location of a bent line shall be rejected. The minimum heating area shall be: four times the thickness for plates, twice the dimension of the flange for profiles.

The bending procedure shall be coherent with the dimensions adjustment introduced in the details.

Bending in high yield steel sections shall be carried out at  $850 \square 1000$  °C.

- **Welding**

All welding shall be performed by qualified operator in accordance with the Structural Welding Code AWS D1.1 or equivalent European Standard. A shielded arc-welding process shall be used. A welds shall be made in such a manner that residual shrinkage stresses will be reduced to a minimum. No stress relieving treatment will be required. Pocket and cracks, which can constitute “acid pocket” in hot dip galvanizing, must be sealed with weld head.

- **Tolerances**

Tolerances of finished members, after zinc coating, shall be as follows:

a) Finished members shall not have lateral variations greater than 1/1000 of the actual length between points of lateral supports.

b) Longitudinal dimensions in finished members shall have a tolerance  $\square 1.5$  mm for members up to 3 m in length. For members over 3 m long, an additional 1 mm for every 3 m length may be allowed, but in no case a tolerance more than 3 mm shall be allowed for any member.

c) Tolerances in one connection and bending as follows:

- Distance between hole axis:  $\square 0.5$  mm
- Diameter of the holes of galvanized materials :  $\pm 0.3$  mm
- Bending angle:  $\pm 30'$

d) For the tolerances on laminated row material, reference shall be made to the relevant material Standard.

- **Markings**

All individual pieces shall be marked with the correct designations shown on the detailed approved drawings. Markings shall be done by stamping the marks into the metal before galvanizing and details shall be clearly legible after galvanizing.

Marking of bolts shall be made on bolt heads, to identify class, size, and length. Markings may be raised or depressed.

The piece marking must be made with numerals and/or letters of 19 mm minimum height.

The following sentence in Arabic language shall be gravid in all steel angles of towers:

**(الإسهامات شركة الكهرباء الوطنية فقط تحت طائلة المسئولية)**

- **Cleaning, galvanizing and painting**

- a) **Cleaning**

After fabrication has been completed and accepted, all materials shall be clear of rust, loose scale, dirt, oil, grease and other foreign substances.

- b) **Galvanizing**

All materials shall be hot-dip galvanized after fabrication and cleaning.

Galvanizing for structural steel products shall meet the requirements of ISO 1461, or equivalent. In addition, welded assemblies, which may be particularly susceptible to cracking and/or distortion, shall be galvanized and tested in accordance with ASTM A143 (Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement) or equivalent. All surface shall be free from hard zinc accumulation.

The coat of the zinc coating shall be not less than those specified in the Data Schedule.

Treatment to prevent the formation of white rust during shipment is required, but such treatment must be to the approval of the Employer. The preparation for galvanizing and the galvanizing itself shall not distort or adversely affect the mechanical properties of the material.

If any galvanized part is found to be imperfect it is to be replaced. The whole of the expense involved in the replacement of the imperfect part is to be borne by the Contractor.

The Contractor shall provide an instrument for checking galvanizing thickness, e.g. Elcometer, or otherwise agree with the Employer an approved method of testing galvanizing on Site.

If, in the opinion of the Employer, the extent of damage found after receiving by galvanized part, appears capable of repair, the Contractor may, following the agreement of the Employer, to proceed with repair by approved methods. The agreement to the repair shall not bind the Employer to accept the repaired part when this is re-offered for inspection.

Repairs of limited areas with zinc coating will be permitted, at the discretion of the Employer. Adequate surface preparation and correct application are essential to this process and will be subject to the approval of the Employer. Zinc rich paint used will have not less than 92% zinc content.

In the event that it is found that galvanized parts are subject to the formation of white rust during shipment or storage on Site, the Employer shall either:

- Approve a system of scrubbing and protective painting to be applied on Site, if in his opinion this is expedient, or.
- Forthwith order that the affected parts shall be condemned and that all future shipments shall receive, before dispatch from the works, special dip or spray treatment to individual members to his approval without extra charge to the Employer.

Nuts shall be galvanized before threading.

Finished materials shall be treated and packed in proper way, to avoid white rust during sea transportation and storage (spaces are recommended).

Materials, on which galvanizing has been largely damaged, shall be regalvanized after pickling.

### c) Painting of galvanized surfaces

All the towers shall be painted by the Contractor with one or more coatings of approved paint, and shall submit for approval the manufacturer, the type of paint, the number and thickness of coats

recommended by the manufacturer, the means of application and the equipment he intends to use for this purpose.

All top parts of towers and above the level of the top phase Conductor strut member shall be painted in an approved shade of Orange and White paint. The finished painted surface will be expected to resist attack from wind borne sulphur dioxide with small traces of bromine and chlorine and the general atmospheric conditions which are humid and saline with temperatures up to 50°C.

Contractor shall give full details of the chemical base of the paint they intend to supply e.g. calcium plumbate, chlorinated rubber etc.

Painting of towers shall comply with the civil aircraft authority in Jordan. The type and manufacturer of the paint together with the means of application shall be approved by the Employer.

**d) Tower Lighting System**

All towers shall be provided with lighting system according to the **ICAO** (International Civil Aviation Organization). **The lighting system shall be fed by solar panel or other system approved by the Employer and supplied by the Contractor.**

**• Shop assembly**

Preassembly is required at factory on one tower of each type and height before galvanization, including every combination of leg extensions.

During assembly all parts must be matched with precision without resorting to additional thicknesses other than those shown in the structural drawings and without using of special tools, such as to introduce inadmissible efforts and deformations.

Full scale load test shall be made on galvanized structure, unless otherwise agreed with the Employer.

**• Accessories included in tower supply**

The following tower accessories shall be provided:

**a) Step bolts**

Each tower shall be provided with permanent step bolts of an approved type on two diagonally opposite legs spaced alternately on the angle flanges at not more than 380 mm between centers, starting immediately above the anti-climbing device and continuing to each earthwire. The minimum diameter of the step bolts shall be 16 mm and their length 180 mm. Step bolts shall not be used as connection bolts.

Holes for removable step bolts below the anti-climbing device shall be provided at no more than 380 mm between centers, on the legs to which the permanent step bolts are fitted.

b) Attachment devices

Attachment devices shall be suitably furnished on all cross arms to suspend and to terminate insulators set or earthwire assemblies. The devices shall have minimum ultimate tensile strength equal to that of the hardware.

The Contractor shall coordinate the interfaces between tower and fitting Suppliers.

c) Supports for ant climbing devices and signs.

#### 5.4.3 Bolts and nuts

Members of lattice steel structures shall be secured by means of bolts and nuts with approved plain and spring washers. All bolts and nuts shall conform to ISO 898, and spring washers to BS 1802, or such other standards as may be approved. Nuts and heads of all bolts shall preferably be of the hexagonal type. All bolts and screwed rods shall be galvanized including the threaded portions. All nuts shall be galvanized with the exception of the threads which shall be oiled. The nuts of all bolts in the devices connecting the insulator sets or fittings to the towers shall be locked by the use of locking nuts. The screwed threads of any bolts or studs shall not form part of bearing plane between members.

When in position, all bolts or screwed rods shall project through the corresponding nuts for at least a full turn but such protection shall not exceed 10 mm.

Where for any type of support high tensile steel bolts are employed then bolts of this type are to be used for all connections for every type of tower on that line so avoiding the use of mild steel bolts where high tensile type should be employed.

Anti-theft Bolts shall be used in fixing the steel angles bolts of the first trunk of towers (up to 10 meters from ground).

All washers are to be included under this Contract, including locking devices and antivibration arrangements, which are to be subject to the approval of the Employer.

Taper washers are to be fitted where necessary.

Nuts shall be finger tight on the bolt for delivery and will be rejected if they are, in the opinion of the Employer, considered to have an excessively loose or tight fit. Bolts with redied threads after galvanizing will be rejected.

The Contractor shall request his Supplier to select two samples of each type of bolt and nut to be used in the Contract and send these two samples to the

Employer for approval within one month of the date of issuing the sub order. The Employer will then reject bolt consignments which fail in any respect below the standard supplying good quality.

#### **5.4.4 Type Tests - Full-scale tower load tests**

The Employer reserves the right to verify the adequacy of tower design and fabrication by means of full-scale tests of selected assembled towers.

Full-scale tower load tests must be performed in accordance with IEC 60652 “Loading tests on Transmission Line structures”; it may be up to failure and shall comply with the following requirements:

- Tower prototype
  - The tower shall be fabricated from detailed drawings approved in a manner as close to final production procedures as practicable. The tower shall be complete in every detail and fully galvanized. Black prototype may be proposed (for time schedule reasons), subject to approval.
- Erection
  - The tower shall be erected on a rigid foundation using the specified tower bolts and nuts, tightened to the specified torque.
- Test program
  - The test program with diagrams showing the loads in each load test, the proposed methods of applying loads (rigging) and the deflection measurement shall be issued for approval.
- Loading
  - Test loads shall be the ultimate design loads. All test loads corresponding to conductor and earthwire loading shall be applied directly to the regular attachment details provided for these loads. Test wind loads, equivalent to wind loads on the tower, shall be applied to achieve as close as possible the design total load and overturning moment.
- Deflection measurement
  - Deflections shall be recorded at the beginning and end of each loading period, to provide longitudinal and transverse deflections of specified points (generally the SW and phases attachments).
- Load tests - The initially applied loads and the increment of loadings shall be 50 per cent of the final loads given in the loading diagrams. The next increments according IEC 60652. Each load increment shall be maintained

for not less than one minute except that, under full design load, the period of five minutes shall be maintained. All test loads shall be removed completely before the loads for testing under a different loading condition are applied.

- Destruction tests - After the successful completion of the load tests, if required, the tower shall be further tested to destruction in a selected load case. The load increment shall not exceed five per cent of full design loads.
- Modification of tower components - Any conspicuous yielding or permanent deformation or any failure of any part of the tower under any of the tests specified above shall be considered a defect and shall require design revision. The retest in the same load case is required.
- Material tests - Steel materials used for tower prototype shall be subjected to tension or bend test in accordance with the relevant material Standard. The test specimen shall be selected as follows:
  - Two sets selected from the destructed members of each test tower.
  - Two sets selected from the undisturbed members of each test tower.
  - Two sets of bolts and nuts selected at random of each test tower.
  - Load cells - Load cells calibration shall be carried out before and after each test or series of tests.

#### **5.4.5 Acceptance Tests**

The acceptance test shall be performed in accordance to:

- EN10025 or equivalent - ISO 1461 or equivalent
- ISO898 or equivalent

As a minimum, the following test shall be carried out for each 40tons of steel passing through the fabrication plan:

- Yield strength
- Ultimate tensile strength
- Percentage elongation
- Thickness of zinc coating
- Adherence of zinc coating
- Surface appearance

All no tested structural parts shall be preassembly at factory site, to check the drawing and fabrication correctness.

## 5.5 Insulators and fittings

The insulator shall be type: **5.5.1 Composite insulator - Long rod type**

In long rod types the zinc collar and sleeve are required to prevent electrical corrosion. Ball and socket joints on insulator sets shall be lightly coated with an approved grease before erection.

The composite long rod shall be sound and free from defects which may affect the performances or the life of the insulator.

All surfaces of metal parts shall be smooth with no projecting points or irregularities which may cause corona. The metal parts shall be resistant to the effect of acid, salts or alkali dust and sand to which it may be exposed in the atmosphere.

All insulators shall be designed to withstand the fault currents show in Data Schedule.

The manufacturer has to provide evidence about his long term experience with the manufacturing of composite insulators using silicone rubber technology for the housing.

A minimum of 20 years of experience is required. An insulator reference list with the supply references of the past 10 years must be provided containing customers, countries where installed, quantities and voltage level.

The insulator core has to be an epoxy resin rod with high strength axial glass fiber reinforcement (Fiber Reinforced Plastic Rod). Glass fibers and resin must be optimized with regard to mechanical strength and moisture absorption.

The interface formed between rod and housing must be of a high quality to prevent brittle fracture phenomena. The use of E-CR-glass fibers providing both high electrical strength and equivalent acid resistance is recommended for tensile-loaded applications.

The material for the housing must be Silicone Rubber, the only material that has shown a long-term hydrophobicity in service.

To simultaneously achieve an excellent pollution performance as well as a tracking performance of the housing, the use of HTV (High Temperature Vulcanizing) silicone rubber filled with an appropriate amount of ATH

(aluminum tri hydrate) is mandatory. The characteristically properties of such a Silicone Rubber are as follows:

- Density : > 1.55 g/cm<sup>3</sup>
- Passing Voltage Level of IEC 60587) : 4.5 and 6 kV2)
- Flammability Class of IEC 60695-11-10 of 3 mm Specimen : V0
- Tear Strength (ISO 34-1) : > 10 N/mm<sup>2</sup>
- Elongation at Break (DIN 53504-S1) : > 200 %

The use of other silicone rubber grades such as LSR (Liquid Silicone Rubber) or RTV (Room Temperature Vulcanizing) as well as EPDM (Ethylen Propylene Dien Monomere) is not permitted.

Only Insulators with Silicone Rubber housing applied to the rod by injection moulding process are accepted. Using direct moulding, the mould line must be turned at least every meter by at least 60°. This prevents possible effects of a straight axial mould line. It is absolutely essential that the interface between housing and core is chemically bonded. The thickness of the silicone rubber covering the rod must be at least 3 mm. The concentricity of the rod embedded in the Silicone Rubber housing has to be proven.

The shed design must be in accordance with IEC 60815 and a flat, aerodynamic alternating shed profile is required (sheds with rips are not accepted in order to avoid the accumulation of dirt). Recently published guides recommend that a creepage factor of 3.5 should not be exceeded to prevent ineffectiveness of creepage distance.

The insulators shall be equipped with hot dip galvanized steel end fittings applicable for Ball & Socket connection in compliance with IEC 60120. The end fittings must be made of forged high tensile strength quality steel. Cast end fittings are not permitted. The locking devices shall be made of stainless steel. The end fittings have to be protected by means of over-molding or an additional corona shed.

### **5.5.1.1 Marking**

Each insulator shall be marked with Supplier mark, guaranteed electromechanical strength, date of manufacturing, before galvanizing.

The guaranteed electro-mechanical strength and the type of the units in each crate shall be clearly marked on each crate in a waterproof medium.

### **5.5.1.2**

**Galvanizing** See  
fittings  
galvanization.

### 5.5.1.3 Tolerances

The permitted tolerances are related to long rod, and have to meet the requirements according to IEC 61109. In accordance to the standards, the following tolerances are permitted for all dimensions excluding special requests:

$$\begin{aligned} \pm (0.04 \times L + 1.5) & \quad \text{when } L \leq 300 \text{ mm} \\ \pm (0.025 \times L + 6) & \quad \text{when } L > 300 \text{ mm, limited to 50 mm} \end{aligned}$$

### 5.5.1.4 Type Tests

Type test shall be performed by third party according to IEC 61466, 60120, 61109, 60372. Type test certificate may be accepted provided that tested insulator structure corresponds to the offered one. The submitted type test certificate shall not be older than 10 years.

### 5.5.1.5 Acceptance Tests

Acceptance tests are required according to IEC 61466, 60120, 61109, 60372.

## 5.5.2 Fittings

### 5.5.2.1 General

All line fittings to be furnished shall be made of aluminium, aluminium alloy, galvanized steel or malleable iron. The current carrying capacity of conductor connection, repairs and armour rod shall not be less than that of specified conductor.

All pins for securing the attachments shall be of nonferrous approved material (stainless steel or other).

All bolts and nuts shall be galvanized as specified and shall be made of steel having minimum tensile strength of 800 N/mm<sup>2</sup> (class 8.8); sharp corners or projections, which would produce electrical stress, shall be avoided. Smooth surfaces, free from abrasion, are required.

### 5.5.2.2 Clamps, joints and armour rods

All suspension clamps shall be installed over armour rod and shall be made of aluminium or aluminium alloy outer-surface. In OPGW, neoprene or other non-metallic protection is installed between wires and armour rods.

Tension clamps and joints will have galvanized steel and aluminum alloy sleeves for bimetallic conductor. OPGW tension clamp shall be performed type. The aluminum joint compound shall be chemically inert of a petroleum grease base. It shall include titanium dioxide for high electrical efficiency and zinc

chromate as an oxide inhibitor. It shall remain workable through a temperature range from 0°C to 110°C. It shall be non-toxic and insoluble in water. Armor rod are required between OPGW wire and warning sphere (if any).

#### **5.5.2.3 Counterweight (if any)**

The counterweight equipment shall be of vertical type, consisting of adaptor to be fastened to the suspension clamp, hanger and accessories. The equipment and counterweight shall not reduce the live parts to tower clearance below the minimum design clearance.

All counterweight units shall be made of concrete, cast iron, galvanized steel. Each unit will have weight 30÷50 kg.

#### **5.5.2.4 Marking**

All components of line accessories shall be marked, where practicable, by means of legible relief process or impress process, as designated by the Supplier and approved on the drawings. Marking for ferrous metal shall be done before galvanizing.

#### **5.5.2.5 Type Tests**

Type tests reference is made are mainly related to electrical test on complete insulator sets for suspension and tension sets.

Type tests are defined in Inspection and Testing Chapter.

#### **5.5.2.6 Acceptance Tests**

The acceptance tests shall be performed in accordance to IEC61284, 60383 and ISO1461.

### **5.5.3 Vibration damping system**

#### **5.5.3.1 Stockbridge dampers**

The damper clamps shall be forged Aluminum alloy.

For OPGW the damper clamps shall be designed to fit it on suitable armour rods to ensure that dampers shall not damage the OPGW.

The clamping bolts shall be of steel having a minimum tensile strength of 800 N/mm<sup>2</sup> and shall be designed to facilitate an easy damper mounting. The screws shall be locked in an approved manner. The washers shall be made of stainless steel.

Bolts and nuts shall be ISO Metric precision Hexagon to EN BS3692, Metal washers shall be ISO Metric to EN BS4320 “Bright series” and spring washer shall be ISO Metric to EN BS4464.

The damper shall be designed so that water collection is eliminated. If this is not possible, they shall have drainage outlets with a minimum diameter of 6 mm.

All ferrous parts of the damper component elements shall be hot dip galvanized.

The messenger cable shall comprise a suitable number of high tensile steel wire strands (minimum 19 wires) shall be straight and sufficiently stiff to remain straight when the vibration damper is suspended by its clamp; the minimum required tensile strength of cable is 1220 N/mm<sup>2</sup>.

The dampers shall be free from visible and audible corona discharge and radio interference at the voltage level specified in the Data Schedule.

No audible noise shall be induced by the wind under any weather conditions.

#### **5.5.3.2 Marking and galvanization** See fittings galvanization.

All vibration dampers shall be marked to ensure a system of traceability. Where practicable and unless otherwise agreed between the Employer and the manufacturer, dampers and spacers shall be clearly and indelibly marked with 3mm minimum high characters as follow:

- Identification of vibration damper (reference number)
- Manufacturer's identification
- Date of manufacture (month and year)
- OPGW or conductor diameter range or designation
- Clamp bolt installation torque

#### **5.5.3.3 Type Tests**

Here below the particular test requirement for individual items.

##### **Stockbridge dampers**

Stockbridge dampers shall be type and sample tested in accordance with IEC 61897. The following tests shall be performed:

- Dynamic characteristic test

This test is intended to establish the dynamic characteristics of the dampers.

The damper shall be vertically mounted on a shaker table and driven with a constant table velocity of both 0.10 m/s and 0.05 m/s. The frequency range shall be calculated with the formula:  $f = 0.2 \frac{D}{V}$

D with  $f$  = frequency  
(Hz)       $V$  = wind velocity  
(m/s)

$D$  = conductor diameter (m)

for a wind velocity range of 0.5 - 7 m/s. The sweep rate shall be 0.2 decades/minute. The reaction force and the phase angle between the reaction force and the velocity shall be measured and power and impedance shall be plotted against the frequency over the given frequency range.

One half width values of the resonant peaks of the power curves provide good information about damping capabilities of a damper. This value shall be calculated for each resonant peak of the power curves. The values shall not be smaller than 0.3.

- Fatigue test

This test is intended to demonstrate that the dampers have an acceptable fatigue limit dampers. The damper shall be attached to a shaker and driven in a vertical direction for 100 million cycles. The frequency range shall be calculated as in "Dynamic characteristic test".

After the fatigue test a new dynamic characteristic test shall be performed. There shall be no significant difference in the dynamic characteristics before and after the fatigue test.

- Attachment of clamp to messenger cable

The tests are intended to demonstrate the suitability of the attachment of the clamp to the messenger cable.

- Attachment of weights to messenger cable

The tests are intended to demonstrate the suitability of the attachment of the weights to the messenger cable.

- Breakaway-head bolt test

The tests are intended to demonstrate the suitability of the used breakaway-head bolts.

- Clamp bolt tightening test

The tests are intended to demonstrate the suitability of the used clamp bolts.

- Clamp slip test

This test is intended to verify the clamp slip force and shall be performed in accordance with IEC 61897.

The damper clamp shall be installed on the conductor using the following torque:

- 45 Nm for M10;
- 60 Nm for M12 or bigger threads.

Then a force shall be applied to the clamp along the axis of the conductor. The minimum force required to cause the clamp to slip on the conductor shall be recorded.

In addition to the type tests shown above, corona and radio interference tests have to be carried out, generally installed complete insulator set to be tested.

#### **5.5.3.4 Acceptance Tests**

The acceptance tests shall be performed in accordance to IEC61897, 61854. As a minimum the following test shall be carried out:

- verification of dimensions;
- check of dynamic characteristic (see type tests);
- check of clamp slip (see type tests);
- galvanizing.

#### **5.5.4 Earthing system**

The earthing system is realized by the required rods and length of galvanized steel tape. Therefore the fabrication may be included in lattice tower supply and delivered at same time of stubs, to guarantee the completion of civil works. The final quantities shall be determined after successful measurement of installed system.

The rods and tape shall be delivered in standard lengths with holes and bolt for pieces connections.

Each connection with 2 bolts, 12 mm diameter.

### **5.6 Packing**

#### **5.6.1 Steel bundle**

The whole of the plant shall be packed where necessary in no returnable cases or in nonreturnable drums or otherwise prepared for overseas shipment to a tropical country without sustaining damage.

All packing shall become the property of the Employer.

The Contractor shall at suitable intervals during the execution of the Contract deliver such packing to stores selected by the Employer at no extra cost.

Bundles of steel angle sections shall be properly tied together by an approved method and care taken to ensure that they are robust and not of excessive length for handling during shipment.

Bundles shall be as large as possible to provide stiffness and resistance to careless handling.

Unless the Contractor can offer an equally acceptable method, bundles of angles shall be arranged in rectangular formation with notched outer stout wooden battens to locate the angles, the battens being compressed on the bundles by outside tie bolts-the above binders being located at sufficiently close intervals to form a strong and homogenous element.

The Contractor's attention is drawn to the provision to suitably protect all steelwork before shipment to prevent damage to galvanized surfaces by white rust.

### **5.6.2 Packing crates for metal parts**

Small pieces, plates, cleats, fittings shall be packed in cases.

Packing cases shall be strongly constructed and in no case is timber less than 25 mm in thickness to be used. The contents of packing cases shall be securely bolted or fastened in position with struts or cross battens. Cross battens supporting weight in any direction shall not rely for their support on nails or screws driven lengthwise into the grain of the wood, but shall be supported by cleats secured from the inside.

Bolts and nuts shall be double bagged and crated for shipment, assembled with nuts and washers

Crating together of components of dissimilar metals shall be avoided.

Particular attention shall be given to strutting before packing cases are fastened down.

Cases shall be up-ended after packing to prove that there is no movement of the contents. Timber wedges or chocks shall be firmly fastened in place to prevent their displacement when the timber shrinks.

If light parts are fastened to the sides of a case, hoop iron straps secured by screws shall be used for the purpose. Nails driven in and bent over shall not be permitted.

Where bolts are used, large washers shall be fitted under the head and nut to distribute the pressure and the timber is to be strengthened by means of a pad.

### **5.6.3 Insulator packing**

All insulators shall be carefully packed in crate for transport by sea, rail and road. Each crate shall contain only insulator units of the same type. Crate shall be of hexagonal or rectangular cross-section.

Crates shall be wooden and should be close-boarded. They shall be manufactured from sound seasoned softwoods and suitable for prolonged storage on site under the climatic conditions present and to prevent damage due to termite attack. They shall be steelbanded for additional strength at not less than three positions along their length. Crates shall be designed with internal struts or partitions to support the insulator and prevent insulator movement. Insulator shall be fitted with the retaining clips.

#### **5.6.4 Damper and small item**

Dampers shall be packed in non-returnable timber crates to prevent damage during transport and handling. Small items (bolts and other) shall be packed in jute bags up to a gross weight of 25 kg within larger containers. Containers over 25 kg shall be delivered on pallets suitable for handling by forklifts. Components of dead ends, mid-span joints, armor rods etc., shall be packed as complete.

#### **5.6.5 Additional requirements**

All packing will be inspected before shipment but the Contractor shall be entirely responsible that the methods of packing are suitable to withstand rough handling many times in transit.

All stencil marks on the outside of casings shall be either of a water-proof material or protected by shellac or varnish to prevent obliteration in transit.

Wood wool shall be avoided as far as possible.

Waterproof paper and felt linings shall overlap to seams at least 12 mm (1/2 inch) and the seams secured together in an approved manner, but the enclosure shall be provided with screened openings to obtain ventilation.

Each crate or package shall contain a packing list in a water proof envelope and copies in triplicate shall be forwarded to the Employer prior to dispatch. All items of material shall be clearly marked for easy identification against the packing list.

All cases, packages, etc. shall be clearly marked on the outside as instructed by the Employer with a shipping mark, indicating the total weight, where the weight is bearing and the correct position for lifting slings. An identification mark shall relate to the appropriate shipping documents.

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



## CONSTRUCTION

### 6.1 Access, survey and environmental impact

#### 6.1.1 Construction of access

The Employer will provide the following facilities:

- Such right of access along the route of each line section as the Employer agrees is necessary to enable the Contractor to proceed with the clearance of any trees and scrub for erection and investigation of foundation conditions.
- The right to construct and make use of a reasonable width of track along the route for the transport of stores and material and the carrying out of erection operations, except where the route crosses buildings, gardens or other ground over which the Employer decides that such a track is not reasonably practicable.
- The right to transport material from road on to each continuous length of the route at agreed points of access providing that this right of access shall not involve the Employer in excessive compensation claims way-leave charges.

After obtaining preliminary approval of the Employer, the Contractor shall at an early stage of the Contract arrange all proposed points of access with landowners or other interested bodies and thereafter prepare access maps.

The Contractor shall then submit the approved access maps to the Employer for approval and for settlement of way-leave arrangements, and compensation claims, etc.

Where the above facilities are provided no other access shall be used except with the consent of the Employer.

The access shall be so arranged that the Employer shall have access for patrol and maintenance to all parts of the finished line where considered practicable by the Employer. Access to all individual tower sites is required, either natural or constructed track, permanent access for the Employer to carry out future maintenance. Such tracks need not be surfaced but shall be graded and shall include culverts to prevent wash out. Tracks shall be at least 4 meters minimum width and wider on sharp bends to provide access to all maintenance plant, equipment and vehicles.

The Contractor shall make all necessary arrangements (other than for matter of way leaves and permanent access tracks) with the occupiers before going on to private land, but if any difficulty should arise, the Contractor shall inform the Employer thereof.

The cost of access, roads construction and of manhandling the material to erection points where such is found necessary shall be deemed to be allowed for within the several rates entered in the Price Schedule and the Contractor shall have no claim whatsoever to extra payment for such construction of access roads and manhandling as may be required.

Where should the use of helicopters be required. Bidders are advised that a permit for such, issued by the military authorities may be necessary.

Should permission to use helicopters not be obtained it must be clearly understood that the Employer will not, under any circumstances, reimburse the Contractor for any extra costs occasioned by the necessity to use other forms of transport to deliver materials or labour to tower sites.

### **6.1.2 Route and access clearance**

The Contractor shall submit in two months from the Award letter date, two copies of a complete set of land maps indicated with the line routes to get the necessary approvals of the right of way of the routes. The maps should be of scale preferably **233** or as available at the department of lands and the relevant municipalities.

Where clearing is in the opinion of the Employer necessary the following requirements shall be observed.

Trees and tall scrub shall be cleared to a distance of 20 m on either side of the center-line of the route.

Trees and bushes shall be cut down to a height of not more than 1.25 m above ground level. In addition, tall trees outside the cleared area, of such height that they could fall within 2 m of Conductors shall be felled by the Contractor after obtaining the necessary permission from owners.

No tree may be felled without the express permission of the Employer and the relevant Authority.

Felled trees and scrub shall be removed from a path 2.5 m wide and running as far as possible continuously along the route. The Contractor shall grub up tree stumps and roots from this track and leave a graded way for traveling by Land rover, Unimog, or similar four-wheeled drive light vehicle for patrolling and maintenance by the Employer. The Contractor shall clear a 3.5 m wide agreed construction access track from public roads, of all trees, stumps, scrub and vegetation.

The cost of such clearing stated above is deemed to be included in the general rates in Price Schedule.

### **6.1.3 Survey**

The survey work shall commence within two weeks from the letter of intent and be completed within a further period of 6 to 8 weeks.

The Employer will indicate the terminal tower positions to the Contractor. Thereafter the

Contractor will be shown the approximate location of the intervening angles points. The Contractor shall peg the angle towers and, prior to carry out any alignment or profile survey, will obtain written acceptance from the Employer as to the suitability of the angle tower positions pegged. The Contractor shall provide all necessary labor instruments and equipment in locating angle positions and executing alignment and profile survey.

The Contractor shall prepare Plan & Profile with tower spotting for Employer approval. Thereafter the prepared tower pegs shall be installed at each tower position and in the two line directions at angle towers. A “sinkage” of 300 mm should be allowed in plotting support position, not to be added to the design height to tower.

In case of sloped ground the survey of diagonal cross section shall be made for base leg selection, documented in separate sheets and approved by the Employer.

The staking chart shall be issued by Contractor with all data related to towers, spans and accessories to be installed.

### **6.1.4 Wayleaves**

Where required, wayleaves and wayleaves for access (subject to the requirements of landowners and their tenants) will be provided by the Employer to enable the Contractor to carry out the Contract Works.

Before the Contractor commences work on any property, he shall be responsible for obtaining from the Employer a wayleave schedule giving details of any special requirement of the tenants or owners concerned. The Contractor shall also be responsible for giving adequate notice of commencement of work to the landowners.

Before construction commences, the Contractor shall provide the Employer (at not less than seven days notice) with lists of the towers that have been pegged and are available for inspection.

### **6.1.5 Crossing of public services**

When the Contractor is about to carry out erection of the conductors, along or across power lines or telecommunication circuits, public roads, waterways or

the like, he shall be responsible for giving requisite notice to the appropriate authorities of the date and time at which he proposes to carry out the work.

Where it is necessary to provide scaffolding over roads, railways, or telecommunication lines in order not to interfere with the passage of traffic, etc., this shall be carried out by the Contractor at such times as may be convenient to the requisite Authority, and such work shall be deemed to be covered in the general schedule rates. Flagmen and approved types of danger or warning notices shall be provided by the Contractor to ensure safety of the public.

Scaffolding and decking shall be erected in a safe manner to the approval of the Employer and the time taken to effect the crossing and remove the temporary work shall be kept to a minimum.

The Contractor shall provide with his Bid, drawings showing the live line scaffolding proposed.

#### **6.1.6 Other crossing**

The Contractor shall at his own expense make the necessary arrangements and take any necessary precautions where the route crosses swamp, rivers or streams, buildings, or chards, plantations, gardens, or other obstacles or ground over which erection cannot be carried out in the normal manner.

#### **6.1.7 Livestock**

Adequate provision shall be made by the Contractor to prevent the straying of or damage to livestock during the execution of the Contract works and until the permanent reinstatement of fences, walls, hedges, gates and the like is completed, the Contractor shall be held responsible for any loss or damage to livestock due to failure to comply with the above requirements.

#### **6.1.8 Damage to crops and property**

The Contractor shall take all precautions to avoid damage to crops and shall ensure that the work is adequately supervised so that damage is reduced to the minimum.

#### **6.1.9 Claims for damage**

The Employer, in conjunction with the Contractor will negotiate the settlement of all claims for damage and the Contractor will be responsible to the Employer for meeting all such claims unless the Employer certifies in writing that the damage is unavoidable. Claims for unavoidable damage will be met by the Employer.

The Contractor shall be responsible for notifying the Employer in writing of all instances of damage which in the opinion of the Contractor are unavoidable. In the event of such notification not being received within fourteen days from the date when the damage is caused, the Employer may at his discretion refuse to consider any claim by the Contractor for compensation resulting there from. The Contractor shall be responsible for the cost of any special erection procedure where the route crosses buildings or other obstacles.

### **6.1.10 Removal of obstructions**

The necessary agreements for the removal of obstructions such as pipes, or for the removal of telecommunication and power lines, which are to be deviated or placed underground will be arranged by the Employer upon advice from the Contractor, with adequate notice, that he is ready to commence work in the section so affected.

## **6.2 Foundations**

### **6.2.1 Geotechnical investigation and foundation selection**

#### **Initial geotechnical investigation**

##### **General**

The services to be carried out by the Contractor are relevant to:

- Site tests
- Laboratory testing
- Soil investigation report
- Correspondence of soil types to foundation and earthing arrangement types

Initial geotechnical investigation shall be planned taking into account the type of foundations and the parameters required for the design. The aim is to establish a clear correspondence between type of soil and type of foundation, and a procedure for foundation type selection at each tower location.

The soil investigations shall be carried out to such a depth that all layers, which significantly influence the foundation strength, are included and it will be sufficient to detect all soil type encountered.

The type, condition, extent, stratification and depth of the soil layers as well as groundwater conditions can be examined by boring, sounding such as Cone Penetration Test (CPT), Standard Penetration Test (SPT), trial pits, sampling and laboratory tests. The results of the soil investigations shall be recorded, in accordance with relevant Standards or codes of practice.

The soil parameters recorded are referred to undisturbed existing soil and they shall be referred to for the evaluation of foundation design parameters, as far as the undisturbed soil is engaged.

When backfilling is used, the relevant stiffness depends on type of soil (cohesive or cohesionless) and grade of compaction. The soil parameter shall be reduced accordingly, particularly in cohesive soil, where the existing cohesion cannot be recovered, while the stiffness of granular soil may be substantially recovered by good compaction.

The permeability of the soil has also to be taken into account, higher in cohesionless granular soil. When backfilling with granular soil is into a surrounding cohesive soil, the tendency of water to accumulate in the backfill shall be considered. In certain circumstances, if it is not possible to assure sufficient compaction, lower values shall be used.

Other tests on soil resistivity are required for earthing arrangement evaluation and selection.

The necessity of sulphate resisting cement has to be evidenced.

### Tests

- Furnishing and storage of all equipment and tools, personnel organization (including provision for accommodation on site), furnishing of insurance and any other necessary operation to perform the required services.
- Mobilization of equipment and accessories, as needed for the completion of works such as: drilling, soil sampling, boring, as specified.
- Field operations for positioning borings and penetration test points, according to locations shown on relevant drawings and/or indicated by the Employer.
- Execution of drilling and in situ tests; the type, location and number of bores, samples, in situ tests shall be agreed with the Employer, aiming to cover all types of soil in the OHTL line route.
- Conservation and packaging of soil samples (if any).
- Transportation to and testing in the laboratory.
- Withdrawal of site machinery, equipment and installation.

## **Laboratory testing**

Laboratory testing shall depend on the type of soil or rock encountered and consists of the types of tests listed in reference Employer documents.

Tests shall be performed in accordance with the latest revision of the ASTM or other equivalent applicable Standard.

Adequate number and type of tests shall be performed on representative samples, in order to characterize the surface soils and to develop representative strength, compressibility and corrosivity properties of the soils, as well as groundwater properties.

## **Soil investigation report and correspondence of soil to foundation and earthing**

The Contractor shall review and evaluate all existing and new field/laboratory test data, to provide soil parameters and recommendations, that will be summarized in the Soil Investigation Report containing all the laboratory/in situ test data, like:

- Moisture content
- Dry unit weight
- Grain size distribution
- Friction angle
- Corrosion potential
- STP blow count values or CPT point and lateral resistance
- Rock, solid or weathered rock presence, based on RQD evaluation
- Soil resistivity

The Contractor shall annex to the Report the correspondence of the encountered soil type to the foundation and earthing type.

## **Soil investigation at tower location**

The Contractor shall issue and submit for approval a Foundation Selection Procedure, for definition of foundation type at each tower location.

The Procedure shall consider the tool used for local test, to be correlated to the Soil Investigation Report results (portable probes may be accepted). The local test results shall identify the proposed foundation type.

The soil condition shall be monitored during the excavation works to evidence possible discrepancies with the actual soil encountered.

The cost of foundations in Price Schedule shall include the excavation through any material and no extra payment will be made for rock. Payment for any additional excavation carried out on the instructions of the Employer shall be same irrespective of the nature of the ground, whether it will be rock or soft

soil. It is therefore advisable that the Bidder shall visit the site in preparation of this Bid to ascertain site and ground conditions. The foundation type shall be shown in staking chart on separate list.

### **Earthing arrangement guide-line**

The Contractor shall issue and submit for approval an Earthing Arrangement Guide-line for initial definition of earthing arrangement to be installed, based on resistivity test result. The Guide-line shall underline the influence of earth and meteorological conditions, and the moisture content at the time of measurement, and possible seasonal changes.

The final arrangement shall be defined after successfully measurement of tower earth resistance, and shown in the staking chart in separate list.

### **6.2.2 Foundation construction**

#### **General**

Bidders are advised that the Contractor will be expected to execute foundation works to the highest international standards associated with the construction of EHV transmission lines. All stages in the production, mixing, placing and curing of concrete, the locating, leveling, aligning and backfilling of foundation steelwork, will be inspected by the Employer's representative. If any material, dimension or practice is not at least equal to the standards set out below, it shall be rejected and alternatives, compliant with the said standards, and in addition, to the satisfaction of the Employer shall be implemented.

#### **Aggregates**

Coarse aggregate shall be capable of passing through a 40mm sieve and be retained on a 5 mm sieve. Fine aggregate shall be not larger than 5 mm and not smaller than 0.06 mm and shall be sharp in texture.

All aggregates shall be free of harmful quantities of organic impurities, clay, silt, salt or unsound particles. The amount of clay silt and fine dust present in aggregate, as coatings or separate particles, may not be more than:

- **15%** by weight in crushed sand.
- **3%** by weight in natural or crushed gravel sand
- **1%** by weight in coarse aggregate.

If the Employer considers that any aggregate which the Contractor proposes to use contains an excess of fine particles or any harmful substances, the Contractor will either replace the aggregate or at his option, and entirely at his

expense, institute a series of approved tests at an approved laboratory to determine the nature and extent of the fine particles and harmful substances. Following receipt by the Employer of the results of the analysis and tests, he will advise the Contractor in writing whether the proposed aggregate may or may not be used. The Employers decision in this respect is absolutely final. Tests to determine the extent of impurities or fine particles shall include (but shall not be restricted to) the relevant tests specified in ASTM C1260, BS EN 933, ASTM.C40-66 (colorimetric test) ASTM.C33-71a.

Combined all in aggregate and aggregate of uniform size shall not be used.

At least four weeks before he envisages first receiving aggregate from any source the Contractor in the presence of the Employer shall obtain samples at the pit, river or plant for testing. Samples shall be taken in accordance with the procedure and quantities laid down in BS EN 932-6 and shall be subjected to those tests which the Employer considers necessary to demonstrate the soundness of the material.

Bidders are advised that some parts of the line route are remote from sources of suitably graded aggregates. Bidders should therefore ensure that they allow in their offer for the full cost obtaining and transporting suitably graded aggregates whatever their source.

### **Cement**

Ordinary Portland cement shall comply with BS EN 197-1. The Contractor may obtain cement, bagged or in bulk, from any approved source in Jordan but shall always submit sufficient samples from each delivery, as required by the Employer, to ensure that all cement complies with the minimum requirements of BS EN 197-1.

In concrete foundations exposed to sulphate attack caused by sea water or sulphates in soils, the Contractor shall adhere to the requirements as shown in table below:

### Classification of Soil Condition

<b>Case</b>	<b>Sulphate as SO<sub>4</sub> in soil</b>	<b>Sulphate as SO<sub>4</sub> in ground water</b>	<b>Type of Portland cement</b>	<b>Minimum cement content</b>
	<b>%</b>	<b>ppm</b>		<b>kg/m<sup>3</sup></b>
1	0.1 – 0.5	150 – 1200	Standard	355
2	0.5 – 1.0	1200 – 2500	Sulphate resist.	355
3	Above 1.0	Above 2500	Sulphate resist.	370

Note: The cement contents recommended in the above table are suitable for concrete mixes having a slump of no more than 40 mm. The concrete shall be capable of being fully compacted to produce a dense impermeable mass.

### Water

All water used in the preparation of concrete for foundations shall be clean fit for drinking and free from all earth, vegetable matter and alkaline substances whether in solution or in suspension.

### Reinforcing

Where reinforcing is specified in any foundation design, it shall comply with BS.4449 or an approved similar standard. Before any reinforcing is used, the Contractor shall provide the Employer with a certified mill certificate verifying its grade and quality and proof test such samples as the Employer considers necessary. All reinforcement shall be clean and free from loose mill scale, dust, loose rust and paint, oil or any other coating which in the opinion of the Employer may destroy or reduce bond.

### Storage

The Contractor shall ensure that all the materials he provides for the preparation of concrete shall be stored in a manner which prevents contamination by dust, clay, water, or any other harmful material.

Heaps of coarse and fine aggregate shall be separated by at least one meter.

Where aggregate is tipped directly onto the ground the bottom 20 cm of the heaps shall not be used. Bagged cement shall be protected from rain, mixing water or damp soil during storage/transport. Cement from accidentally split or damaged bags shall not be used in foundations.

Where the Employer considers it necessary, special precautions shall be taken to ensure that aggregate stored on site shall remain dust free. Such precautions may include the bagging of aggregate at the pit if tower sites are adjacent to dusty roads, or if heavy rain liable to wash out fine material or saturate the aggregate to an extent which might influence the water content of a mix.

Where the Contractor establishes central depots for receiving cement prior to dispatch to individual sites he shall ensure that the cement storage areas are sufficiently raised above the surrounding ground to prevent contamination of the cement by surface water. The material of which storage plinths are made shall be approved by the Employer. Waterproof tarpaulins big enough to completely cover the top surface and exposed sides of cement stock piles shall always be in place except when access to the stockpiles is required. Bagged cement shall be stored in piles of not more than 10 bags in height.

Where sulphate resisting or any other special cement is stored it shall be stored completely separate from cement of other grades. If necessary the Employer may require identifying marks to be imprinted or fastened to bags containing special cements.

The Contractor shall ensure that bulk deliveries of bagged cement are used up before using cement from later deliveries. The Contractor shall also ensure that handling of bagged cement is kept to a minimum.

### **Ready mixed concrete**

In the event that the Contractor proposes to use ready mixed concrete for foundation work, approval must first be obtained from the Employer, who will inspect the batching plant and sand, cement and gravel used in the making of concrete at the works. No ready mixed concrete is to be used in foundation work if it has been mixed in the lorry during its journey to site for more than 45 minutes. At the discretion of the Employer, ready mixed concrete cannot be used in foundations if the journey to site is in excess of 45 minutes, if the cement is added to the drum at site and is thoroughly mixed prior to placing. Alternatively, and at the discretion of the Employer, ready mixed concrete may be accepted if the lorry carries its own water drum; water may be added to the cement and aggregate in the mixing drum during the lorry's journey, provided the concrete is not mixed for more than 45 minutes prior to placing. The Employer's decision to reject any of the above methods of supplying ready mixed concrete shall be final.

### **Design mix**

Prior to ordering any aggregate the Contractor shall inform the Employer of the location of the source(s) of his aggregates and deliver samples to the Employer. Grading of aggregates should, together with the required minimum cement content and water cement ratio, ensure adequate durability density and characteristic strength of the finished concrete. The Contractor will submit in writing to the Employer the make-up of the mix he proposes to use together with the grading analysis for the particular material and any details concerning his or others experience with the use of aggregate obtained from the same source.

The Contractor will authorize at an approved laboratory tests to show the sieve analyses, relative densities, moisture content of the samples of aggregate from each source. At least four test specimens of concrete shall be mixed at the approved laboratory and tested after 7 and 28 days in the manner prescribed later in this section. The average crushing strength of the Cylinder samples tested after 28 days shall be not less than  $24.0 \text{ N/mm}^2$ .

The cement content of the test specimens and of all concrete used in foundations shall be not less than the equivalent of  $290 \text{ kg/m}^3$ . Depending on the moisture content of the samples of aggregate the Contractor will report to the Employer on the expected water/cement ratio and the aggregate/cement ratio of concrete to be produced on site. After successful testing of the test specimens made at site, the Employer may then approve the source(s) of aggregate and the mix design.

No changes to the approved mix design will be permitted unless the type or source of aggregate differs from those already tested, in which case further tests at both the laboratory and at site will be made.

Any concrete placed which does not conform to the approved mix designs shall be removed and replaced by the Contractor at his own cost.

### **Mixing and placing of concrete**

Proportions of aggregates and cement and the quantity of water for each batch of concrete shall be closely monitored by an experienced mixer operator. Aggregate shall preferably be weight batched but where this is no possible, volume batching shall be permitted, provided that the net volumes of the loading equipment is known and the equipment is approved by the Employer. Containers for measuring quantities of water shall be clearly marked and only approved quantities of water shall be used in the manufacture of concrete.

Mechanical mixers shall be in good condition and well maintained. After loading, the constituent parts of the concrete shall be mixed together for a period of not less than two minutes or 30 revolutions of the barrel whichever is the greater. For mixers with a capacity greater than  $1.5 \text{ m}^3$  these periods may be increased if the Employer so requires. Mixing periods when high speed pan

mixers are used are to be agreed with the Employer. When the ingredients are adequately mixed the fresh concrete shall be discharged from the mixer and placed in the foundation with the minimum of delay. Specially fabricated chutes shall be used to ensure that fresh concrete is not dropped by more than 1.50 meters high.

No concrete shall be placed until all form-work, installation of parts to be embedded, and preparation of surfaces involved in the placing have been approved. No concrete shall be placed in or through water except with the written permission of the Employer and the method of depositing such concrete shall be approved by the Employer. Concrete shall not be placed in running water and shall not be subjected to the action of running water until after the concrete has hardened for seven days. All surfaces forms and embedded materials that have become encrusted with dried mortar or grout from concrete previously placed, mud or other foreign material, shall be cleaned of all such refuse before the surrounding or adjacent concrete is placed. Immediately before placing concrete, all surfaces of foundation upon or against which the concrete is to be placed shall be free from standing water, mud and other foreign matter.

The surfaces of concrete which have set, and against which new concrete is to be poured, shall be thoroughly cleaned to remove all foreign material and laitance, and be saturated with water immediately before placing concrete. Concrete shall be deposited continuously and as rapidly as possible until the unit being poured is complete. If for any reason the work is stopped before completing the unit of operation, a construction joint shall be installed in accordance with the instructions of the Employer. Concrete shall be so deposited as to maintain, until the completion of a unit, a plastic surface approximately horizontal. Under no conditions will concrete be dropped through rebar or other obstructions.

The method and equipment used for transporting concrete shall be such that concrete having the required composition and consistency will be delivered as near as practical to its final position without objectionable segregation or loss of slump. All concrete mixing and placing equipment and methods shall be subject to approval by the Employer. Concrete placement will not be permitted when, in the opinion of the Employer, weather conditions or other pertinent factors prevent proper placement and consolidation. The Contractor shall inform the Employer at least 24 hours in advance of the times and places at which he intends to place concrete.

Bidders are reminded that as a minimum standard the following series of inspections should be carried out by the Contractor before concreting can begin:

- Stubs to be cleaned of all dirt and temporary protection of galvanizing.
- Cleats to be in place and fully tightened.

- Shutters coated with mould oil and correct in type, quantity and condition.
- Template to be complete, diagonals and back to back within the specified tolerances.
- Center lines of template to coincide at the center peg.
- Shutters for the pyramids are to be well struttured and correctly located around the stubs.
- Rake and elevation of stubs to be within specified tolerance.
- Datum hole to minimum depth.
- Clearance under stubs is as specified and the correct height to top of stub is maintained.
- Vibrator is to be in working order.
- Mixer to be in working order
- There is provision to maintain continuous mixing and pouring, by hand if necessary and approved by the Employer in the event of a mixer breaking down.
- Where necessary, re-bar is on site ready bent and complete with tie wire, stirrups and concrete or plastic performed spacer packs.
- A reliable level is at hand.
- There is sufficient aggregate, cement and water to complete one or more foundation legs.
- Excavations are safe and not cluttered around the top edges.
- The mixer barrel is clean, and the paddles are complete and in place and the barrel will rotate at the speed specified by the Manufacturer.
- A suitable chutes is in place.
- Both an air thermometer and concrete thermometer are on site.
- There is a large quantity of hessian sacking at hand.

Where any of the above items are not complied with, the Employer may suspend concreting pending their implementation.

Stubs for tower foundations may only be installed with the use of approved templates. The main members of the template must be in the form of trussed beams. The stubs shall be held in correct position by the template while the concrete is placed. The templates are not to be struck until at least 48 hours after the foundations have been completed and backfilled. Stub setting templates shall be of approved type with sufficient rigidity to ensure correct setting of the stubs having regard to the steeply sloping nature of the ground and necessity for packing at low spots where using hillside extensions.

Unless otherwise approved, supports having concrete foundations are not to be erected until ten days after completing the foundation concrete work.

The backfilling of all types of foundations shall be thoroughly rammed, the ramming to be carried out at intervals of not greater than 300 mm to ensure

thorough consolidation. Probe tests are to be carried out to prove the degree of compaction of the backfill as the Employer requires. In no circumstances shall peat or equivalent material be used as backfill for concrete block foundations. Where necessary excavations in peaty material shall be backfilled in an approved manner with suitable soil or hardcore from an approved source at rates agreed by the Employer.

Backfilled excavations that settle or erode before final acceptance of the work and structures of facilities damaged by such settlement or erosion shall be repaired at the Contractor's expense. The settled or eroded areas shall be refilled, compacted and leveled to conform to the adjacent ground surface. Damaged facilities shall be repaired in a manner acceptable to the Employer.

### **Testing of concrete**

The Contractor will take test samples at each of the first 20 sites he concretes and thereafter as required by the Employer. Samples will be taken and tested in accordance with BS EN 12350, BS EN 12390-7, and BS.1881. Testing will be carried out by an approved laboratory. The test specimens shall be cylinder/cubes and the mould shall be of metal. Each mould shall be provided with a metal base having a smooth machined surface. The interior surfaces or the mould and base should be lightly oiled before concrete is placed in the mould.

Test specimens should be molded by placing the fresh concrete in the mould in 5 cm layers, each layer being thoroughly compacted with a steel bar 40 cm long and having ramming face 2.5 cm square and weighing 2.8 kg. The concrete should be subjected to at least 35 strokes per layer. Alternatively, the concrete should be compacted by vibration, each layer being vibrated by means of an electric pneumatic hammer, or by means of a suitable vibrating table.

Concrete for the test specimens should be taken at the point of deposit. To ensure that the specimens are representative of the concrete in the foundations, a number of samples shall be taken from different points. Four specimens shall be taken to be representative of the tower foundations in question.

The tests specimens should be stored at the site at a place free from vibration, under damp sacks for 24 hours + 0.5 hour, after which time they should be removed from the moulds, marked and stored in water at a temperature of 10 to 21 C until the test date. Specimens which are to be sent to a laboratory for testing should be packed for transit in damp sand, or other suitable damp material, and should reach the laboratory at least 24 hours before test. On arrival at the laboratory, they should be similarly stored in water until the date of the test.

The tests should be made at the age of the concrete corresponding to that for which the strengths are specified. Compression tests should be made between smooth plane steel plates without end packing, and a load should be applied axially at the rate of approximately  $14 \text{ N/mm}^2$  per minute. One compression plate of the testing machine should be provided with a ball seating in the form of portion of a sphere, the center of which coincides with the central point of the face of the plate. Test Specimens should be placed in the machine in such a manner that the load is applied to the sides of the specimens as cast.

The cylinder strengths for concrete are to be not less than  $16.0 \text{ N/mm}^2$  within 7 days after mixing and ( **$24.0 \text{ N/mm}^2$  for 132 k.v and  $34.3 \text{ N/mm}^2$  for 400 k.v**) within 28 days after mixing. The cost of testing is deemed to be included in the Contractor's General Schedule rates.

**Note: for Cube strength =  $1.25 \times$  Cylinder strength.**

One shall be tested at 7 days to obtain an indication of the concrete strength. The remaining three shall be tested at 28 days and the average of their strengths shall be calculated. Should the average of the strengths fall below the specified 28 days strength, the Employer may order such concrete to be removed and replaced at the Contractor's expense, or the Employer may allow the Contractor to remove from the foundation in question a cylinder for further testing in accordance with BS EN 12350 and BS.1881. The diameter of the cylinder, will be not less than three times the size of the maximum aggregate and its length will be at least equal to the diameter- after allowing for preparation and facing prior to the test.

The Contractor is to pay for all remedial work and testing.

### **Shuttering**

Shutters shall conform to the shape, line dimensions of the concrete as called for on the drawings and shall be sufficiently strong to carry the dead weight of the concrete without undue deflection or bulging, and sufficiently tight to prevent leakage of mortar. They shall be properly braced and tied together so as to maintain position and shape.

Members used in forms at exposed surfaces shall be dressed to uniform thickness and shall be free from loose knots or other defects. Joints in forms shall be horizontal or vertical. At all unexposed surfaces and rough work, undressed timber may be used. Timber shall not have nails withdrawn and the surfaces to be in contact with concrete shall be thoroughly cleaned. Shutters shall not be removed until a minimum of 48 hours has passed from time of placement and concrete has hardened sufficiently to support any construction loads that may be imposed prior to tower erection. When stripping forms, metal

wedges or tools shall not be used to pry panels loose, If wedging is necessary, it shall be done with wood wedges lightly tapped to break adhesion. Stripping of formwork shall begin from the top of a foundation.

### **Reinforcing steel**

Steel reinforcing bars shall be positioned in the concrete at places shown on the drawings, or where reasonably directed by the Employer. Before reinforcing bars are placed in position, surfaces shall be cleaned of heavy flaky rust, loose mill scale, dirt grease and all foreign matter.

Once in position, reinforcing bars shall be maintained in a clean condition until they are completely embedded in concrete reinforcing bars shall have at least the minimum concrete cover shown on the drawings. Reinforcing bars shall be accurately placed and secured in position such that they will not move during placing of concrete.

Clean metal spacers or precast concrete blocks may be used for supporting reinforcing bars.

### **Consolidation of concrete**

Concrete shall be consolidated to maximum practical density, without segregation, by vibration so that it is free from pockets of coarse aggregate and in tight contact against all surfaces and embedded materials.

Vibration of concrete in structures shall be by electric or pneumatic driven immersion types vibrators operating at speeds of at least 8000 rpm when immersed in concrete. The vibrator shall be inserted vertically at close enough intervals so that the zones of influence overlap.

The vibrator shall be inserted to the full depth of the layer being treated and withdrawn slowly. When concrete is being placed in layers, the tip of the vibrator shall extend approximately 100 mm into the underlying layer.

Vibrators shall not be used to move concrete horizontally. Care shall be exercised to avoid over vibration of the concrete and direct contact with reinforcing of foundation steelwork.

### **Curing of concrete**

For tower foundations where excavations are to be backfilled immediately following the striking of shutters, the concrete is to be thoroughly wetted before backfilling commences. Where shutters are to be struck and backfilling of the excavation is not to take place immediately, the concrete is to be covered with wetted Hessian sacking and be enclosed in polythene sheeting to avoid rapid drying of the concrete. In all cases concrete exposed to the sun shall be kept moist and cool for a period of five days after casting.

## **Surplus concrete**

Surplus concrete, spillage and unacceptable concrete shall be removed from the site and be disposed of at the direction of the Employer. Water which has been used for cleaning concrete mixers and handling equipment, or any other waste containing concrete materials shall be dumped in a suitable location away from the Site unless written permission has been obtained from the Landowner. In no case is waste water to be allowed to contaminate sources of drinking water or areas of agriculture.

## **Hot weather concreting**

In hot weather the following additional precaution shall be taken:

- In hot weather suitable means shall be provided, to shield the aggregates stockpiles from the direct rays of the sun or to cool the mixing water/aggregates to ensure that the temperature of the concrete when deposited shall not exceed 32°C.
- In hot dry weather suitable means shall be provided to avoid premature stiffening of concrete placed in contact with hot dry surfaces. Where necessary the surfaces including reinforcement, against which the concrete is to be placed shall be shielded from the rays of the sun and shall be sprayed with water to prevent excessive absorption by the surfaces of water from the final concrete.

## **Finishing and painting**

Concrete foundations shall extend to at least 150mm above ground and shall be sloped off around the steel leg section and smoothly finished to ensure drainage away from the steelwork. All concrete shall be coated with two coats of an approved bitumen based paint. The application of this paint will cover all of the concrete surface above and under finished ground level.

No paint may be applied to concrete until at least 48 hours after shutters have been struck and the second coat may not be applied until 24 hours after the first coat. All surfaces to be painted must be dry, clean and free of oil, grease etc.

## **Foundation dimensions tolerances**

The center peg of a foundation shall not depart from the longitudinal position shown on the approved profile by more than 300 mm. The center peg shall not depart from the central axis of a section by more than 25 mm.

For rectangular based towers the difference in elevation of foundation stubs shall not be more than 5 mm between adjacent tower legs on the narrow face and 10mm between adjacent tower legs on the wide face. The difference between diagonally opposite legs shall not be more than 10 mm.

For square based towers, the difference in elevation between adjacent legs on any face may not be more than 10mm provided the difference in elevation between two diagonally opposite legs does not exceed 10 mm.

For rectangular and square based towers the face dimensions between the tops of stubs may not vary by more than 5 mm from the approved foundation drawings. The diagonals between any two stubs must not differ from the equivalent dimension shown on approved foundation drawings by more than 20 mm.

The slope of stubs either on the face or diagonal directions shall not differ from the equivalent approved dimension by more than 5 mm/m of the stubs.

### **6.2.3 Rock filled gabions**

Certain towers will be located in or adjacent to the beds of wades which for 2 or 3 days per year may be subject to heavy flooding. The Contractor will install, on the instruction given and at locations indicated by the Employer, rock filled gabions nominally 10 m long 2 m wide and 1.5 high. The frame of the gabions shall be of plain reinforcing rod suitably bent and closed by welding. The rock fill material shall be of an approved quality generally being such that it will not wash out of the framework under the action of severe winter flooding. Bidders are to enter rates in schedule for complete 10 m long gabions and rates for variations in this length.

### **6.2.4 Towers**

#### **General**

The Contractor shall erect the towers and accessories in accordance with the approved shop/erection drawings. The towers shall be completed with all members in place and bolts, including step bolts and accessories. The bolt shall be tightened at specified torque values before any stringing work is started.

Steel tower shall be installed minimum seven days after the last placing of concrete in the foundation and the back-filling has been completed or such other time approved by the Employer, depending upon the type of cement used and local conditions.

#### **Handling and storage**

In the storage area and at the tower site, all tower steel angles and plates shall be kept clear of the ground in a clean and tidy condition, properly protected and

away from adjacent roadways. Contact with standing water, or other substances likely to attack galvanizing, shall be avoided.

Care shall be taken during handling and storage to prevent structural injury to members or damage to galvanized or other protective surfaces. No steelwork shall be dragged over the ground surface or handled in such a manner as to damage the galvanized surfaces.

All superficial rust stains, corrosive salts and other foreign materials deposited prior to or during installation of the tower shall be removed without causing damage to the protective surfaces.

In addition, any foreign material that will tend to adhere permanently to the structures shall be removed.

### **Erection procedures**

The Contractor shall submit to Employer approval the erection procedure, including organization and equipment.

The Contractor must ensure that tower erection and steel handling procedures and equipment shall be such as to ensure the maximum safety of all personnel associated with the project, as well as members of the public.

The towers may be erected by assembly in sections on the ground and hoisting successive sections into place, or they may be built-up on site from individual members.

If the Contractor proposes to use tower erection method by assembling the tower or portions thereof on the ground and raise this to the vertical position, this shall be taken into account during design and detailing of the towers and foundations. If the towers are erected by assembling in sections, initial bolting shall be adequate for all loads and erection stresses, but also to allow alignment. The Contractor shall make use of temporary struts on panels prior to lifting, if there is a risk of damage to that panel during lifting.

Any lifting devices attached to the tower shall be supported only at the approved locations.

When in position, all bolts or studding shall fit completely through the corresponding nuts and assembled as per approved drawing (screw, nut, washer, etc.), but should there be any protrusion, it shall not exceed 10 mm. No thread is allowed in the shear section.

Proper precautions shall be taken to ensure that no parts of the towers are unduly stressed or damaged during erection. A reasonable amount of drifting will be allowed in assembling towers, but reaming for correction of mismatched holes due to shop errors will not be permitted.

Tower members arriving on site with distortions, due to handling during transit, shall be straightened or replaced by the Contractor in accordance with accepted tolerances. Suitable ladders shall be used whenever necessary during erection,

but such ladders and removable step bolts shall be removed when erection work is not in progress.

Before the assembly of members, joints/surfaces shall be free of all earth, or any other substance which might prevent the correct alignment of members.

After erection all towers shall be cleaned of all foreign matter or surplus paint. Suspension towers shall be vertical after stringing with a tolerance of 1:300 at the apex related to the tower's actual height.

In general, tower superstructures shall be assembled and erected with bolts finger tight only. Final tightening of bolts to approved torques shall only take place when all members are in place.

Whenever wire slings or ropes are liable to abrade a tower member, the member shall be suitably protected by heavy hessian bags or strips, or by some other approved method.

Angle-tension and terminal towers shall be erected so that after stringing a maximum tolerance of 1:500 at the apex related to the tower's actual height is allowed in the direction of the permanent load.

The allowed maximum torsional tolerance shall be 1:100 of the distance from crossarm point to tower axis, measured in longitudinal direction.

### **Bolt tightening**

After the tower shall assembly and erection with bolts manually installed, the final tightening of bolts shall take place (when all members are in place).

The bolts shall be tightened to an approved torque, as indicated in the following table:

<b>Bolts Size (mm)</b>	<b>Tightening Torque (Nm)</b>
16	100 – 120
20	140 – 180
24	310 – 370



### **Misfabricated members and damaged members**

If manufacturing defects in the steel members are discovered, the Contractor shall notify the Employer, who will decide whether the defects may be corrected in the field or the members returned to the manufacturer for correction or replacement.

Straightening shall be done only by the use of methods that will not damage the galvanized coating, after receiving approval of Company.

Tolerances for lateral variations of straightened members shall be as follows:

Member type	Tolerances
Compression Members	$\pm 2 /1000$
Tension-only Members	$\pm 6 /1000$

Members that are damaged resulting in reduction in their strength shall be replaced by the Contractor.

### **Galvanizing**

The Contractor shall have available on site, for the Employer use, an instrument suitable for the accurate checking of galvanizing thickness. The measuring instrument shall be available from the time of arrival of the first consignment of steelwork until the Commissioning.

Tower members arriving on site with damaged galvanizing, due to mishandling or formation of white rust, shall be repaired by an approved means and submitted to the Employer for approval before erection starting. Rejected members shall be reworked until the Employer is satisfied that the repaired coating will provide protection to the member similar to an undamaged galvanized coating.

If evidence of white rust is apparent upon receipt of bundled steel section at site, the Contractor shall determine the extent of damage, if any, and submit to Employer for approval the remedial measures necessary to remove the rust and provide protection.

### **Towers painting**

All painting, where required by local Authorities, shall be done in fine weather and surfaces must be dry before commencement of each coat.

Details of the paint, manufacturer, surface preparation and method of application shall be submitted for Employer approval prior to commencement of painting.

- Aircraft warning

Same as chapter 5.4.2 c&d

The painting shall be done after all other works on the towers are completed. Surfaces to be painted shall be cleaned to remove all dirt, deposits, grease, oil etc. and painted with 10 microns thickness coat suitable primer and two 30 microns thickness finish coats suitable applied in accordance with the manufacturer's instructions.

- Painting of bottom parts of tower

At sites which are liable to be flooded, the tower body (all types) shall be painted with two coats of coal tar epoxy to a height of 2 m above ground level, or 50 cm above the max water flood level.

Before application of coal tar epoxy, galvanized steel members shall be painted with one coat of grasping paint, to provide suitable surface for adhesion of the coating.

The first coat shall have thickness not less than 150 microns. The coating shall be checked for thickness using a magnetic coating thickness gauge and for pinholes using a spark tester. Any deficiencies shall be repaired immediately. A second coat of coal tar epoxy shall be applied after a minimum of four hours after the application of the first coat but not later than five days after the application of the first coat, to give a total dry film thickness of not less than 300 microns.

Coal tar epoxy shall not be applied when relative humidity exceeds 85%. Should humidity restrictions affect the painting program, the Contractor shall recommend suitable alternatives for review and approval by the Employer.

### **6.2.5 Insulator sets General**

The Contractor shall assemble and install the insulator sets (insulator and fittings) in accordance with the approved detailed drawings.

#### **Handling and storage**

Insulators and fittings shall remain in their crates until erection and shall be handled carefully to avoid damage.

Insulators shall be cleaned immediately prior to lifting onto structures with a soft cloth to remove all dust and deposits. Abrasives or wire brushes shall not

be used. Lifting shall be done with approved cradles or slings to avoid damages.

### **Installation**

All locking devices and split pins shall be correctly installed.

Where possible, the split pin end of bolts or other locking devices shall be installed so that they are visible from the structure body.

Insulator strings must not be used as ladders and the Contractor shall provide suitable ladders for access to the conductor end of assemblies.

When all works on the insulator assemblies at a tower have been completed, insulators shall be cleaned with a soft cloth.

### **6.2.6 Conductors and OPGW**

#### **General**

The following requirements are related to stringing, sagging and clamping of phase conductors and OPGW.

#### **Handling and preparation**

The drums shall be moved with crane and due care shall be taken to avoid contact with ground or objects which may cause damage, choc and pressures.

The drum supports shall be on flat and cleaned ground, prepared with due consistency and drainage.

#### **Stringing program and procedure**

Two months before starting, the Contractor shall submit to the approval the work schedule, and the procedure including the following information:

Brake and winch locations and stringing lengths

Joint locations of conductors

Location of tower with joint box of OPGW and down-lead details

Stringing tension

Crossing details and protection locations (and details)

Drums identifications

Pilot wire size, non-rotating type, UTS minimum 90

kN Personnel location for operation, control and

surveillance Details on single activity operation.

All activities shall be in accordance to the good practice. A reference may be IEEE 524 "Guide to the installation of conductors of overhead transmission lines".

## **6.2.7 Equipments**

### **Stringing pulley**

Suitable pulleys shall be used, with condition, quantity and characteristics which guarantee the necessary progress and continuity of the stringing.

The groove shall have neoprene or other protection inside, and minimum diameter 20 times the diameter of conductors; 600 mm for OPGW.

An inspection is required before pulley installation on towers, to check the free rotation under running conductors.

### **Drum supports**

The drum supports shall have breaking and synchronizing devices, for adjustment to stringing velocity of the brake.

### **Pilot and pulling wires**

The first pilot wire shall be either galvanized steel or nylon.

The pulling wire shall be of anti-revolving galvanized steel, with suitable strength for pulling all conductors or OPGW in safety conditions.

### **Winch**

The motorized winch shall have suitable power and pull force for stringing in soft and safety condition and placed in line with the pull direction.

The bull-wheel shall have minimum diameter 40 times the conductor diameter.

### **Brake**

The brake shall be equipped with a stringing tension control device.

The bull-wheel shall be covered with Teflon or other material to minimize the friction between the surface and passing through wires.

The bull-wheel diameter shall be suitable for the strung conductor, minimum 640 mm.

### **Come-along clamp and tension stocking**

The come-along clamps shall be self-tightening type, the stocking preformed type. The Contractor shall submit to approval the drawings and specification.

### **Hydraulic press for joint compression**

The hydraulic press shall be motorized, with power and forces suitable for compression of dies according to detail drawings of joints and repair sleeves.

### **Measurement tools**

A conductor length measurement tool shall be available on the brake, during stringing operation.

## **6.2.8 OPGW stringing requirements**

Special requirements are listed below:

- The pulley groove internal diameter shall be not less than 600 mm
- The bull-wheel diameter shall be not less than 1200 mm
- The OPGW bending radius shall be not less than 500 mm
- The stocking shall be approved for use on OPGW
- The OPGW ends shall be protected, to avoid moisture and dust entrance.

### **6.2.9 Crossing**

Roads, railways, navigable canals, transmission and telecommunication overhead lines, buildings shall be protected with temporary structures or cradles, generally guyed, approved by the Employer and Local Authorities.

All metal protections shall be earthed and the Contractor shall guarantee warning, surveillance and safety.

### **6.2.10 Stringing and sagging in pulley**

The OPGW shall be strung in pulley before the conductors, with stringing minimum tension required to avoid interferences with ground and obstacles, and the tension shall be raised to the values of approved sagging tables of OPGW in pulley.

The sagging tables shall be submitted min. 60 days before the starting of activity.

Particular care shall be given to OPGW down leads to the joint box.

The conductor shall be strung with the same procedure as above, and the tensions shall raise to the values of approved sagging tables of conductors in pulley. The sequence of phase stringing shall be prepared by the Contractor and approved by the Employer. The conductor joints shall be realized according to

the Supplier drawings and the dimensional check and the electrical resistance measurement shall be made within 24 hours.

During the stringing, the drums and the conductors shall be continuously monitored, to detect possible defects.

In case of defects, the activity shall be suspended and a joint survey with the Employer will decide the way to proceed.

#### **6.2.11 Stringing table and profile**

In case of difficult orography and presence of obstacles between brake and winch, a stringing sag/tension table may be required, to check the required clearances, and the strung conductor shape shall be shown on the profile of the concerned section of line.

#### **6.2.12 Shieldwire earthing**

Earthing wire shall be installed for connection of OPGW pulley to the tower, to discharge possible atmospheric over-voltages.

#### **6.2.13 Wire repairing**

Minor damages on wires can be repaired on conductors. Repair sleeve shall be installed if one or two wires are cut. One repair sleeve only is accepted in one span, max two in the length of one drum, and it is not allowed in crossing span over roads, railways, overhead lines, navigable canals.

If more than two wires are broken or damaged in more than 1/3 of their sections, the conductor shall be replaced in the involved parts and jointed to the other part. Damaged OPGW shall be replaced on the whole section between two joint boxes.

#### **6.2.14 Compression joint of conductors**

The fullest possible use shall be made of the maximum conductor lengths in order to reduce the number of joints to the minimum. The number and location of line and earth conductor tension joints shall be approved.

Tension joints shall not be less than 15 m from the nearest conductor clamp, and joints between different wires in the same span should be adequately segregated to the satisfaction of the Employer.

Unless the Employer agrees to the contrary mid-span joints shall not be used:

- At locations which would allow less than 3 clear spans between midspan joints. (This means 3 clear spans irrespective of the tower types used).

- In spans crossing railways, power lines, telecommunication lines, public roads or buildings.
- In single span sections (adjacent tension tower).

Conductor repair sleeves shall not be used without the permission of the Employer.

### 6.2.15 Sagging table

The sagging table shall take into account the long-term creep as equivalent to temperature gap, translated in calculated over-tension.

The table will include the following data in initial condition, for each span in the section between tension towers or in the section between brake and winch:

- Sag and tension in pulley.
- Distance (offset) between the suspension clamps point (where it will later installed) and the vertical plane passing through the attachment point of the suspension set to the cross arm, for marking the position where the clamp shall be.
- Sag and tension after clamping. The horizontal tension is constant in the section and depends on ruling span, as defined in “Design Criteria”, here shown for easy reference:

$$\sqrt{\frac{\square S_{i3}}{\square S_i}}$$

where:  $S_i$  = single span lengths between two tension towers

The table shall be issued for a given range of temperature with steps of  $5^{\circ}\text{C}$ .

The sag of OPGW shall be 10% less than the ones of conductors in EDS final condition. The calculation shall be made with dedicate software, particularly in hillside area, and the offsets shall guarantee the verticality of the suspension sets after clamping.

### 6.3 Tools and appliances

A Schedule of construction Tools to be delivered to the Employer is given in the Price Schedule.

The Bidder may add an additional schedule (schedule of deviations) to the Schedule of Tools and Appliances (Schedule which may be added according to the Employer needs and includes the requested items by the Employer and their quantities) and the relative rates and Prices of any special items, in sufficient

number that may be required for maintenance of material supplied under this Contract.

Line erection tackle need not be included. Each tool or appliance is to be clearly marked with its size and/or purpose and is not to be used for erection purposes by the Contractor. The tools and appliances with the appropriate boxes are to be handed over to the Employer at the time of arrival at site and not later than the date of the Taking-Over Certificate. In all cases a full description of the items of plant offered, preferably in the form of manufacturer's brochures and specification, is required from Bidders. The Contractor will where required by the Employer, provide test certificates and die-stamp or identify each piece of equipment in an approved manner.

- 45) Suspension saddles shall be suitable for lifting AAAC phase conductors at suspension points. The conductor support shoes shall be suitably lined and flared so as not to crush or score the Conductors during lifting. An SWL of 3 tons is required and proof tests to 4.5 tons shall be carried out before shipment. Test certificates will be required.
- 46) Aluminium alloy hook ladders shall be at least 8 m long and shall be proof tested to simulate a distributed load of 300kg in either the horizontal or vertical position. Hooks shall be bolted onto the frame of the ladder and shall incorporate a safety chain from each hook which shall be capable of being firmly attached to the frame.
- 47) Pullifts shall have safe working loads of 3 tons as specified in Data Schedule. All pullifts offered shall be tested at the manufacturer's works and certificates issued showing a proof load at least 50% in excess of the safe working load.
- 48) "Tirfor" hoists shall have a safe working load of 5 tons. Rope for use with "Tirfor" hoists shall be of a construction such as "Maxiflex" recommended by the manufacturer of the hoists.
- 49) Wire rope slings, unless otherwise stated, shall be complete with two thimbles and clamped at each end by means of Talurit type compression clamp. Lengths specified in Data Schedule shall be the overall length of the sling and not the length of rope contained in the sling. The construction of the wire rope shall be approved by the Engineer.
- f) Hydraulic press for the assembly by the Employer of various lengths of sling with hard or soft eyes together with clamps suitable for wire rope whose

diameters are specified in Data Schedule. Wire rope shall be drummed and of approved construction.

50) Trolleys shall be suitable for conductors up to 29mm diameter. The trolley shall be equipped with a driving mechanism so that it can be propelled by the operator up reasonable inclines.

The trolley shall also be equipped with an automatic brake. All wheels shall be lined with suitable material to prevent damage to conductors. The trolleys shall be designed to give the best possible maneuverability around spacers, dampers, clamps, etc.

51) A conductor stringing blocks shall be suitable for conductor diameters up to 30 mm. Each sheave shall have a minimum diameter of 640 mm at the bottom of the groove. Each conductor sheave shall be suitably lined with an approved material to prevent flattening of conductor strands. The minimum radius at the base of the groove shall be 22 mm. The groove of this sheave will be lined or constructed from high carbon steel to reduce wear. All bearings shall be sealed, roller or ball type.

i) Conductor pulling clamps shall be suitable for AAAC conductor overall diameter 30 mm. They shall be of three types.

1. Wedge type clamp bodies and wedges shall be of galvanized steel.  
2. Automatic self-gripping come along clamps shall be of forged, heat treated steel.

3. Bolted clamp bodies shall be of aluminium alloy.

The loading bar shall be made of one piece steel rod onto which steel bolts washers and nuts shall be located.

The surfaces bearing on conductor shall, for all types of clamps, be machined so as to ensure that the tensile load at the end of the clamp is evenly distributed around the surface of the conductor.

j) Sets of temporary earthing equipment shall consist of one, telescopic, fiberglass rod 3m total length, complete with a screwing head together with 6 PVC covered 8 m lengths of 150 mm<sup>2</sup> pure aluminum conductor. Each length of conductor shall be equipped with an earth end clamp which shall have a hardened steel threaded point capable of piercing a galvanized or corroded steel surface to provide a good earth connection. In addition an alloy line end clamp shall be provided, which shall be spring loaded and capable of being further tightened around a conductor of up to 2.2mm diameter, to provide a good electrical connection. The line end clamp and the screwing head of the pole shall be such that the latter is capable of

holding, fixing and tightening the end clamp onto the conductor when attached to the temporary earth lead.

The leads are expected to withstand a fault current of 2.5 kA for 10 seconds.

- k) Drum carriers shall be capable of transporting one conductor drum of up to 7500 kg in weight. The outside diameter of the drum will be up to 2.5 m and the width up to 1.55 m. Each drum carrier will be so designed that it can self-load with the aid of one operator. An overrun brake attached to the towing hitch will also be required. Tyres shall be at least 12 ply rating.
- l) "Unimog" tractors  
The Unimog or an alternative vehicle to the "Unimog" will be accepted. The tractor is to be fitted with a hydraulic loader of capacity up to 3500 kg at a radius of 1700 mm, and shall have generally the characteristics of the HIAB 650A loader. The Unimog shall be equipped with an 8 tons capacity winch. The offered Unimog shall be fully equipped including any structural modification or additional equipment necessary to operate the loader or winch/trailer which are to be fitted or supplied.
- m) Self braking drum jacks shall be capable of supporting one drum as described in (k) above. The braking mechanism will be such as to automatically reduce to a minimum, over-running of the drum during wire stringing operations. Preference will be given to drums which can be dismantled handled, and erected by a team of two men.
- o) Mess/tool wagons shall be four wheel drive vehicles specially converted to provide messing facilities, shelter and limited tool storage for up to six linesmen. Each vehicle shall as a minimum be provided with air conditioning, a refrigerator, cooker, cupboards, bench seats and a table. There will be facilities for the storage of gas cylinders and all furniture and fittings will be fixed in position.
- p) Tower erection equipment will comprise the following:
  - 1. One aluminium tubular lattice derrick triangular in section, at least 18 m overall length with swivel head bracket for attaching 4 guys at 90 degrees to each other. The derrick will be tested at a luff of 20 degrees from the vertical with a load of 2.5 tons. The derrick will be fabricated in panels (maximum 3) which will bolt together prior to erection. No panel may be more than 10 m in length.
  - 2. Five steel "wallace" toggles, the minimum diameter of the toggle body being 15 0mm.



3. Five sets of 3x2 blocks suitable for non-metallic 16 mm rope.
4. Six snatch blocks with a safe working load of 3 tons and each with a closed eye.
5. One 2.5 ton wheel mounted portable diesel powered winch complete with anchoring facilities and 150 m of 14mm diameter steel wire rope of an approved construction to provide reasonable flexibility during tower erection/dismantling.

### **6.3.1 Means of LTA & E**

The means of handling, loading, transport storage and erection to be adopted by the Contractor of any material provided by the Employer shall be approved by the Employer, prior to any such material being handed over to the Contractor. In addition, the Contractor will authorize in writing, one or more of his staff to accept from time to time, such material as is considered reasonable to achieve completion of the various sections of the line by the guaranteed completion date.

Any material provided by the Employer and received by the Contractor and which is subsequently found to have suffered damage or has been lost or stolen due, in the opinion of the Employer, to careless handling, inefficiency or inadequate working methods on the part of the Contractor, then at the option of the Employer, the Contractor shall replace the said material or pay to the Employer a sum equal to the cost of replacing the goods at the Employer's stores. To this end the Contractor shall negotiate an "all risks" insurance policy. The terms of the policy shall be subject to the approval of the Employer, to cover loss or damage to said material.

## Inspection and Testing

### 7.1 General

The Employer representative has the right to inspect materials and equipment during the fabrication. The Employer will witness all type tests and selected factory acceptance tests (FAT). For some materials where the Manufacturer can demonstrate long experience or similar product, existing type tests certificates on similar product may be accepted, not older than 10 years. This situation is typical for conductor, OPGW, insulator units, dampers and spacer dampers. In case no certificates are available, the type tests shall be performed according to the Standards shown in Material Schedule or equivalent, the cost shall be included in the materials supply price.

For insulator sets, type tests reports might be accepted if they have successfully passed a previous type test in an independent testing laboratory accepted by NEPCO according to the requirements of this document in the last 10 years, provided that the tested sets are **identical** to the submitted sets for each component and no alterations to the design, materials type, or the production process were made that might affect the performance. If the contractor fails to provide a type test report or certificate accepted by the employer, the type tests shall be performed according to the Standards shown in Material Schedule or equivalent, the cost shall be included in the materials supply price.

The required type tests are here below described for towers, insulator sets and foundation, and are conditional for design approval. These type tests shall be carried out on prototypes and quoted in Price Schedule and shall include manufacture, supply erection, dismantling of all materials, equipment and provision for test facilities.

The cost of the FAT, test materials, equipments, or any other costs related to the test shall be included in the Materials Supply Price in the price schedules. The expenses of two employers' representatives witnessing the test shall be quoted in the price schedule.

If the test was not attended by the employer, a full report in accordance to the approved test procedure shall be submitted to the employer for review and approval. The employer reserves the right to have the Tests witnessed by 3<sup>rd</sup> party without any additional cost.

Instruments shall be approved and shall, if required by the Employer, be calibrated by the National Physical Laboratory or such other body as may be approved, at the expense of the Contractor. The type tests shall be carried out at the Manufacturer's works or in independent laboratories, the acceptance test at the Manufacturer's work or at site.

At least 28 working days' notice of the date, time and place of all tests shall be given to the Employer so that arrangements can be made to have the test witnessed.

The Contractor shall provide food, accommodation, Visa, transportation, round trip air fare (economic class) between Employer home offices and any other countries where equipments are to be tested and any internal transportation within the country of the test, with no cash pocket money.

Prior to the tests, the Contractor shall submit an outline of the procedures and tests in its plans to demonstrate fulfillment of the requirements specified in the subsequent sections of the detailed technical specifications.

Any costs incurred by Employer representative in attending a repeat type or acceptance test brought about as a result of a failure of the subject under test and postponement of the test program shall be to the account of the Contractor.

During the erection the Employer will inspect at site the various components installed. The passing of such inspection or test will not, however, prejudice the right of the Employer to reject the plant, if it does not comply with the specification when erected or give complete satisfaction in service.

## **7.2 Required type tests**

### **7.2.1 Towers N/A**

The Employer will select straight line and angle towers detailed in Price Schedule, which shall be assembled at the manufacturer's works, or other approved place, for test full scale load, if required by the Employer.

If required by the Employer, tests to destruction shall then be carried out on all or any of the structures submitted for tests.

All structure tests, on which results are approved, will be paid for at the rates stated in the Schedule of Prices.

The payment will be made only for a successful test and the Bidders should note that different rates are required for tests to destruction and tests to ultimate design load only. No part of a tower tested to destruction shall be used in the permanent works and the Contractor shall confirm disposal to the Employer.

The load test shall be carried out according to IEC 60652.

All structural parts not included in the loaded structure shall be preassembled at work for dimensional check.

### 7.2.2 Insulator set

The tests shall be conducted and witnessed by two employes at one of the following international independent laboratories (**KEMA, CESI, IPH Germany, ETH Switzerland, SAG Germany , and Kinectrics Canada**) and/or carried out at one of international accredited laboratory has a certificate of (ISO/IEC 17025) and approved by the employer with the presens of both (two employer) and representitive from above mentioned laboratories (**KEMA, CESI, IPH Germany, ETH Switzerland, SAG Germany , and Kinectrics Canada**).

Type tests shall be performed to verify the main suspension and tension insulator sets electrical performances,

- Electrical test

The insulator sets, complete with all component, and conductor fittings, tension clamps and damper (installed on conductor or equivalent pipe) shall be tested in independent laboratory, and the following test are required, with reference Standard:

- Power frequency withstand voltage (wet-dry) IEC 60383
- Lightning impulse withstand voltage ( $\pm$ - dry) IEC 60383
- Switching impulse withstand voltage (wet) IEC 60383
- Corona extinction voltage IEC 61284
- RIV test IEC 61284
- Power arc IEC 61467

- Mechanical test

Type test may be required to confirm the ultimate tensile strength of the compression clamps and joints installed on the real conductor. Other tests may be required on special components.

### 7.2.3 Foundation uplift tests

To prove that pad & chimney, concrete block or auger foundations attain the required resistance to uplift the Contractor will carry out tests adjacent to the line route at positions, if decided by the Employer for the particular foundation types specified, correlated to the soil type.

The Contractor will cast a separate single leg foundation to the appropriate design and subject the leg to an uplift test until the foundation fails. The particular rates called for in Price Schedule must include the excavation concreting and backfilling of the foundation, the test operation, the supply and

removal of the testing equipment and any ancillary works which are necessary for the test to be carried out. The Contractor should also include in his rates for testing the cost of breaking out the concrete and cutting off the stub to a depth of not less than 70 cm below ground level after the test has been concluded.

### **7.3 Acceptance tests (FAT)**

All materials acceptance tests at factory shall be performed according related specified Standard or equivalent subject to Employer approval.

The material delivered locally at site (reinforcing bars, cement, aggregate etc.) shall be supplied with the certificates proving quality and origin.

### **7.4 Routine tests**

The quality plan of each material supplier shall be submitted by Contractor.

### **7.5 Tests on completion**

The final acceptance of the line includes:

- Check of line components
- Electrical tests for continuity and insulation check.

Furthermore, the line shall be energized at full working voltage before handing over and the arrangement for this, and such other tests as the Employer shall desire to make on the complete line, shall be assisted by the Contractor who shall provide such labour, transport and other assistance as is required, without extra charge. Apparatus for special tests shall be provided by the Employer.

### **7.6 Tests at end of maintenance period**

The Contractor shall be responsible for checking that total and relative sags of Conductors are within the specified tolerances. Such checks shall be carried out at selected points along the route as requested by the Employer and the Contractor shall provide surveying instruments to enable the checks to be carried out with the line live and in service.



## DATA SCHEDULE

### 8.1 For 132 kV OHTLs:-

#### 8.1.1 Technical specification data System data

Description	Unit	Data
• System voltage	kV	132
• System highest voltage	kV	145
• System frequency	Hz	50
• Number of circuit per tower	No.	2
• Number of phase per circuit	No.	3
• Number of conductors per phase for single conductor lines	No.	1
• Number of conductors per phase for Bundle conductor lines	No.	2
• Number of overhead OPGW earth wire	No.	1
• Nominal current for each circuit single conductor lines	A	800
• Nominal current for each circuit bundle conductor lines.	A	1600

#### Ambient condition

Description	Unit	Data
• Keraunic level	days/year	15
• Temperatures:		
- Maximum ambient	°C	45
- Minimum ambient	°C	-5
- Annual average	°C	26

#### Electrical design

Description	Unit	Data
• Short circuit		40kAx1sec
• Insulation voltage levels:		
- Power frequency	kV	275

- Switching	kV	550
- Lightning impulse	kV	650
• Minimum unit insulation creepage length (phase to phase voltage)	mm/kV	38
• RIV level on $300\Omega$ resistance at 1 MHz	dB	34
• Audible noise at ROW border in fair weather	dB	40
• Max tower earth resistance	Ohms	10

### Temperatures and unit loads

Description	Unit	Conductor & OPGW	Insulator set	Tower
• EDS temperature – no wind	°C	26	-	-
• Max temperature – no wind	°C	75	-	-
• Min temperature – no wind	°C	-5	-	-
• Max wind:				
- Temperature	°C	-5	-	-
- Pressure	daN/m <sup>2</sup>	70	84	150 *
• Normal Wind with ice				
- Temperature	°C	-5	-	
- Pressure	daN/m <sup>2</sup>	60	72	100*
- Ice thickness	mm	10	-	-
- Ice density	kg/m <sup>3</sup>	900	-	-
• Ice				
- Temperature	°C	-5	-	-
- Ice thickness	mm	10	-	-
- Ice density	kg/m <sup>3</sup>	900	-	-
• Reduced wind (for clearance only)				
- Temperature	°C	-5	-	-
- Pressure	daN/m <sup>2</sup>	18	21.6	-
• Phase distances (for clearance only)				
- Temperature	°C	40	-	-
• Conditions				
- Max OPGW sag in EDS (% of Conductor sag)	%	90	-	-

- Ruling span range (min□max)	m	167.5 - 505	-	-
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Note: \* on one tower face only

### Safety factors & overload factors

Description	Safety Factor
• Conductor & OPGW	
- EDS condition	5
- Other conditions	2.5
• Insulator and fittings	
- Normal condition	3
- Security condition	2.2
- Safety condition	3
• Dead clamps and mid-span joint	95% of wire's UTS
• Tower	
- Normal condition (Suspension Tower)	
Vertical *	2
Transversal	2
Longitudinal	2
- Normal condition (Tension Tower)	
Vertical *	2.5
Transversal	2.5
Longitudinal	2.5
- Security condition	
Vertical	1.25
Transversal	1.25
Longitudinal	1.25
- Safety condition	
Vertical	2

Transversal	2
Longitudinal	2

Note: \* With the minimum weight span the safety factor shall be 1, for suspension tower only.

Description	Overload Factor
• Foundation <i>overload</i> factor on ultimate loads from tower	1.2

## Internal clearances

Description	Pressure (daN/m <sup>2</sup> )		Swing angle (deg)	Clearance
	Conductor & OPGW	Insulator set		
• Suspension string				
- Still air	0	0	5	1520 mm
- Reduced wind	18	21.6	27	1300 mm
- High wind	30	36	52	350 mm
• Jumper loop				
- Still air	0	0	0	1520 mm
- Reduced wind	18	21.6	20	1300 mm
- High wind	30	36	40	350 mm
• Jumper insulator string				
- Still air	0	0	5	1520 mm
- Reduced wind	18	21.6	15	1300 mm
- High wind	30	36	30	350 mm
• Minimum tower internal clearance for tower DTU:				
- Phase to phase				1400 mm
- Phase to earth				1200 mm
• Minimum vertical distance phase to phase in span (m)				$75 \sqrt{f + l} + 0.75$ 0. · 1.4

• Minimum horizontal distance phase to phase in span (m)				$62\sqrt{f} + l + 0.75 \cdot 1.4$
• Minimum vertical distance phase to earth in span (m)				$0.75\sqrt{f} + 0.75 \cdot 1.2$
• Minimum horizontal distance phase to earth in span (m)				$0.62\sqrt{f} + 0.75 \cdot 1.2$
• Shielding angle				$30^\circ$

### External clearances for tower spotting

Description	Clearance (m)
• Vertical clearance *	
- Normal ground not accessible to vehicles	7
- Residential area	15.0
- Motorways	15.0
- Roads	11.0
- Buildings, structures, walls, wireless and TV aerials and scaffolding	4.6
- Trees	3.7
- Telephone lines	4.6
- Power lines (above or below)	2.7
- Power line supports (any part on which a man may stand)	3.7
- Railway (from rail level)	9.0
• Horizontal clearance **	
- From water pipelines	75
- From oil pipelines	100
- From gas pipelines	100
- From oil or gas storage tanks	150
- From main roads	45
- From minor un-paves roads	20
- From railways or railway communication systems	50
- From telecommunication lines or cables	50
- From high and low voltage power lines	50

Note: \*The above clearances shall be observed within the overhead line area and up to 4 m outside the outer phase.

## Tower types and ratings

Tower type		basic span	Line angle	Wind span		Max weight span		Min weight span	Max single span
				Normal	Broken	Normal	Broken		
		m	deg	m	m	m	m	m	m
DL&2DL	Susp.	335	0	410	310	670	505	>60% wind span	505
			2	340	260				
D1&2D1	Tens.	335	0-10	410	310	1010	750	-200	650
	Heavy Susp.	335	0	650	490	1010	750	>60% wind span	650
	Section	335	0	410	310	1220	750	-610	650
D3&2D3	Tens.	335	10-30	410	310	1010	750	-200	505
D6&2D6	Tens.	335	30-60	410	310	1010	750	-200	505
D9/DT&2D9/2DT	Tens.	335	60-90	410	310	1010	750	-200	505
	Term.	335	45 line side 45 gantry side	410	0	700	0	-200	505



DTU&2DTU	Tens. & Term.	150	0-5° Entry angle	300	210	650	490	-100	200
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## Lattice steel towers

Description	Unit	Required data
• Step bolt diameter (min.)	mm	16
• All tower steel parts hot dip galvanized	-	Yes
• Zinc coat thickness:		
- For steel sections	mm	min. 85
- For bolts and nuts	mm	min. 55
- For earthing strip	mm	min. 120
• Minimum bolt diameter:		
- Mild tensile steel	mm	16
- High tensile steel	mm	12
• Max number of bolt sizes in one tower	No.	2
• Maximum slenderness ratio – L/r:		
- Main leg, stub and main compression members in crossarm, □	-	120
- All other members having computed stresses, □	-	200
- Redundant members without computed stressed, □	-	250
- Tension members only, □	-	350
• Minimum thickness of steel members:		
- Main leg, stub and main compression members in crossarm	mm	6
- All other members having computed stresses	mm	5
- Redundant members without computed stressed	mm	5
- Gusset plates	mm	6
• Earthing tape section	mm	40x4
• Minimum equal angle sections		Lx40x40xt
• Maximum length of structural member	m	9

• Tolerances of finished members:		
- Max lateral variations of actual length between points of lateral supports	ratio	1/1000
- Finished members without ends finished for contact bearing:		
- Members up to 3 m length	mm	$\pm 1.5$
- Members greater than 3 m length:		
<input type="checkbox"/> 3 m to 6 m	mm	$\pm 2.5$
<input type="checkbox"/> greater than 6 m	mm	$\pm 3.0$

## Plates

Description	Unit	Required data
• Required plates		
a) Danger plate	N°	2
b) Circuit plate	N°	2
c) Phase colour plate	N°	6
d) Tower number plate	N°	2
e) Aerial plate (every 10 towers)	N°	1

## Soil parameter for foundation design

Description	Unit	Normal soil	Soft rock	Hard rock	Poor soil
• Weight of earth per cubic meter	kN/m <sup>3</sup>	1600	1900	2000	1500
• Angle of frustum of earth resisting uplift					
- Undercut construction	degree	30	30	--	--

- Non-undercut construction	degree	25	--	--	15
• Mass of concrete per cubic meter	kg	2300	2300	2300	2300
• Ultimate earth pressure for standard foundation under specified loads	daN/cm <sup>2</sup>	5	15	20	2
• Ultimate adhesion value between galvanized steel and concrete	daN/cm <sup>2</sup>	7	7	7	7
• Ultimate lateral earth pressure at depth 1 m **	daN/cm <sup>2</sup> /m	0.5	1.0	--	0.4 *
• Ultimate friction between concrete surface and undisturbed soil	daN/cm <sup>2</sup>	0.35 h*	3.9	7.0	0.2 h*
• Minimum portion of stub loads to be allowed for in the design of stub cleats	%	100%	100%	100%	100%
• Minimum net concrete cover on outer steel surface	cm	5	5	5	5
• Minimum height of concrete top above ground level	cm	30	30	30	30 ***
• Minimum concrete strength on cylinder sample	daN/cm <sup>2</sup>	235	235	235	235
• Minimum rebar strength	daN/cm <sup>2</sup>	3500	3500	3500	3500

Note: The specified loads include the tower safety factor and foundation overload factor.

\*) h = depth in m

\*\*) For auger foundation the lateral earth pressure shall be multiplied by 3  
 (\*\*\*) In case of flooded area the eight shall guarantee concrete top above flooding level.

### 8.1.2 Material data sheets

#### Conductor AAAC

Description	Unit	Required data	Offered data
• Code		AAAC YEW/400	

• Standard		EN 50182 EN 50183	
• Manufacturer	Company	---	
• Total cross section	mm <sup>2</sup>	400	
• Stranded conductor overall diameter	mm	28.42	
• Number of aluminium alloy wires	N°	37	
• Diameter of aluminium alloy wires	mm	4.06	
• Ultimate tensile strength (UTS)	daN	13600	
• Standard mass without greese	kg/km	1321	
• Standard length on drum tolerance		± 2%	
• Modulus of elasticity	kN/mm <sup>2</sup>		
• Coefficient of linear expansion	1/°C		
• Direction of strand		Right	
• DC resistance at 20°C	Ohm/km	0.069	
• Max tension	kN		
• Long term creep (10 years) temperature gap	°C		
• Overall reel dimension:			
- Diameter	mm		
- Width	mm		
- Reel lengths range	mm		
• Grease		NILL	

## OPGW

Electromechanical data	Unit	Required data	Offered data
• Type			
• Standard		EN 50182 IEC 60793	

• Manufacturer	Company	--	
• Total cross section	mm <sup>2</sup>		
• Core diameter	mm		
• Overall diameter	mm	$\leq 18 \pm 2\%$	
• Alu Alloy wire no.	n x mm		
• Alu Alloy wire dia	mm		
• Alu Alloy wire section	mm <sup>2</sup>		
• Alu Clad wire no.	n x mm		
• Alu Clad wire dia	mm		
• Alu Clad wire section	mm <sup>2</sup>		
• Ultimate tensile strength (UTS)	daN	9200	
• Modulus of elasticity	kN/mm <sup>2</sup>		
• Coefficient of linear expansion	1/°C		
• Mass	kg/km	$\leq 650 \pm 2\%$	
• Direction of strand (outer layer)		right	
• Short circuit performance	kA/sec	14kA $\times$ 1sec	
• DC resistance at 20°C	Ohm/km		
• Max tension			
• Long term creep (10 years) - Temperature gap	°C		
• Bending minimum radius	mm	500	
• Overall reel dimension:			
- Diameter	mm		
- Width	mm		
- OPGW reel lengths range	mm		
• Grease		Nil	



<b>Optical fiber data</b>	<b>Unit</b>	<b>Required data</b>	<b>Offered data</b>
• Number of optical fibers on OPGW – Minimum	No.	36	
• Standard		IEC 60793 IEC 60794 ITU-TG652	
• Fiber type		CCITT G652D	
• Attenuation			
- Attenuation at wave length 1285-1330 nm	dB/km	□ 0.4	
- Attenuation at wave length 1550 nm	dB/km	□ 0.25	
• Cut-off wave length	nm	1190<□ 1330	
• Dispersion			
- Chromate dispersion at 1285-1330 nm wave length	ps/nm.km	□ 3.5	
- Chromate dispersion at 1550 nm wave length	dB	□ 20	
- Zero dispersion wave length	nm	131±120	
• Mode			
- Mode field diameter	□m	9±1	
- Mode field concentricity error	□m	≤1	
• Geometry			
- Cladding diameter	□m	125±30	
- Cladding non circularity	%	≤2%	
- Coating diameter	□m	250±15	
• Individual splice loss	dB	□ 0.15	
• Mean splice loss	dB	□ 0.1	

• BIT error rate	BET	$10^{-9}$ or better	
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### Lattice steel tower (Refer to annexures)

Description	Unit	Required data	Offered data
• Tower material			
- Section and plates			
<input type="checkbox"/> Standard		EN 10025	
<input type="checkbox"/> Standard steel – yield point	daN/cm <sup>2</sup>	2750	
<input type="checkbox"/> High tensile steel – yield point	daN/cm <sup>2</sup>	3550	
- Bolts			
<input type="checkbox"/> Standard		ISO 898	
<input type="checkbox"/> Class		5.6 – 6.8 – 8.8	
- Galvanizing			
<input type="checkbox"/> Standard		ISO 1461	
<input type="checkbox"/> Zinc coat on section and plates	□m	90	
<input type="checkbox"/> Zinc coat on bolts	□m	55	
• Tower DL			
- Height of crossarm chord of tower $\pm 0$ with leg extension $\pm 0$	m		
- Weight for complete tower with leg extension $\pm 0$ including stubs:			
- 3	kg		
$\pm 0$	kg		
+ 3	kg		
+ 6	kg		
+ 9	kg		

+ 12	kg		
• Tower D1			
- Height of crossarm chord of tower $\pm 0$ with leg extension $\pm 0$	m		
- Weight for complete tower with leg extension $\pm 0$ including stubs:			
- 3	kg		
$\pm 0$	kg		
+ 3	kg		
+ 6	kg		
+ 9	kg		
+ 12	kg		
• Tower D3			
- Height of crossarm chord of tower $\pm 0$ with leg extension $\pm 0$	m		
- Weight for complete tower with leg extension $\pm 0$ including stubs:			
- 3	kg		
$\pm 0$	kg		
+ 3	kg		
+ 6	kg		
+ 9	kg		
+ 12	kg		
• Tower D6			
- Height of crossarm chord of tower $\pm 0$ with leg extension $\pm 0$	m		
- Weight for complete tower with leg extension $\pm 0$ including stubs:			
- 3	kg		
$\pm 0$	kg		
+ 3	kg		
+ 6	kg		
+ 9	kg		
+ 12	kg		
• Tower D9/DT			

- Height of crossarm chord of tower $\pm 0$ with leg extension $\pm 0$	m		
- Weight for complete tower with leg extension $\pm 0$ including stubs:			
- 3	kg		
$\pm 0$	kg		
+ 3	kg		
+ 6	kg		
+ 9	kg		
+ 12	kg		
• Tower DTU			
- Height of crossarm chord of tower $\pm 0$ with leg extension $\pm 0$	m	$\leq 12$	
- Weight for complete tower with leg extension $\pm 0$ including stubs:			
- 2	kg		
$\pm 0$	kg		
+ 2	kg		
+ 4	kg		

**Foundation – Data offered (Refer to annexures)**

Tower	Description	Unit	Normal soil	Soft rock	Hard rock	Poor soil
DL	- Excavation volume	$m^3$				
	- Concrete volume	$m^3$				
	-Steel reinforcement weight	kg				
D1	- Excavation volume	$m^3$				
	- Concrete volume	$m^3$				
	- Steel reinforcement weight	kg				
D3	- Excavation volume	$m^3$				
	- Concrete volume	$m^3$				
	- Steel reinforcement weight	kg				
D6	- Excavation volume	$m^3$				
	- Concrete volume	$m^3$				
	- Steel reinforcement weight	kg				

D9/DT	- Excavation volume	$\text{m}^3$				
	- Concrete volume	$\text{m}^3$				
	- Steel reinforcement weight	kg				
DTU	- Excavation volume	$\text{m}^3$				
	- Concrete volume	$\text{m}^3$				
	- Steel reinforcement weight	kg				
	Minimum concrete characteristic strength (cylinder)	$\text{daN/cm}^2$				
	Minimum steel rebar yield point	$\text{daN/cm}^2$				

## Composite insulator

Description	Unit	Required data	Offered data
• Code			
• Standard		IEC 60120 IEC 60372 IEC 61109 IEC 61466	
• Manufacturer	Company		
• Material		HTV	
• Length	mm		
• Diameter of core	mm		
• Diameter of short shed	mm		
• Diameter of large shed	mm		
• Coupling		Ball socket	
• Pin diameter	mm		
• Locking device		stainless steel split	



• Min creepage (leakage) distance	mm	5510	
• Mass of unit	kg		
• Ultimate tensile strength for UTS Suspension	kN	80	
• Ultimate tensile strength UTS for Tension	kN	160	
• Min wet power frequency withstand voltage	kV		
• Min dry lightning impulse withstand voltage	kV		

### Phase suspension insulator set

Description	Unit	Required data	Offered data
• Set type		I string	
• Standard		IEC 60383 IEC60815 IEC 61284 ISO 1461	
• Manufacturer	Company		
• N° of insulator string*	N°	1 or 2	
• Armour rods		yes	
• UTS of set ( one string) for <b>single conductor lines</b>	kN	80	

• UTS of set ( two string) for <b>single conductor lines</b>	kN	2x80	
• UTS of set ( one string) for <b>bundle conductor lines</b>	KN	160	
• UTS of set ( two string) for <b>bundle conductor lines</b>	KN	2x160	
• Mass of set (without insulators) with single string	Kg		
• Counterweight: max weight for <b>single conductor lines</b>	Kg	$\geq 100$	
• Counterweight: max weight for <b>bundle conductor lines</b>	kg	$\geq 200$	
• Conductor spacing for <b>bundle conductor lines.</b>	mm	350.	
• Total length of insulator set ( for single and double string)	mm	2005-2350	
• String axis spacing	mm	$\geq 450$	
• Suspension clamp tightening	Nm		
• Suspension clamp min withstand slipping load	kN		
• Dry lightning impulse voltage:			
- pos.	kV	650	
- neg.	kV	650	
• Dry switching impulse withstand voltage	kV	550	
• Wet power frequency withstand voltage	kV	275	
• Dry power frequency withstand voltage	kV	275	
• RIV level on $300\Omega$ resistance at 1 MHz	dB	34	
• Galvanizing			
- All components	□m	85	
- Bolts, nuts and washer	□m	55	

Note: \* 2 strings can be required in special crossing. \*\* bundle conductors is two conductors.

Description	Unit	Required data	Offered data
• Standard		IEC 60383 IEC 60815 IEC 61284 ISO 1461	
• Manufacturer	Company		
• N° of insulator string*	N°	1 or 2	
• Insulator unit UTS	kN	160	
• UTS of set (one string) for <b>both single &amp; bundle conductor lines.</b>	kN	160	
• UTS of set (two string) for <b>both single &amp; bundle conductor lines.</b>	kN	2x160	
• Low duty for upright and inverted**	kN	160	
• Mass of set (without insulators)	kg		
• Total length of insulator set	mm	Min 2685 Max 3590	
• String axis spacing	mm	450	
• Dead end clamps min withstand tension (%) UTS of conductor)	%	95	
• Dry lightning impulse voltage:			
- pos.	kV	650	
- neg.	kV	650	
• Dry switching impulse withstand voltage	kV	550	
• Wet power frequency withstand voltage	kV	275	
• Dry power frequency withstand voltage	kV	275	
• RIV level on 300Ω resistance at 1 MHz	dB	34	
• Galvanizing			
- All components	□m	85	
- Bolts, nuts and washer	□m	55	

Note: \* 2 strings can be required in special crossing.

\*\* Inverted insulators should be equipped with adjustable arcing horn **Phase conductor compression joint and repair sleeve** . \*\*\* bundle conductors is two conductors.

Description	Unit	Required data	Offered data
• Standard		IEC 61284 ISO 1461	
• Manufacturer	Company		
• Corona extinction voltage	kV		
• RIV level on $300\Omega$ resistance at 1 MHz	dB	34	
• Joint			
- Overall length	mm		
- Grease type			
- Mechanical strength (% UTS conductor)	%	95	
• Repair sleeve			
- Overall length	mm		
• Galvanizing			
- All components	□m	85	
- Bolts, nuts and washer	□m	55	

### OPGW fittings

Description	Unit	Required data	Offered data
• Standard		IEC 60383 IEC 61284 ISO 1461	
• Manufacturer	Company		
• Suspension set			
- Neoprene insert in suspension set		Yes	
- Armour rod		Yes	
- UTS of suspension set	kN		
- Suspension clamp tightening	Nm		
- Suspension clamp min withstand slipping load	kN		
• Tension set			
- Preformed armour rod		Yes	



- UTS tension set	kN		
- Tension set type		preformed	
- Mechanical strength (% UTS OPGW)	%	95	
• Galvanizing			
- All components	□m	85	
- Bolts, nuts and washer	□m	55	

### Stockbridge damper

Description	Unit	Required data	Offered data
• Standard		IEC 60383 IEC 61284 ISO 1461	
• Manufacturer	Company		
• Phase conductor			
- Damper type		stockbridge	
- Damper mass	kg		
- Damper slipping withstand load	daN		
- RIV level on $300\Omega$ resistance at 1 MHz	dB	34	
• OPGW shieldwire			
- Damper type		stockbridge	
- Damper mass	kg		
- Damper slipping withstand load	daN		
- Warning sphere mass	kg		
• Galvanizing			
- All components	□m	85	
- Bolts, nuts and washer	□m	55	

### Plates

Description	Unit	Required data	Offered data
• Manufacturer	Company		
• Colour required background/indication			
a) Danger plate		white/red	

b) I Circuit plate			
II Circuit plate			
c) Phase plate		red/yellow/blue	
d) Tower number plate			
e) Aerial plate every 10 towers)			
• Material plate / coat			

### Warning sphere for shield wire

Description	Unit	Required data	Offered data
• Manufacturer	Company		
• Material		fiberglass	
• Diameter	mm		
• Color			
• Mass	kg		
• Spheres separation (approximately)	m	60	

## 8.2 For 400 kV OHTLs:-

### 8.2.1 Technical specification data System data

Description	Unit	Data
System voltage	kV	400
System highest voltage	kV	420
System frequency	Hz	50
Number of circuit per tower	No.	2
Number of phase per circuit	No.	3
Number of conductor per phase	No.	2
Number of overhead OPGW earthwire	No.	2
Line length (approx.)	km	106
Nominal current for each circuit	A	1100

### Ambient condition

Description	Unit	Data
Altitude above sea level	m	1000
Keraunic level	days/year	15
Temperatures:		
- Maximum ambient	C°	45
- Minimum ambient	C°	-5
- Annual average	C°	26

### Electrical design

Description	Unit	Data
• Short circuit		40kA $\times$ 1sec
• Insulation voltage levels:		
- Switching impulse	kV	1050
- Lightning impulse	kV	1425
• Minimum unit insulation creepage length (phase to phase voltage)	mm/kV	38

• Corona extinction voltage	kV	270
• RIV level on $300\Omega$ resistance at 1 MHz	$\mu$ V	100
• Audible noise at ROW border in fair weather	dB	40
• Max tower earth resistance	Ohms	10

## Temperatures and unit loads

Description	Unit	Conductor & OPGW	Insulator set	Tower
• EDS temperature – no wind	°C	26	-	-
• Max temperature – no wind	°C	75	-	-
• Min temperature – no wind	°C	-5	-	-
• Max wind:			-	-
- Temperature	°C	-5		
- Pressure	daN/m <sup>2</sup>	70	84	262 *
• Normal Wind with ice			-	
- Temperature	°C	-5		
- Pressure	daN/m <sup>2</sup>	42	51	160*
- Ice thickness	mm	10	-	-
- Ice density	kg/m <sup>3</sup>	900	-	-
• Ice			-	-
- Temperature	°C	-5		
- Ice thickness	mm	10	-	-
- Ice density	kg/m <sup>3</sup>	900	-	-
• Reduced wind (for clearance only)			-	-
- Temperature	°C	-5		
- Pressure	daN/m <sup>2</sup>	18	21.6	-
• Phase distances (for clearance only)			-	-
- Temperature	°C	40		
• Conditions			-	-
- Max OPGW sag in EDS (% of Conductor sag)	%	90		
- Ruling span range (min□max)	m	205 - 615		

Note: \* on one tower face only **Safety factors & overload factors**

<b>Description</b>	<b>Safety Factor</b>
• Conductor & OPGW - EDS condition - Other conditions	4.5 2.5
• Insulator and fittings - Normal condition - Security condition - Safety condition	3 2.2 3
• Dead clamps and mid-span joint	95% of wire's UTS
• Tower - Normal condition Vertical * Transversal Longitudinal - Security condition Vertical Transversal Longitudinal - Safety condition Vertical Transversal Longitudinal	1.2 1.7 1.7 1.25 1.25 1.25 2 2 2

Note: \* With the minimum weight span the safety factor shall be 1.

Description	Overload Factor
• Foundation <u>overload</u> factor on ultimate loads from tower	1.2

### Internal clearances

Description	Pressure (daN/m <sup>2</sup> )		Swing angle (deg)	Clearance
	Conductor & OPGW	Insulator set		
• Suspension string				
- Still air	0	0	5	3800 mm
- Reduced wind	18	21.6	27	3000 mm
- High wind	30	36	52	800 mm
• Jumper loop				
- Still air	0	0	0	3800 mm
- Reduced wind	18	21.6	20	3000 mm
- High wind	30	36	40	800 mm
• Jumper insulator string				
- Still air	0	0	5	3800 mm
- Reduced wind	18	21.6	15	3000 mm
- High wind	30	36	30	800 mm

<ul style="list-style-type: none"> <li>• Minimum tower internal clearance for tower 4DTU:           <ul style="list-style-type: none"> <li>- Phase to phase - Phase to earth</li> </ul> </li> </ul>				3800 mm 2800 mm
<ul style="list-style-type: none"> <li>• Minimum vertical distance phase to phase in span (m)</li> </ul>				$\overline{l} + 0.75 \cdot 3.2$ (m) 0.
<ul style="list-style-type: none"> <li>• Minimum horizontal distance phase to phase in span (m)</li> </ul>				0. $\overline{l} + 0.75 \cdot 3.2$ (m)
<ul style="list-style-type: none"> <li>• Minimum vertical distance phase to earth in span (m)</li> </ul>				$0.75\sqrt{f} + 0.75 \cdot 2.8$
<ul style="list-style-type: none"> <li>• Minimum horizontal distance phase to earth in span (m)</li> </ul>				$0.62\sqrt{f} + 0.75 \cdot 2.8$
• Shielding angle				20°

\* 30° shielding angle is allowed for tower 4DTU.

### External clearances for tower spotting

Description	Clearance (m)
<ul style="list-style-type: none"> <li>• Vertical clearance *           <ul style="list-style-type: none"> <li>- Normal ground not accessible to vehicles</li> <li>- Residential area</li> <li>- Motorways</li> <li>- Roads</li> <li>- Buildings, structures, walls, wireless and TV aerials and scaffolding</li> </ul> </li> </ul>	8.6 15.0 15.0 11.0 7.6

- Trees	5.7
- Telephone lines	5.0
- Power lines (above or below)	6.0
- Power line supports (any part on which a man may stand)	8.0
- Railway (from rail level)	12.0
• Horizontal clearance **	
- From water pipelines	75
- From oil pipelines	100
- From gas pipelines	100
- From oil or gas storage tanks	150
- From main roads	45
- From minor un-paves roads	20
- From railways or railway communication systems	50
- From telecommunication lines or cables	50
- From high and low voltage power lines	50

Note: \* The above clearances shall be observed within the overhead line area and up to 4 m outside the outer phase.

\*\* Dimensions given are for guidance only and may be amended during survey as a result of negotiations with the relevant authorities.

## Lattice steel towers

Tower type		basic span	Line angle	Wind span		Max weight span		Min weight span	Max single span
				Normal	Broke n	Normal	Broke n		
		m	deg	M	m	m	m	m	m
4DL	Susp.	410	0	450	340	820	615	>60% wind span	900
			2	355	270				
4D1	Tens.	410	0-10	450	340	1230	900	-300	900
	Heavy Susp.	410	0	850	640	1230	900	>60% wind span	900
	Section	410	0	450	340	1450	900		
4D3	Tens.	410	10-30	450	340	1230	900	-300	900
4D6	Tens.	410	30-60	450	340	1230	900	-300	900
4D9/ 4DT	Tens.	410	60-90	450	340	1230	900	-300	900
	Term.	410	45 line side 45 gantry side	400	0	900	0	-300	
4DTu	Tens.& Term.	150	0-5° Entry angle	300	210	650	490	-100	200

Description	Unit	Required data
• Step bolt diameter (min.)	mm	16
• All tower steel parts hot dip galvanized	-	Yes
• Zinc coat thickness: - For steel sections - For bolts and nuts - For earthing strip	□m □m □m	min. 85 min. 55 min. 120
• Minimum bolt diameter: - High tensile steel - Mild tensile	mm mm	12 16

• Max number of bolt sizes in one tower	No.	2
• Maximum slenderness ratio – L/r:	-	
- Main leg, stub and main compression members in crossarm, <input type="checkbox"/>	-	120
- All other members having computed stresses, <input type="checkbox"/>	-	200
- Redundant members without computed stressed, <input type="checkbox"/>	-	250
- Tension members only, <input type="checkbox"/>	-	350
• Minimum thickness of steel members:		
- Main leg, stub and main compression members in crossarm	mm	6
- All other members having computed stresses	mm	5
- Redundant members without computed stressed	mm	5
- Gusset plates	mm	6
• Earthing tape section	mm	40x4
• Minimum equal angle sections		Lx40x40xt
• Maximum length of structural member	m	9
• Tolerances of finished members:		
- Max lateral variations of actual length between points of lateral supports	ratio	1/1000
- Finished members without ends finished for contact bearing:		
- Members up to 3 m length	mm	± 1.5
- Members greater than 3 m length: <input type="checkbox"/>		
3 m to 6 m	mm	± 2.5
<input type="checkbox"/> greater than 6 m	mm	± 3.0

### Plates

Description	Unit	Required data
• Required plates		
a) Danger plate	N°	2
b) Circuit plate	N°	2
c) Phase plate	N°	6
d) Tower number plate	N°	2
e) Aerial plate (every 10 towers)	N°	1

## Soil parameter for foundation design

Description	Unit	Normal soil	Soft rock	Hard rock	Poor soil
• Weight of earth per cubic meter	kN/m <sup>3</sup>	1600	1900	2000	1500
• Angle of frustum of earth resisting uplift - Undercut construction - Non-undercut construction	degree degree	30 25	30 --	-- --	-- 15
• Mass of concrete per cubic meter	kg	2300	2300	2300	2300
• Ultimate earth pressure for standard foundation under specified loads	daN/cm <sup>2</sup>	5	15	20	2
• Ultimate adhesion value between galvanized steel and concrete	daN/cm <sup>2</sup>	7	7	7	7
• Ultimate lateral earth pressure at depth 1 m **	daN/cm <sup>2</sup> /m	0.5	1.0	--	0.4 *
• Ultimate friction between concrete surface and undisturbed soil	daN/cm <sup>2</sup>	0.35 h*	3.9	7.0	0.2 h*
• Minimum portion of stub loads to be allowed for in the design of stub cleats	%	100%	100%	100%	100%
• Minimum net concrete cover on outer steel surface	cm	5	5	5	5
• Minimum height of concrete top above ground level	cm	30	30	30	30 ***
• Minimum concrete strength on cylinder sample	daN/cm <sup>2</sup>	343	343	343	343
• Minimum rebar strength	daN/cm <sup>2</sup>	3500	3500	3500	3500

Note: The specified loads include the tower safety factor and foundation overload factor.

\*) h = depth in m

\*\*) For auger foundation the lateral earth pressure shall be multiplied by 3

(Broms) \*\*\* In case of flooded area the eight shall guarantee concrete top above flooding level.

## 8.2.2 Material data sheets

### Conductor ACSR/ACS

Description	Unit	Required data	Offered data
• Code		ACSR/ACS (560/50)	
• Standard		ASTM B 416 EN 50128	
• Manufacturer	Company	---	
• Total cross section	mm <sup>2</sup>		
• Aluminium cross section	mm <sup>2</sup>		
• Aluminium clad steel cross section	mm <sup>2</sup>		
• Stranded conductor overall diameter	mm	32.2	
• Number of aluminium wires	N°		
• Diameter of aluminium wires	mm		
• Number of aluminium clad steel wires	N°		
• Diameter of aluminium clad steel wires	mm		
• Ultimate tensile strength (UTS)	daN	15000	
• Standard mass	Kg/km	1874	
• Standard length on drum tolerance		±2%	
• Modulus of elasticity	KN/mm <sup>2</sup>		
• Coefficient of linear expansion	1/°C		
• Direction of strand		right	
• DC resistance at 20°C	Ohm/km	0.0496	
• Max tension	KN		
• Long term creep (10 years) temperture gap	°C		
• Overall reel dimension: - Diameter - Width - Reel lengths range	mm mm mm		
• Grease		NIL	

<b>Electromechanical data</b>	<b>Unit</b>	<b>Required data</b>	<b>Offered data</b>
• Type			
• Standard		EN 50182 IEC 60793	
• Manufacturer	Company	--	
• Total cross section	mm <sup>2</sup>		
• Core diameter	mm		
• Overall diameter	mm	≤18±2%	
• Alu Alloy wire no.	n x mm		
• Alu Alloy wire dia	mm		
• Alu Alloy wire section	mm <sup>2</sup>		
• Alu Clad wire no.	n x mm		
• Alu Clad wire dia	mm		
• Alu Clad wire section	mm <sup>2</sup>		
• Ultimate tensile strength (UTS)	daN	9200	
• Modulus of elasticity	kN/mm <sup>2</sup>		
• Coefficient of linear expansion	1/°C		
• Mass	kg/km	≤650±2%	
• Direction of strand (outer layer)		right	
• Short circuit performance	kA/sec	14kAx1sec	
• DC resistance at 20°C	Ohm/km		
• Max tension			
• Long term creep (10 years) – Temperature gap	°C		
• Bending minimum radius	mm	500	



• Overall reel dimension:			
- Diameter	mm		
- Width	mm		
- OPGW reel lengths range	mm		
• Grease		Nil	

<b>Optical fiber data</b>	<b>Unit</b>	<b>Required data</b>	<b>Offered data</b>
• Number of optical fibers on OPGW – Minimum	No.	36	
• Standard		IEC 60793 IEC 60794 ITU-T G.655D	
• Fiber type		ITU-T G.655D	
• Attenuation			
- Attenuation at wave length 1625 nm	dB/km	□ 0.4	
- Attenuation at wave length 1550 nm	dB/km	□ 0.35	
• Cut-off wave length	nm	□ 1450	
• Dispersion			
- Chromate dispersion at 1460-1550 nm wave length	ps/nm.km	-4.2 to 6.2	
- Chromate dispersion at 1550-1625 nm wave length	ps/nm.km	2.8 to 11.2	
• Mode			
- Mode field diameter	□ m	8-11	
- Mode field concentricity error	□ m	≤ 0.6	
• Geometry			

- Cladding diameter	□m	125±1	
- Cladding non circularity	%	≤1%	
- Coating diameter	□m	250±15	
• Individual splice loss	dB	□ 0.15	
• Mean splice loss	dB	□ 0.1	

### Lattice steel tower

Description	Unit	Required data	Offered data
<ul style="list-style-type: none"> <li>• Tower material <ul style="list-style-type: none"> <li>- Section and plates □ Standard <ul style="list-style-type: none"> <li>□ Standard steel – yield point</li> <li>□ High tensile steel – yield point</li> </ul> </li> <li>- Bolts <ul style="list-style-type: none"> <li>□ Standard</li> <li>□ Class</li> </ul> </li> <li>- Galvanizing □ Standard <ul style="list-style-type: none"> <li>□ Zinc coat on section and plates</li> <li>□ Zinc coat on bolts</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>daN/cm<sup>2</sup></li> <li>daN/cm<sup>2</sup></li> <li>□m</li> <li>□m</li> </ul>	<ul style="list-style-type: none"> <li>EN 10025</li> <li>2750</li> <li>3550</li> <li>ISO 898</li> <li>5.6 – 6.8 – 8.8</li> <li>ISO 1461</li> <li>90</li> <li>55</li> </ul>	
• Tower 4DL			
<ul style="list-style-type: none"> <li>- Height of crossarm chord of tower ±0 with leg extension ±0</li> </ul>	m		

	- Weight for complete tower with leg extension $\pm 0$ including stubs:			
	- 3	kg		
	$\pm 0$	kg		
	+ 3	kg		
	+ 6	kg		
	+ 9	kg		
	+ 12	kg		
• Tower 4D1				
	- Height of crossarm chord of tower $\pm 0$ with leg extension $\pm 0$	m		
	- Weight for complete tower with leg extension $\pm 0$ including stubs:			
	- 3	kg		
	$\pm 0$	kg		
	+ 3	kg		
	+ 6	kg		
	+ 9	kg		
	+ 12	kg		
• Tower 4D3				
	- Height of crossarm chord of tower $\pm 0$ with leg extension $\pm 0$	m		
	- Weight for complete tower with leg extension $\pm 0$ including stubs:			
	- 3	kg		
	$\pm 0$	kg		
	+ 3	kg		
	+ 6	kg		
	+ 9	kg		
	+ 12	kg		
• Tower 4D6				
	- Height of crossarm chord of tower $\pm 0$ with leg extension $\pm 0$	m		
	- Weight for complete tower with leg extension $\pm 0$ including stubs:			
	- 3	kg		
	$\pm 0$	kg		
	+ 3	kg		
	+ 6	kg		
	+ 9	kg		

+ 12	kg		
• Tower 4D9/4DT			
- Height of crossarm chord of tower $\pm 0$ with leg extension $\pm 0$	m		
- Weight for complete tower with leg extension $\pm 0$ including stubs:			
- 3	kg		
$\pm 0$	kg		
+ 3	kg		
+ 6	kg		
+ 9	kg		
+ 12	kg		
• Tower 4DTu			
- Height of crossarm chord of tower $\pm 0$ with leg extension $\pm 0$	m	$\leq 14$	
- Weight for complete tower with leg extension $\pm 0$ including stubs:			
- 2	kg		
$\pm 0$	kg		
+ 2	kg		
+ 4	kg		

### Foundation – Data offered

Tower	Description	Unit	Normal soil	Soft rock	Hard rock	Poor soil
4DL	- Excavation volume - Concrete volume - Steel reinforcement weight	$m^3$ $m^3$ kg				
4D1	- Excavation volume - Concrete volume - Steel reinforcement weight	$m^3$ $m^3$ kg				
4D3	- Excavation volume - Concrete volume - Steel reinforcement weight	$m^3$ $m^3$ kg				

4D6	- Excavation volume - Concrete volume - Steel reinforcement weight	$\text{m}^3$ $\text{m}^3 \text{ kg}$				
4D9/4DT	- Excavation volume - Concrete volume - Steel reinforcement weight	$\text{m}^3$ $\text{m}^3 \text{ kg}$				
4DTu	- Excavation volume - Concrete volume - Steel reinforcement weight	$\text{m}^3$ $\text{m}^3 \text{ kg}$				
	Minimum concrete characteristic strength (cylinder)	$\text{daN/cm}^2$				
	Minimum steel rebar yield point	$\text{daN/cm}^2$				

### Composite insulator

Description	Unit	Required data	Offered data
• Code			
• Standard		IEC 60120 IEC 60372 IEC 61109 IEC 61466	
• Manufacturer	Company		
• Material		HTV	
• Length	mm		

• Diameter of core	mm		
• Diameter of short shed	mm		
• Diameter of large shed	mm		
• Coupling		Ball socket	
• Pin diameter	mm		
• Locking device		stainless steel split	
• Min creepage (leakage) distance	mm	15960	
• Mass of unit	kg		
• Ultimate tensile strength for UTS Suspension	kN	210	
• Ultimate tensile strength UTS for Tension	kN	160	
• Min wet power frequency withstand voltage	kV		
• Min dry lightning impulse withstand voltage	kV	1425	

### Phase suspension insulator set

Description	Unit	Required data	Offered data
• Set type		I string	

• Standard		IEC 60383 IEC60815 IEC 61284 ISO 1461	
• Manufacturer	Company		
• N° of insulator string*	N°	1 or 2	
• Armour rods		yes	
• UTS of set (one string)	kN	160	
• UTS of set (two string)	kN	2×160	
• Mass of set (without insulators) with single string	Kg		
• Counterweight: max weight	Kg	≥200	
• Total length of insulator set ( for single and double string)	mm	5170	
• N° of conductor per bundle	N°	2	
• Conductor bundle spacing	mm	500	
• String axis spacing	mm	500	
• Suspension clamp tightening	Nm		
• Suspension clamp min withstand slipping load	kN		
• Dry lightning impulse voltage: - pos. - neg.	kV kV	1425	
• Dry switching impulse withstand voltage	kV	1050	
• Wet power frequency withstand voltage	kV		
• Dry power frequency withstand voltage	kV		
• Corona extinction voltage	kV	270	
• RIV level on 300Ω resistance at 1 MHz	□V	100	
• Galvanizing - All components - Bolts, nuts and washer	□m □m	85 55	

Note: \* 2 strings can be required in special crossing.

### Phase tension insulator set

Description	Unit	Required data	Offered data
• Standard		IEC 60383 IEC 60815 IEC 61284 ISO 1461	
• Manufacturer	Company		
• N° of insulator string	N°	2	
• Insulator unit UTS	kN	2×210	
• UTS of set (one string)	kN	210	
• UTS of set (two string)	kN	2×210	
• Low duty (upright and inverted)*	kN	160	
• Mass of set (without insulators)	kg		
• Total length of insulator set	mm	Min 5500 Max 6910	
• N° of conductor per bundle	N°	2	
• Conductor bundle spacing	mm	500	
• String axis spacing	mm	500	
• Dead end clamps min withstand tension (% UTS of conductor)	%	95	
• Dry lightning impulse voltage: - pos. - neg.	kV	1425	
• Dry switching impulse withstand voltage	kV	1050	
• Wet power frequency withstand voltage	kV		
• Dry power frequency withstand voltage	kV		
• Corona extinction voltage	kV	270	
• RIV level on 300Ω resistance at 1 MHz	□V	100	
• Galvanizing - All components - Bolts, nuts and washer	□m	85 55	

Note:

\* Inverted insulators should be equipped with adjustable arcing horn **Phase**



### conductor compression joint and repair sleeve

Description	Unit	Required data	Offered data
• Standard		IEC 61284 ISO 1461	
• Manufacturer	Company		
• Corona extinction voltage	kV		
• RIV level on $300\Omega$ resistance at 1 MHz	dB	100	
• Joint <ul style="list-style-type: none"> <li>- Overall length</li> <li>- Grease type</li> <li>- Mechanical strength (%) UTS conductor</li> </ul>	mm %	95	
• Repair sleeve <ul style="list-style-type: none"> <li>- Overall length</li> </ul>	mm		
• Galvanizing <ul style="list-style-type: none"> <li>- All components</li> <li>- Bolts, nuts and washer</li> </ul>	□m □m	85 55	

### OPGW fittings

Description	Unit	Required data	Offered data
• Standard		IEC 60383 IEC 61284 ISO 1461	
• Manufacturer	Company		
• Suspension set <ul style="list-style-type: none"> <li>- Neoprene insert in suspension set</li> <li>- Armour rod</li> <li>- UTS of suspension set</li> <li>- Suspension clamp tightening</li> <li>- Suspension clamp min withstand slipping load</li> </ul>	kN Nm kN	Yes Yes	
• Tension set <ul style="list-style-type: none"> <li>- Preformed armour rod</li> <li>- UTS tension set</li> </ul>	kN	Yes	

- Tension set type		preformed	
- Mechanical strength (% UTS OPGW)	%	95	
• Galvanizing			
- All components	□m	85	
- Bolts, nuts and washer	□m	55	

### Stockbridge damper

Description	Unit	Required data	Offered data
• Standard		IEC 60383 IEC 61284 ISO 1461	
• Manufacturer	Company		
• Phase conductor - Damper type - Damper mass - Damper slipping withstand load - Corona extinction voltage - RIV level on $300\Omega$ resistance at 1 MHz	kg daN kV □V	stockbridge 270 100	
• OPGW shieldwire - Damper type - Damper mass - Damper slipping withstand load - Warning sphere mass	kg daN kg	stockbridge	
• Galvanizing - All components - Bolts, nuts and washer	□m □m	85 55	

### Phase conductor spacer damper

Description	Unit	Required data	Offered data

Standard		IEC 60383 IEC 61284 ISO 1461	
Manufacturer	Company		
Bundle spacing	mm	500	
Type (Spacer Damper)			
- Mass	kg		
- Slipping withstand load	kN		
- Compression load without deformation	daN	6	
- Corona extinction voltage	kV		
- RIV level on $300\Omega$ resistance at 1 MHz	$\mu$ V	270 100	
Galvanizing - All components			
- Bolts, nuts and washer	m	85	
	m	55	
Speer movements			
- Longitudinal parallel to the conductor	mm	max $\pm$ 60	
- Vertical movement at right angle to the conductor	mm	max $\pm$ 60	
- Torsional, angular movement in a vertical	mm	max $\pm$ 2	

plan parallel to the conductor

### Phase conductor spacer (rigid) for jumper loop

Description	Unit	Required data	Offered data
Standard		IEC 60383 IEC 61284 ISO 1461	
Manufacturer	Company		
Bundle spacing	mm	350	

Type (Spacer Damper)	kg kN daN kV μV	6 270 100	
- Mass - Slipping withstand load - Compression load without deformation - Corona extinction voltage - RIV level on $300\Omega$ resistance at 1 MHz			
Galvanizing	m m	85 55	

#### Speer movements

- Longitudinal parallel to the conductor - Vertical movement at right angle to the conductor	mm mm	max $\pm 60$ max $\pm 60$	
- Torsional, angular movement in a vertical	mm	max $\pm 2$	

plan parallel to the conductor

## Plates

Description	Unit	Required data	Offered data
• Manufacturer	Company		
• Colour required background/indication a) Danger plate b) I Circuit plate II Circuit plate c) Phase plate d) Tower number plate e) Aerial plate every 10 towers)		white/red red/yellow/blue	
• Material plate / coat			



## Warning sphere for shield wire

Description	Unit	Required data	Offered data
• Manufacturer	Company		
• Material		fiberglass	
• Diameter	mm		
• Color			
• Mass	kg		
• Spheres separation (approximately)	m	60	

## DOCUMENT LIST

### Bidder document

The bidders are request to submit all the following documents:

Ref. No.	DESCRIPTION	Bid Stage	Remarks
1.1	<b>Technical description</b>	X	
1.2	<b>Statement of compliance with list of deviation, if any</b>	X	
1.3	<b>Material data schedule</b>	X	
1.4	<b>Preliminary design technical documents</b>		
1.4.1	Conductor final sag/tension calculation	X	
1.4.2	Shield wires/OPGW final sag/tension calculation	X	
1.4.3	Insulator sets and conductor accessories arrangement drawings	X	

1.4.4	Shieldwires fittings and accessories for OPGW, arrangement drawings	X	
1.4.5	Damping system	X	
1.4.6	Method of stringing and sagging, with technical details of equipment and machinery	X	
<b>1.6</b>	<b>Vendor list references<sup>1</sup></b>	<b>X</b>	
<b>1.7</b>	<b>Detailed project schedule<sup>2</sup></b>	<b>X</b>	
<b>1.8</b>	<b>Price schedule</b>	<b>X</b>	
<b>1.9</b>	<b>Detailed Organization chart<sup>3</sup></b>	<b>X</b>	
<b>1.10</b>	<b>Construction organization<sup>4</sup></b>	<b>X</b>	
<b>1.11</b>	<b>Detailed list of equipment<sup>5</sup></b>	<b>X</b>	
<b>1.12</b>	<b>Laboratory for Electrical Insulator set type test (Name, references, location)</b>	<b>X</b>	

**X** indicates the requirements for submission

**<sup>1</sup>Vendor list and supplier**

The Employer can decide any supplier in the Bid vendor list without any modification of the price reported in the “Price schedule”.

**<sup>2</sup>Detailed project schedule**

The Bidder shall supply an exhaustive document (bare-chart), where all principal activities are reported in function of start time and duration. As minimum the following activities shall be indicated:

- Line route definition
- Survey
- Plan and Profiles
- Tower pegging and staking chart
- Design and details for each tower type
- Tower type tests for each tower (The Employer could decide types to be tested) - Foundation design for each tower - Insulator set design
- Electrical test on insulator set
- bush clearing and access roads
- Foundation construction
- Tower erection
- Insulator set erection
- Stringing and sagging
- Commissioning
- Guaranteed dates for completion and handover

This document is to be completed by the Bidder and the periods and dates entered are binding the Contractor.

Compliance with the required completion date is essential to allow the Employer to satisfy known future load demand and it is imperative that these dates are adhered to.

The Bidder shall include in the period entered above a realistic allowance for the time taken for clearing through customs of goods at the port of Aqaba. This allowance shall be based on the situation existing at the time of Tender preparation, being two weeks.

### **<sup>3</sup>Detailed organization chart**

The Bidder shall supply an exhaustive document, with the main manpower that will be used in the Project and the key men Curriculum Vitae. As minimum the following information shall be given:

- Project Manager CV
- Site Manager CV
- Safety and quality Manager CV
- Design engineer – Structural CV
- Design engineer – Civil CV
- Line construction Manager CV



- Stringing engineer CV

The assigned persons proposed in the bidding document shall be available during the Project execution.

#### **<sup>4</sup>Construction organization**

The Bidder must indicate the minimum following information about his Project construction organization:

- Foundation gangs number
- Tower erection gangs number
- Minimum number of stringing gangs
- Average rate of foundation production (N/ month)
- Average rate of tower erection production (N/ month)
- Average rate of stringing production (line km/ month)

#### **<sup>5</sup>Detailed list of equipment**

The Bidder shall supply an exhaustive document, with the main equipment used in the Project. As minimum the following equipment information (quantity and type) shall be given:

- Mechanical excavators
- Air compressors complete with breakers and drills
- Concrete mixers
- Water Bowsers
- Foundation templates
- Sets of concrete shutters
- Vibrators
- Motorized pumps
- Erection derricks, motorized winches and all ancillary tools and equipment for tower erection
- Cranes for tower erection
- Stringing winches
- Tensioners (brakes)
- Drum elevators
- Running pulleys
- Pilot (x 1000m)
- Tractors

The equipment proposed in the bidding document shall be available during the Project execution.

## Contractor document schedule

Ref. No.	DESCRIPTION	Basic design stage	Detail drawing stage	As Built stage
<b>2.1</b>	<b>Planning and management</b>			
2.1.1	Project schedule and progress	X		
2.1.2	Technical document list and status	X		X
2.1.2	Supplier list and references	X		
2.1.4	Material procurement schedule and status	X		X
2.1.5	Type test schedule			
2.1.6	Inspection plan (Quality Control Plan)	X		
2.1.7	Acceptance test schedule	X		
2.1.8	Organization chart	X		
2.1.9	Local Sub-Contractor list and references	X		
<b>2.2</b>	<b>OHTL engineering basic data</b>			
2.2.1	Phase conductor mechanical calculation	X		X
2.2.2	OPGW mechanical calculation	X		X
<b>2.3</b>	<b>Survey</b>			
2.3.1	Topographic map / Line route chorography	X		X
2.3.2	Plan and profile drawings	X	X	X
2.3.3	Plan and profile PLS CAD files	X	X	X
2.3.4	Preliminary staking chart for tower pegging (structure list)	X		
2.3.5	Tower diagonal sections, where required	X		X

Ref. No.	DESCRIPTION	Basic design stage	Detail drawing stage	As Built stage
2.3.6	Final staking chart (including foundation and grounding)			X
2.3.7	Line list of material	X		
2.3.8	Stringing chart	X		X
2.3.9	Sagging chart	X		X



2.3.10	Detailed planimetries, where required		X	X
2.3.11	Key map with joint boxes and repeater location		X	X
<b>2.4</b>	<b>Structural engineering</b>			
	- Towers design reports			
	- Towers shop/erection drawings			
	- Tower bill of materials		X	X
	- Tower load test procedure			
	- Tower load test report			
	Stub setting dimensions			
<b>2.5</b>	<b>Civil works engineering</b>			
2.5.1	Preliminary soil investigation report	X		
2.5.2	Foundation design report			
2.5.3	Foundation construction drawing and setting dimensions			
2.5.4	Local soil investigation procedure	X		X
2.5.5	Foundation type selection procedure	X		X
2.5.6	Foundation load test (uplift, if any) procedure		X	
2.5.7	Earthing arrangement selection and measurement	X		X
<b>2.6</b>	<b>Materials engineering</b>			
2.6.1	Materials data schedules	X		X
2.6.2	Material Requisition	X		
2.6.3	Assembly and detail drawing of insulating sets, fittings and insulator for phase conductor	X	X	X
2.6.4	Assembly and detail drawing of sets, fittings and accessories for OPGW, including joint box	X	X	X

Ref. No.	DESCRIPTION	Basic design stage	Detail drawing stage	As Built stage

2.6.5	Calculation report and detail drawings of dampers, installation instructions	X	X	X
2.6.6	Electrical and mechanical type test procedures and reports on insulator set and fittings, procedure and reports	X		X
2.6.7	Electrical and mechanical type test on conductors and OPGW, procedures and reports	X		X
2.6.8	Conductors and OPGW drums details, insulator and fittings packing details	X		X
2.6.9	Earthing arrangement and detail drawings	X	X	X
<b>2.7</b>	<b>Materials fabrication</b>			
2.7.1	Supplier QA QC manuals and procedures	X		X
2.7.2	Rough material certificates	X		X
2.7.3	Measurement equipment certificates	X		X
2.7.4	Inspection reports including, type tests and acceptance tests	X		X
2.7.5	Packing list	X		X
<b>2.8</b>	<b>Construction and erection</b>			
2.8.1	Access roads maps	X		X
2.8.2	Plan & detail of access roads, finger roads, structure pads			X
2.8.3	Access roads warning signs		X	X
2.8.4	Details of culverts/retaining walls			X
2.8.5	Civil construction method statement (including earthing arrangement)	X		X
2.8.6	Tower erection method statement	X		X
2.8.7	Conductors and OPGW stringing, sagging, clamping and jointing method statement	X		X
2.8.8	Inspection reports	X		X
2.8.9	Local rough material certificates (concrete etc.)	X		
2.8.10	Measurement equipment certificates	X		
2.8.11	Measurement data (dimensions, sags, electrical resistance, etc.) and reports			X



Ref. No.	DESCRIPTION	Basic design stage	Detail drawing stage	As Built stage
<b>2.9</b>	<b>Commissioning</b>			
2.9.1	Measurement data			<b>X</b>
2.9.2	Final inspection report			<b>X</b>
<b>2.10</b>	<b>Operation &amp; Maintenance</b>			<b>X</b>
<b>2.11</b>	<b>Spare part list</b>			<b>X</b>
<b>X</b> indicates the requirements for submission				

## ANNEX 1 – GENERAL MAP

### A. AAWDCP Main S/S with the existing Aqaba - Ma'an ( 2IN/2Out) 400kv OHTL. having length of about (0.5) km.



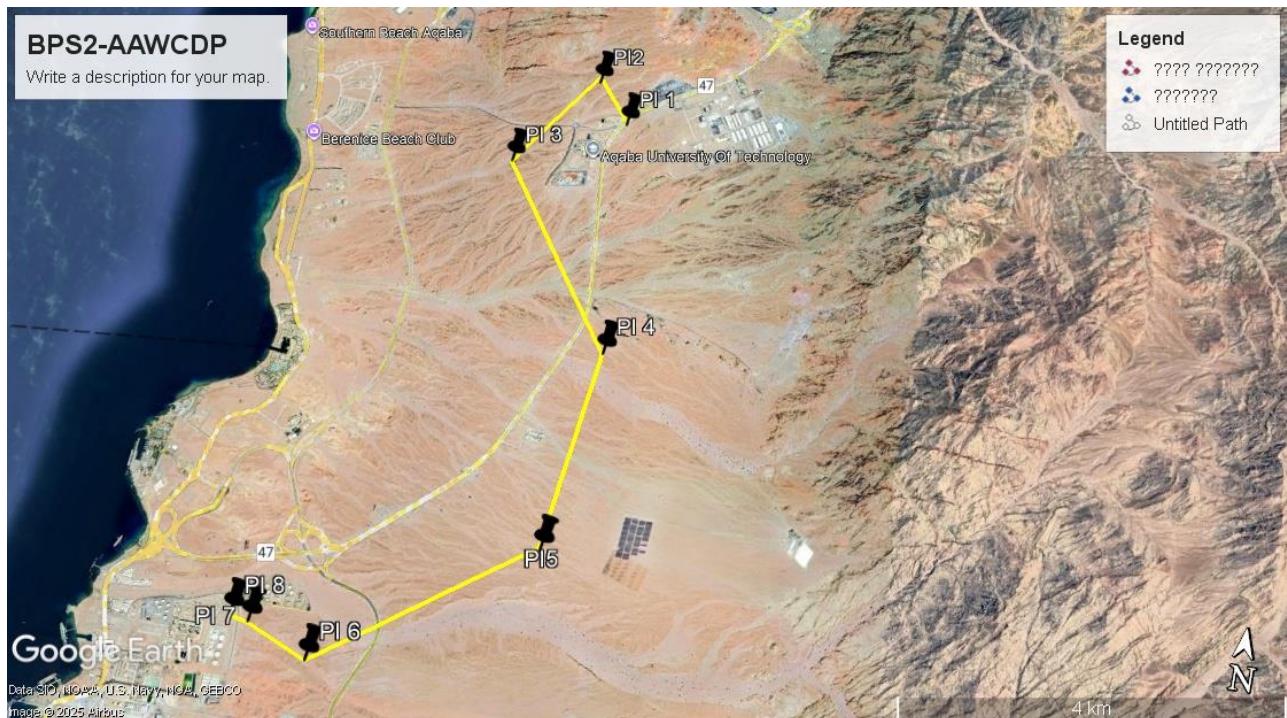
#### OHTL to connect AAWDCP Main S/S with the existing Aqaba - Ma'an 400kv (2In)

Point	latitude	longitude
PI 1	31.769	36.018

#### OHTL to connect AAWDCP Main S/S with the existing Aqaba - Ma'an 400kv (2Out)

Point	latitude	longitude
PI 1	31.769	36.018

**B. AAWDCP Main S/S with BPS2. having length of about (12) km**



OHTL to connect AAWDCP Main S/S with BPS2 132 k.V		
Point	latitude	longitude
PI 1	29.441166627	35.017333962
PI 2	29.446497234	35.012626567
PI 3	29.434710958	35.003030244
PI 4	29.413511537	35.019556773
PI 5	29.391836591	35.016443483
PI 6	29.376918591	34.991800906
PI 7	29.379596184	34.983916117
PI 8	29.380045365	34.981475601

**C. AAWDCP Main S/S with Qwera PV S/S passing by BPS3 S/S.having length of about (66) km.**



**OHTL to connect Qwera PV S/S with BPS3 S/S 132 k.V**

Point	latitude	longitude
PI 1	29.752	35.366
PI 2	29.757	35.337
PI 3	29.750	35.312
PI 4	29.726	35.284
PI 5	29.720	35.280
PI 6	29.715	35.274
PI 7	29.705	35.277
PI 8	29.699	35.272
PI 9	29.701	35.270



OHTL to connect BPS3 S/S with AAWDCP Main S/S 132 k.V		
Point	latitude	longitude
PI 1	29.701	35.269
PI 2	29.698	35.272
PI 3	29.649	35.221
PI 4	29.638	35.217
PI 5	29.618	35.203
PI 6	29.583	35.195
PI 7	29.571	35.191
PI 8	29.557	35.189
PI 9	29.547	35.183
PI 10	29.497	35.162
PI 11	29.472	35.151
PI 12	29.431	35.129
PI 13	29.424	35.123
PI 14	29.407	35.109
PI 15	29.400	35.101
PI 16	29.393	35.096
PI 17	29.391	35.093
PI 18	29.385	35.087
Point	latitude	longitude
PI 19	29.382	35.084
PI 20	29.378	35.075
PI 21	29.377	35.072
PI 22	29.374	35.073
PI 23	29.370	35.073
PI 24	29.369	35.068
PI 25	29.372	35.061
PI 26	29.374	35.057
PI 27	29.377	35.057
PI 28	29.379	35.055
PI 29	29.383	35.052
PI 30	29.383	35.046
PI 31	29.383	35.032
PI 32	29.380	35.010
PI 33	29.379	34.981
PI 34	29.379	34.983
PI 35	29.376	34.991

**D.BPS4 S/S with existed Bayader – Queen Alia OHTL(2IN/2out). having length of about (20) km.**



**OHTL to connect BPS4 S/S with existed Bayader – Queen Alia 132 k.V  
(2In)**

Point	latitude	longitude
PI 1	31.769	36.018
PI 2	31.778	36.002
PI 3	31.782	35.983
PI 4	31.783	35.949
PI 5	31.783	35.941
PI 6	31.781	35.935
PI 7	31.770	35.924

<b>OHTL to connect AAWDCP Main S/S with BPS2 132 k.V (2Out)</b>		
Point	latitude	longitude
PI 1	31.769	36.018
PI 2	31.777	36.001
PI 3	31.782	35.983
PI 4	31.782	35.950
PI 5	31.782	35.941
PI 6	31.780	35.935
PI 7	31.770	35.925

## ANNEX 2 – Tower Weights

### –132Kv bundle Conductor/Phase Towers Weights (black steel)

Tower Type	Weight (kg)	Stubs weight/Set (four legs) (kg)
2DL Tower	DL -3m	6675.86
	DL +0m	7273.18
	DL +3m	8380.85
	DL +6m	9064.2
	DL +9m	9766.76
	DL +12m	10874.86
2D1 Tower	D1 -3m	11192.42
	D1 +0m	12235.68
	D1 +3m	13871.98
	D1 +6m	15359.99
	D1 +9m	16762.09
	D1 +12m	18651.3
2D3 Tower	D3 -3m	11310.04
	D3 +0m	12480.4
	D3 +3m	14409.84
	D3 +6m	16062.29
	D3 +9m	17447.52
	D3 +12m	19690.77
2D6 Tower	D6 -3m	13487.13
	D6 +0m	14921.05
	D6 +3m	17092.75
	D6 +6m	18976.06
	D6 +9m	20581.57
	D6 +12m	23336.93
2D9/2DT Tower	D9/DT -3m	19259.84
	D9/DT +0m	20795.48
	D9/DT +3m	23978.39

	<b>D9/DT +6m</b>	<b>25789.2</b>	
	<b>D9/DT +9m</b>	<b>28330.81</b>	
	<b>D9/DT +12m</b>	<b>31908.7</b>	
<b>2DTu Tower</b>	<b>2DTU +0m</b>	<b>11103.81</b>	<b>930.78</b>

### ANNEX 3- Bundle conductor towers Legs Weights for 132 KV (black steel)

<b>Tower Type</b>	<b>Leg Code Name</b>	<b>Four legs</b>
<b>2DL Tower</b>	<b>-2m L.E.</b>	<b>611.74</b>
	<b>-1m L.E.</b>	<b>826.78</b>
	<b>0m L.E. Standard Leg</b>	<b>1041.76</b>
	<b>+1m L.E.</b>	<b>1185.88</b>
	<b>+2m L.E.</b>	<b>1593.72</b>
	<b>+3m L.E.</b>	<b>1847.5</b>
<hr/>		
<b>2D1 Tower</b>	<b>-2m L.E.</b>	<b>1183.48</b>
	<b>-1m L.E.</b>	<b>1574.78</b>
	<b>0m L.E. Standard Leg</b>	<b>1921.64</b>
	<b>+1m L.E.</b>	<b>2197.16</b>
	<b>+2m L.E.</b>	<b>2547.92</b>
	<b>+3m L.E.</b>	<b>3189.22</b>
<hr/>		
<b>2D3 Tower</b>	<b>-2m L.E.</b>	<b>1387.6</b>
	<b>-1m L.E.</b>	<b>1800.4</b>
	<b>0m L.E. Standard Leg</b>	<b>2176.64</b>
	<b>+1m L.E.</b>	<b>2691.8</b>
	<b>+2m L.E.</b>	<b>3037.48</b>
	<b>+3m L.E.</b>	<b>3690.48</b>
<hr/>		
<b>2D6 Tower</b>	<b>-2m L.E.</b>	<b>1740.56</b>
	<b>-1m L.E.</b>	<b>2212.04</b>
	<b>0m L.E. Standard Leg</b>	<b>2669.2</b>
	<b>+1m L.E.</b>	<b>3180.16</b>
	<b>+2m L.E.</b>	<b>3643.12</b>
	<b>+3m L.E.</b>	<b>4425.7</b>

<b>2D9/2DT Tower</b>	<b>-2m L.E.</b>	<b>2746</b>
	<b>-1m L.E.</b>	<b>3299.04</b>
	<b>0m L.E. Standard Leg</b>	<b>3836.96</b>
	<b>+1m L.E.</b>	<b>4597.88</b>
	<b>+2m L.E.</b>	<b>5133.08</b>
	<b>+3m L.E.</b>	<b>5847.44</b>
<b>2DTU Tower</b>	<b>0m L.E. Standard Leg</b>	<b>1621.22</b>
	<b>+2m L.E.</b>	<b>2522.5</b>

#### ANNEX 4- Bundle conductor Foundations Weights (4 Legs) for 132 KV

Tower Type	Soil Type	Concrete (m3)	Excavation (m3)	Reinforcement (kg)
<b>2DL Tower</b>	<b>Normal Soil</b>	<b>7.148</b>	<b>26.308</b>	<b>811.3</b>
	<b>Soft rock</b>	<b>5.136</b>	<b>13.520</b>	<b>463.5</b>
<b>2D1 Tower</b>	<b>Normal Soil</b>	<b>17.984</b>	<b>72.280</b>	<b>1386.4</b>
	<b>Soft rock</b>	<b>11.784</b>	<b>36.504</b>	<b>764.1</b>
<b>2D3 Tower</b>	<b>Normal Soil</b>	<b>23.1</b>	<b>117.836</b>	<b>1802</b>
	<b>Soft rock</b>	<b>18.244</b>	<b>42.024</b>	<b>776.4</b>
<b>2D6 Tower</b>	<b>Normal Soil</b>	<b>33.28</b>	<b>221.756</b>	<b>3292.4</b>
	<b>Soft rock</b>	<b>25.14</b>	<b>62.428</b>	<b>1110.8</b>
<b>2D9/2DT Tower</b>	<b>Normal Soil</b>	<b>42.032</b>	<b>282.46</b>	<b>4444.4</b>
	<b>Soft rock</b>	<b>29.888</b>	<b>78.652</b>	<b>1342</b>
<b>2DTu Tower</b>	<b>Normal Soil</b>	<b>183.776</b>	<b>903.84</b>	<b>6338.4</b>
	<b>Soft rock</b>	<b>30.852</b>	<b>77.136</b>	<b>2084</b>

## ANNEX 5 – single conductor Towers Weights for 132 KV (black steel)

Tower Type		Weight (kg)	Stubs weight/Set (four legs) (kg)
DL Tower	DL -3m	5268.82	110.42
	DL +0m	5792.64	
	DL +3m	6697.06	
	DL +6m	7256.71	
	DL +9m	7876.77	
	DL +12m	8935.11	
D1 Tower	D1 -3m	8017.52	237.85
	D1 +0m	8769.32	
	D1 +3m	10014.48	
	D1 +6m	10999.29	
	D1 +9m	11999.76	
	D1 +12m	13581.36	
D3 Tower	D3 -3m	8415.90	366.95
	D3 +0m	9391.76	
	D3 +3m	10805.93	
	D3 +6m	11875.23	
	D3 +9m	12965.28	
	D3 +12m	14724.74	
D6 Tower	D6 -3m	10119.55	473.49
	D6 +0m	11192.67	
	D6 +3m	12892.11	
	D6 +6m	14278.80	
	D6 +9m	15585.44	
	D6 +12m	17246.70	
D9/DT Tower	D9/DT -3m	13078.76	627.22
	D9/DT +0m	14416.74	
	D9/DT +3m	16474.55	
	D9/DT +6m	18273.92	
	D9/DT +9m	19711.97	

	<b>D9/DT +12m</b>	<b>22866.31</b>	
<b>DTu Tower</b>	<b>DTU +0m</b>	<b>8300</b>	<b>444.78</b>
<b>DTp Tower</b>	<b>DTp +0m</b>	<b>14172.29</b>	<b>633.42</b>
<b>ST Tower</b>	<b>ST+0</b>	<b>10652</b>	<b>450</b>

## ANNEX 6 – single conductor towers Legs Weights for 132 KV (black steel)

<b>Tower Type</b>	<b>Leg Code Name</b>	<b>Weight (kg) / Per one Leg</b>
<b>DL Tower</b>	<b>-2m L.E.</b>	<b>134.50</b>
	<b>-1m L.E.</b>	<b>178.67</b>
	<b>0m L.E. Standard Leg</b>	<b>231.60</b>
	<b>+1m L.E.</b>	<b>270.12</b>
	<b>+2m L.E.</b>	<b>356.99</b>
	<b>+3m L.E.</b>	<b>414.57</b>
<b>D1 Tower</b>	<b>-2m L.E.</b>	<b>224.32</b>
	<b>-1m L.E.</b>	<b>286.53</b>
	<b>0m L.E. Standard Leg</b>	<b>358.87</b>
	<b>+1m L.E.</b>	<b>415.01</b>
	<b>+2m L.E.</b>	<b>495.19</b>
	<b>+3m L.E.</b>	<b>602.73</b>
<b>D3 Tower</b>	<b>-2m L.E.</b>	<b>263.17</b>
	<b>-1m L.E.</b>	<b>330.29</b>
	<b>0m L.E. Standard Leg</b>	<b>435.78</b>
	<b>+1m L.E.</b>	<b>485.47</b>
	<b>+2m L.E.</b>	<b>572.21</b>
	<b>+3m L.E.</b>	<b>699.50</b>
<b>D6 Tower</b>	<b>-2m L.E.</b>	<b>323.18</b>
	<b>-1m L.E.</b>	<b>414.12</b>
	<b>0m L.E. Standard Leg</b>	<b>510.15</b>
	<b>+1m L.E.</b>	<b>576.06</b>
	<b>+2m L.E.</b>	<b>663.84</b>

	<b>+3m L.E.</b>	<b>837.81</b>
<b>D9/DT Tower</b>	<b>-2m L.E.</b>	<b>399.69</b>
	<b>-1m L.E.</b>	<b>491.65</b>
	<b>0m L.E. Standard Leg</b>	<b>614.07</b>
	<b>+1m L.E.</b>	<b>729.19</b>
	<b>+2m L.E.</b>	<b>831.03</b>
	<b>+3m L.E.</b>	<b>987.99</b>

## ANNEX 7 – single conductor towers Foundations Weights (4 Legs) for 132 KV

Tower Type	Soil Type	Concrete (m3)	Excavation (m3)	Reinforcement (kg)
<b>DL Tower</b>	<b>Poor Soil</b>	<b>11.16</b>	<b>81.4</b>	<b>792</b>
	<b>Normal Soil</b>	<b>5.84</b>	<b>18.8</b>	<b>303</b>
	<b>Soft Rock</b>	<b>4.56</b>	<b>13.6</b>	<b>228</b>
	<b>Hard Rock</b>	<b>3.868</b>	<b>6.252</b>	<b>330</b>
<b>D1 Tower</b>	<b>Poor Soil</b>	<b>25.64</b>	<b>191.8</b>	<b>1212</b>
	<b>Normal Soil</b>	<b>13.73</b>	<b>50.9</b>	<b>643</b>
	<b>Soft Rock</b>	<b>8.55</b>	<b>24.3</b>	<b>382</b>
	<b>Hard Rock</b>	<b>2.06</b>	<b>3.9</b>	<b>780</b>
<b>D3 Tower</b>	<b>Poor Soil</b>	<b>29.15</b>	<b>186.2</b>	<b>1980</b>
	<b>Normal Soil</b>	<b>13.37</b>	<b>58.9</b>	<b>800</b>
	<b>Soft Rock</b>	<b>9.44</b>	<b>32.0</b>	<b>482</b>
	<b>Hard Rock</b>	<b>2.33</b>	<b>4.8</b>	<b>650</b>
<b>D6 Tower</b>	<b>Poor Soil</b>	<b>40.92</b>	<b>264</b>	<b>2796</b>
	<b>Normal Soil</b>	<b>17.72</b>	<b>85.5</b>	<b>1123</b>
	<b>Soft Rock</b>	<b>12.4</b>	<b>42.4</b>	<b>589</b>
	<b>Hard Rock</b>	<b>3.0</b>	<b>6.2</b>	<b>850</b>
<b>D9/DT Tower</b>	<b>Poor Soil</b>	<b>47.52</b>	<b>319.7</b>	<b>4224</b>
	<b>Normal Soil</b>	<b>21.05</b>	<b>95.1</b>	<b>1338</b>
	<b>Soft Rock</b>	<b>14.11</b>	<b>51.5</b>	<b>778</b>
	<b>Hard Rock</b>	<b>3.4</b>	<b>6.7</b>	<b>1010</b>
<b>DTu Tower</b>	<b>Poor Soil</b>	<b>48.94</b>	<b>319.3</b>	<b>4251</b>
	<b>Normal Soil</b>	<b>23.6</b>	<b>74.4</b>	<b>1488</b>
	<b>Soft Rock</b>	<b>15.12</b>	<b>35.2</b>	<b>876</b>
	<b>Hard Rock</b>	<b>4.96</b>	<b>7.6</b>	<b>1071</b>

DTp Tower	Normal Soil	11.75	40.55	566.7
	Soft Rock	6.86	13.52	368.2

### ANNEX 8 –400Kv Bundle Conductor/Phase Towers Weights (black steel)

Tower Type	Weight (kg)	Stubs weight/Set (four legs) (kg)
4D9/4DT Tower	4D9/4DT +0m	43333

### ANNEX 9 –Legs Weights for 400 KV (one leg) (black steel)

Tower Type	Leg Code Name	One leg
4D9/4DT Tower	+1m L.E.	1957
	+2m L.E.	2158

### ANNEX 10 – Foundations Weights (4 Legs) for 400 KV

Tower Type	Soil Type	Concrete (m3)	Excavation (m3)	Reinforcement (kg)
D9/DT Tower	Normal Soil	52.01	348.48	5124
	Soft Rock	43.78	280.85	4436
	Poor Soil	80.02	540.59	7207