وزارة الطاقة
Ministry of Energy

M I N I S T R Y O F E N E R G Y
S Y R I A N A R A B R E P U B L I C

Public Establishment for Transmission and Distribution of Electricity **(PETDE)**

Request for Bids
Plant

One stage, Two-envelope
(Without Prequalification)

Procurement of

Rehabilitation (Supply and Installation) of 400 kV high-voltage interconnector transmission lines between Syria and Jordan (South Syria- Deir Ali till the Border), including the supply of necessary spare parts

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RFB No.: SY-PETDE-505405-CW-RFB

Project : Syria Electricity Emergency Project Employer:

Employer : Public Establishment for Transmission and Distribution of Electricity- PETDE

Country : Syrian Arab Republic

Issued on : [February, 18,2026]

Volume 2 of 2

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Scope of Supply of Plant and Installation Services by the Contractor

1. PROJECT OVERVIEW & GENERAL REQUIREMENTS:

1.1 Project Purpose and Background

The purpose of this project is to rehabilitate the damaged 400kV high voltage interconnector overhead transmission line between Syria and Jordan (South Syria – Dir Ali Substation till the Syrian Jordanian border) to enable electricity imports into Syria and improving the stability of the Public Establishment for Transmission and Distribution of Electricity's (PETDE's) electricity network.

The aforementioned line is a single circuit lattice steel towers equipped with twin conductor per phase of ACSR type, two ground wires (one ACSR earth-wire & one OPGW), and glass insulators, with total length of (87.5km approximately) inside Syria.

1.2 Brief Project Description:

The Contractor shall perform on Turnkey basis (TK) the engineering, material procurement, quality management, factory inspection and testing, transport and delivery of all materials including Towers, Conductors, ACSR Earth-wire, OPGW Earth-wire, Steel Angles, Insulators and all associated Fittings 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.

Remaining lengths of conductor, ACSR Earth-wire, OPGW Earth-wire, empty drums, steel angles, insulators and all associated fittings are PETDE property and shall be returned to designated stores by the Contractor.

All required works must be completed in conformance with the technical and financial schedules, quantities, standards, specification and drawings related to the tender for the existing 400kV overhead transmission line and Employer's Requirements.

1.3 Provided Information by the Employer (PETDE):

- The relevant team acting on behalf of the Employer shall affect the site hand-over to the Contractor.
- Designs and drawings for the required Tower, drawings for fittings of conductors, insulators and grounding wires for the existing line are attached separately to the tender document to enable the contractor to supply similar materials for use in the execution of the required work.

2. TECHNICAL SPECIFICATIONS OF EXISTING TRANSMISSION LINE:

2.1 Climatic and Environmental Design Conditions:

The existing line was commissioned using the following ambient parameters:

Annual Minimum / Maximum Temperature	-10 / 45 °C
Annual Average Temperature	+20 °C
Conductor Temperature	+75 °C
Temperature at Ice Formation	-5 °C
Temperature at Maximum Wind Speed	+15 °C
Wind Speed in the Presence of Ice	20 m/s
Maximum Wind Speed	36 m/s
Ice Thickness	10 mm
Average Annual Humidity	55-60%
Annual Lightning Occurrence Hours	15 hours
Annual Rainfall	350-400 mm
Elevation Above Sea Level	600 m
Pollution Conditions	Winds Carrying Dust + Smoke from Factories

2.2 Specifications of Existing Line Materials:

To ensure compatibility, the specifications for the existing line are listed below. The contractor shall supply materials matching these specifications, as further detailed in the technical schedules and drawings attached to the tender document.

2.2.1. Lattice Steel Towers:

The existing towers are 400kV, single circuit, lattice steel structures, and the project involves rehabilitating this line which requires rebuilding one new tower that has been identified (number 177) of this line.

The type of this tower is (Suspension - 4SL) with approximate weight of (**12.54 ton**). Detailed specifications are according to related datasheet and the attached tender drawings of existing line components.

2.2.2. Phase Conductors:

The phase conductor of existing line is a twin-bundled ACSR (550/70 mm^2) connected by spacer-damper along the entire line. Additionally, spacers are installed for the jumper-loops of the tension and end towers.

The existing phase conductor specifications as follows:

Description	Data
Nominal cross-section	550/70 mm²
Diameter	32.4 mm
Actual cross-section	621.3 mm²
Nominal current	1050 A
Resistance	0.05259 ohm/km
Maximum allowable stress	9.2 kg/mm²
Average stress at +20 degrees Celsius	5.6 kg/mm²
Weight per linear meter	2.092 kg/m

Note: Detailed specifications of existing phase conductor according to the related table in datasheets section and the attached tender drawings of existing line components.

2.2.3. ACSR Earth-wire:

The Earth-wire of existing line is ACSR (105/75 mm²) installed on one side of the towers with the following specifications:

Description	Data
Nominal cross-section	105/75 mm²
Diameter	17.5 mm
Actual cross-section	181.5 mm²
Maximum allowable stress	24.36 kg / mm²
Average stress at +20 degrees Celsius	8 kg/mm²
Weight per linear meter	0.932 kg/m

Note: Detailed specifications of existing Earth-wire according to the related table in datasheets section and the attached tender drawings of existing line components.

2.2.4. Fiber Optic Earth-wire (OPGW):

The OPGW of existing line is AA/ACS (170 mm²) installed on one side of the towers with the following specifications:

Description	Data
Type of conductor	Aluminum / Steel (AA/ACS)
Actual cross-section	173.2 mm²
Diameter	≤ 18 mm
Ultimate tensile strength	≥ 108 KN
Maximum allowable stress at a temperature of (-5) and ice thickness of (10) mm and wind pressure of (777) Newton/m²	Minimum cutting force 2.5 kg/mm²
Average stress at a temperature of +25°C	Minimum cutting force 5 kg/mm²
Number of optical fibers	48

Note: Detailed specifications of existing OPGW and related fittings according to the related table in datasheets section and the attached tender drawings of existing line components.

2.2.5. Insulators:

The insulators of existing line are 210KN toughened glass type as follows:

Type of string	Number of discs per string
Double tension string	2X37 Regular discs
Single tension string	37 Regular discs
Single suspension string	26 Anti-pollution discs
Double suspension string	2X26 Anti-pollution discs
Single suspension string with additional counterweights	26 Anti-pollution discs

Note: Detailed specifications of existing insulators according to the related table in datasheets section and the attached tender drawings of existing line components.

2.2.6. Fittings & Accessories:

The specifications of the existing fittings for conductors and insulators (tension and suspension sets, mid-span joints, repair sleeves, conductor spacer dampers, jumper-loop spacers, and counterweights …etc.) and existing fittings for the OPGW and ACSR earth-wires (tension and suspension sets, mid span joint, repair sleeves, vibration dampers and warning spheres …etc.) are according to the related table in datasheets section and the attached tender drawings of existing line components.

3. SCOPE OF WORK:

3.1 General:

The Rehabilitation works will be implemented through Turnkey basis (TK) Contract, for the supply and installation of steelworks, conductors, insulators, OPGW & ACSR earth-wires as specified in the detailed scope of work and technical specifications.

The scope includes the supply of spare materials for transmission line components, which are included in the supply schedules (Schedule of Rates and Prices No. 1 & 2) as additional quantities of materials that will be installed on the transmission line as listed in the installation schedule (Installation and Other Services No.4). Bidders should quote the imported materials (material supplied from abroad) in schedule No.1, while supplied within the Employer's Country should be quoted in schedule No.2.

Site survey report shall identify all critical issues including: crossing with the roads and existing structures, potential access issues, existing components (towers, insulators, etc.), potential clearance issues, exiting sags of conductor and earth wire along the route, replacing, required members, bolts and nuts on the existing steel towers shall be clearly indicated in the report.

3.2 Overall Scope Summary:

1- The Contractor shall submit the proposed work program within ten days from the commencement date, detailing the activities relating to the project, materials delivery and erection for the complete contract works for comment and management approval, detail and time scale.
2- Site survey of existing OHL and infrastructure along the line route including inspection of towers and all other relevant points which may affect installation works.
3- Construct access dirt roads (with a width of 4 meters) in case of no access to reach the towers where necessary to implement the required works along the line route.
4- It is the contractor's responsibility to provide all the necessary accessories to secure the grounding conductors to the tower body.
5- Supply and install the required lattice steel suspension tower (type 4SL), and necessary fittings/accessories on the existing foundations.
6- Supply and install the required various insulator strings and their fittings according to the required technical specifications and quantities.
7- Supply and install the required ACSR conductors (550/70 mm^2) and their fittings on the specified line sections according to the required technical specifications and quantities.
8- Supply and install the required ACSR and OPGW earth-wires and their fittings on the specified line sections according to the required technical specifications and quantities.
9- OPGW earth-wire should be installed on towers only using the tensioner and puller machines.
10- The contractor should dismantle the damaged or broken insulator strings and their fittings, as well as those with broken insulators (discs), preserving the intact parts, reassembling and

reinstalling these insulator strings, provided that the intact and damaged strings along with their fittings will be identified by the employer supervision team.

11- The Contractor shall carry out any work necessary to complete the project as intended, irrespective of whether every item is specifically listed in the Bill of Quantities and are mandatory for execution. The cost for such work is considered included in the price schedules.

12- Supply all materials and carry out all other works required by the commitment until the project is fully ready for taking over.

13- Protecting all project materials from damage, harm, and loss during installation or storage.

4. DETAILED SCOPE OF WORK (SUPPLY AND INSTALLATION SERVICES):

4.1 Supply, Assembly, and Erection of Tower No. (177):

- **Tower spotting:**
  The Contractor shall perform optimized tower spotting using the specialized software PLS-CADD. The final deliverable shall be an AutoCAD drawing (plan and profile) showing 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. The associated PLS-CADD backup files shall be submitted to the Employer.

- **Bolts and nuts:**
  Members of lattice steel structures shall be secured by means of bolts and nuts with approved plan 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.

- **Included accessories in tower supply:**
  Step bolts, attachment devices, anti-climbing devices and signs shall be provided and installed according to tender drawings of existing line components.

  The works include, but not be limited to, the following:

  - Labor, machinery and depreciation costs of fixed materials and equipment for the work crews distributed along the route, as well as the assembly, hoisting, and installation of the towers.
  - Labor, machinery and depreciation costs of fixed materials and equipment for the maintenance work crews of bolt tightening and welding of bolts up to a height of 4 meters above the ground, followed by the application of three coats of zinc rich paint on all weld points.

- Labor and machinery costs for leveling the grounds in front of the tower site where required.

4.2 Supply & Installation of Grounding System (for Tower No.177):

a. The Contractor shall supply and install the complete grounding system for tower No. (177) by connecting the grounding conductor to the tower legs, including all supplementary components and connection accessories such as plastic pipes, clips, clamps, bolts, and various connectors, inclusive of the depreciation of all fixed tools and equipment.
b. Install the (105/75) mm^2 grounding conductor of 80m length as per the approved drawings.
c. Connect and securely fix the grounding conductor to the tower legs, in addition to extend the pipe within the concrete chimney around the grounding conductor to prevent contact between the grounding conductor and the concrete foundation of the tower.
d. Execute all connections and details as required by the drawings. ensuring that the bonding lugs provided by the contractor are welded to the grounding conductor after crimping to prevent future failure.

The works include, but not be limited to, the following:

- All materials, tools, machinery, equipment, and labor required for the complete and satisfactory execution of this work, ready for service.
- If soil resistivity needs to be improved, backfilling shall be carried out with an improved soil type approved by the supervision engineer.
- The supervision team shall perform earth resistance measurements. If the measured resistance exceeds 10 Ohms, appropriate corrective actions must be taken by the Contractor.

4.3 Supply, Fabrication and Installation of steel angles for the replacement of missing/damaged steel members:

The Contractor shall supply, fabrication and installation of missing steel angles, replacement of all damaged angles according to the existing towers design, specifications, and drawings provided by the employer, along the line route for the following sections:

- Towers number (31) to (34),
- Towers number (38, 54, 55, 56, 57, 63, 75, 76, 85, 144, 145, 211),
- Towers number (178) to (187),
- Towers number (193) to (204).

The standard rolled steel sections for all members shall be not less than (6) meter length. The quantities for each size of steel members shall be according to the details in Annexes (1 & 2).

Provided that these angles shall be cut, drilled and installed by the Contractor at their designated locations, tightening and welding of bolts up to a height of 4 meters above the ground, followed by the application of three coats of zinc rich paint on all weld points.

The works include, but not be limited to, the following:

- Cost of materials for fabrication, drilling, and installation of damaged angles (including cutting discs, welding rods, drilling bits, bolts, and nuts).
- Depreciation of fixed materials and tools.
- Labor costs for dismantling of damaged steel angles to be replaced with new ones.
- Labor costs for cutting, drilling, and maintaining of steel angles.
- Labor costs for assembly, hoisting, and installation of steel angles, including bolt tightening.
- Equipment and machinery costs for dismantling, cutting, drilling, and maintaining of steel angles.
- Equipment and machinery costs for assembly, hoisting, and installation of steel angles.

4.4 Supply, installation and stringing of new twin phase conductor and replacement of damaged insulators for towers section (1 to 251):

The contractor should supply and install the required ACSR (550/70 mm^2) conductors, glass insulators and their fittings (tension and suspension sets, mid-span joints, repair sleeves, conductor spacer dampers, jumper-loop spacers, and counterweights, ... etc.) on the complete line sections (1 to 251), according to the required technical specifications.

The works include, but not be limited to, the following:

- Submission of sag-tension calculations for ACSR conductor for the required spans. Calculation shall be done in respect to conditions given in Sag-Tension requirements of the existing conductor and submitted in PLS CADD software.
- Installation, sagging and calibration of new twin ACSR (550/70 mm^2) conductor for each of the three phases and all associated fittings in addition to replace the damaged spacers for the required spans.
- The contractor should check the clearances between conductors and ground and between jumpers and structures during erection and before handing over the line.
- Replacement of damaged insulator strings/discs including the installation of all required types of insulators, and all associated hardware fittings, as well as lifting and tensioning operations for the required spans along the line.
- Labor, equipment and machinery costs for installation of conductor, insulators and all associated hardware fittings for the required spans.

4.5 Supply, installation and stringing of ACSR earth-wire:

The contractor should supply and install the required ACSR (105/75 mm^2) earth-wire and its fittings (tension and suspension sets, mid span joint, repair sleeves, vibration dampers and warning spheres, ... etc.) along the line, according to the required technical specifications.

The works include, but not be limited to, the following:

- Submission of sag-tension calculations for ACSR earth-wire for the entire line spans. Calculation shall be done in respect to conditions given in Sag-Tension requirements of the existing earth-wire and submitted in PLS CADD software.
- Installation, sagging and calibration of ACSR earth-wire on one side of the towers (instead of the damaged one) and all associated fittings for the entire line spans.
- The contractor should check the clearances between ACSR earth-wire and conductors during erection and before handing over the line.
- Labor, equipment and machinery costs for installation of ACSR earth-wire and all associated hardware fittings for the entire line spans.

4.6 Supply, installation and stringing of OPGW earth-wire:

The contractor should supply and install the required OPGW (170 mm^2) earth-wire and its fittings (tension and suspension sets, and vibration dampers, ... etc.) along the line, according to the required technical specifications.

The scope includes the splicing and testing of the optical fibers, installation of splice closures (joint boxes), and all necessary accessories.

All installation and stringing must be performed exclusively using tensioner and puller machines.

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 towers and joint box locations.

The works include, but not be limited to, the following:

- Submission of sag-tension calculations for OPGW earth-wire for the entire line spans. Calculation shall be done in respect to conditions given in Sag-Tension requirements of the existing OPGW earth-wire and submitted in PLS CADD software.
- Conducting optical fibers inspection and testing of all reels at the site prior to installation to ensure the integrity of the fibers, confirming no breaks or damage are present, and providing a complete and detailed test report, documenting the measurement results and attenuation values for each optical fiber according to its corresponding drum.
- Supply, installation, sagging and calibration of OPGW earth-wire on one side of the towers (instead of the damaged one) and all associated fittings for the entire line spans.
- Safely and automatically stringing and tension of the OPGW using Tensioner and Puller machines, ensuring that the cable does not touch the ground. The Tensioner and Puller should be equipped with measuring devices to determine the applied tension force on the cable.
- Supply and install all suspension and tension sets, and vibration dampers.
- Supply and install a galvanized steel mounting base (where necessary) for the junction box onto the tower structure using bolts instead of welding, ensuring that this base is compatible with the dimensions of the specified box.

- Supply and install the junction boxes for OPGW conductor on towers at height of approximately (8-12) meters above ground level under the direction of supervision engineer.
- Fixing the OPGW conductor part connecting from the top of the tower to the junction box using special fasteners (fixing clamps) with a spacing of (2 to 3 meters between fixing points) while sufficient loop of excess OPGW conductor length (5m from each side) must be left at the junction box to allow for future re-splicing if necessary.
- Performing the optical fiber splicing at each junction box and end box so that the attenuation value at each joint does not exceed (0.15 dB) for each single connection and (0.1 dB) as an average value for all connections on a single line. If the attenuation value exceeds the required value, the contractor must redo the splicing process so that the attenuation value matches the required value according to the instructions of the supervising engineer.
- Upon completion of the OPGW installation for each section, the contractor shall perform a full attenuation test for that section before proceeding with fiber splicing through testing devices and provide a detailed report on the resulting attenuation value after stringing due to any damage or harm to the OPGW conductor, necessitating the replacement of this conductor. If high/unacceptable attenuation is detected, the contractor shall replace the entire damaged section at their own expense. This includes the replacement of the OPGW cable and all associated hardware (e.g., tension sets, suspension sets, junction box, …etc.).
- Submission of a detailed report showing all measurements resulting from the splicing process for all optical fibers of all joint boxes, so that this report indicates the precise distances between the joints and the attenuation value at each joint measured in (dB) for each optical fiber within the cable according to its color, number of joint box as well as the tower number for all joints.
- The Contractor shall submit a detailed study covering the characteristics, location and determination of number of dampers to be used for OPGW ground wire for the range of spans, both for suspension and for tension points along the line, based on the latest engineering professional international standards and recommendations (IEC, IEEE and CIGRE) with respect to aeolian vibrations.
- The contractor should check the clearances between OPGW earth-wire and conductors during erection and before handing over the line.
- The required work includes labor, equipment and machinery costs for installation of OPGW earth-wire and all associated hardware fittings for the entire line spans.

5. GENERAL TECHNICAL REQUIREMENTS:

5.1 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.

5.2 Applicable Standards and Codes

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 is 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. All Standard shall be in last version.

5.3 Marking, Labeling and Packing

The Contractor shall prepare all equipment and materials for shipment in such a manner as to protect them from damage in transit, and shall be responsible for and make good any and all damage due to improper preparation or loading for shipment.
Marking shall be done identically on labels and by stamping the marks into the metal before painting, galvanizing, etc., and shall be clearly readable after painting, galvanizing, etc.
All parts of the plant shall be packed at the place of manufacture. The packing shall be suitable for shipment by sea and for all special requirements of the transportation to the site.
Where necessary, double packing shall be used in order to prevent damage and corrosion during transportation, unloading, reloading and during intermediate storage.
All parts shall be suitably protected against corrosion, water, sand, heat, any adverse atmospheric conditions, shocks, impact, vibrations, etc. for later transport and storage.

5.4 Corrosion Protection and Coatings

1.4.1 Galvanizing

Galvanizing work shall generally conform in all respects to internationally recognized standards, e.g. DIN EN ISO 12944, EN ISO 1461 or equivalent standards and shall be performed by the hot dip process, unless otherwise specified.

It is essential that the shape of steel members and assemblies which are to be hot-dip galvanized shall conform to the requirements of the process.

All defects of the steel surface including cracks, surface laminations, laps and folds shall be removed. All drilling, cutting, welding, forming and final fabrication of individual members and assemblies shall be completed before the structures are galvanized. The surface of the steelwork to be galvanized shall be free from paint, oil, grease and similar contaminants.

On removal from the galvanizing bath, the resultant coating shall be smooth, continuous, free from gross surface imperfections such as bare spots, lumps, blisters and inclusions of flux, ash or dross.

Bolts, nuts and washers, including general grade high-tensile friction-grip bolts shall be hot-dip galvanized and subsequently centrifuged. Nuts shall be tapped up to 0.4 mm oversize after galvanizing and the threads oiled to permit the nuts to be finger-turned on the bolt for the full depth of the nut.

Galvanized steelwork, which is to be stored during sea transport or at the works on site, shall be stacked so as to provide adequate ventilation to all surfaces to avoid wet storage staining (white rust).

1.4.2 Sprayed metal coatings

Corrosion protection can also be achieved by spraying aluminum, zinc, tin, copper, lead or other suitable metals on the surfaces of structures. Composition of coating metals, methods of surface preparation and application of coatings, requirements for thickness and adhesion and subsequent treatment shall conform, e. g. to DIN EN ISO 2063 or equivalent.

5.5 Spare parts

A list of spare parts is included in Price Schedule, detailing the spares holdings required by the Employer. The local transport shall be at stores nominated by the Employer.

The spare parts 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.

6. INSPECTION AND TESTING:

As part of the quality assurance obligations, the Employer shall witness Factory Acceptance Tests (FAT) for the manufactured materials (steel members, phase conductors, insulators, OPGW & ACSR earth-wires, and hardware fittings) at the Manufacturer's premises. The FAT shall be carried out in the presence of the Employer's appointed representatives (2 persons for one week) and shall be conducted in accordance with the relevant international standards referenced in this tender, and the approved quality assurance plan.

The Contractor shall provide sufficient prior notice of the tests, along with all necessary test procedure. All costs for the FAT during manufacture and preparation of test records including round trip airfares, visa fees, hotel accommodations, transportation, and all meals are to be borne by the contractor and shall be quoted in the price schedules.

No materials shall be dispatched from the factory until the FAT has been successfully completed and certified by the Employer's representatives. In case of failure of tests all costs of repeated trips of the employer’s representatives will be borne by the contractor.

6.1 Factory Acceptance Tests for ACSR conductor:

The acceptance test shall be performed in accordance to EN 50182 and EN 50183 and other related standards. As a minimum, the following tests shall be carried out:

a) Hard Drawn Aluminum Wires:

- Appearance and finish.
- Diameter.
- Conductivity.
- Tensile Test.
- Wrapping Test.

b) Aluminum Clad Steel Wires:

- Appearance and finish.
- Diameter.
- Tensile Test.
- Determination of Stress at 1% elongation.
- Torsion Test.
- Wrapping Test.
- Uniformity of Coating.
- Adhesion of Coating.

c) Complete Conductor:

- Appearance and finish.
- Overall Diameter.
- Stranding and Lay Ratio.
- Weight per meter.
- Dc resistance.
- Breaking load test.

6.2 Factory Acceptance Tests for insulators:

The acceptance test shall be performed in accordance to IEC 61466, 60120, 61109, 60372 and other related standards. As a minimum, the following tests shall be carried out:

- Visual examination.
- Verification of dimensions.
- Verification of end fittings & locking system.
- Verification of specified mechanical load (SML).
- Galvanizing test.

6.3 Factory Acceptance Tests for steel angles:

The acceptance test shall be performed in accordance to BS EN10025, EN ISO 1461, ISO 898, and other related standards. As a minimum, the following tests shall be carried out:

- Yield strength.

- Ultimate tensile strength.
- Percentage elongation.
- Thickness of zinc coating.
- Adherence of zinc coating.
- Appearance tests (surface, dimension, weight, … etc.).
- Chemical composition of the ladle analysis.

6.4 Factory Acceptance Tests for OPGW earth-wire:

The acceptance test shall be performed in accordance to BS EN 50182 and IEC 60794-1-1, IEC 60794-2, IEC 60794-4, and other related standards. As a minimum, the following tests shall be carried out:

- Visual Tests (verification of dimensions, appearance and finish, … etc.).
- Mechanical Tests (tensile strength, Crush Test, Torsion Test, … etc.).
- Electrical Tests (DC Resistance, Short-Circuit, … etc.).
- Optical fibers shall be tested in accordance with the requirement of CCITT G652D and IEC 793 as appropriate.

6.5 Factory Acceptance Tests of clamps, fittings and accessories:

The line clamps, and fittings used in the insulator and earth-wire attachment to tower sets as well as for the conductor and earth-wire assembling will be subjected to FAT tests according to IEC 61284, IEC 61854, IEC 61467, IEC 61897 or equivalent test standards, as agreed with the Employer/Employer’s Representatives.

7. TRAINING OF EMPLOYER'S PERSONNEL:

The Contractor shall conduct dedicated training for PETDE's engineers/employees (8 persons) for duration of 2 weeks. The offshore training prices for shall be quoted in the Price Schedules valid for the whole implementation period of the contract.

The Contractor shall cover the cost for trainees inclusive of round-trip airfares between the Employer’s country to the country or countries in which training is to take place, visa fees, hotel accommodations, transportation, and all meals, … etc.

7.1 Overhead transmission line training course (6 persons / two weeks)

The training shall cover the following topics:

1. Overhead transmission line design principles,
2. Sag – tension calculations,
3. Mechanical loading calculations,
4. Foundation design calculations,
5. Corona and electrical calculations,
6. Conductor stringing,
7. Line maintenance and repair work.

7.2 Optical fibers ground wire (OPGW) training course (2 persons / two weeks)

The training shall cover the following topics:

1. Introduction & Fundamentals,
2. Pre-installation Engineering & Standards,
3. Safe and Proper Installation,
4. Splicing (Jointing) of fibers,
5. Termination & Accessories,
6. Maintenance & Troubleshooting.

Technical specifications & Datasheets of Transmission Line Components

[Note to Bidders: The Bidder should fill in the offered data and specifications in conformance with standards, technical specification and drawings related to the tender for the existing 400kV overhead transmission line components and Employer's Requirements.]

DATA SHEET (1) - GUARANTEED TECHNICAL SPECIFICATION FOR STEEL ANGLES FOR LATTICE STEEL TOWERS (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	Steel members type	--	Hot dip galvanized steel angles	
2	Manufacturer	--	Specify	
3	Reference standard	--	EN 10025, EN 10056, ISO 657 or other equivalent standards	
4	Steel grades	--	--	
4.1	High tensile steel	--	S355JR or equivalent	
4.2	Standard tensile steel	--	S275JR or equivalent	
5	Galvanizing system	--	Hot dip galvanizing	
5.1	- Thickness	µm	≥ 85	
5.2	- Weight	g/m2	≥ 610	
6	- Galvanizing Standard	--	DIN EN ISO 12944, EN ISO 1461, BS 729 or equivalent standards	
7	Thickness of parts:	--	--	
7.1	- Main parts	mm	According to towers design	
7.2	- Other parts	mm	According to towers design	
7.3	- Plates	mm	According to towers design	
8	Screws (Bolts) diameter	mm	According to towers design	
8.1	Bolts grades	--	5.8 or equivalent	
8.2	Bolts Standard	--	ISO 898 or equivalent	

Note: Towers steel members should be according to the existing towers design, specifications and drawings provided to the contractor by the employer (PETDE).

Date : Signature :

DATA SHEET (2) - GUARANTEED TECHNICAL SPECIFICATION FOR ACSR PHASE CONDUCTOR

(To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	Conductor designation/code name	--	ACSR 550/70	
1.1	Manufacturer	--	Specify	
1.2	Reference standard	--	ASTM B 416, IEC 50182 or any other eq. standard	
1.3	Overall cross-section	mm2	621.3	
1.4	Number of Aluminum Strand	No.	54	
1.5	Number of Steel Strands	No.	7	
1.7	Aluminum Strand Diameter	mm	3.6	
1.8	Steel Strand Diameter	mm	3.6	
1.9	Overall Conductor Diameter	mm	32.4	
1.10	Conductor Weight Without Lubrication	kg /m	Specify	
1.11	Conductor Weight After Lubrication	kg /m	Specify	
1.12	Ultimate tensile strength (UTS)	daN	17060	
1.13	Elasticity Factor	kg/mm2	6870	
1.14	Linear Expansion Factor	1/ °C	19.3 X 10-6	
1.15	Max. Electrical Resistance at 20°C	ohm /km	0.05259	
1.16	Lubrication Degree	--	Specify	
1.17	Melting Point of Grease	°C	Specify	
2	Conductor Drums	--	--	
2.1	Standard length of conductor on drum	m	Specify	
2.2	Drum Weight	kg	Specify	
2.3	Drum Diameter	mm x mm	Specify	

Date : Signature :

DATA SHEET (3) - GUARANTEED TECHNICAL SPECIFICATION FOR ACSR EARTHWIRE
(To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	Earth-wire designation/code name	--	ACSR 105/75	
1.1	Manufacturer	--	Specify	
1.2	Reference standard	--	ASTM B 416, IEC 50182 or any other eq. standard	
1.3	Overall cross-section	mm2	181.5	
1.4	Number of Aluminum Strand	No.	14	
1.5	Number of Steel Strands	No.	19	
1.7	Aluminum Strand Diameter	Mm	3.1	
1.8	Steel Strand Diameter	Mm	2.25	
1.9	Overall Conductor Diameter	Mm	17.5	
1.10	Conductor Weight Without Lubrication	kg /m	Specify	
1.11	Conductor Weight After Lubrication	kg /m	Specify	
1.12	Ultimate tensile strength (UTS)	daN	10845	
1.13	Elasticity Factor	kg/mm2	10790	
1.14	Linear Expansion Factor	1/ °C	15 X 10-6	
1.15	Max. Electrical Resistance at 20°C	ohm /km	0.2736	
1.16	Short circuit current capacity	(kA)2.sec	≥ 196KA^2s	
1.17	Lubrication Degree	--	Specify	
1.18	Melting Point of Grease	°C	Specify	
2	Conductor Drums	--	--	
2.1	Standard length of conductor on drum	M	Specify	
2.2	Drum Weight	kg	Specify	
2.3	Drum Diameter	mm x mm	Specify	

Date : Signature :

DATA SHEET (4) - GUARANTEED TECHNICAL SPECIFICATION FOR EARTHWIRE SUSPENTION SET (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	**Earth-wire Suspension Set**	--	--	
1.1	Manufacturer	--	Specify	
1.2	Guaranteed Ultimate Tensile strength (minimum failing load)	KN	70	
1.3	Overall length of set (max) (To centerline of conductor including 75mm shackle)	mm	200	
1.4	Mass of set	Kg	Specify	
1.5	Drawing No. of complete set	--	Specify	
2	**Earth-wire Suspension clamp**	--	Corona free	
2.1	Diameter	mm	Specify	
2.2	Material - Clamp body: - U – BOLTS: - Hanger:	--	Specify	
2.3	Ultimate Tensile Strength	KN	Specify	
2.4	Slipping Strength: Min/Max	%UTS	25	
2.5	Bolt torque	Kg.m	Specify	
2.6	Weight	Kg	Specify	
2.7	Conductor take off angle	deg	20	
2.8	Drawing No . of complete set		Specify	
2.9	Relevant Standard		IEC 284 or eq.	

Date : Signature :

DATA SHEET (5) - GUARANTEED TECHNICAL SPECIFICATION FOR EARTHWIRE TENSION SET (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	**Earth-wire Tension Set**	--	--	
1.1	Manufacturer	--	Specify	
1.2	Guaranteed Ultimate Tensile strength (minimum failing load)	KN	125	
1.3	Overall length of set (max) (To jumper terminal including 75mm clevis-tongue)	mm	400	
1.4	Mass of set	Kg	Specify	
1.5	Drawing No . of complete set	--	Specify	
2	**Tension Clamp**	--	Compression	
2.1	Internal Diameter: AL/ST	mm	Specify	
2.2	External Diameter: AL/ST	mm	Specify	
2.3	Material: (Al. tube/ Steel tube)	--	Specify	
2.4	Die Cat Number (Al tube / Steel tube)	--	Specify	
2.5	Number and size of press: (Al tube / St tube)	--	Specify	
2.6	Length of AL tube: (Before press / After press)	mm/mm	Specify	
2.7	Drop angle of jumper pad	deg	2×15	
2.8	Compressor Capacity AL/ST	Ton	Specify	
2.9	Mechanical Strength	KN	95% of Cond's UTS	
2.10	Weight	Kg	Specify	
2.11	Drawing No . of complete set	--	Specify	
2.12	Relevant Standard	--	IEC 284 or eq.	

Date : Signature :

DATA SHEET (6) - GUARANTEED TECHNICAL SPECIFICATION FOR ACSR CONDUCTOR MIDSPAN JOINTS & REPAIR SLEEVES (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	**Mid span joint for (550/70)**	--	Compression	
1.1	Internal Diameter: AL/ST	mm	Specify	
1.2	External Diameter: AL/ST	mm	Specify	
1.3	Material: (Al. tube / Steel tube)	--	Specify	
1.4	Die Cat Number: (Al tube / St tube)	--	Specify	
1.5	Number and size of press: (Al tube / St tube)	No.	Specify	
1.6	Length before and after press: (Al tube / St tube)	mm/mm	Specify	
1.7	Mechanical Strength	KN	95% of Cond's UTS	
1.8	Weight	Kg	Specify	
1.9	Compressor Capacity	Ton	Specify	
1.10	Drawing No. of complete joint	--	Specify	
1.11	Relevant Standard	--	IEC 284 or eq.	
2	**Repair sleeve for (550/70)**	--	Compression	
2.1	Internal Diameter	mm	Specify	
2.2	Die Cat Number	--	Specify	
2.3	Number of press:	No.	Specify	
2.4	Length of sleeve before and after press:	mm/mm	Specify	
2.5	Mechanical Strength	KN	Specify	
2.6	Weight	Kg	Specify	
2.7	Compressor Capacity	Ton	Specify	
2.8	Material	--	Specify	
2.9	Drawing No. of Repair sleeve	--	Specify	

Date : Signature :

DATA SHEET (7) - GUARANTEED TECHNICAL SPECIFICATION FOR ACSR EARTHWIRE MIDSPAN JOINTS & REPAIR SLEEVES (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	**Mid span joint for (105/75)**	--	Compression	
1.1	Internal Diameter: AL/ST	Mm	Specify	
1.2	External Diameter: AL/ST	Mm	Specify	
1.3	Material: (Al. tube / Steel tube)	--	Specify	
1.4	Die Cat Number: (Al tube / St tube)	--	Specify	
1.5	Number and size of press: (Al tube / St tube)	No.	Specify	
1.6	Length before and after press: (Al tube / St tube)	mm/mm	Specify	
1.7	Mechanical Strength	KN	95% of Cond's UTS	
1.8	Weight	Kg	Specify	
1.9	Compressor Capacity	Ton	Specify	
1.10	Drawing No. of complete joint	--	Specify	
1.11	Relevant Standard	--	IEC 284 or eq.	
2	**Repair sleeve for (105/75)**	--	Compression	
2.1	Internal Diameter	Mm	Specify	
2.2	Die Cat Number	--	Specify	
2.3	Number of press:	No.	Specify	
2.4	Length of sleeve before and after press:	mm/mm	Specify	
2.5	Mechanical Strength	KN	Specify	
2.6	Weight	Kg	Specify	
2.7	Compressor Capacity	Ton	Specify	
2.8	Material	--	Specify	
2.9	Drawing No. of Repair sleeve	--	Specify	

Date : Signature :

DATA SHEET (8) - GUARANTEED TECHNICAL SPECIFICATION FOR SPACER DAMPERS OF ACSR CONDUCTOR (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	**Phase conductor spacer**	**--**	**ACSR Spacer Damper**	
1.1	Material: - Center frame - Clamp arm - Bush - Elastomeric element - Bolt	--	Specify	
1.2	Sub-conductor configuration	--	Twin	
1.3	Bundle spacing	mm	500	
1.4	Damping constant	N·s/m	Specify	
1.5	Resonant frequency	HZ	Specify	
1.6	Max single span length	m	645	
1.7	Clamp bolt torque	Kg.m	Specify	
1.8	Compression load without deformation	daN	Specify	
1.9	Electrical resistance between clamps	Ohm	Specify	
1.10	Weight	Kg	Specify	
1.11	Drawing No. of Spacer Damper	--	Specify	
2	**Jumper loop spacer**	**--**	**ACSR Rigid spacer**	
2.1	Sub-conductor configuration	--	Twin	
2.2	Bundle spacing	mm	500	
2.3	Material	--	Specify	
2.4	Weight	Kg	Specify	
2.5	Compression load without deformation			
2.6	Drawing No. of Rigid Damper	--	Specify	
3	Relevant Standards	--	IEC 60383, IEC 61284, ISO 1461 or eq.	

Date : Signature :

DATA SHEET (9) - GUARANTEED TECHNICAL SPECIFICATION FOR WARNING SPHERES OF EARTHWIRES (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	**Warning spheres**	--	Suitable for ACSR earth-wires	
1.1	Manufacturer	--	Specify	
1.2	Sphere Diameter	mm	600	
1.3	Material: - Clamp - Ball body - Bolts & Nuts - Armor rod	--	Specify	
1.4	Color	--	Half White / Half Red	
1.5	Weight		Specify	
1.6	Drawing No. of Warning Sphere	--	Specify	

Date : Signature :

DATA SHEET (10) - GUARANTEED TECHNICAL SPECIFICATION FOR OPGW & ACSR EARTHWIRES VIBRATION DAMPERS
(To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	Designation & type	--	Stock-bridge vibration dampers	
2	Manufacturer	--	Specify	
3	Reference standard	--	EN IEC 61897 or eq.	
4	Counterweight material	--	CAST Iron	
5	Elastic system material	--	Galv. Steel Wire	
6	Material of clamp body and keeper	--	Al alloy	
7	**ACSR earth-wire vibration dampers**	--	--	
7.1	Mass of complete ACSR earth-wire damper	Kg	Specify	
7.2	Drawing No. for ACSR earth-wire damper	--	Specify	
8	**OPGW vibration dampers**	--	--	
8.1	Mass of complete OPGW damper	Kg	≥ 2	
8.2	Drawing No. for OPGW damper	--	Specify	

Date : Signature :

DATA SHEET (11) - GUARANTEED TECHNICAL SPECIFICATION FOR SUSPENSION GLASS INSULATORS (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	Insulators type designation/code name	--	Anti-Pollution / U210 BP	
2	Manufacturer	--	Specify	
3	Reference standard	--	IEC 60305, IEC 60383, IEC 60507 or any other eq. standard	
4	Ultimate tensile strength UTS	KN	210	
5	Dielectric material	--	Toughened glass	
6	Spacing between cap and pin	Mm	170	
7	Diameter	Mm	Max. 320	
8	Creepage Distance	Mm	Min. 545	
9	Standard Coupling	Mm	20 (IEC-120)	
10	Dry Power Frequency Withstand Voltage	KV	90	
11	Wet Power Frequency Withstand Voltage	KV	50	
12	Dry Impulse Withstand Voltage	KV	140	
13	Puncture Voltage in Oil	KV	130	
14	Corona extinction level	KV	Specify	
15	Zink Collars	--	required	
16	RIV level (1Mhz, 1V)	dB	34	
17	Cementing material	--	Aluminous or Portland Cement	
18	Material of: Cap, Pin & Cotter pin	--	Malleable cast iron, Forged steel, Stainless Steel	
19	Approx. Unit Net Weight	Kg	Specify	
20	N° of Insulators in Wooden Crate	Pcs	Specify	
21	Drawing No. of Disc	--	Specify	

Date : Signature :

DATA SHEET (12) - GUARANTEED TECHNICAL SPECIFICATION FOR TENSION GLASS INSULATORS (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	Insulators type designation/code name	--	Standard / U210 B	
2	Manufacturer	--	Specify	
3	Reference standard	--	IEC 60305, IEC 60383, IEC 60507 or any other eq. standard	
4	Ultimate tensile strength UTS	KN	210	
5	Dielectric material	--	Toughened glass	
6	Spacing between cap and pin	mm	170	
7	Diameter	mm	Max. 280	
8	Creepage Distance	mm	Min. 380	
9	Standard Coupling	mm	20 (IEC-120)	
10	Dry Power Frequency Withstand Voltage	KV	75	
11	Wet Power Frequency Withstand Voltage	KV	45	
12	Dry Impulse Withstand Voltage	KV	110	
13	Puncture Voltage in Oil	KV	130	
14	Corona extinction level	KV	Specify	
15	Zink Collars	--	Required	
16	RIV level (1Mhz, 1V)	dB	34	
17	Cementing material	--	Aluminous or Portland Cement	
18	Material of: Cap, Pin & Cotter pin	--	Malleable cast iron, Forged steel, Stainless Steel	
19	Approx. Unit Net Weight	kg	Specify	
20	N° of Insulators in Wooden Crate	pcs	Specify	
21	Drawing No. of Disc	--	Specify	

Date : Signature :

DATA SHEET (13) - GUARANTEED TECHNICAL SPECIFICATION FOR SUSPENTION INSULATOR SET (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	Designation & type	--	Suspension Insulator Set	
2	Manufacturer	--	Specify	
3	Guaranteed Ultimate Tensile strength (Single Suspension string)	KN	1x210	
4	Guaranteed Ultimate Tensile strength (Double Suspension string)	KN	2x210	
5	No. of insulators (discs) per set	--	--	
5.1	Single Suspension string	No.	1x26 Anti-pollution discs	
5.2	Double Suspension string	No.	2x26 Anti-pollution discs	
6	Armour rods	--	Required	
7	Mass of complete set (without insulators)	Kg	Specify	
8	Counterweight (max weight)	Kg	Specify	
9	Total length of insulator set (For single and double string)	mm	Specify	
10	No. of conductor per bundle	No.	2	
11	Conductor bundle spacing	mm	500	
12	String axis spacing	mm	Specify	
13	Suspension clamp tightening	N.m	Specify	
14	Suspension clamp min withstand slipping Load	kN	Specify	
15	Galvanizing Type	--	Hot Dip	
15.1	Galvanizing thickness (All components)	mm	85≥	
15.2	Galvanizing thickness (Bolts, nuts and washer)	mm	55 ≥	
16	Reference standard	--	IEC 60383, IEC60815 IEC 61284, ISO 1461 or eq.	
17	Set drawing reference	--	Specify	

Date : Signature :

DATA SHEET (14) - GUARANTEED TECHNICAL SPECIFICATION FOR TENSION INSULATOR SET

(To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	Designation & type	--	Tension Insulator Set	
2	Manufacturer	--	Specify	
3	Guaranteed Ultimate Tensile strength (Single Tension string)	KN	1x210	
4	Guaranteed Ultimate Tensile strength (Double Tension string)	KN	2x210	
5	No. of insulators (discs) per set	--	--	
5.1	Single Tension string	No.	1x37 regular discs	
5.2	Double Tension string	No.	2x37 regular discs	
7	Mass of complete set (without insulators)	Kg	Specify	
9	Total length of insulator set (For single and double string)	mm	Specify	
10	No. of conductor per bundle	No.	2	
11	Conductor bundle spacing	mm	500	
12	String axis spacing	mm	Specify	
13	Dead end clamps min withstand tension (% UTS of conductor)	%	95	
15	Galvanizing Type	--	Hot Dip	
15.1	Galvanizing thickness (All components)	Mm	85≥	
15.2	Galvanizing thickness (Bolts, nuts and washer)	Mm	55 ≥	
16	Reference standard	--	IEC 60383, IEC60815 IEC 61284, ISO 1461 or eq.	
17	Set drawing reference	--	Specify	

Date : Signature :

DATA SHEET (15) - GUARANTEED TECHNICAL SPECIFICATION FOR OPGW EARTHWIRE (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	OPGW type designation/code name	--	Specify	
2	Manufacturer	--	Specify	
3	Reference standard	--	EN 50182, IEC 60793, IEC 61089, IEEE 1138, IEC 60889, ASTM B 1138, IEC 61232 or any other eq. standard	
4	Number and diameter of AL strands	(no. x mm)	Specify	
5	Number and diameter of ST strands	(no. x mm)	Specify	
6	Direction of outer layer	--	RIGHT HAND	
7	Total area of cross section	(mm^2)	Specify	
8	Area of optical unit cross section	(mm^2)	Specify	
9	Overall diameter	(mm)	≤ 18.0	
10	Guaranteed Ultimate Tensile Strength (UTS)	(kN)	≥ 108	
11	Every day working pressure as % of UTS	%	20 %	
12	Final Modulus of elasticity	(kN/mm^2)	Specify	
13	Coefficient of linear expansion	($x10^{-6}$/°C)	≥14 ×10-6/℃	
14	DC Resistance at 20° C	(Ohm/km)	≤0.270	
15	Conductor maximum continuous operating temperature	(° C)	≥80	
16	Installation minimum bending radius	(mm)	Specify	
17	Operation minimum bending radius	(mm)	Specify	
18	Standard maximum mass of OPGW	(kg / km)	Specify	
19	Standard mass of Grease	(kg / km)	Specify	
20	Drop point of grease	(° C)	100-120	
21	Short circuit current capacity	$(kA)^2$.sec	≥ 196 KA^2s	
22	Initial temperature of short circuit	(° C)	45	

Item	Description	Unit	Requirements	Offered Data
23	Assumed temperature rise of short circuit (final - initial)	(° C)	135	
24	Final temperature of short circuit	(° C)	180≥	
25	Optical unit characteristics:	--	--	
	- Type & Material	--	Stainless Steel tube	
	- Outer diameter	(mm)	Specify	
	- Inner diameter	(mm)	Specify	
	- Tube thickness	(mm)	Specify	
	- Color coding of tubes	--	Yes	
26	Number of Fibers	(no.)	48	
27	Fiber strain in OPGW	(%)	≥ 0.5	
28	Water penetration compound	--	Yes	
29	Drawing numbers of cross section	--	Specify	
30	Document and drawing reference of OPGW	--	Specify	

Date : Signature :

DATA SHEET (16) - GUARANTEED TECHNICAL SPECIFICATION FOR SINGLE MODE OPTICAL FIBER (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	Fibers designation & type	--	G.652D	
2	Optical fibers mode	--	Single Mode	
3	Reference standard of optical fibers	--	ITU-T G.652	
4	Coating diameter	(μm)	235-250	
5	Cladding diameter	(μm)	125.0±1.0	
6	Cladding non-circularity	%	≤ 1.0	
7	Mode field diameter	(μm)	9.2±0.5/1310nm 10.4±0.8/1550nm	
8	Mode field concentricity error	(μm)	≤ 0.5	
9	Cut-off wavelength-fiber λc	(nm)	≤ 1260	
10	Cut-off wavelength-cable λcc	(nm)	≤ 1260	
11	Attenuation at 1310 nm	(dB/km)	≤ 0.35	
12	Attenuation at 1550 nm	(dB/km)	≤ 0.23	
13	Zero dispersion wavelength	(nm)	1300-1322	
14	Chromatic dispersion at 1310 nm	(ps/nm. km)	≤ 3.5	
15	Chromatic dispersion at 1550 nm	(ps/nm. km)	≤ 18	
16	Fiber identification codes	--	Yes, Color coding	
17	Proof test	(%)	1	
18	Document and drawing reference	--	Specify	
19	Splice type	--	Fusion splice	
20	Maximum individual loss	(dB)	≤ 0.15	
21	Mean loss	(dB)	≤ 0.1	

Date : Signature :

DATA SHEET (17) - GUARANTEED TECHNICAL SPECIFICATION FOR OPTICAL FIBER APPROACH CABLE (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	Designation & type	--	Specify	
2	Manufacturer	--	Specify	
3	Reference standard of design & manufacture	--	IEC 60793 and IEC60794 or eq.	
4	Overall Outer Diameter	(mm)	Specify	
5	Guaranteed ultimate tensile strength	(kN)	> 8	
6	Operating temperature range	(^{o} C)	(-40) to (+80)	
7	Standard maximum mass of cable	(kg / km)	Specify	
8	Installation minimum bending radius	(mm)	240	
9	Number of fibers	No.	48	
10	Construction type of cable	--	Layer Stranding	
11	Material of fiber tube	--	PBT	
12	External fiber tube diameter	(mm)	2.4	
13	Fiber tube thickness	(mm)	0.3	
14	Tube filling compound	--	Thixotropic jelly compound	
15	Material of central member	--	FRP	
16	Diameter of central member	(mm)	mentioned by bidder	
17	Water blocking compound	--	Jell	
18	Material of core cover yarn layer	--	Polyester binder	
19	Material of inner sheath	--	Specify	
20	Nominal thickness of inner sheath	(mm)	-	
21	Material of intermediate sheath	--	Specify	

Item	Description	Unit	Requirements	Offered Data
22	Nominal thickness of intermediate sheath	(mm)	-	
23	Material of armor layer	--	Corrugated steel tape	
24	Nominal thickness of armor layer	(mm)	0.25	
25	Material of outer sheath	--	HDPE	
26	Nominal thickness of outer sheath	(mm)	Specify	
27	Conductive coating graphite	--	4.5.1	
28	Document and drawing reference	--	Specify	

Date : Signature :

DATA SHEET (18) - GUARANTEED TECHNICAL SPECIFICATION FOR OPTICAL FIBER JOINT BOXES (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	Type	--	OPGW Joint Closure	
2	Capacity	No.	48 fibers at least	
3	Material	--	Metal And Aluminum Alloy	
4	Entrance	--	2 Ports	
5	Usage	--	OPGW Connecting	
6	Color	--	Any	
7	Protection Grade of outer part	--	IP 68 or better	
8	Protection degree of inner part	--	IP55	
9	Fiber bending additional attenuation	dB	≤ 0.01	
10	Applicable temperature range	℃	—40 ~ +80	
11	Diameter for OPGW	mm	≥ 18	
12	Number of trays fitted in enclosure	pcs	2, 4,8	
13	Splicing	--	Shrinkable protection sleeve	
14	Method of mounting	--	Tower	
15	Number of shrinkable protection sleeves with each closure	pcs	96	

Date : Signature :

DATA SHEET (19) - GUARANTEED TECHNICAL SPECIFICATION FOR TERMINATION / DISTRIBUTION BOX (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	Designation & type	--	Specify	
2	Manufacturer	--	Specify	
3	Material of outer part (box)	--	Paint steel / Stainless Steel	
4	Protection degree of outer part	(IP)	54	
5	Material of inner part (enclosure)	--	ST, PVC	
6	Protection degree of inner part	(IP)	52	
7	Material of organizer tray		PVC	
8	Number of cable entries provided	(no.)	4	
9	Number of patch cord outlets	(no.)	96	
10	Number of total splices in box	(no.)	96	
11	Dimensions of box (H x W x D)	(mm)	Specify	
12	Mass of complete box	(kg)	Specify	
13	Finish of box surface and painting	--	Painted steel pallet, Powder	
14	Functions available:	--	--	
	- circuit re-routing/jumpering	(Y/N)	Yes	
	- circuit disconnection	(Y/N)	Yes	
	- patching and connections	(Y/N)	Yes	
	- manual patching	(Y/N)	Yes	
	- bridging measurements	(Y/N)	Yes	
15	Earth connections to frame	(Y/N)	Yes	
16	Caps for each unused coupler	(Y/N)	Yes	
17	Drawing number	--	Specify	
18	Document reference	--	Specify	
19	Connectors:	--	FC –PC	
	Manufacturer	--	Specify	
	Reference of Standards	--	IEC or eq.	
	Maximum loss of connector	(dB)	≤0.3	
	Mean loss of connector	(dB)	≤0.2	

Date : Signature :

DATA SHEET (20) - GUARANTEED TECHNICAL SPECIFICATION FOR OPGW FITTINGS / SUSPENTION SET (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	Designation & type	--	OPGW Suspension Set	
2	Manufacturer	--	Specify	
3	Guaranteed Ultimate Tensile strength (minimum failing load)	KN	> 95% of UTS of OPGW	
4	Slip load as % of OPGW	%	20% UTS	
5	Mass of complete set	kg	Specify	
6	Material used for:	--	--	
	- Clamp	--	Al. Alloy	
	- Spiral	--	Al Clad Steel	
	- Non-metallic	--	High-Temp. Silicone Rubber	
	- Split	--	stain steel	
7	Kind of galvanization of steel	--	Hot Dip	
8	Standard of galvanization of steel	--	ASTM A153 or eq.	
9	Method of set connection with OPGW	--	With Rubber	
10	Method of earthing connection to tower	--	Earthing Bond & parallel groove	
11	Set drawing reference	--	Specify	
12	Tower fixing clamps: drawing no. /title	--	Specify	
13	Armor rod set document and drawing no. /title	--	Specify	

Date : Signature :

DATA SHEET (21) - GUARANTEED TECHNICAL SPECIFICATION FOR OPGW FITTINGS / TENSION SET (To be filled and submitted in the technical documents envelope)

Item	Description	Unit	Requirements	Offered Data
1	Designation & type	--	OPGW Tension Set	
2	Manufacturer	--	Specify	
3	Guaranteed Ultimate Tensile strength (minimum failing load)	KN	> 95% of UTS of OPGW	
4	Slip load as % of OPGW	%	97% UTS	
5	Mass of complete set	kg	Specify	
6	Material used for:	--	--	
	- Armor rods	--	Al Clad Steel	
	- Dead end helical grip	--	Al Clad Steel	
	- Fittings for attachment to tower	--	Steel	
7	Kind of galvanization of steel	--	Hot Dip	
8	Standard of galvanization of steel	--	ASTM A153 or eq.	
9	Method of set connection with OPGW	--	Helical method	
10	Method of earthing connection to tower	--	Earthing Bond & parallel groove	
11	Set drawing reference	--	Specify	
12	Tower fixing clamps: drawing no. /title	--	Specify	
13	Armor rod set document and drawing no. /title	--	Specify	

Date : Signature :

Annex (1) - Required quantities for each size of steel members to be installed instead of missing/damaged members on towers

Item	Steel angles dimensions	Required Quantities (Ton)
1	90X90X6	**4**
2	80X80X6	**4**
3	75X75X5	**4**
4	70X70X5	**4**
5	65X65X5	**10**
6	60X60X5	**5**
7	50X50X5	**15**
8	45X45X5	**14**
Total quantities (Ton)		**60**

Annex (2) - Required quantities for each size of steel members to be supplied as spare parts

Item	Steel angles dimensions	Required Quantities (Ton)
1	90X90X6	**1**
2	80X80X6	**1**
3	75X75X5	**1**
4	70X70X5	**1**
5	65X65X5	**1**
6	60X60X5	**1**
7	50X50X5	**2**
8	45X45X5	**2**
Total quantities (Ton)		**10**

Drawings

Designs and drawings for the required Tower, drawings for fittings of conductors, insulators and grounding wires for the existing line are provided in separate file.

SL. No.	DESCRIPTION
1	Panel assembly drawings for tower type 4SL
2	400kV Der Ali – Jordan line (Final towers schedule)
3	400kV single suspension insulator set drawing (included in Insulators_and_Hardware_Fittings_Drawings)
4	400kV double suspension insulator set drawing (included in Insulators_and_Hardware_Fittings_Drawings)
5	400kV double tension insulator set drawing (included in Insulators_and_Hardware_Fittings_Drawings)
6	400kV low duty tension insulator set drawing (included in Insulators_and_Hardware_Fittings_Drawings)
7	400kV pilot jumper suspension insulator set drawing (included in Insulators_and_Hardware_Fittings_Drawings)
8	Spacer damper for twin ACSR 550/70 mm² drawing (included in Insulators_and_Hardware_Fittings_Drawings)
9	Earth wire suspension set for ACSR 105/75 mm² drawing (included in Insulators_and_Hardware_Fittings_Drawings)
10	Earth wire tension set for ACSR 105/75 mm² drawing (included in Insulators_and_Hardware_Fittings_Drawings)
11	Vibration damper for ACSR 105/75 mm² drawing (included in Insulators_and_Hardware_Fittings_Drawings)
12	Rigid Spacer for twin ACSR 550/70 mm² drawing (included in Insulators_and_Hardware_Fittings_Drawings)
13	Aircraft warning spheres for ACSR 105/75 mm² drawing (included in Insulators_and_Hardware_Fittings_Drawings)

SL. No.	DESCRIPTION
14	T connector for ACSR 550/70 mm² drawing (included in Insulators_and_Hardware_Fittings_Drawings)
15	Compression mid-span joint for ACSR 550/70 mm² drawing (included in Insulators_and_Hardware_Fittings_Drawings)
16	U210 BP Fog type toughened glass insulator drawing (included in Insulators_and_Hardware_Fittings_Drawings)
17	U210 B Standard type toughened glass insulator drawing (included in Insulators_and_Hardware_Fittings_Drawings)
18	Deirali - Jordan Boarder Line Route (KMZ) file

SEEP ESMP

This is provided in separate file

Terms of Reference for Preparation of Construction-ESMP

This is provided in separate file