Corrigendum

Please find attached revised Section-1 of Technical Specification TB-388-316-003.

All other Sections of Technical Specification of 230kV Cables & Accessories, Doc. No. TB-388-316-003 shall remain unchanged.
1.1 SCOPE

The scope covers the supply and services required for the comprehensive functional system covering 230kV Cables, cable sealing end, cable joints, accessories etc. for connection between 230kV GIS and 230kV Station Transformer.

Scope of work covers Survey of route, Design, Manufacture, Testing, Erection, testing & commissioning of (including laying of cable at site in BHEL provided trench) and commissioning including site testing, performance and acceptance testing of complete 230kV Cable system (Cables, cable sealing end, cable joints, earthing, link boxes etc.) complete in all respect along with accessories as per the specification complete with all auxiliaries, accessories and spare parts.

This section covers the scope and quantities of 230 kV Cables & Accessories. The Specific Technical Requirements for the above item as specified by the customer (BIFPCL) are given in Section-2. The offered items shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification.

In case of any discrepancies between the requirements mentioned under Section-1/Section-2 and those specified in the Section-3, the order of precedence shall be as follows:

a. Statutory Regulations
b. Section-1
c. Section – 2: BIFPCL Specification
d. Section 3
e. International standards

In case of any discrepancies between the requirements mentioned under Section-1/Section-2 and those specified in the Section-3, the specifications given under Section-1/Section-2 shall prevail and shall be treated as binding requirements.

A. SUPPLIES:

A. Supply of 230 kV Cable – As per Section-2.

B. Supply of 230 kV cable Accessories: The cable accessories comprise but are not limited to cable sealing, cable terminations, joints, bonding and earthing accessories forming 230kV Cable system.

B. INSTALLATION SERVICES:

Complete cable installation services including laying, termination, clamping, testing and commissioning of the cable system, point to point is in vendors’ scope.

The Specification envisages turnkey execution of a COMPLETE, POINT TO POINT, 230kV CABLE SYSTEM and the scope includes all materials and service necessary to execute the job to the satisfaction of customer and BHEL. Any other item/service required for the execution for the complete job shall be included in the offer, whether specifically mentioned in the
specification or not, The Bill of quantities included in the offer shall clearly reflect such items along with their respective quantities.

Bidder shall offer both Supplies and Installation Services as per the BOQ given in this Technical Specification. Bids, in which only Supplies or only Installation Services are offered, shall be rejected.

Bidder to submit filled up Annexure-A attached with Section-1 confirming that there are no deviations and the offer is in full compliance with the specification.

1.2 The equipment is required for the following project:

<table>
<thead>
<tr>
<th>Name of the Project</th>
<th>Name of the Customer</th>
<th>Name of the Consultant</th>
<th>Main Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td>400/230kV GIS FOR 2x660MW MAITREE SUPER THERMAL POWER PROJECT, RAMPAL, BANGLADESH</td>
<td>BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED (BIFPCL), BANGLADESH</td>
<td>M/s FICHTNER GmbH &amp; Co KG, Stuttgart, GERMANY</td>
<td>BHEL</td>
</tr>
</tbody>
</table>

1.3 BILL OF QUANTITIES:

Material and Services required for the execution of the job are listed below. All item listed in the following BOQs shall be offered. Any item not appearing herein but required for completeness of the job is deemed to be included in the scope.

1.3.1: SUPPLY ITEMS

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Description</th>
<th>Unit</th>
<th>Main Qty. (A)</th>
<th>Spare Qty. (B)</th>
<th>Total Qty. (A+B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>230 kV Cable - 1C X 500 mm², Copper, XLPE insulated, underground cables with HDPE outer sheath with embedded Optical fibre cable along with junction box/ termination box at both ends.</td>
<td>M</td>
<td>3x200 =600M</td>
<td>1x200 =200M</td>
<td>800M</td>
</tr>
<tr>
<td>2.</td>
<td>230kV cable sealing end (outdoor type) suitable for terminating the cables in the Air insulated ST yard including all accessories like necessary hardware, clamps for fixing the cable on structure etc. (excluding terminal connector)</td>
<td>Nos.</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>230kV GIS cable termination according to latest IEC standards for terminating the cables in 230kV GIS including all accessories like necessary hardware, clamps for fixing the cable on structure etc.</td>
<td>Nos.</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>230kV Straight through joints for 230kV cable, if required. It shall be complete in all respects.</td>
<td>Nos.</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Single pole link box without SVL including all cable/cable accessories required for the connection</td>
<td>Nos.</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Single pole link box with SVL including all cable/cable accessories required for the connection</td>
<td>Nos.</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>Sheath Voltage Limiter</td>
<td>Nos.</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>S.N.</td>
<td>Description</td>
<td>Unit</td>
<td>Main Qty. (A)</td>
<td>Spare Qty. (B)</td>
<td>Total Qty. (A+B)</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------</td>
<td>---------------</td>
<td>----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>8.</td>
<td>Earthing &amp; Bonding of above system</td>
<td>Lot</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>9.</td>
<td>Nonmagnetic, Single type clamps/ spacers/ saddles for fixing 1 No. 230kV</td>
<td>Lot</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>cable in trenches, on CSE Structure/ GIS (Cable to be laid directly in</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>covered concrete trenches filled with sand)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Optical fiber cable in each circuit for temperature sensing and fault</td>
<td>M</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>location along with Junction Box on both sides.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Consumables having limited shelf life required during erection, testing</td>
<td>Lot</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>and commissioning. (1 lot is for complete package)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

(1) The un-price BOQ shall be strictly as per cl. No. 1.3 of quantities.

(2) Manufacturing lengths and drum length shall be determined as per the joint route survey with BIFPCL/ FICHTNER/ BHEL & the quantities of Straight through joints may increase /decrease as per requirement.

(3) The exact length may vary by ±30% at Contract Stage based on actual measurement at site and calculations submitted by the bidder. Individual quantity may vary to any extent and may get deleted during contract/execution stage.

(4) Earthing of HT cables shall be in supplier scope. Earth mat grid exists and interconnected at both end (Generator transformer and switchyard). The accessories shall necessary include the following but not limited to: Earthing cable, earth continuity cables etc. as per the requirements. The complete earthing BOQ items and shall be clearly mentioned in the offer.

(5) Earthing and Link Box: Design of support structure for link box, earthing cable, installation of link box, installation of earthing cable, connection of bonding cable, etc. to complete.

(6) Earthing shall be single point bonding.

(7) The cable racks/ support angles for 230kV cable trenches will be supplied by BHEL as per supplier recommendation. The trench section design will be given by supplier during detailed engineering. Cable shall be routed through BHEL constructed RCC trench. Refer enclosed drawing (DWG. No. Maitree-0-BTW-LD-TB-0-388-316-001-TBG-D) for tentative 230kV trench route.

(8) Support structure for cable sealing end shall be provided by BHEL based on the detailed design input provided by successful bidder.

(9) Earthing of 230kV cable rack with suitable size of earthing conductor shall be in BHEL scope.

(10) The necessary hole required for fixing clamps for 230kV Cable on cable rack assembly shall be
done by vendor.

(11) The necessary power supply at site for testing shall be provided by BHEL at one point only.

(12) Any other tools and tackles and accessories required to complete the cable laying, termination and ETC shall be included in the offer. Please note BHEL shall not provide any equipment, tool and tackles for carrying out any test or laying of cables.

(13) Earthing of 230kV cables shall be in supplier scope. Earth mat grid will available at both end of cables.

(14) The loading/unloading of cables and its accessories from store to switchyard and vice versa at the time of ETC shall be in supplier scope.

(15) Office facilities & accommodation for supplier staff, Travel expenses for supplier staff, Transportation of all tools and equipment, Transportation of material, tools and equipment between store/warehouse and switchyard, complete erection shall be in supplier scope.

(16) Site test- Provision of test engineer, supply of test equipment, cranes for lifting of AC voltage site test equipment, DC voltage test equipment on outer sheath, AC voltage test of insulation with voltage of Uo (complying with IEC 60840), etc. shall be in supplier scope.

(17) Cable laying- Provision of man power in the grade of Forman and skilled technician, Provision of laying supervisor, Provision of laying tools and equipment, Cable pulling, Cut cable, place cable, Supply of cable cleat, Installation of cable cleat etc. to complete the site work shall be in supplier scope.

(18) Jointing and terminating- Tools for Jointing and terminating, Scaffolding, Cranes of lifting etc. to complete the site work shall be in supplier scope.

1.3.2: OTHER SERVICES FOR CABLES: INSTALLATION SERVICES

The specification envisages turnkey execution of a COMPLETE, POINT TO POINT, 230kV CABLE SYSTEM and the scope includes services (including laying, supervision, termination, clamping, testing and commissioning of the cable system) necessary to execute the job to satisfaction of BIFPCL/ FICHTNER and BHEL.

Any other item/service required for the execution for the complete job shall be included in the offer, whether specifically mentioned in the specification or not.

Bids in which only Supplies or only Installation Services are offered shall be rejected.
<table>
<thead>
<tr>
<th>Sl. no.</th>
<th>Item Description</th>
<th>Unit</th>
<th>Total Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Services - Joint Route survey of site for laying of cable, installation of accessories etc.</td>
<td>Lot</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Services - Measurement of soil thermal resistivity to be expected along the cable routes and measurement of thermal resistivity and temperature of the backfilling material along the cable route</td>
<td>Lot</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Services - Supervision of excavation and execution of concrete cable trenches, cable ducts and supporting structure for installation of cables.</td>
<td>Lot</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>Services – Erection, Testing &amp; Commissioning of 230 kV Cable with embedded Optical fibre cable along with junction box/ termination box at both ends - 1C X 500 mm2 including laying of cables in trenches, bedding into sand, filling of concrete cable trenches with sand, or laying into ducts and rooms, fastening on racks, cable brackets or supporting structure, cable ducts including cable racks by making holes as well as cable supporting structures and sealing ends and joint supports and fixing of all accessories like Clamps, Cleat clamps etc. as required to complete</td>
<td>M</td>
<td>800</td>
</tr>
<tr>
<td>5.</td>
<td>Service – Erection, Testing &amp; Commissioning of 230kV cable sealing end (outdoor type) suitable for terminating the cables in the Air insulated ST yard including all accessories like necessary hardware, clamps for fixing the cable on structure etc. It includes fixing of clamps &amp; connectors, if required.</td>
<td>Nos.</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Service – Erection, Testing &amp; Commissioning of 230kV GIS cable termination according to latest IEC standards for terminating the cables in 230kV GIS including all accessories like necessary hardware, clamps for fixing the cable on structure etc. It includes fixing of clamps &amp; connectors, if required.</td>
<td>Nos.</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>Service – Erection, Testing &amp; Commissioning of 230kV Straight through joints for 230kV cable, if required. It shall be complete in all respects.</td>
<td>Nos.</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>Service – Erection, Testing &amp; Commissioning of earthing system for 230kV cable including installation of 1-phase earthing link box without SVL (Sheath Voltage Limiter) and earthing/bonding cable along with cable accessories required.</td>
<td>Nos.</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>Service – Erection, Testing &amp; Commissioning of earthing system for 230kV cable including installation of 1-phase earthing link box with SVL (Sheath Voltage Limiter) and earthing/bonding cable along with cable accessories required.</td>
<td>Nos.</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>Services - Installation, Testing and Commissioning of Optical fiber cable in each circuit for temperature sensing and fault location along with Junction Box on both sides.</td>
<td>M</td>
<td>0</td>
</tr>
<tr>
<td>11.</td>
<td>AC Voltage Test for insulation with voltage of Uo for 24 hrs</td>
<td>-</td>
<td>1 circuit (3-Phases) +</td>
</tr>
<tr>
<td>Sl. no.</td>
<td>Item Description</td>
<td>Unit</td>
<td>Total Qty.</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>12</td>
<td>Site tests as per clause no. B0.7.3.2 of Section-2</td>
<td>Lot</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Training to BIFPCL/BHEL engineers - Visit to manufacturer’s works = 15 mandays</td>
<td>Lot</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Training to BIFPCL/BHEL engineers - ETC, Operation and maintenance of 230kV Cables &amp; Accessories at site = 15 mandays</td>
<td>Lot</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Supervision of excavation and execution of concrete cable trenches, if necessary, shuttering and Employer/Engineering of the cable trenches, as well as the preparation of the cable ducts and supporting structures for Installation of the cables. It is in BHEL’s scope.

1.3.3: 230kV XLPE CABLE CALCULATIONS DOCUMENT TO BE SUBMITTED:

230kV XLPE CABLE CALCULATIONS DOCUMENT TO BE SUBMITTED AT TENDER STAGE:

- (a) Current carrying capacity of the cable at 100% load as per latest IEC 60287 part 1 & 2 including thermal dissipation images taking into consideration the laying conditions. Calculation shall be done for Cables in buried toughs filled with sand.
- (b) Short circuit calculations of conductor and metallic sheath as per IEC 60949 and IEC 61443.
- (c) Short circuit calculations of grounding/ bonding cable.
- (d) Induced voltage calculations as per CIGRE WG.21.07 (Electra No. 28, 47) and or ANSI/ IEEE std. 575 at:
  - Normal operation – single circuit
  - Normal operation – double circuit
  - Fault condition – Three Phase fault
  - Fault condition – Phase to Phase fault
  - Fault condition – Single Phase to ground fault
- (e) Sequence impedance calculations
- (f) Surge impedance calculations
- (g) Maximum pulling tension calculation
- (h) Design calculation for thickness of insulation
1.4 Training:

The bidder shall provide comprehensive training for Employer’s (BFPCL/BHEL’s) engineering, operating & maintenance staff covering all aspects of 230kV Cables & Accessories.

The bidder shall train, instruct and supervise the Employer’s (BFPLIC/ BHEL) staff to an adequate standard of knowledge and capability for good trouble shooting, repair of the 230kV Cables & Accessories as well as to an adequate standard for safe and efficient commercial operation.

The training shall at least include:

- Training at manufacturer’s works.
- Classroom and hands on training.
- On the job training during erection, testing and commissioning.

The bidder shall submit the training plan for the classroom, on the job including schedule, place, contents of lectures etc. for the Employer’s approval no less than six (6) months in advance to the cold commissioning.

Post training assessment shall be carried out and documented in case the results of the training are below the expectations, which have been agreed upon by both bidder and Employer before training, the respective training modules shall be repeated in an improved way and the related cost for the repeated training shall be borne by the Contractor.

1.5 It may be noted that:

- Any cable or accessories damage during laying will be repaired/replaced by bidder. Cable joints shall not be permitted.
Supplier will submit detailed bar chart indicating all the milestones from Engineering till manufacturing/testing, dispatch to site and commissioning.

Bidder to submit list of consumables with shelf life of less than two years. It shall be supplied before erection after clearance from BHEL.

Store will be provided by BHEL. Bidder to provide their requirement of space in open and closed store during tender stage. Supervision of loading, unloading from store to switchyard & along with verification shall be in bidder's scope.

Office facilities & accommodation for supplier staff, Travel expenses for supplier staff, Transportation of all tools and equipment, Transportation of material tools and equipment between storage/warehouse and complete ETC shall be in supplier scope.

The exact requirement shall also be decided by supplier after visiting site & making precise measurements of cable length. Manufacturing lengths and drum length shall be determined as per the joint route survey with BIFPCL/ FICHTNER/ BHEL.

- The Payment of cables length (for supply) will be as per approved quantities after joint survey.
- The Payment of cables length (for installation) will be as per actual measurement at site which shall also include cable sealing end/joints.

Support structure and foundation for cable sealing end shall be provided by BHEL based on the input (configuration, loads etc.) provided by supplier.

The necessary power supply at site shall be provided by BHEL at one point only.

Terminal connector for overhead connection with cable sealing end shall be provided by BHEL.

The cable trench construction is in BHEL scope as per detailed design and drawing provided by bidder.

Cable Laying: The bidder shall employ fully qualified and experienced personnel (Refer Section-2)

Termination: Provision of cable jointer and termination material, tools and Terminating Scaffolding, cranes for lifting the sealing end materials, assemble of sealing ends. Design of support structure for sealing end, etc. to complete.

Site Test: Provision of test engineer, supply of all test equipment and arrangement like cranes for lifting of AC voltage site test equipment, DC voltage test equipment, AC voltage test of insulation with voltage of Uo (complying with applicable IEC) etc. for completion of total site work.
• Any other tools and tackles and accessories required to complete the cable laying, termination and ETC shall be included in the offer. Please note BHEL shall not provide any equipment, tool and tackles for carrying out any test /or laying of cables.

• For system details and transport details refer Project Information in section 3.

• Packing of 230kV Cables & Accessories shall be suitable for long term (minimum 2 years) outdoor or indoor storage of Cables & Accessories in project conditions.

• Bidder shall do sizing calculations of 230kV Cables as per Section-2. These cables will be used for connection between 230kV GIS and 230kV Station Transformer (110/55/55MVA, 230/11.5/11.5kV, Z=26%).

1.7 Drawings Enclosed:

<table>
<thead>
<tr>
<th>S. N.</th>
<th>BIFPCL/BHEL Drg. No.</th>
<th>Drawing Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Maitree-0-BAY-EDB-TB-3-510-316-001-TBG-C</td>
<td>SINGLE LINE DIAGRAM OF 400/230kV GIS (230kV GIS SLD is only for reference)</td>
</tr>
</tbody>
</table>

1.8 Type Testing

Type test certificates for same or similar to be offered for 230kV Cables & Accessories will be acceptable.

In case reports of type tests carried out in in an internationally recognized test laboratory in last ten years (as on 22.09.2015) is not available then type tests on the offered cables shall be carried out before or along with the first inspection lot and witnessed by Employer/ Engineer.

In case the contractor is not able to submit valid Report of Type Test(s) or in case Type tests Reports are not found to be meeting the specification requirements, or not including all specified tests, the contractor shall conduct all such tests under this contract. The costs of such test shall be deemed to be included in the price. The BIFPCL/BHEL shall have right to witness the Type Tests. Waiver of Type Tests will not be entertained in normal circumstances.

All acceptance, routine and sites tests as per the specification (Refer Section-2) and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

Tests Witness

Tests shall be performed in presence of Owner’s representative if so desired by the Owner. The bidder shall give at least ten (10) days' advance notice of the date when the tests are to be carried out.
1.9 INSPECTION & TESTING

All acceptance, routine and sites tests as per the specification (Refer Section-2) and relevant international standards shall be carried out. Charges for these shall be deemed to be included in the item price. Prior to dispatch, the routine & acceptance tests shall be carried out on 230kV Cable and accessories in accordance with Section-2 and applicable IEC/IEEE/International standards and the material shall be offered for final inspection.

1.10 Tests after installation on Site

As per Section-2.

1.11 Proven-ness Criteria:

230kV Cable:

The Bidder/ Bidder’s sub-vendor should have designed, manufactured and supplied at lease twenty (20) km of 230kV or higher grade XLPE insulated cables in one or more installation(s) put together, which shall be in successful operation for at least two (2) years, prior to date of Techno-Commercial bid opening i.e. 22.09.2015.

230kV Cable Accessories:

The Bidder/ Bidder’s sub-vendor should have designed, manufactured and supplied at lease twenty (20) numbers of cable Terminations of 230kV grade or higher, which should have been in successful operation for at least two (2) years, prior to date of Techno-Commercial bid opening i.e. 22.09.2015.

1.12 Warranty:

Refer relevant clause given elsewhere.

1.13 Sea Worthy Packing, Packing & Shipping Instructions:

Refer Annexure-E of Section-3.

1.14 QUALITY PLAN

The contractor shall carry out the works in accordance with sound quality management principles which shall include such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirement shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Contractor shall submit detailed Quality Plan for BHEL / customer’s approval.

Attached Manufacturing Quality Assurance Plan (MQP) and Field Quality Plan formats in Section-3 shall be followed.
1.15 INFORMATION TO BE FURNISHED BY THE CONTRACTOR/ SUB CONTRACTOR
Information/ documents to be furnished at the TENDER STAGE shall be as per section 2 & 3.

1.16 DRAWINGS / DOCUMENTS
The drawings / documents submitted shall be project and product specific and shall incorporate all project details and title block and numbering scheme of the customer as detailed in Section 2 & 3.

1.17 Specification for Optical Fiber Unit to embedded along with 230kV Cable
Two optical fiber units shall be applied as distributed temperature sensor. An optical fiber unit shall consist of four multi-mode fibers enclosed with a stainless steel tube of diameter 2mm (approx.) and the interstices between the tube and the optical fibers shall be filled with suitable jelly. The two optical fiber units shall be located 180 degrees apart over the cable core.

Further basic specification of OFC shall be as under:
1. Number of optical unit = 02
2. Multimode 50/125 Micro meter (OM-2)
3. 4 fibers per optical unit
4. Maximum attenuation:- Un cabled: at 850 nm: ≤ 2.40 DB / KM
   At 1350 nm: ≤ 0.50 DB / KM
   Cabled: At 850 nm: ≤ 3.50 DB / KM
   At 1350 nm: ≤ 1.00 DB / KM

1.18 For scope split between GIS supplier and Cable termination supplier for connection of 230kV cable termination with GIS shall be governed as per IEC 62271-209.