

Clarification I

Sr. No.	Reference to Tender Clause	Description	Bidder's Queries	NEA Response
1	Vol I, Chapter 6.1, Project Specific Requirement	Annexure - II - List of Preferred (Shortlisted) Make	It is observed that the List provided in Annexure - II is not updated. It is requested to please update the List of Preferred Makes.	List of Preferred Makes shall not be updated
2	Vol III, Section IV, Schedule 1A	Part A, B - Cables	LT 1Gx30 sq.mm unarmored cable may not be necessary, since metering is provided in protection panel of DT. However, one new size of LT cable namely 3.5Cx120 or 95 sq.mm may be included in the BOQ for connection of Service Pillar to Feeder Pillar. Please incorporate. Straight Through Joining Kits, Outdoor & Indoor Termination kits for 11kV & LT cables may be separated and quantified as separate line items from Cables in BOQ. Please incorporate. The quantity of all mentioned items are included in the cost of cable and the bidders are required to estimate the quantity as per their design	Please refer Volume II, Section 3, E for Service cable for specification, Please note that Armored is required for service cable. Surge Counter is not required with the Lighting Arrestor. Please provide as per the TS
3	Vol III, Section IV, Schedule 1A	Part A, D - 9 kV LA (3 Nos. in 1 Set)	It is requested to please confirm whether Surge counter is required with Lighting Arrestor. Also please confirm whether Polymer type Lighting Arrestor is also acceptable. Please confirm.	Please note that no changes in the BOQ Please provide as per the TS
4	Vol II, Section 6.3, Specification of Equipment	I: FEEDER PILLAR BOX	In distribution service pillar, two nos. incomers may not be required since at that level interconnection from other DT circuit is not necessary and loop-in-loop out to another box is not feasible since with 100A incomer and after providing 30 connections, no spare power will be available. Further, 200A single incomer is suggested to provide 30 service connections.	Please note that no changes in the BOQ Please provide as per the TS
5	Vol II, Section 6.3, Specification of Equipment, J - Fiber Optic Cable, Clause - 1.2 Applicable Standards	v) TEC-spec no-G/OFC-01/03: Aug 99 (including all amendments up to September 2000)	Please note that this specification has been further amended in 2003. It is requested to please check and update the required governing standard. Please confirm that latest standards including all amendments till 2003 shall govern.	The governing standard shall be latest including all amendment.
6	Vol III, Section IV, Schedule 1A	Part A, G - 3 - Optical Fiber -24 Fiber (DWSM) OPGW fiber optic cable with required hardware sets including FODP, all cable fittings and accessories as required	Please note that details provided in the specification consists of parameters which are only sufficient for fiber optic cable designing and not OPGW. Hence you are requested to please provide the following details for OPGW wire like Voltage level, equivalent earth wire, wind zone, span length , terrain category, reliability level, fault current rating, everyday temperature, MAT. Also accessories may be separated from cable and be made separate BOQ items with quantity. Please incorporate.	Please refer to the attached sheet 1
	Part A, G - 1 - Optical Fiber - Un- Armored Optical Fiber (48 Fibers) along with the all accessories connectors, switches etc.	FO Cable accessories may be separated from cable and be made separate BOQ items with quantity. Please incorporate.	The quantity of all mentioned items are included in the cost of Optical Fiber and the bidders are required to estimate the quantity as per their design	

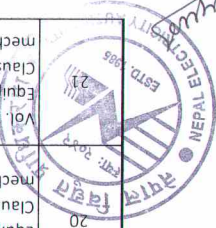


Sr. No.	Reference to Tender Clause	Description	Bidder's Queries	NEA Response
8	Vol III, Section IV, Schedule 1A & Vol II, Section 6.3, Specification of Equipment	Part A, I - HDPE Pipe	We understand that the specifications for 160mm dia HDPE pipe stands for PN6, PE 63, however Table - A given with the specifications does not meet the properties of PN6. Please provide the Properties of PN6, PE 63. Also we suggest that HDPE pipes shall be with smooth outer surface. Please confirm. We understand that the specifications for 125mm dia HDPE pipe stands for PN6, PE 80, however Table - B given with the specifications does not meet the properties of PN6. Please provide the properties of PN6, PE 80. Also we suggest that HDPE pipes shall be with smooth outer surface. Please confirm. Technical specifications for Metering unit is not available in tender documents. Please provide detailed specifications for type of Meter and Enclosure to be provided with Metering Unit. CT/PT Metering units should not be installed on RMU or DTs. This should either be installed on Double pole structure of DTs or pedestal mounted. Please confirm. Please note that specified thickness of 14mm for GI pipe is very much on higher size. Instead GI pipe of 6.3mm thickness (heavy gauge) is sufficient for laying of cables in road crossing. Please confirm.	Please refer to the attached sheet 2. The corrected Technical data for PN6, PE80 is attached.
9	Vol III, Section IV, Schedule 1A	Part A, K - Metering units- separate enclosure suitable to be mounted on the RMU or Transformer including CT, PT and other Accessories	Enclosure to be provided with Metering Unit. MU to be installed in RMU / DT shall be mounted on the respective equipment. For inter DC connection, the double pole structure may be used.	
10	Vol III, Section IV, Schedule 1A & Vol II, Section 6.3, Specification of Equipment	Part A, I - GI Pipe	Please note that specified thickness of 14mm for GI pipe is very much on higher size. Instead GI pipe of 6.3mm thickness (heavy gauge) is sufficient for laying of cables in road crossing. Please confirm.	Please provide as per the TS
11	Vol III, Section IV, Schedule 1A	Part B, 1.4, Earthing	Earthing principle and type of earthing for various equipment like DTs, RMU, Distribution boxes, 11kV line, LT line etc. by various methods like earthing rod, earthing pipe, treated or untreated, earthing conductor etc. should be specified clearly in the TS so that a realistic assessment can be done for the lot item. It is requested to please specify the type of earthing for various equipment. The requirement of earthing conductor of copper clad MS 25x6mm strip may also be reviewed.	The earthing system shall be provided as per the site conditions like resistivity etc and type of the installed equipment. The MS strip shall be used as a riser.
12	Vol III, Section IV, Schedule 1A	Part C, Mandatory Spares	Few Mandatory spares of some equipment are not relevant. This list may be reviewed. Spare quantity for HT & LT Termination kits is not asked in BOQ. Please consider some spares quantity for HT & LT Terminations kits.	Please quote your rates as per the BPS.
13	Vol III, Section IV, Schedule 4A	Part A, A - Poles, 3- Dismantling	We presume that dismantling of only 200 poles is in the bidder's scope. All other dismantling like poles, conductor, hardware, accessories etc for HT & LT line or dismantling of service connection, shifting of consumer meter etc if required shall be in NEA scope. Please confirm.	Dismantling of the service connection and installation of the new service cable from Service pillar to Existing meter is in PSR for Dismantling of HT/LT System. bidder scope. Please refer Clause 2.8 of cutting shall be reimbursed by the NEA.
	Vol III, Section IV, Schedule 4A	Part C, Civil Works, S No 7 - Black topping as per TS of Road Department and/or Kathmandu Municipality	We presume that all necessary permission and charges including necessary fees etc paid towards road cutting & restoration to the local authorities, Road Dept., Municipality etc shall be in NEA scope. Please confirm.	Necessary permission charge for road

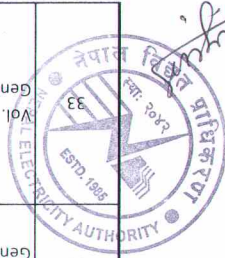


Sr. No.	Reference to Tender Clause	Description	Bidder's Queries	NEA Response
15	Vol III, Section IV, Schedule 4A	Part C, Civil Works, S No 13 - Geotechnical /Soil Investigation as per technical specification	No. of locations for Soil investigations where soil investigation is to be carried out should be clearly identified. Therefore it is requested to please quantify the No. of locations where Soil Investigation is to be carried out.	Soil investigation shall be done in the area where foundation of equipment is to be placed, and number of location where Soil investigation is to be carried out shall be determined during Detail Engineering design. Please make necessary site visit to access the no. of location.
16	Vol III, Section IV, Schedule 4A	Part C, Civil Works, S No 14 & 15 - Construction of Cubicle/Room	No details are provided in tender document for construction of Cubicle Room. It is requested to please provide size and drawing of Cubicle Room. (Single Stored & Double stored both)	To be decided during DDE
17	Vol. II - Section 6.8 – Communication requirement	Clause -1- Communication Network - The Contractor shall make ready all the equipment like RMU, DTS, FPI and GO switch to connect with the new distribution center without any problems, like data acquisition from distribution field level (until Distribution Transformers) till monitoring and controlling of the overall electrical distribution network including Ring Main Units (RMUs), Sectionalizers, ARCBs (Auto Reclosure Circuit Breakers) and FPIs (Fault passage indicators) within the network. Clause -1- Communication Network - All electrical equipment until distribution transformers will be monitored and remotely operated by the use of field RTUs over a optical fiber communication network and backup Rf mesh canopy.	Since Transformers are not part of supply scope therefore we have not considered any FRTU/Meter or communication equipment for transformer communication with control center/sub station. Our scope for integration of field equipment for communication shall only be limited to equipment supplied under the present scope. Please confirm. Since FRTU communication is envisaged through Fiber Optic Cable therefore we are not considering wireless communication over Rf mesh or GSM Network since same is not in our scope of supply. Please confirm.	Confirmed.
18	Vol. II - Section 6.3 – Specification of Equipment H. - Ring Main Unit (RMU) - Clause 3.1 - Application - Outdoor.	The manufacturers shall confirm the normal current ratings mentioned in Technical Data Sheet (TDS) at 50 degrees ambient without derating	RMU is rated for 630A @ 40 deg C ambient as per IEC 62271-1. Current deration shall be applicable @ 50 deg C. Derated current at 50 deg C shall be 571A. Please confirm.	As per PSR Clause 5.2
19	Vol. II - Section 6.3 – Specification of Equipment H. - Ring Main Unit (RMU) - Clause 4.2.1 - Sfg Gas Annual Loss	The vendor shall guarantee that pressure of the Sfg gas shall be above the operating limit throughout the lifetime of the equipment. The switchgear shall not remain energized with load connected if there is no Sfg gas inside the tank	Please note that Lifetime of switchgear is 30 years. Considering 0.1% per year for lifetime i.e. 3% gas leakage is permissible. After loss of 3%, Sfg gas will remain as 1.358 bar which is above operating limit. Further, Customer to ensure upstream breaker to trip incase of low pressure. Operation of RMU is not recommended in case of complete Sfg gas loss due to leakage from other causes. Warranty of the product including Sfg gas tank shall be as per contractual terms. Please confirm.	Confirmed
20	Vol. II - Section 6.3 – Specification of Equipment H. - Ring Main Unit (RMU) - Clause 5.2 - General structural and mechanical construction.	For outdoor RMUs a weather proofing process shall be carried out. Sheet metal must be grit Blazed / thermally sprayed and polyurethane painted with about 70 micron thicknesses, to achieve outdoor worthiness and corrosion proofness.	The fabricated parts are pre-treated using 7 tank process. The Parts are then painted using power coating paint with appropriate thickness of 60-80 microns. This coating is suitable for corrosivity for outdoor application. Grit/shot blasting of components are not feasible and shall not be done. Polyurethane paint is not envisaged. Please confirm.	To be decided.(Thickness of paint shall be > 70 Microns shall be painted with environment friendly paint. Paint material shall be decided during DDE.
21	Vol. II - Section 6.3 – Specification of Equipment H. - Ring Main Unit (RMU) - Clause 5.2 - General structural and mechanical construction.	The units should be constructed from 3 mm thick hot rolled steel sheets, however Sfg enclosures are stainless	RMU enclosure shall be fabricated with 2 mm thick CRCA only. HRCA enclosure shall not be provided. Please confirm.	Provide as per TS.

Clarification I



Sr. No.	Reference to Tender Clause	Description	Bidder's Queries	NEA Response
22	Vol. II - Section 6.3 – Specification of Equipment H. - Ring Main Unit (RMU) - Clause 5.2 - General structural and mechanical construction.	RMU enclosure must be shielded against solar irradiation and tested for an ambient of 50 degree centigrade without derating of the equipment	RMU is rated for 630A @ 40 deg C ambient as per IEC 62271-1. Current deration shall be applicable @ 50 deg C. Derated current at 50 deg C shall be 571A.	As per PSR Clause 5.2
23	Vol. II - Section 6.3 – Clause - 6.2 - General Technical Requirements.	Necessary current sensors / transformers for protection and metering (wherever required).	We are providing metering in 5 Way/4 Way/3Way RMUs. Metering CTs are provided in each Breaker Module (V Module) to measure the power of V module. Metering CTs are not provided in LBS (C Module). MFM (MFT) shall be provided by NEA. Space of 96 x 96 sq. mm is provided in Metering panel to mount the MFM (MFT). Please note that Metering which consist of PTs. Metering CTs are Low Burden CTs having VA burden of 2.5VA and shall be mounted inside cable chamber of breaker module. Please confirm.	Confirmed
24	Vol. II - Section 6.3 – Clause - 6.3 - General Technical Requirements.	The three numbers of continuous Busbars made up of EC grade tinned copper of rating current 630A shall be provided	Bus bar shall be made of bare copper. Note that bus bars are enclosed inside the SF6 insulated sealed tank. Tinned copper bus bar is not required. We request NEA to accept the same.	Provide as per TS.
25	Vol. II - Section 6.3 – Clause - 6.4 - General Technical Requirements.	The rated current of Isolator shall be 630 Amps Continuous at Maximum Ambient temperatures. No derating shall be allowed	RMU is rated for 630A @ 40 deg C ambient as per IEC 62271-1. Current deration shall be applicable @ 50 deg C. Derated current at 50 deg C shall be 571A.	As per PSR Clause 5.2
26	Vol. II - Section 6.3 – Clause - 6.4 - General Technical Requirements.	The selection of the main & earth switch is made by a level on the facial	The selection/operation of main and earth switch of LBS shall be as per type tested design with all necessary safety/mandatory interlocks.	Confirmed
27	Vol. II - Section 6.3 – Clause - 6.6 - General Technical Requirements.	Minimum number of operations at rated current (as per IEC 62271-100,102): Mechanical endurance M2 (2000), Electrical endurance-Class E3	We confirm the criteria of mechanical endurance of 2000 operation which is termed as M1 class instead of M2 class.	As per relevant IEC.
28	Vol. II - Section 6.3 – Clause - 6.6 - General Technical Requirements. Circuit Breaker (SF6 or Vacuum.)	The circuit breaker shall be fitted with a mechanical flag which shall operate in event of fault occurrences. The breaker ON/OFF position shall be indicated by suitable flag.	Mechanical flag is not applicable. Same is not asked in relay specification. Trip indication shall be through LED indication	Confirmed. However, the CB ON/OFF flag indication shall be provided.
29	Vol. II - Section 6.3 – Clause - 6.6 - General Technical Requirements.	O/C elements current setting variable from 10% to 200% of CT secondary rating	O/C elements current setting varies from 20% to 200% of CT secondary rating.	Confirmed.
30	Vol. II - Section 6.3 – Clause - 6.7 - General Technical Requirements.	It is preferable to have bushings accessible from the rear side of RMU	All RMUs are accessed from front only.	To be decided during DDE
31	Vol. II - Section 6.3 – Clause - 6.11.1 & 6.11.3 - Fault passage indicators	FPI with LCD/LED display. Capable of displaying the fault and phase currents.	FPI comes with LED display for faults. Since FPI is fault indicating devices, it starts blinking in the event of fault in respective feeders. It doesn't have current displaying facility. Please accept the same.	Confirmed.
32	Vol. II - Section 6.3 – Clause - 6.15 - General Technical Requirements.	All the I/O signals need to be brought to the Terminal Strip on a Din Rail, also the Din Rail should have space to mount the MFT's provided by SIA.	MFT shall be provided by NEA for power measurement of breaker module (V module). We have provided metering CTs in breaker (V module). MFT shall be mounted in metering panel and contact shall be brought to terminal blocks for connection with FRTU.	Confirmed.
	Vol. II - Section 6.3 – Clause - 6.15 - General Technical Requirements.	The CT/PT should provide metering grade core for connecting MFT provided with FRTU	We are providing metering in 5 Way/4 Way/3Way RMUs. Metering CTs are provided in each Breaker Module (V Module) to measure the power of V module. Metering CTs are not provided in LBS (C Module). MFM (MFT) shall be provided by NEA. Space of 96 x 96 sq. mm is provided in Metering panel to mount the MFM (MFT). Please note that Metering which consist of PTs. Metering CTs are Low Burden CTs having VA burden of 2.5VA and shall be mounted inside cable chamber of breaker module. Please confirm.	Confirmed



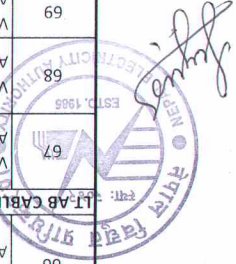
Sr. No.	Reference to Tender Clause	Description	Clarification I	NEA Response
34	Vol. II - Section 6.3 – Clause - 7.8 - Power Connection	At the bottom of the cable compartment, an earthing bar system made of copper with a minimum cross section of 120 mm ² should be fitted.	The earthing busbar has cross section of 30x3 sq mm and is tested for 21kA as per IEC.	Shall be equivalent to 120 sq. mm.
35	Equipment H.1 - FRTU - Clause 3 - Functions	Detection of amperometric faults, adjustable for each feeder	We request NEA to elaborate amperometric faults.	The FPI in the feeders should be communicable type and capable of communicating to FRTU.
36	Vol. II - Section 6.3 – Specification of Equipment H.1 - FRTU - Clause 3 - Functions	Load current measurement on the line fitted with a fault detector.	Sensors are separate from FRTU. We shall interface Relay or meter with FRTU IEC103 protocol from relay and meters. Load current measurement on the line fitted fault detector is not feasible since fault detector is a fault indicating device. It is not for current measurement.	The communication protocol shall be compatible with the upcoming DCC, which will be connected through IEC104 protocol.
37	Vol. II - Section 6.3 – Specification of Equipment H.1 - FRTU - Clause 3 - Functions	It shall be possible to issue control command from the front panel of the FRTU with security button	ON/OFF push button shall be provided on the for LBS & Breaker to facilitate the same. Any extra hardware on FRTU is not required.	Confirmed.
38	Vol. II - Section 6.3 – Specification of Equipment H.1 - FRTU - Clause 5.2 - Event Transmission.	It shall be possible to configure each time-stamped event to correspond to the appearance or disappearance of an alarming event or an alarming closure failure.	We can configure this event for tripping facility interlock enable / disable but for scada alarm display, NEA need to change in their SCADA alarm enable/disable.	Confirmed
39	Vol. II - Section 6.3 – Specification of Equipment H.1 - FRTU	It shall be possible to view LBS/breaker status from the front mimic of FRTU.	Mimic is the part of RMU. LBS/Breaker status from the front mimic is available on RMU. Same is not required on FRTU. FRTU is having inbuilt web visualization that facilitates to see all DI/DOs status & to give ON/OFF command from FRTU after connecting laptop with it. Also all digital input & digital output module have LED indication to facilitate to see all digital input output status.	Confirmed.
40	Vol. II - Section 6.3 – Specification of CABLES	Voltage Grade	Please note that as all the required cables are to be manufactured with reference to IEC/ International Standards. Hence the voltage grade of the cables shall be as per IEC. Such as: LT Cables: 0.6/1.0 kV HT Cables: 6/10 kV	Confirmed
11KV HT XLPE CABLES				
41	Vol. II - Section 6.3 – Specification of XLPE CABLES: Clause: C1	11 KV XLPE POWER CABLE	Please note that, as the cables are required as per IEC: 60502 P-2. Hence, the voltage grade shall be 6/10 KV (12) instead of 6.35/11 KV(12). Also, Number 1.2 of your technical specification clearly depict the voltage grade to be 6/10 (12) KV.	Voltage grade is 6/10 KV (12)
42	Vol. II - Section 6.3 – Specification of XLPE CABLES: Clause: C1-1.2, General Construction	XLPE insulation	Kindly note that XLPE insulation as per IEC: 60502 P-2 shall be provided. Treeing Resistant XLPE (TR-XLPE) insulation shall not be applicable as per Clause 1.11 INSULATION of technical Specification. Kindly clarify.	As per IEC standard
43	Vol. II - Section 6.3 – Specification of XLPE CABLES: Clause: C1-1.2, General Construction	Each Core Shall have a Polyethylene Sheath	This statement shall not be applicable for the 10 KV HT Cables. Please note that all 3 cores (conductors+conductor scrm + XLPE insulation + insulation scrm) shall be laid Together and then Common Covering i.e. Inner Sheath (inner covering) shall be provided. Hence, Each core shall not be sheathed.	To be decided during DDE
44	Vol. II - Section 6.3 – Specification of XLPE CABLES: Clause: C1-1.5, General Construction	Cable sheath shall be embossed "ELECTRIC CABLE 11000V"	Please note that as the cables are as per IEC: 60502-2 and applicable voltage Grade is 6/10 KV. Hence, Cables Sheath shall be embossed "ELECTRIC CABLE 10000V"	Provide as per specification.
45	Vol. II - Section 6.3 – Specification of	Metallic Screen shall be of plain copper wires, helically applied over the	Please note that as the metallic screening is required with Copper Wire along with Copper Tape in open Helix to meet the System Short Circuit rating as	Short Circuit Current for the cables shall be read as (as per IEC)
			Conductor Size, sq.mm/ Short Circuit	

Sr. No.	Reference to Tender Clause	Description	Bidder's Queries	NEA Response
46	Vol. II - Section 6.3 – Specification of XPLE CABLES: Clause: C1-1.15, Metallic Screen	The Combination of metallic sheath (lead sheath) in combination with wire screen shall be designed to meet the requirement of the system short circuit rating as specified in bidding documents.	Please note that as per clarification point 8, incomplete data is provided. However, please note that desired short circuit can be meet by Copper screening only. Lead sheath shall not be necessarily required.	To be decided during DDE
47	Vol. II - Section 6.3 – Specification of XPLE CABLES: Clause: C1-1.15, Metallic Screen	INNER SHEATH	NO DATA FOR INNER SHEATH IS PROVIDED in the technical specification. The specification is a minimum requirement, all necessary arrangement shall be provided such as to satisfactory operation of the equipment.	
48	Vol. II - Section 6.3 – Specification of XPLE CABLES: Clause: 27.5, Identification	VIII) Marking for FRLS Cables.	Please note that as per Clause number 1.16, Outer sheath is required of Extruded HDPE compound. Hence, "FRLS" identification shall not be applicable.	Complied
49	Vol. II - Section 6.3 – Specification of XPLE CABLES: Clause: 2.1, Cable Drum	Cable are to be supplied in returnable Steel Drums	Please note that cables shall be supplied in Non-returnable Steel Drums.	Complied
50	Technical Data Sheets for HT Cables	8. Maximum System Voltage 10. Rated voltage between conductor and screen. 11. Rated voltage between two conductors 17. Operating Capacitance 23. Nominal Thickness of PVC Inner Sheath 26. Nominal Thickness of PVC Outer sheath 37. Fire Resistant Treated	8. Shall be 10 kV as per clarification number 3 insatd of 11 kV. 10. shall be 12/sqrt(3) 11. Shall be as per cl. 8. 17. NEA requirement has mentioned the same value of capacitance for all the cables. However, value for capacitance varies with the conductor sizes. same shall be 0.22 µF/km for 150 sq.mm, 0.29 µF/km for 300 sq.mm and 0.32 µF/km for 400 sq.mm cable. 23. Nominal Thickness of inner sheath depends upon the diameter under inner sheath of every individual cable. Hence, for each cable the thickness shall be as per IEC: 60502-2. the value mentioned i.e. 3.5 shall not be applicable. 26. Firstly, please note the outer sheath material shall be HDPE instead of PVC. Also, Nominal Thickness of Outer sheath depends upon the diameter under outer sheath of every individual cable. Hence, for each cable the thickness shall be different and shall be as per IEC: 60502-2. the value mentioned i.e. 3.5 shall not be applicable. 37. As the cables are HDPE outer sheathed. hence, same shall not be applicable	23. Shall be provided as per IEC. 26. Outer Sheath is HDPE and Thickness shall be as per IEC. 37. Complied
51	Vol. II - Section 6.3 – Specification of XPLE CABLES: Clause: 2.1, Cable Drum	Cable are to be supplied in returnable Steel Drums	Please note that cables shall be supplied in Non-returnable Steel Drums.	Complied
LT XPLE CABLES				
	Vol. II - Section 6.3 – Specification of LT XPLE CABLES: Clause:1, Scope	Voltage Grade of the required Cables	Please note that, as the cables are required as per IEC: 60502 P-1. Hence, the voltage grade shall be 600/1000 V instead of 600/1100 V. Please confirm.	confirmed
53	Vol. II - Section 6.3 – Specification of LT XPLE CABLES: Clause: 2, Standards	ASTM G -53 / DIN 56687 - UV Testing for XLPF insulation	UV Testing shall only be applicable for Outer sheath (which only gets exposed to direct Sun light throughout cables life span) as per ASTM G 154. Thereby, testing shall not be applicable for insulation.	Confirmed
54	Vol. II - Section 6.3 – Specification of LT XPLE CABLES: Clause: 4, Conductor	Aluminum Conductor to form compacted and circular/ Shaped conductor.	There is Conflict between Clause no. 4 and Datasheet of appendix-1 of Specification: As per Datasheet of appendix-1, Conductor shape is mentioned as Stranded Compacted Circular and same is mentioned as stranded compacted circular/shaped. We request you to please clarify the Required Circular	Conductor shall be Stranded Compacted Circular

Clarification I

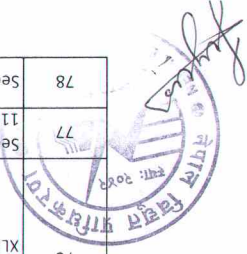
NEPAL ELECTRICITY AUTHORITY
PROJECT MANAGEMENT DIRECTORATE
Power Transmission and Distribution System Strengthening Project
Kathmandu Valley West Distribution System Enhancement Project
PMD/PTDSSP/ K/VWDSEP -75/76-01: Design, Supply, Installation and Commissioning of Underground Distribution Network under Kirtipur, Kuleshwar, Baneshwor, Balaju and Jorpati Distribution Center including Reinforcement and Automation

Sr. No.	Reference to Tender Clause	Description	Bidder's Queries	NEA Response
55	Vol. II - Section 6.3 – Specification of LT XPLE CABLES: Clause: 5; Insulation	The XLPF insulation shall be preferably fire resistant and resistant to chemical like acids, alkalis, oils and ozone.	Kindly note that XLPF insulation shall not be resistant to FIRE & OZON as XLPF being hydrocarbon doesn't exhibit these properties.	Provide as per specification.
56	Vol. II - Section 6.3 – Specification of LT XPLE CABLES: Clause: 6; Core	All Cores black. For core identifications, a XLPF colored line (1mm width + 0.5 mm height) shall be extruded over insulation.	Core identification shall be provided with Red, Yellow and Blue and Black core color (for 3.5 cores) and Black color (1 core).	Confirmed.
57	Vol. II - Section 6.3 – Specification of LT XPLE CABLES: Clause: 8; Inner Sheath	Inner sheath shall be extruded FRLS PVC Type - ST2	Please note that as the cables are FRLS Sheathed. Hence Outer sheath of the cables shall be "FRLS" PVC Type ST2 instead of inner sheath and inner sheath shall be PVC Type-ST2.	Confirmed.
58	Vol. II - Section 6.3 – Specification of LT XPLE CABLES: Clause: 9; Armoring	The armor of the cables shall be either with Round Wire or Flat Strip	There is Conflict between Clause no. 9 and Datasheet of Specification. As per Datasheets provided at the end of Specification, Only Round wire armor is required however specification is open for both Round Wire or Flat Strip. We request you to please clarify the Armoring Requirements.	Provide as per specification whichever is suitable for Trouble-free operation.
59	Vol. II - Section 6.3 – Specification of LT XPLE CABLES: Appendix-1	2. Single Core Armored Cable- dimensional details	Please note that Nominal thickness of insulation and minimum thickness of outer sheath shall be as per IEC: 60502-1. the values mentioned are of Indian Standard.	Provide as per relevant IEC
60	Vol. II - Section 6.3 – Specification of LT XPLE CABLES: Appendix-1	3. Three and Half core armored cables	Please note that minimum thickness of inner sheath and minimum thickness of outer sheath shall be as per IEC: 60502-1. the values mentioned are of Indian Standard which shall be not applicable.	Provide as per relevant IEC
61	Vol. II - Section 6.3 – Specification of LT XPLE CABLES: Appendix-1	Thicknesses of sheaths and dia of armor	Every detail shall be as per IEC.	Provide as per relevant IEC
HT AB CABLES				
62	Vol. II - Section 6.3 – Specification of HV ABC CABLES: Clause:1.0 Scope	Voltage Grade of the required Cables	Please note that, as the cables are required Generally as per IEC: 60502 P-2. Hence, the voltage grade shall be 6/10 KV (12) instead of 6.35/11 KV(12).	Confirmed
63	Vol. II - Section 6.3 – Specification of HV ABC CABLES: Clause: 2.6	Metallic Screen	Please note that as per Table 1 point 13, Earth fault current carrying capacity of metallic screen is required as 2.14 KA for 1 Sec and same is required to be match by use of 0.1 mm copper tape. Please note that the required Earth fault current carrying capacity of Copper wire along with copper tape in open helix as binder. EVEN TWO LAYERS OF 0.1 COPPER TAPE SHALL NOT BE SUFFICIENT. Please check & Confirm.	Please provide screen required for Earth fault current carrying capacity of 2.14 KA for 1 Sec
64	Vol. II - Section 6.3 – Specification of HV ABC CABLES: Clause: 2.7	Embossing of Electric cable: 6.35/11 KV	Please note that as the cables are as per IEC: 60502-2 and applicable voltage grade is 6/10 KV. Hence, Cables sheath shall be embossed "Electric cable: 6/10 KV"	Confirmed
65	Vol. II - Section 6.3 – Specification of HV ABC CABLES: Clause: 3.0	Phase Identification	Ridges shall be provided instead of ribs on cores as per IEC and NFC.	Confirmed
66	Vol. II - Section 6.3 – Specification of HV ABC CABLES: Clause: 6 :Table 1	No and Dia of messenger wires (no./mm)	as the required messenger size is 50 sq.mm. hence, the no and dia of wires shall be 7/3.02 instead of 7/3.15.	Please note that final messenger size shall not be less than 50 sq. mm and shall mechanical suitable to bear all the loads.
LT AB CABLES				
67	Vol. II - Section 6.3 – Specification of LV ABC CABLES: Clause: 1.0 Scope	Voltage Grade of the required Cables	Please note that, as the cables are required GENERALLY as per IEC: 60502 P-1 & NFC. Hence, the voltage grade shall be 600/1000 V instead of 600/1100 V.	confirmed
68	Vol. II - Section 6.3 – Specification of LV ABC CABLES: Table 1	Thickness of insulation for Lighting wire (16 Sq.mm)	Please note that there is no information provided for thickness of insulation for lighting wire in the specification. Same shall be 1.2 mm (nom) as per NFC 33-209.	Confirmed as per relevant standard.
69	Vol. II - Section 6.3 – Specification of LV ABC CABLES: Clause: 3.0	Phase Identification	Ribbing on the external surface of the insulation shall not be in Circular formation. It shall be in triangular form on cores as per NFC.	Confirmed



Sr. No.	Reference to Tender Clause	Description	Bidder's Queries	NEA Response
70	Vol. II - Section 6.3 – Specification of LV ABC CABLES	Tolerance on the Drum Length	Please note that cable is a commodity that can not be manufactured in exact length. Hence, there shall be a tolerance on the drum length of the cable. Tolerance on the individual length shall be $\pm 5\%$ and on overall length shall be $\pm 5\%$	As per IEC relevant standard
71	Section 8 - Special Conditions of Contract 14. Taxes and Duties - G		Kindly confirm no income Tax shall be payable on income by contractor for the supplies of Plant & Equipment to be Supplied from Abroad i.e. for which Custom Duty Benefit shall be availed i.e. as per Sch. 1 of BPS. And there will not be any deductions in the payment of such supplies. We envisage that for only Supply of Goods and services which are within the employers country and payable in "NPR", TDS shall be deducted. Kindly Confirm.	Please refer this act of Nepal for Taxation policy of Nepal. https://ird.gov.np/Content/Tax,Laws,Rules/Acts/IncomeTax
72	Section IV Price Schedule No.1 Sl. No. 1 1.1 (single phase 6,16 A) 1.2 (single phase 30 A) 1.3 (single phase 60 A) 1.4 (3 phase upto 25 kVA) 1.5 (3 phase phase 25 to 50 kVA)	Service Cables along with all accessories required for connection of meter to service pillar 1.1 (single phase 6,16 A) 1.2 (single phase 30 A) 1.3 (single phase 60 A) 1.4 (3 phase upto 25 kVA) 1.5 (3 phase phase 25 to 50 kVA)	Quantity for the referred items is Consumers - in view of length of the Service cable been variable for every consumer, you are requested to incorporate the Quantity of Service Cable in Mtrs.	Changes in BOQ shall not be made, please make necessary assessment after site visit.
73	Section IV Price Schedule No.1 Sl. No. 1 1.1 (single phase 6,16 A) 1.2 (single phase 30 A) 1.3 (single phase 60 A) 1.4 (3 phase upto 25 kVA) 1.5 (3 phase phase 25 to 50 kVA)	Service Cables along with all accessories required for connection of meter to service pillar 1.1 (single phase 6,16 A) 1.2 (single phase 30 A) 1.3 (single phase 60 A) 1.4 (3 phase upto 25 kVA) 1.5 (3 phase phase 25 to 50 kVA)	Size Specification for Service Cable is not furnished in the BOQ & only Current Rating / Load rating is mentioned, also the specification is not furnished in the Volume II Section 6 Chapter 3. You are requested to clearly define the Size Specification for Service Cable required for respective consumers and also the detailed specifications for the service cables may please be furnished.	Please find specification for service cable in 6.3 Specification of Equipment :Section E.
74	Section 6.1 – Project Specific Requirement 2.6 Laying of Service cable	As per the approved drawing, the service cable shall be laid underground by the Contractor in the approved area.	Kindly furnish the approved drawing for underground laying of Service Cable	Shall be decided during DDE
75	Section 6.1 – Project Specific Requirement 2.6 Laying of Service cable	Supply of service cable shall include supply of other accessories required for laying of cable (PVC pipe of suitable size and strength, connectors, junction box as required).	As per the clause for Underground Laying of Service Cable PVC Pipe to be used. You are requested to provide the specifications of PVC Pipe to be used for the purpose.	See attached PVC Specifications attachment 3.
76	Section 6.3 C XLPE Cables	The metallic screen shall be of plain copper wires, helically applied over the radial moisture barrier. A binder tape of annealed plain copper shall be applied in the form of an open helix over the copper wire screen. The combination of the metallic sheath (lead sheath) in combination with wire screen shall be designed to meet the requirement of the system short circuit rating as specified in the bidding documents.	For designing of Metallic Screen Kindly specify the Earth Fault Current Rating of Cable. Understand for 11KV Cable, Lead Sheath is not required Kindly Confirm. Also with reference from technical Data Sheet for the 11KV XLPE Cables, Thickness of Copper Screen is 1.2mm, you are requested to reconfirm the same wrt to the above.	Please provide screen required for Earth fault current carrying capacity of 2,14 kA for 1 Sec, Lead sheath shall be decided during DDE, Please Provide as per requirement of IEC.
77	Section 6.3 C 11KV XLPE Cables 1.16	The armor of cables shall consist of aluminum wires or strips.	Kindly Confirm the armoring of 11kV Cables as either Wire or Strip	Shall be decided during DDE
78	Section 6.3 C2 LT XLPE POWER CABLE	The armor of cables shall consist of either galvanized round steel wires or galvanized steel strips.	Kindly Confirm the armoring of LT XLPE Cables as either GS Wire or Strip	Shall be decided during DDE

Clarification I



Sr. No.	Reference to Tender Clause	Description	Bidder's Queries	NEA Response
79	Section 6.1 – Project Specific Requirement Cl. 2.4 Cl. 9	The fiber optic cable is intended for the SCADA communication between the equipment and the future Distribution SCADA control room.	For integration with Existing NEA Network, our scope shall be limited to laying of underground Fiber optic cable up to the FO termination point of customer scope. Kindly Confirm	Confirmed but the contractor is required to handover the system complete after testing of the communication network, if the said DCC is not functional upto the time of commissioning.
80	Section 6.1 – Project Specific Requirement Cl. 2.5	2.5 Connection of existing 11/0.4 kV DT substations and new distribution transformer (DT) and LT feeder panel; 2.5.1 The contractor shall provide necessary provision for connection of existing Distribution Transformers strictly in accordance with the finalized and approved locations. 2.5.2 For new DT (Completely Self Protected and SCADA enabled), the contractor shall provide necessary provision for connection such that it is ready for connection with Distribution control center.	Since transformers are not part of our supply hence any FRTU/ Meter/ any communication equipment for transformer communication with control center / Sub-station shall not be bidder's scope under present contract. Kindly confirm	As per Specification.
81	Schedule-I, Item No. F(5)	3 phase, 415 V, Distribution service Pillar for LT, 100 Amps incoming; 2 nos with busbars for upto 30 connection distribution service pillar suitable for outdoor installation, in accordance with Technical Specification. (TYPE E)	You are requested to provide the specification for Service Pillar. Kindly confirm the specification of 2 No. incomers as MCCB or TPN with fuse base assembly	Please provide 2 nos. of 100 A TPN MCCB for Service pillar (Type E)
82	Schedule-I, Item No. G(3)	24 Fiber (DWSM) OPGW fiber optic cable with required hardware sets including FODP, all cable fittings and accessories as required	You are requested to provide the specification for OPGW FO Cable	Please refer to attached sheet 1.
83	Section 6.3 Chapter 3 Spec H	The units should be constructed from 3 mm thick hot rolled steel sheets, however Sfb enclosures are stainless.	As per Standard practice outer enclosure shall be made of CRCA of 2 mm thickness, Kindly Confirm	Provide as per specifications
84	Section 6.3 Chapter 3 Spec K	The HDPE pipe should be suitable for 6 kgf/cm ² pressures with thickness not less than 6.5 mm and weight of the HDPE pipe should not be less than 2.5 kg per meter.	With reference to Table A & B provided in the specifications the Thickness of HDPE is corresponding to pressure rating of 4kgf/Cm ² . Also the requirements as per past tenders of PTDEEP was of pressure rating 4kgf/cm ² . You are requested to kindly rectify the specifications	Please see attachment 2
85	Section 6.3 C1 11 KV XLPE Cables Cl. 23	REINSTATEMENT After the subsidence has ceased the trench may be permanently reinstated and the surface restored to the best possible condition.	With reference to Sch. 4 Part C of Civil Works - Reinstatement of Trenches for Bitumen Roads are payable against Item No. 7 however as per our site investigations we are finding concrete roads also in certain areas, We understand reinstatement of concrete roads shall be payable against respective items of Civil Works Sl. No. 1 to 6	Confirmed
86	Price Schedule Sch. 4 Item 14 & 15	Construction of Cubicle/Room for providing Distribution Transformer along with RMU and LT ACB including finishing but excluding excavation, RCC, Reinforcement, PCC etc as above Construction of double-decker Cubicle/Room for providing Distribution Transformer alongwith RMU and LT feeder pillar including finishing but excluding excavation, RCC, Reinforcement, PCC etc as above	You are requested to provide tentative drawing for the said Cubicle Rooms or atleast provide the Size of the Cubicle Rooms	To be decided during DDE
Section 6.3 – Specification of Equipment		1.2 Applicable Standards v) TEC-spec no-G/OFC-01/03. Aug 99 (including all amendments up to September 2000)	You are requested to kindly revisit the specifications for Fiber optic Cable as per the latest standards. Kindly Confirm for changes if any.	Please confirm to latest standard.
Section 6.8 – Communication Requirement		All electrical equipment until distribution transformers will be monitored and remotely operated by the use of field RTUs over a optical fiber communication network and backup Rf mesh canopy. The distribution control center shall also be connected with the AMI system mentioned in the previous chapters.	Wireless Communication over Rf Mesh or GSM Network with necessary equipment like nodes, routers / repeaters, Collectors / gateways and simcards etc. shall not be part of our scope. Kindly Confirm.	Provide as per specifications.



Sr. No.	Reference to Tender Clause	Description	Bidder's Queries	NEA Response
89	Section 6.8 – Communication requirement	The scope under this project includes integration of the data and control signal from the field IEDs, FRTU and RTUs installed with the proposed RF mesh network and distribution center. The proposed system shall be compatible to operate with the RF network mentioned above and the optical fiber network under planning and construction.	We shall be considering all FRTU communications over Fiber Optic Cable and FRTU shall be provided with IEC 104 open protocol. Kindly confirm the acceptance.	Confirmed
90	Section 6.8 – Communication requirement			confirmed
91	Section 1, 4.7	What are those evidences required to provide by bidder to show their continued eligibility satisfactory ? & what will be the time period for the same ?		
92	Section 1, 4.8	Need clarification on United nation security council taken under VII of the chapter of the united nation ?	As per Bidding documents	
93	Section 1, 7.2	Is there Employer's person will available with us during visit & examine the site ?	Site Visit shall be done by Bidder.	
94	Section 1, 8.1	In case employer amend the bidding document then what will be the last date of bid submission ?	11 July 2019.	
95	Section 1, 16	What will be the procedure to substitute alternative standards, brands name and catalog numbers to establish that alternative standards, brands name and catalog numbers are equivalent or Better.	Shall submit necessary documents of alternative standards, brands name and catalog numbers to establish that alternative standards, brands name and catalog numbers are equivalent or Better.	
96	Section 1, 18.5	Not clear -- current edition of Incoterms	shall be as mentioned in Incoterm 2010.	
97	Section 1, 21	Not clear -- Bid Security/Bid Securing Declaration	Shall submit Bid Security as mention in BDS clause 20.1, 21.1	
98	Section 1, 39.5	By what amount the performance security increased in case of unbalanced lowest evaluated bid price.	Up to 20% of Lowest evaluated Bid Price.	
99	Section 1, 46.1	Do we have a correspondent institution located in Nepal.	Any "A" class certified Banks in Nepal.	
100	Section 2, c itb 22.1	What is the procedure to submit two copies of bid.	Submission of original Hardcopy with 2 copies with the Bid. (Please refer to ITB Clause)	
101	Section 3, 2.5	Is it mandatory to test all items from IEC lab or we can perform test with in-house facility.	Bidder shall submit type test report from IEC or STL accredited independent testing Laboratory.	
102	Section 7, 39.3	In how many days employer will respond upon receipt of the application for change request.	As per Bidding documents	
103	Section 8, 7.3	Is it required to mention quantities & cost of spare part used during warranty in bidding form ?	Fill as per indicated in BPS schedule 6.	
			Follow the specifications of the bidding documents or any other relevant documents for laying of cables.	
			Required relevant international standard for safety	
			Required relevant standard for safety	
			Updated Layout & SLD to be provided	Provided SLD and Layout are for reference only. Bidders are requested to visit the sites for additional information.
107			Cable specification & conductor either Copper or Aluminum to be specified	As per Specification provided in Volume II



Clarification I

Sr. No.	Reference to Tender Clause	Description	Bidder's Queries	NEA Response
108			Please clarify whether the project contains overhead lines.	No new Overhead bare conductor lines are in the scope.
109			2. In BOQ, the number of "PCC Pole 11.0M Long" in "Schedule 1" is not consistent with "Schedule 4 (a)". Please clarify.	Please fill as per BOQ.
110			3. Please specify the model of the household cable.	Refer to clarification above.
111			4. Please specify the number of transformers and their installation methods.	Please refer BOQ for Transformer Numbers, and installation method shall be as per NEA's Specifications.
112	Section -1 ITB, SI No. 18.4 a	Plant to be Supplied from Abroad (Schedule No. 1): (ii) all customs duties and other taxes paid or payable in the Employer's country on the plant if the contract is awarded to the Bidder.	What are the applicable Nepal Taxes rate and duties need to be consider if material supplied from abroad.	Please Note that 1% Custom Tax is applicable on Schedule 1, which shall be reimbursed by the Employer.
113	Price Schedule No. 2:	Plant and Equipment including Mandatory Spares Parts to be supplied from within Nepal	In Col. 10. (Custom, VAT and other taxes). What are the custom, VAT and Taxes need to be considered.	13% VAT is added on Schedule 2 which shall be reimbursed by the Employer.
114	Price Schedule No. 2:	Plant and Equipment including Mandatory Spares Parts to be supplied from within Nepal	Only one single page refereeing Part -A, Part B and Part C. No detail break up items as in Schedule 1. Do we need to prepare the Price schedule 2 as similar to Schedule 1 and fill up the price as applicable.	Confirmed
115	Time Schedule	ITB 16.1 (b): The period following completion of plant and services in accordance with provisions of the contract shall be 5 Years.		
116		Special Conditions of Contract: The Time for Completion of the whole of the Facilities shall be 1095 Days from the Effective Date as described in the Contract Agreement		
117		Project Specific Requirement:.....Integration with existing systems, testing and commissioning, along with the support services including operation and maintenance of the installed system for a period of 3 years after the commissioning of project.	What is the Project Time Schedule, Defect Liability Period and the total contract period.	As per bidding documents
118		Project Specific Requirement: Support services (operational support and maintenance) for 3 years after issuance of operational acceptance certificate.		
119	Project Specific Requirement. SI No.9	Dismantling of Existing 11 kV system including DTs, LT overhead system and the street lights etc. (to be identified during survey) and existing 11kV and LT reinforcement of the system (to be identified during survey). Cost for such works shall be included in the installation of the respective items.	Please provide the Bill of Quantity for such works.	Please quote as per BOQ.
	Project Specific Requirement. SI No.2.6 Pg-6.1-7	Laying of Service cable: Service cable current carrying capacity shall be as per consumer approved load or higher capacity. Supply of service cable shall include supply of other accessories required for laying of cable (PVC pipe of suitable size and strength, connectors, junction box as required).	Please provide the length, size and type of service cable to be considered along with the accessories.	Shall be decided in DDE.
	Project Specific Requirement. SI No.2.6 Pg-6.1-8	Dismantling of Existing 11 kV, LT overhead system and the street lights: connectors, junction box as required).	Please provide the Bill of Quantity for such works.	Please quote as per BOQ.



NEPAL ELECTRICITY AUTHORITY

PROJECT MANAGEMENT DIRECTORATE

**Power Transmission and Distribution System Strengthening Project
Kathmandu Valley West Distribution System Enhancement Project**

PMD/PTDSSP/ K/VWDSEP -75/76-01: Design, Supply, Installation and Commissioning of Underground Distribution Network under Kirtipur, Kuleshwor, Baneshwor, Balaju and Jorpati Distribution Center including Reinforcement and Automation

Clarification I

Sr. No.	Reference to Tender Clause	Description	Bidder's Queries	NEA Response
122	Project Specific Requirement. SI No.2.6 Pg-6.1-18	Support services (including Maintenance) for 3 years: The Contractor is required to provide field personnel for support service including Engineers, Supervisors etc.	Number of field personnel for support service including Engineers, Supervisors required to be consider.	Confirmed
123	Price Schedule 4 in Section I" Pipes"	HDPE pipe 125 mm dia, HDPE Pipe 160mm dia, GI Pipe 250mm dia , 14mm thick for crossing	Does this Pipe installation work is for manual laying (i.e open cut trench) and joining work	Pipe installation work is for both manual laying and HDD method.
124	Price Schedule 1 in Section I" Pipes"	HDPE pipe 125 mm dia, HDPE Pipe 160mm dia,	Request to mention the pressure of the pipe (4kg, 6kg or 10kg)	Please refer to the attached sheet 2.
125	Price Schedule 1 in Section G-3" Optical Fiber"	24 Fiber (DWSM) OPGW fiber optic cable with required hardware sets including FODP, all cable fittings and accessories as required	Request to provide details specification of OPGW cable and of FODP. Also provide the qty of FODP.	Please refer to the attached sheet 1.
126	Price Schedule 1 in Section K" Metering Units"	Metering units- separate enclosure suitable to be mounted on the RMLU or Transformer including CT, PT and other Accessories	Do we need to consider the Metering Unit in this item. Also provide the detail specification and drawing of Enclosure to be mounted on RMLU or Transformer.	Metering unit shall be included in the item, specification and drawing of Enclosure shall be decided during DDE.
127	Price Schedule 1 in Section L" Service Cable"	Service Cable along with all accessories required for connection of meter to service pillar (single phase 5,16 A)	Please provide the specification of Service cable required to be supplied. Also provide the drawing and specification of Service pillar from where connection to be provided.	Service pillar is to be provided by Contractor, Please refer Section 3.E for Specification of service cable.
128	Project Specific Requirement. SI No.2.6.3 Pg-6.1-7	Supply of service cable shall include supply of other accessories required for laying of cable (PVC pipe of suitable size and strength, connectors, junction box as required).	Please provide the Size and Specification of PVC Pipe , Connector and Junction box required to be supplied.	Shall be decided in DDE.
129		Type test certificate	Kindly mention whether type test certificate from CPRI, India is acceptable.	Please Submit type test certificate IEC or STL certified Lab



Attachment 1: Specification of OPGW Cable.

Specification for OPGW cabling and associated hardware & fittings

The broad scope of this specification include the survey, planning, design, engineering, manufacturing, supply, transportation, insurance, delivery at site, unloading, handling, storage, , installation, splicing, termination, testing, demonstration for acceptance and commissioning and documentation for:

- a) OPGW fibre optic cable including all associated hardware, accessories & fittings
- b) Fibre Optic Distribution Panels (FODP) & Joint Box
- c) All other associated work/items described in the technical specifications.

1.0 Fibre Optic Cabling

In this section of the technical specification, the functional & technical specifications of OPGW cable, associated hardware & fittings for the requirements for G.652D Dual-window Single mode (DWSM) telecommunications grade fibre optic cable is mentioned. Bidders shall furnish with their bids, detailed descriptions of the fibres & cable(s) proposed.

All optical fibre cabling including fibre itself and all associated installation hardware shall have a minimum guaranteed design life span of 25 years. Documentary evidence in support of guaranteed life span of cable & fibre shall be submitted by the Contractor during detailed engineering.

1.1 Required Optical Fibre Characteristics

The optical fibre to be provided should have following characteristics :

1.1.1 Physical Characteristic

Dual-Window Single mode (DWSM), G.652D optical fibres shall be provided in the fibre optic cables. DWSM optical fibres shall meet the requirements defined in Table 1-1(a).

1.1.2 Attenuation

The attenuation coefficient for wavelengths between 1525 nm and 1575 nm shall not exceed the attenuation coefficient at 1550 nm by more than 0.05 dB/km. The attenuation coefficient between 1285 nm and 1330 nm shall not exceed the attenuation coefficient at 1310 nm by more than 0.05 dB/km. The attenuation of the fibre shall be distributed uniformly throughout its length such that there are no point discontinuities in excess of 0.10 dB. The fibre attenuation characteristics specified in table 1-1 (a) shall be “guaranteed” fibre attenuation of any & every fibre reel.

The overall optical fibre path attenuation shall not be more than calculated below :

Maximum attenuation @ 1550 nm : $0.21 \text{ dB/km} \times \text{total km} + 0.05 \text{ dB/splice} \times \text{no. of splices} + 0.5 \text{ dB/connector} \times \text{no. of connectors.}$

Maximum attenuation @ 1310 nm : $0.35 \text{ dB/km} \times \text{total km} + 0.05 \text{ dB/splice} \times \text{no. of splices} + 0.5 \text{ dB/connector} \times \text{no. of connectors.}$



Table 2-1(a)
DWSM Optical Fibre Characteristics

Fibre Description:	Dual-Window Single-Mode
Mode Field Diameter:	8.6 to 9.5 μm ($\pm 0.6\mu\text{m}$)
Cladding Diameter:	125.0 $\mu\text{m} \pm 1 \mu\text{m}$
Mode field concentricity error	$\leq 0.6\mu\text{m}$
Cladding non-circularity	$\leq 1\%$
Cable Cut-off Wavelength λ_{cc}	$\leq 1260 \text{ nm}$
1550 nm loss performance	As per G.652 D
Proof Test Level	$\geq 0.69 \text{ Gpa}$
Attenuation Coefficient:	@ 1310 nm $\leq 0.35 \text{ dB/km}$ @ 1550 nm $\leq 0.21 \text{ dB/km}$
Chromatic Dispersion; Maximum:	18 ps/(nm x km) @ 1550 nm 3.5 ps/(nm x km) 1288-1339nm 5.3 ps/(nm x km) 1271-1360nm
Zero Dispersion Wavelength : Zero Dispersion Slope :	1300 to 1324 nm 0.092 ps/(nm ² xkm) maximum
Polarization mode dispersion coefficient	$\leq 0.2 \text{ ps/km}^{1/2}$
Temperature Dependence :	Induced attenuation $\leq 0.05 \text{ dB } (-60^\circ\text{C} - +85^\circ\text{C})$
Bend Performance :	@ 1310 nm (75 $\pm$ 2 mm dia Mandrel), 100 turns; Attenuation Rise $\leq 0.05 \text{ dB/km}$ @ 1550 nm (75 $\pm$ 2 mm dia Mandrel), 100 turns; Attenuation Rise $\leq 0.10 \text{ dB/km}$ @ 1550 nm (32 $\pm$ 0.5 mm dia Mandrel, 1 turn); Attenuation Rise $\leq 0.50 \text{ dB/km}$

1.2 Fibre Optic Cable Construction

The OPGW (Optical Ground Wire) cable is proposed to be installed on the new transmission lines along with transmission line construction. The design of cable shall account for the varying operating and environmental conditions that the cable shall experience while in service. The OPGW cable to be supplied shall be designed to meet the overall requirements of all the transmission lines. The Tower span details shall be collected by the contractor during survey. To meet the overall requirement of the distribution line(s), the contractor may offer more than one design without any additional cost to Employer, in case single design is not meeting the requirement. OPGW cable to be designed to meet Distribution line sag-tension parameters and other details to be provided by contractor. Any other details, as required for cable design etc. shall be collected by the Contractor during survey.



1.2.1 Optical Fibre Cable Link Lengths

For the purpose of payment the actual cable lengths to be delivered shall take into account various factors such as sag, service loops, splicing, working lengths & wastage etc. and no additional payment shall be payable in this regard. The unit rate for FO cable quoted in the Bid price Schedules shall take into account all such factors.

1.2.2 Optical Fibre Identification

All optical fibres shall be individually coated. Individual optical fibres within a fibre unit and fibre units shall be identifiable in accordance with EIA/TIA 598 or IEC 60304 or Bellcore GR-20 colour-coding scheme.

Colouring utilized for colour coding optical fibres shall be integrated into the fibre coating and shall be homogenous. The colour shall not bleed from one fibre to another and shall not fade during fibre preparation for termination or splicing.

Each cable shall have traceability of each fibre back to the original fibre manufacturer's fibre number and parameters of the fibre. If more than the specified number of fibres is included in any cable, the spare fibres shall be tested by the cable manufacturer and any defective fibres shall be suitably bundled, tagged and identified at the factory by the vendor.

1.2.3 Buffer Tube

Loose tube construction shall be implemented. The individually coated optical fibre(s) shall be surrounded by a buffer for protection from physical damage during fabrication, installation and operation of the cable. The fibre coating and buffer shall be strippable for splicing and termination. Each fibre unit shall be individually identifiable utilizing colour coding. Buffer tubes shall be filled with a water-blocking gel.

1.2.4 Optical Fibre Strain & Sag-Tension chart

The OPGW cable shall be designed and installed such that the optical fibres experience no strain under all loading conditions of transmission lines. Zero fibre strain condition shall apply even after a 25 year cable creep.

For the purpose of this specification, the following definitions shall apply:

- Maximum Working Tension (MWT) is defined as the maximum cable tension at which there is no fibre strain.
- The no fibre strain condition is defined as fibre strain of less than or equal to 0.05%, as determined by direct measurements through IEC/ETSI (FOTP) specified optical reflectometry
- The Cable strain margin is defined as the maximum cable strain at which there is no fibre strain.
- The cable Maximum Allowable Tension (MAT) is defined as the maximum tension experienced by the Cable under the worst case loading condition.
- The cable max strain is defined as the maximum strain experienced by the Cable under the worst case loading condition.



[Handwritten signature]

Attachment 1: Specification of OPGW Cable.

- The cable Every Day Tension (EDT) is defined as the maximum cable tension on any span under normal conditions.
 - The Ultimate /Rated Tensile Strength (UTS/ RTS/ breaking strength) is defined as the maximum tensile load applied and held constant for one minute at which the specimen shall not break.
- While preparing the Sag-tension charts for the OPGW cable the following conditions shall be met:
- The Max Allowable Tension (MAT) / max strain shall be less than or equal to the MWT/ Strain margin of the cable.
 - The sag shall not exceed the earth wire sag in all conditions.
 - The Max Allowable Tension shall also be less than or equal to 0.4 times the UTS.
 - The 25 year creep at 25% of UTS (creep test as per IEEE 1138) shall be such that the 25 year creep plus the cable strain at Max Allowable Tension (MAT) is less than or equal to the cable strain margin.
 - The everyday tension (EDT) shall not exceed 20% of the UTS for the OPGW cable.

The Sag-tension chart of OPGW cable indicating the maximum tension, cable strain and sag shall be calculated and submitted along with the bid under various conditions as per tower design of the transmission line.

The size of OPGW shall be selected such that max. tension and sag at specified temperature and wind condition remains within the limits as per GTR.

1.2.5 Cable Materials

The materials used for optical fibre cable construction, shall meet the following requirements:

1.2.5.1 Filling Materials

The interstices of the fibre optic unit and cable shall be filled with a suitable compound to prohibit any moisture ingress or any water longitudinal migration within the fibre optic unit or along the fibre optic cable. The water tightness of the cable shall meet or exceed the test performance criteria as per IEC 60794-1-F-5.

The filling compound used shall be a non-toxic homogenous waterproofing compound that is free of dirt and foreign matter, non-hygroscopic, electrically nonconductive and non-nutritive to fungus. The compound shall also be fully compatible with all cable components it may come in contact with and shall inhibit the generation of hydrogen within the cable.

The waterproofing filling materials shall not affect fibre coating, colour coding, or encapsulant commonly used in splice enclosures, shall be dermatologically safe, non-staining and easily removable with a non-toxic cleaning solvent.

1.2.5.2 Metallic Members

When the fibre optic cable design incorporates metallic elements in its construction, all metallic elements shall be electrically continuous.



1.2.6 Marking, Packaging and Shipping

This section describes the requirements for marking, packaging and shipping the overhead fibre optic cable.

(a) Drum Markings: Each side of every reel of cable shall be permanently marked in white lettering with the vendors' address, the Purchaser's destination address, cable part number and specification as to the type of cable, length, number of fibres, a unique drum number including the name of the transmission line & segment no., factory inspection stamp and date.

(b) Cable Drums: All optical fibre cabling shall be supplied on strong drums provided with lagging of adequate strength, constructed to protect the cabling against all damage and displacement during transit, storage and subsequent handling during installation. Both ends of the cable shall be sealed as to prevent the escape of filling compounds and dust & moisture ingress during shipment and handling. Spare cable caps shall be provided with each drum as required.

The spare cable shall be supplied on sturdy, corrosion resistant, steel drums suitable for long periods of storage and re-transport & handling.

There shall be no factory splices allowed within a continuous length of cable. Only one continuous cable length shall be provided on each drum. The lengths of cable to be supplied on each drum shall be determined by a "schedule" prepared by the Contractor and approved by the Employer.

1.3. Optical Ground Wire (OPGW)

OPGW cable construction shall comply with IEEE-1138, 2009. The cable provided shall meet both the construction and performance requirements such that the ground wire function, the optical fibre integrity and optical transmission characteristics are suitable for the intended purpose. The cable shall consist of optical fibre units as defined in this specification. There shall be no factory splices within the cable structure of a continuous cable length.

The composite fibre optic overhead ground wire shall be made up of multiple buffer tubes embedded in a water tight aluminium/aluminium alloy protective central fibre optic unit surrounded by concentric-lay stranded metallic wires in single or multiple layers. Each buffer tube shall have maximum 12 no. of fibres. All fibres in single buffer tube or directly in central fibre optic unit is not acceptable. The dual purpose of the composite cable is to provide the electrical and physical characteristics of conventional overhead ground wire while providing the optical transmission properties of optical fibre.

1.3.1 Central Fibre Optic Unit

The central fibre optic unit shall be designed to house and protect multiple buffered optical fibre units from damage due to forces such as crushing, bending, twisting, tensile stress and moisture. The central fibre optic unit and the outer stranded metallic conductors shall serve together as an integral unit to protect the optical fibres from degradation due to vibration and galloping, wind and ice loadings, wide temperature variations, lightning and fault current, as well as environmental effects which may produce hydrogen.

The OPGW design of dissimilar materials for stranded wires and tubes are not allowed. Central fibre unit may be of aluminium / aluminium alloy tube. There shall be no exposed areas of tubing



Attachment 1: Specification of OPGW Cable.

that can make electrical contact either directly or indirectly through moisture, contamination, protrusions, etc with the surrounding stranded wires. The tube may be fabricated as a seamless tube, seam welded, or a tube without a welded seam.

1.3.2 Basic Construction

The OPGW cable construction shall conform to the applicable requirements of this specification, applicable clauses of IEC 61089 related to stranded conductors and **Table 1.2(a)** OPGW Mechanical and Electrical Characteristics. In addition, the basic construction shall include bare concentric-lay-stranded metallic wires with the outer layer having left hand lay. The wires may be of multiple layers with a combination of various metallic wires within each layer. The direction of lay for each successive layer shall be reversed. The finished wires shall contain no joints or splices unless otherwise agreed to by the Employer and shall conform to all applicable clauses of IEC 61089 as they pertain to stranded conductors.

The wires shall be so stranded that when the complete OPGW is cut, the individual wires can be readily regrouped and then held in place by one hand.

1.3.3 Breaking Strength

The rated breaking strength of the completed OPGW shall be taken as no more than 90 percent of the sum of the rated breaking strengths of the individual wires, calculated from their nominal diameter and the specified minimum tensile strength.

The rated breaking strength shall not include the strength of the optical unit. The fibre optic unit shall not be considered a load bearing tension member when determining the total rated breaking strength of the composite conductor.

1.3.4 Electrical and Mechanical Requirements

Table 1-2(a) provides OPGW Electrical and Mechanical Requirements for the minimum performance characteristics. Additionally, the OPGW mechanical & electrical characteristics shall be similar to that of the earthwire being replaced such that there is no or minimal consequential increase in stresses on towers. OPGW installation sag & tension charts shall be as per transmission line requirement. For the OPGW cable design selection and preparation of sag tension charts, the limits specified in this section shall also be satisfied. The Bidder shall submit sag-tension charts for the above cases with their bids.

Table 1.2(a)
OPGW Electrical and Mechanical Requirements

(1)	Everyday Tension	$\leq 20\%$ of UTS of OPGW
(2)	D.C. Resistance at 20°C:	< 2.0 ohm/Km or Employer provided values
(3)	Short Circuit Current	≥ 2.14 kA for 1.0 second or Employer provided values

Bidder may offer separate design for each short circuit rating however OPGW design with higher short circuit level shall be acceptable.



1.4 Installation Hardware

The scope of supply includes all required fittings and hardware such as Tension assembly, Suspension assembly, Vibration dampers, Reinforcing rods, Earthing clamps, Downlead clamps, splice enclosure etc. The Bidder shall provide documentation justifying the adequacy and suitability of the hardware supplied. The quantity of hardware & fittings to meet any eventuality during site installation minimum@ 1% shall also be provided as part of set/km for each transmission line without any additional cost to Employer.

The OPGW hardware fittings and accessories shall follow the general requirements regarding design, materials, dimensions & tolerances, protection against corrosion and markings as specified in clause 4.0 of EN 61284: 1997 (IEC 61284). The shear strength of all bolts shall be at least 1.5 times the maximum installation torque. The OPGW hardware & accessories drawing & Data Requirement Sheets (DRS) document shall consist of three parts: (1) A technical particulars sheet (2) An assembly drawing i.e. level 1 drawing and (3) Component level drawings i.e. level 2 & lower drawings. All component reference numbers, dimensions and tolerances, bolt tightening torques & shear strength and ratings such as UTS, slip strength etc shall be marked on the drawings.

The fittings and accessories described herein are indicative of installation hardware typically used for OPGW installations and shall not necessarily be limited to the following:

- (a) Suspension Assemblies: Preformed armour grip suspension clamps and aluminium alloy armour rods/ reinforcing rods shall be used. The suspension clamps shall be designed to carry a vertical load of not less than 25 kN. The suspension clamps slippage shall occur between 12kN and 17 kN as measured.

The Contractor shall supply all the components of the suspension assembly including shackles, bolts, nuts, washers, split pins, etc. The total drop of the suspension assembly shall not exceed 150 mm (measured from the centre point of attachment to the centre point of the OPGW). The design of the assembly shall be such that the direction of run of the OPGW shall be the same as that of the conductor.

- (b) Dead End Clamp Assemblies: All dead end clamp assemblies shall preferably be of performed armoured grip type and shall include all necessary hardware for attaching the assembly to the tower strain plates. Dead end clamps shall allow the OPGW to pass through continuously without cable cutting. The slip strength shall be rated not less than 95% of the rated tensile strength of the OPGW.

- (c) Clamp Assembly Earthing Wire: Earthing wire consisting of a 1500 mm length of aluminium or aluminium alloy conductor equivalent in size to the OPGW shall be used to earth suspension and dead end clamp assemblies to the tower structure. The earthing wire shall be permanently fitted with lugs at each end. The lugs shall be attached to the clamp assembly at one end and the tower structure at the other.

- (d) Structure Attachment Clamp Assemblies: Clamp assemblies used to attach the OPGW to the structures, shall have two parallel grooves for the OPGW, one on either side of the connecting bolt. The clamps shall be such that clamping characteristics do not alter adversely when only one OPGW is installed.

The messenger cable shall be made of high strength galvanised steel/stain less steel. It shall



Attachment 1: Specification of OPGW Cable.

be of preformed and post formed quality in order to prevent subsequent droop of weight and to maintain consistent flexural stiffness of the cable in service. The messenger cable other than stainless steel shall be hot dip galvanised in accordance with the recommendations of IS: 4826 for heavily coated wires.

The contractor must indicate the clamp bolt tightening torque to ensure that the slip strength of the clamp is maintained between 2.5 kN and 5 kN. The clamp when installed on the OPGW cable shall not cause excessive stress concentration on the OPGW cable leading to permanent deformation of the OPGW strands and premature fatigue failure in operation.

The vibration analysis of the system, with and without damper and dynamic characteristics of the damper as detailed in Technical Specification, shall have to be submitted. The technical particulars for vibration analysis and damping design of the system are as follows:

Sl. No.	Description	Technical Particulars
1	Span Length in meters (i) Ruling design span: (ii) Maximum span: (iii) Minimum Span:	40 meters 100 meters 30 meters
2	Configuration:	As per Specifications
3	Tensile load in each:	As per sag tension calculations
4	Armour rods used:	Standard preformed armour rods/AGS
5	Maximum permissible dynamic strain:	+/- 150 micro strains

1.5 Fibre Optic Splice Enclosures (Joint Box)

All splices shall be encased in Fibre Optic Splice Enclosures. Suitable splice enclosures shall be provided to encase the optical cable splices in protective, moisture and dust free environment. Splice enclosures shall comply with ingress protection class IP 66 or better. The splice enclosures shall be designed for the storage and protection of required number of optical fibre splices and equipped with sufficient number of splice trays for splicing all fibres in the cable. No more than 12 fibres shall be terminated in a single splice tray. They shall be filled with suitable encapsulate that is easily removable should re-entry be required into the enclosures.

Splice enclosures shall be suitable for outdoor use with each of the cable types provided under this contract. Splice enclosures shall be appropriate for mounting on transmission line towers above anti-climb guard levels at about 10 metres from top of the tower and shall accommodate pass-through splicing. The actual mounting height and location shall be finalised after Survey. Contractor shall be responsible for splicing of fibres and installation of splice enclosures.



1.5.1 Optical Fibre Splices

Splicing of the optical fibre cabling shall be minimized through careful Contractor planning. There shall be no mid-span splices allowed. All required splices shall be planned to occur on tower structures. All optical fibre splicing shall comply with the following:

- (a) All fibre splices shall be accomplished through fusion splicing.
- (b) Each fibre splice shall be fitted with a splice protection sheath fitted over the final splice.
- (c) All splices and bare fibre shall be neatly installed in covered splice trays.
- (d) For each link, bi-directional attenuation of single mode fusion splices, shall not average more than 0.05 dB and no single splice loss shall exceed 0.1 dB when measured at 1550 nm.
- (e) For splicing, fibre optic cable service loops of adequate length shall be provided so that all splices occurring at tower structures can be performed at ground level.

1.6 Fibre Optic Distribution Panel

Fibre Optic Distribution Panels is required for each location for termination of fibres in a manner consistent with the following:

- (a) FODPs shall be suitable for use with each of the cable types provided as part of this contract. FODPs shall accommodate pass-through splicing and fibre terminations.
- (b) FODPs for indoor use shall be supplied in suitable cabinets/racks with locking arrangement
- (c) All FODPs shall be of corrosion resistant, robust construction and shall allow both top or bottom entry for access to the splice trays. Ground lugs shall be provided on all FODPs and the Contractor shall ensure that all FODPs are properly grounded. The FODP shall meet or exceed ingress protection class IP55 specifications.

1.7.1 Optical Fibre Connectors

Optical fibres shall be connectorised with FC-PC type connectors preferably. Alternatively connector with matching patch cord shall also be acceptable. Fibre optic couplings supplied with FODPs shall be appropriate for the fibre connectors to be supported. There shall be no adapters.

1.7 Service Loops

For purposes of this specification, cable and fibre service loops are defined as slack (extra) cable and fibre provided for facilitating the installation, maintenance and repair of the optical fibre cable plant.

- (a) Outdoor Cable Service Loops: In-line splice enclosures installed outdoors and mounted on the utility towers shall be installed with sufficient fibre optic cable service loops such that the recommended minimum bend radius is maintained while allowing for installation or



Attachment 1: Specification of OPGW Cable.

maintenance of the cable to be performed in a controlled environment at ground level.

- (b) Indoor Cable Service Loops: FODPs shall provide at least three (3) metres of cable service loop. Service loops shall be neatly secured and stored, coiled such that the minimum recommended bend radius' are maintained.
- (c) Fibre Units Service Loops: For all fibre optic cable splicing, the cable shall be stripped back a sufficient length such that the fan-out of fibre units shall provide for at least one (1) metre of fibre unit service loop between the stripped cable and the bare fibre fan-out.
- (d) Pigtail Service Loops : Connectorised pigtails spliced to bare fibres shall provide at least 1 metre of service loop installed in the FODP fibre organizer and at least one (1) metre of service loop to the couplings neatly stored behind the FODP coupling panels.
- (e) Fibre Service Loops : At least 0.5 metre of bare fibre service loop shall be provided on each side of all fibre splices. The bare fibre service loops shall be neatly and safely installed inside covered splice trays.

2.0 Applicable Standards

The following standards and codes shall be generally applicable to the equipment and works supplied for OPGW and associated Items

(1) American Society for Testing and Materials ASTM

ASTM-B415 Standard Specification for Hard-Drawn Aluminium-Clad Steel Wire

(2) Bell Communication Research

GR-20 Generic requirements for optical fibre and optical fibre cable

(3) ITU-T/CCITT Recommendations

G.650 Definitions and test methods for the relevant parameters of single-mode fibres
G.652 Characteristics of a single-mode optical fibre cable

(4) IEEE

IEEE-1138 IEEE Standard Construction of Composite Fibre Optic Ground Wire (OPGW) for Use on Electric Utility power Lines

(5) Telecommunication Industry Association EIA/TIA

EIA/TIA-455-3 Procedure to Measure Temperature Cycling Effects on Optical Fibres, Optical Cable, and Other Passive Fiber Optic Components
EIA/TIA-455-16
EIA/TIA-455-20 Salt Spray (Corrosion) Test for Fibre Optic Components
EIA/TIA-455-25 Measurement of Change in Optical Transmittance
Repeated Impact Testing of Fibre Optic Cables and Cable



Attachment 1: Specification of OPGW Cable.

	Assemblies
<i>EIA/TIA-455-32</i>	Fibre Optic Circuit Discontinuities
<i>EIA/TIA-455-33</i>	Fibre Optic Cable Tensile Loading and Bending Test
<i>EIA/TIA-455-41</i>	Compressive Loading Resistance of Fibre Optic Cables
<i>EIA/TIA-455-59</i>	Measurement of Fibre Point Defects Using an OTDR
<i>EIA/TIA-455-62</i>	Measurement of Optical Fibre Macrobend Attenuation
<i>EIA/TIA-455-78</i>	Spectral Attenuation Cutback Measurement for Single- Mode Optical Fibres
<i>EIA/TIA-455-80</i>	Measurement of Cut-Off Wavelength of Single-Mode Fibre by Transmitted Power
<i>EIA/TIA-455-81</i>	Compound Flow (Drip) Test for Filled Fibre Optic Cable
<i>EIA/TIA-455-82</i>	Fluid Penetration Test for Fluid-Blocked Fibre optic Cable
<i>EIA/TIA-455-91</i>	Fibre Optic Cable Twist-Bend Test
<i>EIA/TIA-455-164</i>	Single-Mode Fibre, Measurement of Mode Field Diameter by Far-Field Scanning
<i>EIA/TIA-455-167</i>	Mode Field Diameter Measurement, Variable Aperture Method in the Far-Field
<i>EIA/TIA-455-168</i>	Chromatic Dispersion Measurement of Multimode Graded Index and Single-Mode Optical Fibres by Spectral Group Delay Measurement in the Time Domain
<i>EIA/TIA-455-169</i>	Chromatic Dispersion Measurement of Single-Mode Optical Fibres by the Phase-Shift Method
<i>EIA/TIA-455-170</i>	Cable Cut-off Wavelength of Single-Mode Fibre by Transmitted Power
<i>EIA/TIA-455-174</i>	Mode Field Diameter Measurement
<i>EIA/TIA-455-175</i>	Chromatic Dispersion Measurement of Single-Mode Optical Fibres by the Differential Phase-Shift Method
<i>EIA/TIA-455-176</i>	Method of Measuring Optical Fibre Cross-Sectional Geometry by Automated Grey-Scale Analysis
<i>EIA/TIA-598</i>	Optical Fibre Cable Colour Coding

(6) International Electrotechnical Commission IEC standards

<i>IEC-60793-1 series</i>	Optical fibres – Generic & product specifications, measurement methods & test procedures specification
<i>IEC-60794-1-1</i>	Optical fibre cables – Generic specification
<i>IEC-60794-1-2</i>	Optical fibre cables – Basic optical cable test procedure
<i>IEC-60794-3</i>	Optical fibre cables – Duct, buried and aerial cables – sectional specification
<i>IEC-60794-4</i>	Optical fibre cables – Overhead cables
<i>IEC-61089</i>	Round wire concentric lay overhead electrical stranded conductors
<i>IEC-61232</i>	Aluminium-clad steel wires for electrical purposes
<i>IEC-61284</i>	Overhead lines-Requirements and tests for fittings
<i>IEC-61395</i>	Overhead electrical conductors – Creep test procedures for stranded conductors

Specifications and codes shall be the latest version, inclusive of revisions, which are in force at the date of the contract award. Where new specifications, codes, and revisions are issued during the period



Attachment 1: Specification of OPGW Cable.

of the contract, the Contractor shall attempt to comply with such, provided that no additional expenses are charged to the Employer without Employer's written consent.

In the event the Contractor offers to supply material and/or equipment in compliance to any standard other than Standards listed herein, the Contractor shall include with their proposal, full salient characteristics of the new standard for comparison.



Attachment 2: Table for HDPE Pipes(Read this table for Specification 3 HDPE Pipe)

A) FOR HDPE PIPE 160MM DIA

Sl. No.	Item Description	Unit	Requirement
1	M.F.R. (190°C, 5ka load)	gm/10 mins	0.20 to 1.10
2	Specified base density	kg/mtr ³	940 to 958
3	Material Grade		PE-63
4	Wall Thickness	Mm	11.8 – 13.1
5	Carbon Black	%	2.5 ± 0.5
6	Antiox 1dant	% by mass	<0.3% by mass
7	Overall Migration	Mg/dm ²	10 Max
8	Reversion	%	<=3%
9	Hydraulic Characteristics		No sign of localized swelling, leakage or weeping (at 80°C for 48 & 165 hrs.)
10	Continuous Temperature withstand capacity		120 deg. C

B. FOR HDPE PIPE 125 MM DIA

Sl. No.	Item Description	Unit	Requirement
1	M.F.R. (load) C, 5ka	gm/10 mins	0.20 to 1.10
2	Specified base density	kg/mtr ³	940 to 958
3	Material Grade		PE-80
4	Wall Thickness	mm	7.4 – 8.2
5	Carbon Black	%	2.5 ± 0.5
6	Antioxidant	% by mass	<0.3% by mass
7	Overall Migration	Mg/dm ²	10 Max
8	Reversion	%	<=3%
9	Hydraulic Characteristics		No sign of localized swelling, leakage or weeping (at 80°C for 48 & 165 hrs.)
10	Continuous Temperature withstand capacity	Deg. C	110



TECHNICAL REQUIREMENTS for PVC Pipe

PVC pipe shall be maintenance-free performance in underground, encased and exposed applications in accordance with the National Electrical Code. PVC pipe shall be Corrosion Resistant, Non-Magnetic and non-galvanic, Self Extinguishing and Impact Resistant. Schedule 40 & 80 rigid PVC pipes shall be sunlight resistant and shall be able to use in exposed, encased in concrete, concealed in walls and in direct burial applications including systems for:

- Residential applications, & service entrances

Codes and Standards Compliance

Schedule 40 & 80 rigid PVC pipes shall be able for use with 90° C conductors, in accordance with the National Electrical Code and are manufactured in accordance with NEMA TC2.

PVC fittings shall be manufactured in accordance with NEMA TC3

Specification

All wiring shall be installed in rigid PVC and secured by means of proper fittings.

Exposed conduit shall be securely attached and supported by means of straps. The straps shall be installed at the recommended spacing as specified in the National Electrical Code (NEC). The straps must allow for linear expansion and contraction of the conduit due to temperature change. If the variance in temperature exceeds 15° C, expansion joints shall be installed according to the manufacturer's recommendations.

If rigid PVC conduit is embedded in concrete or direct buried, support straps are not required.

Table for Schedule 40

Size	Average OD (inch)	Minimum Average OD (inch)	Minimum Thickness (inch)	Wall
1/2	0.840	0.578	0.109	
3/4	1.050	0.780	0.113	
1	1.315	1.004	0.133	
1-1/4	1.660	1.335	0.140	
1-1/2	1.900	1.564	0.145	
2	2.375	2.021	0.154	
2-1/2	2.875	2.414	0.203	



Attachment 3: for PVC Pipes

3	3.500	3.008	0.216
3-1/2	4.000	3.486	0.226
4	4.500	3.961	0.237
5	5.563	4.975	0.258
6	6.625	5.986	0.280

Table for Schedule 80

Size	Average OD (inch)	Minimum Average OD (inch)	Minimum Thickness (inch)	Wall
1/2	0.840	0.502	0.147	
3/4	1.050	0.698	0.154	
1	1.315	0.910	0.179	
1-1/4	1.660	1.227	0.191	
1-1/2	1.900	1.446	0.200	
2	2.375	1.881	0.218	
2-1/2	2.875	2.250	0.276	
3	3.500	2.820	0.300	
3-1/2	4.000	3.280	0.318	
4	4.500	3.737	0.377	
5	5.563	4.713	0.375	
6	6.625	5.646	0.432	

