

Addendum No. 2

Tender No: BPC/C&PD/CMS/ TENDER-2026/25 for **Supply, Construction, Testing, and Commissioning of 66 kV Double Circuit Transmission Line from Semtokha-Begana-Dechencholing**, Thimphu, Bhutan.

Pursuant to the Bidding Document, additional Technical Specifications for Power Cable and Transmission Line Arrester (TLA) are hereby issued as Addendum No. 2. Bidders are hereby advised to consider and incorporate the additional Technical Specifications for Power Cable and Transmission Line Arrester (TLA) in the preparation and submission of their bids.

The additional Technical Specifications issued under this Addendum shall form an integral part of the Bidding Document and shall be complied with by the successful bidder during the execution of the Contract. All other terms and conditions of the Bidding Document shall remain unchanged.



CHAPTER XIII

SECTION – I

TECHNICAL SPECIFICATIONS FOR 66 kV XLPE POWER CABLE

1.1 INTRODUCTION

Bhutan Power Corporation Ltd. (BPC) intends to construct a 1x66kV double circuit from Semtokha substation to Dechencholing Substation (Loop-in loop-out (LILO) of existing 66 kV Dechencholing-Damji Line), along with necessary line termination works including supply of cables and construction of cable trenches, at Semtokha substation in Thimphu Dzongkhag, Bhutan. Line termination inside the substation would be at 66 kV voltage level through 1R/Ph, 1Cx630sq.mm XLPE Al cable with bonding arrangement.

Overall project including design, engineering, manufacture, testing, packing, and supply of 66 kV, 630 Sq.mm, Al, XLPE, insulated power cable and all the necessary accessories required for bonding arrangements.

1.2 SCOPE:

The scope under this section covers design, engineering, manufacture, testing, packing, supply of 66 kV, 630 Sq.mm, Al, XLPE, insulated power cable and all the necessary accessories required for bonding arrangements.

The XLPE cable and its accessories shall be complete with all fittings and components necessary for satisfactory performance and ease of maintenance. List of Approved Cable Makes provided in Appendix -2.

STANDARDS

Unless otherwise specified, the cables shall conform, in all respects, to IEC-502, IEC-60840 and IS: 7098 (Part-III)/ with latest amendment or latest edition for cross linked polyethylene insulated Thermoplastic High Density Polyethylene sheathed cable for working voltage of 66 kV.

1.3 CLIMATIC CONDITIONS

The climatic conditions under which the cable shall operate satisfactorily are as follows:

1	Ambient temperature	Min: 0 deg.C Max: 40 deg.C
2	Maximum relative humidity	20-100%
3	Average annual Isokeraunic level	70 Thunderstorm Days
4	Average annual rainfall	75-500 mm
5	Wind Speed	47m/s
6	Altitudes above sea level	Approx 2500m

7	Seismic acceleration level	Horizontal:0.1g Vertical:0.05g
8	Climate	The summer is moderately hot and winter is dry and cold

1.4 PRINCIPAL PARAMETERS

66 kV XLPE single core power cable of single length, with aluminum conductor, shielded with extruded semi-conducting layer, insulated with dry gas cured cross linked polyethylene (XLPE) insulation, insulation screened with extruded semi-conducting layer followed by semi-conducting non-woven water swellable tape, insulated core copper-wire, screened (suitable for 40 kA for 1 sec) tapped with a combination of semi-conducting water swellable and poly aluminum laminated followed by black extruded Thermoplastic HDPE (Poly-ethylene) inner sheath. Aluminum corrugated armored (suitable for 40 kA for 1 sec) and graphite coating Thermoplastic HDPE outer sheathed overall cable, confirming to IEC-60840 for construction, and confirming to IS: 7098 (Part-III)/or any latest amendments thereof.

1.4.1 Outer sheathing should be designed to afford high degree of mechanical protection and should also be heat, oil chemicals and weather resistant. Common acid, alkalis and saline solution should not have adverse effect on the Thermoplastic HDPE sheathing material used.

1.4.2 The cable should be suitable for laying in covered trenches and/or underground for outdoor.

1.4.3 CABLE PARAMETERS 66kV

i.	Voltage grade (U)kV	66
ii.	No. of cores	Single
iii.	Highest system voltage kV	72.5
iv.	Size (mm ²)	630
v.	System Frequency Hz	50
vi.	Variation in frequency	±5 %
vii.	Minimum fault level individually for:	
viii.	Maximum allowable temperature	
ix.	a) Design continuous operation at rated full load current, the max. temperature of the conductor shall not exceed	90 deg.C
	b) The conductor temperature after short circuit for 0.5s shall not exceed	250 deg. C

x.	Basic insulation level. (1.2 / 50 Micro second wave)	325kvp
xi.	1-min. power frequency withstand voltage (rms,wet)	140kV
xii.	System Earthing	Solidly Grounded

1.5 GENERAL TECHNICAL REQUIREMENTS:

1.5.1 CONDUCTOR

The cable conductor shall be made from stranded aluminum to form compact circular shaped conductor having resistance within limits specified in IS: 8130 / and any amendment thereof. The conductor shall confirm to IEC: 228 and the shape shall be compacted circular shaped.

1.5.2 CONDUCTOR SCREEN

The conductor having a semi-conducting screen shall ensure perfectly smooth profile and avoid stress concentration. The conductor screen shall be extruded in the same operation as the insulation; the semi-conducting polymer shall be cross-linked.

1.5.3 INSULATION

The XLPE insulation should be suitable for specified 66 kV system voltage. The manufacturing process shall ensure that insulations shall be free from voids. The insulation shall withstand mechanical and thermal stress under steady state and transient operating conditions. The extrusion method should give very smooth interface between semi-conducting screen and insulation. The insulation of the cable shall be of high standard quality, generally confirming to IEC-60840 and I.S. 7098 part-III / (latest edition).

1.5.4 INSULATION SCREEN

To confine electrical field to the insulation, non- magnetic semi-conducting shield shall be put over the insulation. The insulation shield shall be extruded in the same operation as the conductor shield and the insulation by triple extrusion process.

1.5.4.1 A semi-conducting non-woven water blocking tape shall be provided over the extruded semi conducting layer and over the copper wire metallic screen.

1.5.4.2 To avoid the ingress of moisture, poly-aluminum laminate tape shall be applied longitudinally with suitable overlap.

1.5.5 INNER-SHEATH

The sheath shall be suitable to withstand the site conditions and the desired temperature. It should be of adequate thickness, consistent quality and free from all defects. The sheath shall be extruded and of black Thermoplastic HDPE (Polyethylene).

1.5.6 ARMOUR

Aluminum corrugated armoring shall be provided.

1.5.7 OUTER SHEATH

Extruded Thermoplastic HDPE outer sheath conforming to IEC: 502/ latest edition/amendment shall be applied over armoring with suitable additives to prevent attack by rodents and termites. The outer sheath shall be coated with graphite throughout the length of cable.

1.5.8 CONSTRUCTION

All materials used in the manufacture of cable shall be new unused and of finest quality. All materials should comply with the applicable provision of the tests of the specification. IS, IEC, IEEE, and any other applicable statutory provisions rules and regulations.

1.5.9 CURRENT RATING

The cable will have current ratings and de-rating factors as per relevant IS/IEC standard.

1.5.9.1 The one-second short circuit current rating values each for conductor, screen armour shall be furnished and shall be subject to the purchaser's approval.

1.5.9.2 The current ratings shall be based on maximum conductor temperature of 90 deg.celcius with ambient site condition specified for continuous operation at the rated current.

1.5.10 OPERATION

1.5.10.1 Cables shall be capable of satisfactory operation under a power supply system frequency variation of $\pm 5\%$ voltage variation of $\pm 10\%$ and combined frequency voltage variation shall be $+10\%$ & -15% .

1.5.10.2 Cable shall be suitable for laying in **Ducts/Trench**.

1.5.10.3 Cable shall have heat and moisture resistance property.

1.5.11 LENGTHS

The cable shall be supplied in approved drum length.

1.5.12 IDENTIFICATION MARKING

Identification of cables shall be 'provided externally at three meters' intervals to identify as under.

- I. Name of manufacture
- II. Per meter marking
- III. Year of Manufacture
- IV. Voltage grade to be embossed at the interval of three meter-length.
The identification, by embossing shall be done only on the outer sheath. The name of the purchaser shall also be embossed.

1.5.13 QUALITY ASSURANCE DOCUMENTS

The supplier would be required to submit all the Quality Assurance Documents for approval prior to commencement of manufacturing activities.

1.6 TESTING & INSPECTION

1.6.1 The bidders shall furnish copies of the relevant type test of cable offered along with the bid. The test reports submitted shall be of the tests conducted within the last 10 (ten) years as on the date of bid opening. In case the test reports are of the test conducted earlier than 10 (ten) years as on the date of bid opening, the supplier shall repeat these test(s) at no extra cost to the Purchaser. Cable being supplied shall conform to type tests as per technical specification and shall be subject to routine tests. The purchaser reserves the right to witness any or all the type tests. The Supplier shall intimate the Purchaser the detailed program about the tests at least 1 (one) week in advance.

1.6.2 The reports for all type tests as per technical specification and relevant standards shall be furnished by the Supplier along with equipment/ material drawings. The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO / IEC Guide 25/ 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by the representative(s) of Purchaser or Utility. In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the Technical Specification or any/all additional type tests not carried out, same shall be carried out without any additional cost implication to the Purchaser.

1.6.3 TESTS

1) ACCEPTANCE AND ROUTINE TEST

All acceptance and routine tests as stipulated in the IEC-60840 and IS: 7098 (Part-III) / shall be carried out by the supplier in the presence of purchaser's representative. Sample shall be selected from offered lot, for not less than 10% (Ten percent) of nos. of cable drums. For conducting acceptance tests the next highest whole number shall be considered.

1.7 DOCUMENTATION

1.7.1 LIST OF DRAWINGS AND DOCUMENTS

The Bidder shall furnish one set of following documents along with his offer. The sectional view drawing shows general constructional features of power cable with details of materials/ conductor/ conductor screen / XLPE insulation / water swellable tape / Al. armouring/HDPE sheath etc.

- a) Literature for offered items.
- b) Type test reports

1.8 PACKING AND FORWARDING

1.8.1 The cable shall be packed in steel drums suitable for vertical/horizontal transport as the case may be, and suitable to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the items during transit, due to improper and inadequate packing. Wherever necessary, proper arrangement for lifting shall be provided.

Each consignment shall be accompanied by a detailed packing list containing the following information:

- i. Name of the consignee
- ii. Details of consignment
- iii. Destination
- iv. Total weight of consignment
- v. Handling and unpacking instructions
- vi. Bill of material indicating contents of package

1.11 TECHNICAL & GUARANTEED PARTICULARS

The Bidder shall furnish guaranteed technical particulars as called for in appendix-1 (Schedule-A) of this specification. Particulars, which are subject to guarantee, shall be clearly marked.

SECTION – 2

SPECIFICATION FOR CABLE TERMINATION ACCESSORIES

2.1 SCOPE:

- 2.1.1** This section covers the scope of general technical requirement of the 66 kV cable associated end termination kits, end termination connections, straight through joints, bonding cable, and accessories.

2.2 CABLE JOINTING ACCESSORIES (KITS):

- 2.2.1** 66 kV XLPE cable accessories shall be suitable for the specified size of the cable. The terminating kits shall be suitable for termination of the cables for outdoor installation.
- 2.2.2** 66 kV outdoor type heat shrink termination kit should be provided (refer to BOQ).
- 2.2.3** Cable end termination accessories (kits) shall be suitable for tropical climatic conditions as specified in section I.
- 2.2.4** The particulars of requirement of electrical performance of termination shall be suitable for power cable of specification mentioned in section I.
- 2.2.5** The end termination arrangement shall be of outdoor antifog type and shall be complete with all accessories, including conductor fittings, insulating, sealing, consumable items, filling materials, creepage extenders (skirts) and terminal studs etc. complete.
- 2.2.6** The kits must eliminate all disadvantages normally encountered in resin-based termination and jointing system i.e. shelf life limitations, health hazards, delay in curing.
- 2.2.7** These shall be weather resistant and should withstand the long-term weather effects either due to rain-polluted atmosphere or by heavily industrial and saline polluted atmosphere.
- 2.2.8** Suitable size of the kit shall be stated in case a particular size of cable kit does not confirm to the size of cable.
- 2.2.9** (a) The joints and termination shall have suitability to adopt the most suitable bonding arrangement including but not limited to link boxes with and without Sheath Voltage Limiters (SVL), Earth Continuity Conductor (ECC), etc. as per the latest IS/IEC/IEEE standards (refer to figure 1, 2, & 3).
- b) The successful bidder shall have to submit technical details along with the connection diagram, details of link boxes with and without SVL, etc. during detail engineering.
- c) The connecting cable from end terminations to link boxes shall be laid in heavy duty PVC / Polyethylene pipes at minimum depth of 1 meter from road level. (NA)

d) The link box shall be installed on structure OR pillar. The box shall be easily accessible for maintenance purpose in whether proof masonry manhole boxes. (NA)

e) The link boxes should be dustproof and weatherproof.

2.2.10 The Bidder shall furnish the detailed guaranteed technical Particulars of the accessories like termination kits offered by them in the prescribed format. Any additional details, if desired, shall also be submitted in the offer.

2.2.11 TYPE TESTS ON CABLE ACCESSORIES

The bidder shall submit the following type test in sequence for joints and termination as per IEC 60840.

2.3 TECHNICAL & GUARANTEED PARTICULARS

The Bidder shall furnish guaranteed technical particulars as called for in Appendix-I (Schedule-B) of this specification. Particulars, which are subject to guarantee, shall be clearly marked.

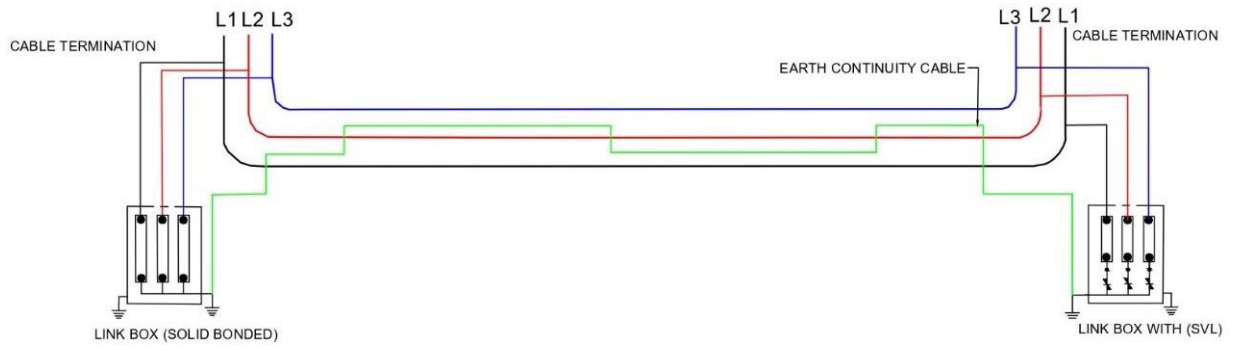


Figure 1: Typical Representation of Single-Point Bonded Cable System up to 1 km.

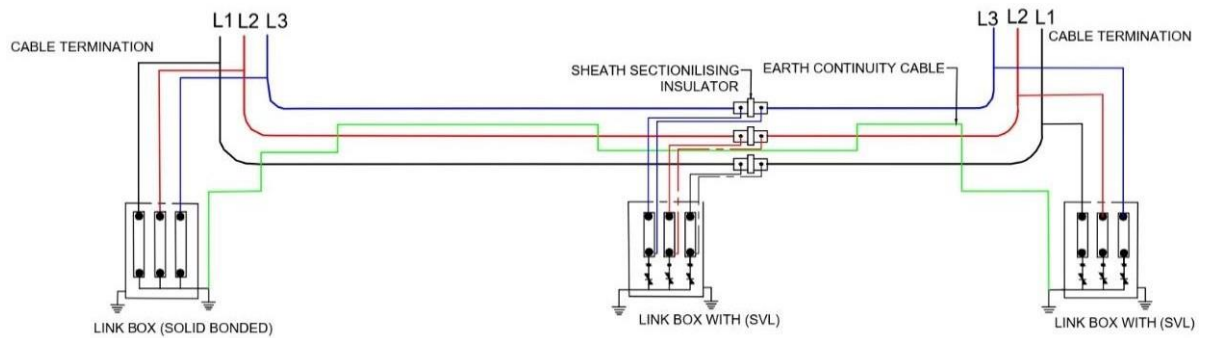


Figure 2: Typical Representation of Sectionalized Single-Point Bonded Cable System from 1 km to 2 km.

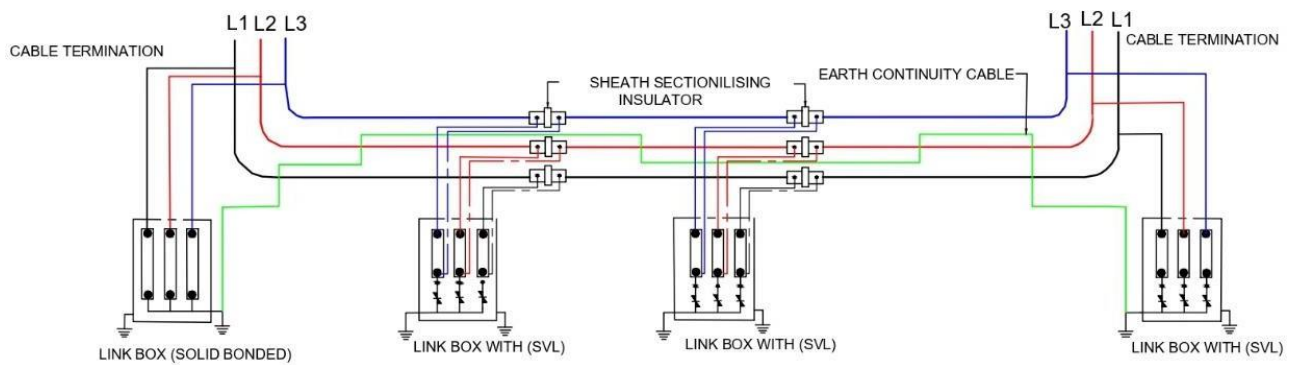


Figure 3: Typical Representation of Sectionalized Single-Point Bonded Cable System above 2 km.

SCHEDULE 'A'
GUARANTEED TECHNICAL PARTICULARS FOR POWER CABLES

Sr.No.	Particulars	66kV x 1C x 630 sq.mm
1	GENERAL	
1.01	Name of the supplier, if any	
1.02	Specifications and standards	
1.03	Specifications and standards (deg.C)	
2.00	CABLE	
2.01	Name of The Manufacturer	
2.02	Place of Manufacturer	
2.03	Cable type	
2.04	Applicable specifications and standard	
2.05	Voltage Grade	
2.06	No.of Cores and size (Nos.)	
2.07	Suitable for neutral earthed / unearthed system	
2.08.a	Describe technique for conductor screen, insulation and insulation screen	
2.08.b	Permissible voltage and frequency variation for Continuous current Carrying capacity in Amp.	
2.09	Continuous current carrying capacity in Amp.	
2.09.01	For site conditions :	
	1. Air (A)	
	2. Ground (A)	
	3. In Duct (A) at 30 Deg.C	
	4. In Trench (A)	
2.09.02	De-rating factors, for various conditions of laying , are not worse than those specified in applicable IS/IEC	
	De-rating factor for fire resistance treatment	
2.10	CONDUCTOR:	
2.10.01	Material	
2.10.02	Shape of conductor	

2.10.03	Nominal cross section area (sq.mm)	
2.10.04	Number of wires (Nos.)	
2.10.05	Diameter of each wire (mm)	
2.10.06	Diameter of conductor (mm)	
2.10.07	Current carrying capacity	
	(a) On continuous basis	
	(b) S.C. Current for 1 sec basis (kA)	
2.11.00	CONDUCTOR SCREENING	
2.11.01	Type	
2.11.02	Material	
2.11.03	Continuous working temp. (°C)	
2.11.4	Minimum Thickness (mm)	
2.11.5	Maximum allowable temperature at termination of short circuit (°C)	
2.12.00	INSULATION	
2.12.01	Material	
	Thickness of insulation	
2.12.02	(1) Between cores (mm)	
	(2) Between cores and inner sheath (mm)	
2.12.03	Tolerances on thickness (percent) of insulation	
2.12.04	Diameter of core over insulation (mm)	
2.12.05	Specific insulation (ohm-cm) resistance at ninety (90) degrees centigrade	
2.12.06	Whether XLPE insulation dry gas cured or not	
2.13.00	INSULATION SCREENING	
2.13.01	Material	
	(1) Thickness of extruded semi conducting	
2.13.02	(2) Details of semi conducting water swellable tapes applied over core to be given	
	(3) Thicknesses of copper woven tapes (mm)	
	(4) Total thickness of tapes	
2.13.03	Diameter of cable over screen mm	
2.13.04	Whether insulation screen is removable without	

	application of heat	
2.14.00	METALLIC SHEATH:	
2.14.01	Material	
2.14.02	Type (seam weld / seamless (extruded)) (annular / spiral) (for reference)	
2.14.03	Thickness of metallic sheath (nom./min.) mm	
2.14.04	Current carrying Capacity of Aluminium sheath (a) On continuous basis (b) S.C. Current for 1sec basis(kA)	
	For corrugated aluminum sheath	
	i. Approx. Height of corrugation	
	ii. Approx. Pitch of corrugation	
	iii. Diameter of cable over trough	
	iv. Diameter of cable over gap	
	v. Nominal cross section area	
2.14.06	Filler Material	
2.15.00	OUTER SHEATH:	
2.15.01	Material	
2.15.02	Thickness of sheath (mm)	
2.15.03	Tolerance on thickness (mm)	
2.15.04	Overall diameter of cable (mm)	
2.16.00	Short circuit withstand capacity of offered cable	
2.16.01	Short circuit current (kA)	
2.16.02	Duration of short circuit (sec)	
2.17.00	Allowable/ attainable maximum conductor temperature (°C) when carrying continuous currents as per item 2.09.00 above	
2.18.00	Allowable/ attainable maximum conductor temperature (°C) at the termination of short circuit current as per item 2.19.00 above	
2.19.00	CABLE CONSTANTS:	
2.19.01	DC Resistance at 20 (twenty) degrees centigrade (ohm/km)	
2.19.02	AC Resistance at operating temperature (ohm/km)	

2.19.03	Loss tangent	
2.19.04	Dielectric constant	
2.20.00	Maximum cable charging current at normal operating voltage (Amp/km)	
2.21.00	Permissible overload capacity of cable	
	a) Conductor temperature	
	b) Ampere	
	c) Duration	
2.22.00	Are the offered 1 core cable guaranteed to perform satisfactorily under installation conditions specified in above sections. If yes, furnish relevant calculations.	
	(a) Induced voltage in the Aluminium sheath when	
	(1) Cable carrying rated load (Volts/km)	
	(2) Cable carrying SC current of 1 kA (Volts/km)	
2.23.00	Recommended minimum bending radius (mm)	
2.24.00	Safe pulling force (kg)	
2.25.00	Cable weight (kg/km)	
2.26.00	Length of cable per drum (mm)	
2.27.00	CABLE DRUM:	
2.27.01	Net weight (kg)	
2.27.02	Drum weight (kg)	
2.27.03	Shipping weight (kg)	
2.27.04	Marking on Outer Sheath	

Appendix-I**SCHEDULE 'B'**
GUARANTEED TECHNICAL PARTICULARS FOR POWER CABLE ACCESSORIES

Sr. No.	Particulars	66 kV
1	Name of Manufacturer	
2	Applicable Standards	
3	Nominal System Voltage	
4	Highest System Voltage	
5	Impulse Voltage at 95 to 100°C temperature	
6	Frequency	
7	AC High Voltage withstand test 15 min dry	
8	Partial Discharge Test at Ambient Pre-Stressed at 1.75U ₀ (67kV) 10sec Measured at 1.5U ₀ (57kV)	
9	Partial Discharge Test at Elevated (95-100°C) Pre-Stressed at 1.75U ₀ (67kV) 10sec Measured at 1.5U ₀ (57kV)	
10	Heating Cycle Voltage Test	
	a) Total Duration of one cycle	
	b) Duration of Heating period	
	c) Duration of natural cooling period	
	d) Temp. of conductor during heating	
	e) AC voltage applied during test	
	f) No. of cycles	
11	Short Circuit Current	
12	Creepage (outdoor)	
13	Shelf life	
14	Allowable kit storage temperature	
15	Accessories	
16	Method of Stress Control	
17	Tubing's & Molded parts	
18	Non-Tracking material	
19	Di-electric strength of insulating material	

Appendix-I

SCHEDULE 'C'
GUARANTEED TECHNICAL PARTICULARS FOR EARTHING CABLE

Sr. No.	Particular	
1	Name of Manufacturer	
2	Type of Cable	
3	Voltage Grade	
4	Reference Standard	
5	No. of Core & Size	
6	Conductor	
6.1	Material	
6.2	Nominal Cross Section Area	
6.3	Form of conductor	
6.4	Max. DC Resistance of conductor at 20 degree C.	
7	Conductor Screening	
7.1	Material	
7.2	Nominal Thickness	
8	Insulation	
8.1	Material	
8.2	Nominal Thickness	
9	Insulation Screening	
9.1	Non metallic	
9.2	Material	
9.3	Nominal Thickness	
9.4	Metallic	
9.5	Material	
9.6	Minimum Diameter / Thickness in mm	
10	Outer Sheath	
10.1	Material	
10.2	Nominal Thickness	
11	Electrical Parameters	
11.1	Short Circuit rating for 1 sec.	
11.2	Continuous current rating in Air / Ground	
11.3	Appx. Overall diameter in mm	
11.4	Appx. Weight in kg/km	
11.5	Embossing on Outer Sheath	
12	Applicable Acceptance Tests	

Appendix 2

LIST OF APPROVED MAKES

1. HT CABLES (66kV ABOVE)

- | | |
|------------------------------------|-------------|
| 1. RPG Cables (KEC International), | India |
| 2. Cables Corporation, | India |
| 3. KEI Industries Limited, | India |
| 4. Tenaga Cable Industries, | Malaysia |
| 5. Polycab Industries, Daman, | India |
| 6. Nexans, | France |
| 7. LS Cables and System, | South Korea |
| 8. Furukawa Electric Co., | Japan |

ADDITIONAL MAKE

- | | |
|--|-------|
| 1. GEMSCAB Industries Ltd., Delhi, | India |
| 2. Universal Cables Limited, M.P, | India |
| 3. Shandong Taikai International Engineering Co. Ltd., | China |

2.TERMINATION KITS

- | | |
|---|--------|
| 1. Vikram Power Technologies Pvt. Ltd. | India |
| 2. 3M Electro & Communication India Private Ltd., | India |
| 3. Nexans/Euro Mould, | Europe |

ADDITIONAL MAKE

- | | |
|--|-------|
| 1. Raychem RPG (P) Ltd., Gujarat, | India |
| 2. PCA Technologies Pvt. Ltd., Vadodara, | India |

CHAPTER XIV

SURGE ARRESTERS (TLA)

1.0 GENERAL

- 1.1 The Surge Arresters shall conform to IEC: 60099-4 except to the extent modified in the specification and shall also be in accordance with requirements under Project Description.
- 1.2 Arresters shall be of hermetically sealed units, self supporting construction, suitable for mounting on tubular support structures to be supplied by the Contractor.
- 1.3 The Surge Arresters shall be designed for use in the geographic and meteorological conditions as given in the Project Description. Surge arrestors shall be suitable for installation at a given altitude and shall be altitude corrected.

2.0 DUTY REQUIREMENTS

- (a) The surge arresters shall be of heavy-duty station class and gapless type without any series or shunt gaps.
- (b) The surge arresters shall be capable of discharging over-voltages occurring during switching of unloaded transformers, reactors and long lines.
- (c) 72.5 kV class arrester shall be capable of discharging energy equivalent to class 3 of IEC.
- (d) The surge arresters shall be suitable for withstanding forces.
- (e) The reference current of the arresters shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.
- (f) The surge arresters shall withstand lightning impulse withstand voltage (LIWL) corresponding to 72.5kV ($\pm 325\text{kVp}$).
- (g) The duty cycle of CBs installed in the system of the Purchaser shall be O - 0.3 sec – CO - 3 min - CO. The Surge Arrester shall be suitable for such circuit breaker duties in the system.

3.0 CONSTRUCTIONAL FEATURES

The features and constructional details of surge arresters shall be in accordance with requirement stipulated hereunder:

- (a) The non-linear blocks shall be of sintered metal oxide material. These shall be provided in such a way as to obtain robust construction, with

excellent mechanical and electrical properties even after repeated operations.

- (b) The surge arresters shall be fitted with pressure relief devices suitable for preventing shattering of porcelain housing and providing path for flow of rated fault currents in the event of arrester failure. Details shall be furnished in the bids along with quality checks.
- (c) The arresters shall not fail due to arrester porcelain contamination.
- (d) Seals shall be provided in such a way that these are always effectively maintained even when discharging rated lightning current.
- (e) Outer insulator shall be porcelain/polymer. The terminal connectors shall be feed through screw clamp type.

Housing shall be so coordinated that external flashover will not occur due to application of any impulse or switching surge voltage up to the maximum design value for arrester.

- (f) The end fittings shall be made of corrosion proof material and preferably be nonmagnetic.
- (g) The name plate shall conform to the requirements of IEC incorporating the year of manufacture.
- (h) The heat treatment cycle details along with necessary quality checks used for individual blocks along with insulation layer formed across each block are to be furnished. Metalizing coating thickness for reduced resistance between adjacent discs is to be furnished with additional information schedule of bid proposal sheets along with procedure for checking the same. Details of thermal stability test for uniform distribution of current on individual disc is to be furnished.
- (i) The manufacturer will submit Data for rejection rate of ZnO blocks during manufacturing/operation for the past three years.

4.0 FITTINGS AND ACCESSORIES

- (a) Arresters shall be complete with insulating base having provision for bolting to flat surface of structure.
- (b) Self contained discharge counters, suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit along with necessary connection. Suitable leakage current meters should also be supplied within the same enclosure. The reading of milliammeter and counters shall be visible through an inspection glass panel. The terminals shall be robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends. The design of the surge monitor shall be such that it is possible to tilt the surge monitor downwards by an angle of up to 45 degrees from Horizontal plane.

- (c) Microprocessor-based instruments for monitoring resistive current or wattloss of the arrester shall have to be supplied, if required.
- (d) Surge monitor consisting of discharge counters and milliammeters should be suitable to be mounted on support structure of the arrester and should be tested for IP55 degree of protection. The standard supporting structure for surge arrester should be provided with a mounting pad, for fixing the surge monitor. The surge monitor should be suitable for mounting on this standard mounting pad.
- (e) Grading/corona rings shall be provided on each complete arrester unit as required.

5.0 TESTS

- 5.1 The surge arresters should have been type tested as per IEC/IS and shall be subjected to routine and acceptance tests in accordance with IEC document. In the switching surge operating duty test, the samples shall be pre-heated to 70 deg. C, (instead of 60 deg. C. as given in IEC) prior to application of long duration surges for contamination test procedures outlined in ANSI : 062-11-1987 may be followed until IEC brings out alternate test procedure for the same.

The test reports of the type tests shall be submitted for the Purchaser's review.

- 5.2
- (a) **Acceptance Tests**
 - (1) Measurement of power frequency reference voltage of the arrester units.
 - (2) Lightning Impulse Residual voltage on arrester units (IEC clause 6.3.2).
 - (3) Internal Ionisation or partial Discharge test.
 - (b) **Special Acceptance Test**
 - (1) Thermal stability test on three sections (IEC Clause 7.2.2).
 - (2) Aging & Energy Capability test on blocks (procedure to be mutually agreed).
 - (3) Wattloss test.
 - (c) **Routine Tests**
 - (1) Measurement of reference voltage.
 - (2) Residual voltage test of arrester unit.
 - (3) Internal Ionisation test or partial discharge test.
 - (4) Sealing test.

- (5) Verticality checks on completely assembled Surge arresters as a sample test on each lot.

(d) **Test on Surge Monitors**

The Surge monitors shall also be connected in series with the test specimens during residual voltage and current Impulse withstand tests to verify efficacy of the same. Additional routine/ functional tests with one 100A and 10kA current impulse, (8/20 micro sec.) shall also be performed on the Surge monitor.

(e) **Test on insulators**

All routine tests shall be conducted on the hollow column insulators as per IEC – 60233.

6.0 SPARE PARTS AND MAINTENANCE EQUIPMENT

The requirement of spares is detailed in Price schedule.

7.0 TECHNICAL PARAMETERS

(A) 72.5kV CLASS SURGE ARRESTER

- | | |
|--|--|
| a) Rated arrester voltage | 60 kV |
| b) Nominal discharge | 10 kA of 8/20 microsecond wave |
| c) Minimum discharge Capability | 7kJ/kV (referred to rated arrester voltage corresponding to minimum discharge Characteristics) |
| d) Continuous operating Voltage at 50 deg.C. | 51 kV rms |
| e) Max. residual voltage at 10 kA nominal discharge current | 170 kVp |
| f) Long duration discharge class | As per IEC |
| g) High current short duration test value (4/10 micro second wave) | 100 kAp |
| h) Low current long duration test value (2000 micro sec) | 900A |
| i) Pressure relief class | A |

GUARANTEED TECHNICAL PARTICULARS OF SURGE ARRESTERS

Sl. No.	Description	Unit	Particulars
1.0	Name of Manufacturer and country		
2.0	Applicable standards		
3.0	Quantity		
4.0	Arrester type		
5.0	Rated voltage	kV	
6.0	Rated frequency	Hz	
7.0	Continuous Operating Voltage	kV	
8.0	Nominal discharge current (8/20 microsec wave)	kA	
9.0	Minimum discharge capacity	kJ/kV	
10.0	Residual voltage for steep current impulse (1/5 micro/sec)	kVp	
11.0	Maximum Residual Voltage at nominal discharge current		
12.0	Current impulse withstand		
12.1	High current impulse	kAp	
12.2	Long duration current impulse (peak current and virtual duration of peak)	A	
13.0	Pressure relief class		
14.0	Line discharge class		
15.0	One minute power frequency withstand voltage of arrester housing	kV	
16.0	Impulse withstand voltage of arrester housing	kVp	
17.0	Nominal creepage distance	mm	
18.0	Cantilever strength	kN	
19.0	Total height	mm	
20.0	Total weight	Kg	

8.0 TESTING AND COMMISSIONING

- 8.1 Shall perform all routine test as per the field Q.P of BPC and instructions of the equipment Supplier, if any.

LIST OF APPROVED MAKES

- 1. Lightning Arresters (LA)**
 1. Raychem RPG (P) Ltd., Gujarat, India
 2. HOGN Electrical Group Ltd., Zhejiang, China
 3. Shandong Takikai, Co. Ltd. China

- 2. Surge Arresters**
 1. Hitachi Energy India Ltd. (formerly ABB), India
 2. Elpro International Ltd., India
 3. Oblum Electrical Ltd., India
 4. Crompton Greaves Ltd., India (Not approved)
 5. Raychem RPG, India
 6. Orient Electric International Group, China
 7. ESPL, Kolkata, India