CORRIGENDUM -2 FOR NIT No: CMC/BR/25-26/FK/PR/KG/1296 for SUPPLY, LAYING, TESTING, COMMISSIONING & HANDING OVER OF 66KV 3CX300 SQMM CABLES WITH REQUIRED ACCESSORIES IN CONNECTION WITH CONVERSION OF 66 KV D/C O/H LINES TO UNDERGROUND ALONG WITH DISMANTLING AT NAJAFGARH, BODELLA, JAFARPUR & BIJWASAN LOCATIONS ON TURNKEY BASIS

CORRIGENDUM DATE: 03-09-2025

Sl. No.	Clause no	Page no	Description	Revised
1	Due date for Bid submission	1	Due date	Due date for bid submission has been extended up to 3:30 PM 09.09.2025
2	Section-I, RFQ	3	Table no.1 Scheme details	Estimated Cost corrected for scheme no. 3, 4 & 5. EMD value remains same. Total also corrected. Refer attached below table.
3	Appendix-I, Commercial Terms & Conditions- Supply, Payment Terms	48	a) 70% pro-rata of supply value shall be payable against R/A bills for supply of equipment and materials within 30 days against receipt of material at site b) 20% pro-rata after installation/erection of equipment duly certified by BRPL Project-in-charge c) 15% pro-rata after completion of successful acceptance testing, commissioning and Handing Over of the entire Installation and duly certified by BRPL Project-in-charge and submission of PBG of 10% of contract value valid up to Defect Liability period i.e.24 months from the date of Handing over of entire Installation Plus 3 months towards Claim period.	a) 70% pro-rata of supply value shall be payable against R/A bills for supply of equipment and materials within 30 days against receipt of material at site b) 20% pro-rata after installation/erection of equipment duly certified by BRPL Project-in-charge c) **10% pro-rata** after completion of successful acceptance testing, commissioning and Handing Over of the entire Installation and duly certified by BRPL Project-in-charge and submission of PBG of 10% of contract value valid up to Defect Liability period i.e.24 months from the date of Handing over of entire Installation Plus 3 months towards Claim period. **Refer revised appendix-I attached herewith**
4	Technical Specifications		Lightning Arrestor, Insulator, Conductor & Monopole	Technical Specs attached as Annexure-I

Table no.1: Scheme Details

S No.	Scheme Name	Scheme Description	Cable Length (Kms)	Estimated Value in (Rs Cr)	EMD Value In (Rs Lakhs)
1	Mehrauli-Bijwasan-Palam	66kV D/C O/H to U/G XLPE cable (25,200m) via Vrindavan Greens to Bijwasan Grid	25.2	20.36	20.36
2	Najafgarh-Jafarpur	66kV O/H to U/G XLPE cable (14,800m) from 220kV Najafgarh Grid to Tower No.16	14.8	12.13	12.13
3	Najafgarh-Bodela	66kV O/H to U/G XLPE cable (36,000m) from crematorium to Bodella-2 Grid on Nala Road	36	28.62	28.62
4	Najafgarh-Nangloi	Conversion of O/H feeders to U/G 3x300sq mm XLPE cable (28,000m)	28	24.24	24.24
5	Najafgarh-Nangloi WW	Conversion of O/H feeders to U/G 3x300sq mm XLPE cable (12,000m)	12	9.98	9.98
6	Najafgarh T18-T37	Partial conversion of O/H NJF-Nagloi/Nagloi WW to U/G XLPE cable (22,000m)	22	17.94	17.94
Total			**138 Kms**	**113.27 Cr**	**113.27 Lakhs**

Revised APPENDIX- I

COMMERCIAL TERMS AND CONDITIONS - SUPPLY

Sl No	Item Description	AS PER BRPL	BIDDER'S CONFIRMATION
1	Validity	120 days from the due date of submission or amended due date of submission	
2	Price basis	a) **Firm**, FOR Delhi store basis. Prices shall be inclusive of all taxes & duties, freight up to Delhi stores. b) Unloading at stores - in Bidder scope c) Transit insurance in Bidder scope	
3	Payment terms	a) 70% pro-rata of supply value shall be payable against R/A bills for supply of equipment and materials within 30 days against receipt of material at site b) 20% pro-rata after installation/erection of equipment duly certified by BRPL Project-in-charge c) 10% pro-rata after completion of successful acceptance testing, commissioning and Handing Over of the entire Installation and duly certified by BRPL Project-in-charge and submission of PBG of 10% of contract value valid up to Defect Liability period i.e. 24 months from the date of Handing over of entire Installation Plus 3 months towards Claim period.	
4	Completion time	06 months from date of LOI/Order	
5	Defect Liability period	DLP shall be 24 Months from the Date of Commissioning or 30 months from the date of delivery of final lot of supplies made, whichever is later. For Cable & Joints: The defect liability period shall be 60 months from the date of commissioning or 66 months from the date of delivery whichever is later. For other Equipment: As per technical Specification of equipment. If not specified, DLP shall be 24 Months from the Date of Commissioning or 30 months from the date of delivery of final lot of supplies made, whichever is later.	
6	Liquidated damages	0.5% (half percent) of the total price for every week of delay or part thereof for undelivered units subject to maximum of 10% of total contract value	
7	Contract Performance Bank Guarantee	10% (Ten percent) of the Contract Price valid up to completion period/handing over.	
8	Performance Bank Guarantee	10% (Ten percent) of the Contract Price valid up to 24 Months from Handing Over & Taking Over (HOTO) Date plus 3 months towards claim period.	

BSES

Technical Specification of

ACSR CONDUCTORS

(Insulated & Bare)

Specification no – BSES-TS-05-ACSR-R0

Rev:		0
Date:		04 Apr 2022
Prepared by	Abhishek Vashistha	
	Rohit Patil	
Reviewed by	Puneet Duggal	
	Amit Tomar	04.04.2022
Approved by	Gaurav Sharma	
	K. Sheshadri	04/04/22

Contents

1. SCOPE

1.1 This specification covers the design, manufacture, testing at manufacturer's works, packing and delivery at site of the ACSR conductor along with necessary accessories.

1.2 The conductor and its accessories shall be complete with all fittings and components necessary for the effective working and efficient performance and satisfactory maintenance under the various operating conditions specified. All such parts shall deemed to be included within the scope of supply where specifically included or not in this specification in the tender schedule. The successful bidder shall not eligible for any extra charge for such accessories.

1.3 The specification includes both insulated & un-insulated ACSR conductor. Following table suggest requirement of conductors under insulated & un-insulated type as per tender enquiry

Conductor name	Zebra	Goat	Panther	Wolf	Dog	Rabbit	Squirrel
Insulated	X	X	X	X	√	√	√
Un-Insulated	√	√	√	√	√	√	√

2. CODES AND STANDARDS

2.1 All equipment and material shall be designed, manufactured and tested in accordance with the latest applicable Indian Standard, IEC standard and CBIP manuals enlisted in the appendix 1, except where modified and / or supplemented by this specification.

2.2 Equipment and material confirming to any other standard, which ensures equal or better quality, may be accepted. In such case copies of English version of the standard adopted shall be submitted by the vendor with the offer

2.3 The electrical installation shall meet the requirement of Indian Electricity Rules as amended up to date; relevant IS code of practice and Indian electricity act. In addition other rules & regulations applicable to the work shall be followed. In case of any discrepancy the most stringent & restrictive one shall be binding.

2.4 The equipment offered shall in general comply with the latest issues including amendments of the standards enlisted in the appendix 1 but not restricted to it.

3. DESIGN

3.1 General

- All steel strands shall be smooth, uniform and free from all imperfections, such as spills and splits, die marks, scratches, abrasions and kinks after drawing and also after stranding.
- The finished material shall have minimum brittleness, as it will be subjected to appreciate vibration while in use.
- The steel strands shall be hot dip galvanized and shall have a maximum zinc coating of 240gms/sq.mm after stranding. The zinc coating shall be smooth, continuous of uniform thickness, free from imperfections and shall withstand three and a half dips after stranding in standard Price test.
- The steel wire rod shall be of such quality and purity that, when drawn to the size of the strands specified and coated with zinc, the finished strands shall be of uniform quality and have the same properties and characteristic as prescribed in relevant ASTM/IS/IEC standards.
- To avoid susceptibility towards wet storage stains (while rust), the finished material shall be provided with a protective coating of boiled linseed oil.
- The finished conductor shall have a smooth surface without any surface cuts, abrasions, scuff

marks and shall be free from dirt, grit etc.

- The Steel wire shall be made from materials produced either by the acid or basic Open Hearth process or by electric process. No steel wire drawn from 'Bessemer processes shall be used. The steel wire shall not contain sulphur or phosphorous exceeding 0.5% and the total of sulphur and phosphorous shall not exceed 0.085%.
- The steel strands shall be performed and post formed in order to prevent spreading of strands in the event of cutting of composite core wire. Care shall be taken to avoid damages to galvanization during performing and post forming operations.

3.2 MATERIALS

- The aluminium strands shall be hard drawn from electrolytic aluminum rods having a purity of not less than 99.5% and a copper content not exceeding 0.04%.
- The steel wire strands shall be drawn from high carbon steel wire rods produced by either the acid or basic open hearth process, the electric furnace process, or the basic oxygen process and shall conform to the following requirements as to the chemical composition:

Element	% composition
Carbon	0.50 to 0.85
Manganese	0.50 to 1.10
Phosphorus	Not more than 0.035
Sulphur	Not more than 0.045
Silicon	0.10 to 0.35

- The zinc used in galvanizing shall be electrolytic high grade zinc of 99.95% purity. It shall conform to and satisfy all the requirements of IS/IEC.

3.3 STANDARD LENGTH

- The standard length of the conductor shall be 3000 meters. A tolerance of +/-5% on the standard length offered by the Bidder shall be permitted. All lengths outside this limit of tolerance shall be treated as random lengths.
- Random lengths will be accepted provided no length is less than 70% of the standard length and the total quantity of such random length shall not be more than 10% of the total quantity ordered. When one number random length has been manufactured at any time, five (5) more individual lengths, each equivalent to the above random length with a tolerance of +/-5% shall also be manufactured and all the above six random lengths shall be dispatched in the same shipment. At any point, the cumulative quantity supplied including such random lengths shall not be more than 12.5% of the total cumulative quantity supplied including such random lengths. However, the last 20% of the quantity ordered shall be supplied only in standard lengths as specified.
- Bidder shall also indicate the maximum single length, above the standard length, he can manufacture in the guaranteed technical particulars of offer. This is required for special stretches like river crossing etc. The employer reserves the right to place orders for the above lengths on the same terms and conditions applicable for the standard lengths during the pendency of the Contract.

3.4 JOINT IN WIRES

- **Aluminium wires**
  No joints shall be permitted in the individual wires in the outer most layer of the finished conductor. However, joints in the 12 wire and 18 wire inner layer of the conductor shall be allowed but these joints shall be made by cold pressure butt welding and shall be such that no such way joints are within 15 meters of each other in the complete stranded conductor. The joints shall withstand a stress of not less than the breaking strength of individual strand guaranteed.

- **Steel Wires**
  There shall be no joint of any kind in the finished wire entering into manufacture of the non strand joint or strand splices in any length of the complete stranded steel core of the conductor.

3.5 INSULATON

S. No.	Particular	Data
1	Voltage Grade	1.1 kV
2	Insulation Material	XLPE
3	Nominal Thickness of Insulation	As per table 3 of IS 7098 P-1

4. QUALITY ASSURANCE

4.1 Vendor shall follow his standard procedures for quality assurance and control. These standard procedures including quality assurance plan shall be submitted to the purchaser for approval.

4.2 The procedures shall be in such a form as to clearly indicate the manufacturing sequence and major inspection points and to reference Bidder's test in inspection procedures.

4.3 Manufacturing and quality control procedures shall be available for audit to the Purchaser and / or its representatives at the place of manufacture.

4.4 The Purchaser and/or its representative reserves the right to inspect the equipment at the point of manufacture and witness factory and other such tests as may be necessary to ensure conformance to the specification.

4.5 The Purchaser and / or its representative shall inspect the Vendor facilities prior to award of contract.

4.6 The Purchaser and/or its representative may conduct surveillance of the Vendor facilities for compliance to his standard procedures of quality assurance and quality control while work is in progress.

5. INSPECTION AND TESTING

5.1 INSPECTION

- The purchaser's representative shall at all times be entitled to have access to the works and all places where conductor shall be manufactured and shall have full facilities for unrestricted inspection of the manufacturer works, raw materials and process of manufacture for conducting necessary tests as detailed herein.
- The manufacturer shall keep the Employer informed in advance of the time of starting and of the progress of manufacture of conductor in its various stages so that arrangements can be made for inspection.
- No material shall be dispatched from its point of manufacture before it has been satisfactory inspected and tested, unless the inspection is waived off by the purchaser in writing. In the latter

case also the conductor shall be dispatched only after satisfactory testing for all tests specified herein have been completed.

- The acceptance of any quantity of material shall in no way relieve the manufacturer of any of his responsibilities for meeting all requirements of the Specification and shall not prevent subsequent rejection if such material is later found to be defective.

5.2 TESTS

The following acceptance and routine tests and tests during manufacture shall be carried out on the conductor. For the purpose of this clause, the following shall apply

- Acceptance tests shall mean those tests which are to be carried out on samples taken from each lot offered for pre-dispatch inspection, for the purpose of acceptance of that lot.
- Routine tests shall mean those tests, which are to be carried out on each strand/spool/length of the conductor to check requirements which are likely to vary during production.
- Tests during manufacture shall mean those tests, which are to be carried out during the process of manufacture to ensure the desired quality of the end product.
- For all acceptance tests, the acceptance values shall be the values shall be the values guaranteed by the Bidder in the guaranteed technical particulars of his proposal or the acceptance value specified in this Specification, whichever is more stringent for that particular test.

5.3 **TYPE TESTS**

Supplier shall submit all Type test report with validity of 5 years, along with the bid. The entire test certificate as per relevant IS/IEC shall be submitted for purchaser review. In case type tests have not been conducted earlier the same has to be carried out without any cost implication to purchaser. Purchaser has the right of witnessing any of the tests for which the supplier has to give prior notice before the date of conducting such tests. The unit rates for each type of the tests to be carried out shall be indicated in the offer. Requirement of type test shall be as listed below. Type test charges shall not be included as part of main price to be indicated in the offer.

The following tests shall be performed on a typical length of conductor. The cost of these tests shall be quoted separately.

a) Surface condition test
b) Test for ultimate breaking load on stranded conductor
c) Stress strain test
d) Measurement of diameter of individual aluminium and steel wires.
e) Measurement of lay ratio.
f) Breaking load of individual wires
g) Ductility test
h) Wrapping test
i) Resistance test and
j) Galvanizing test

5.4 ACCEPTANCE TESTS

a) Visual and dimensional check by drum
b) Visual check for joints scratches etc and lengths of conductor by rewinding
c) Dimensional check on steel and Aluminium strands

d) Galvanizing test on steel strands
e) Torsion and elongation test on steel strands
f) Check for lay ratio of various layers
g) Breaking load test on steel and aluminium strands
h) Wrap test on steel and aluminum strands
i) DC resistance test on aluminium strands
j) UTS Test on welded joint of strands
k) Tensile test (For Aluminium)
l) Test for thickness of insulation
m) Tensile strength & elongation at break test for insulation
n) High voltage test
o) Insulation resistance (Volume resistivity) test

All above tests except (j-o) shall be carried out on aluminium and steel strands after stranding only.

5.5 ROUTINE TESTS

a) Check to ensure that the joints are as per Specification.
b) Check that there are no cuts, fins etc on the strands.
c) Check that drums as per Specification.
d) All acceptance test as mentioned above to be carried out on each coil

6. EMBOSSING & PRINTING

Following text shall be embossed on insulated conductor only

a) BSES, PO No. & Date, Manufacturing month & year, Type of Conductor- one each meter length
b) Printing of running meter No.- on each meter length- White colour

7. APPROVED VENDORS & SUPPLIERS OF RAW MATERIAL

S. No	Material	Approved Suppliers
1	Steel	TATA /SAIL
2	Aluminium	NALCO/BALCO/HINDALCO
3	Insulation	KLJ/KALPENA/DOW/HANWHA/BOREALIS

8. DOCUMENT SUBMISSION MATRIX

Document/Drawing submission shall be as per the matrix given below:

a. All documents/drawings shall be provided in soft copy only via mail or in returnable Pen drives
b. Language of the documents shall be English only.
c. Document check sheet compliance shall be the first sheet for each submission stage i.e. Technical bid, Drawing Approval, Pre Dispatch, Pre closure
d. No submission is acceptable without check list compliance.
e. Deficient/ improper or incomplete document/ drawing submission shall be liable for rejection.
f. Order of documents shall be strictly as per the check list.

g. Any document not included in the below table but necessary for detailed engineering shall be deemed to be included in bidder's scope

S No.	Detail of Document	Bid	Approval	Pre Dispatch
1	Guaranteed Technical Particulars (GTP)	Required	Required	
2	Deviation Sheet, if any	Required	Required	
3	Detailed cross sectional drawing of ACSR Conductor	Required	Required	
4	Dimensional drawing of drum	Required	Required	
5	Type test reports of offered type and rating of ACSR conductor	Required	Required	
6	BIS certificate	Required		
7	Complete cable catalogue	Required		
8	Make of Raw Materials	Required	Required	
09	Inspection test reports and Routine Test Certificates carried out in manufacturer's works			Required
10	Test certificates of all raw materials			Required
11	Calibration test reports of instruments			Required

9. ANNEXURE - I

CONDUCTOR DATA SHEET

S.N.	Particulars	Conductor Details						
1	Conductor Name	Zebra	Goat	Panther	Wolf	Dog	Rabbit	Squirrel
2	Stranding and wire diameter	54/3.18 mm Al. + 7/3.18 mm Steel	30/3.71 mm Al. + 7/3.71 mm Steel	30/3.0 mm Al. + 7/3.0 mm Steel	30/2.59 mm Al. + 7/2.59 mm Steel	6/4.72 mm Al. + 7/1.57 mm Steel	6/3.35 mm Al. + 1/3.35 mm Steel	6/2.11 mm Al +1/2.11 mm Steel
3	Number of strands							
3a	Core	1	1	1	1	1	1	1
3b	1st layer	6	6	6	6	6	6	6
3c	2nd Layer	12	12	12	12	6	--	--
3d	3rd layer	18	18	18	18	--	--	--
3e	4th Layer	24	--	--	--	--	--	--
4	Sectional	428.9 Sq.	324.30	212.10	158.10	105.00	52.88 Sq.	20.98 Sq.

	Area of Aluminum	mm	Sq. mm	Sq. mm	Sq. mm	Sq. mm	mm	mm
5	Total Sectional Area	484.5 Sq. mm.	400.00 Sq. mm	261.50 Sq. mm	194.90 Sq. mm	118.50 Sq. mm	61.70 Sq. mm	24.48 Sq. mm
6	Overall Diameter	28.62 mm	25.97 mm	21.00 mm	18.13 mm	14.15 mm	10.05 mm	6.33 mm
7	Approx. Weight							
7a	Aluminum	1186 kg/Km	878 kg/Km	587 kg/Km	428 kg/Km	287 kg/Km	145 kg/Km	58 kg/Km
7b	Steel	435 kg/Km	610 kg/Km	387 kg/Km	298 kg/Km	107 kg/Km	69 kg/Km	27 kg/Km
7c	Total	1621 kg/Km	1488 kg/Km	974 kg/Km	726 kg/Km	394 kg/Km	214 kg/Km	85 kg/Km
8	Calculated DC resistance at 20°C	0.06868 Ohm/Km	0.09106 Ohm/Km	0.13900 Ohm/Km	0.18710 Ohm/Km	0.27920 Ohm/Km	0.55240 Ohm/Km	1.39400 Ohm/Km
9	Minimum UTS	130.32 KN	137.00 KN	89.67 KN	67.34 KN	32.41 KN	18.25 KN	7.61 KN

Lay Ratio of Aluminum Conductors, Steel Reinforced

S. No.	**Conductor**	**No. of wire**		**Ratio of Aluminum Wire Diameter to Steel wire Diameter**	**Lay ratio to Steel core (6 wire ratio)**		**Lay ratio for Aluminum wire**					
							Outermost Layer		**Layer immediately beneath Outermost Layer**		**Innermost Layer of conductors with 3 Aluminum wire Layers**	
		Aluminum	Steel		Min	Max	Min	Max	Min	Max	Min	Max
1	Zebra	6	1		-	-	10	14	-	-	-	-
		6	7		13	28	10	14	-	-	-	-
		30	7		13	28	10	14	10	16	-	-
		42	7		13	28	10	14	10	16	10	17
		54	7		13	28	10	14	10	16	10	17

Diameter of Aluminum & Steel Strands

S. No.	Conductor Name	Aluminum			Steel		
		Nominal	Maximum	Minimum	Nominal	Maximum	Minimum
1	Zebra	3.18	3.21	3.15	3.18	3.24	3.12
2	Goat	3.71	3.74	3.68	3.71	3.76	3.65
3	Panther	3.00	3.03	2.97	3.00	2.94	2.06
4	Wolf	2.59	2.62	2.56	2.59	2.64	2.54
5	Dog	4.72			1.57		
6	Rabbit	3.35	3.32	3.38	3.35	3.42	3.28
7	Squirrel	2.11	2.13	2.9	2.11	2.15	2.07

10. ANNEXURE - II

VENDOR DATA (GURANTEED TECHNICAL PARTICULARS)(SEPARATE DATA SHEET SHALL BE SUBMITTED FOR EACH TYPE OF CONDUCTOR)

SI.NO.	DESCRIPTION	BSES Requirement	PARTICULARS
1	Name of the material offered	XLPE Insulated ACSR Conductor	
2	Maker's Name	Required	
3	Address and Phone No.		
4	Reference Standards	IS-398Pt-1, IS 1778 , IS 7098	
5	No.of strands/diameter of Galvanised steel wire/Al strand	Required	
6	Apporx.Dia over covered conductor		
7	Minimum Ultimate Tensile Strength of Conductor	18.25	
8	Direction Of Lay	Successive layers shall have opposite directions of lay outermost layer being Right Handed	
9	Lay ratio of Aluminum wire		
10	Continuous max. current rating of ACSR	Required	
	Conductor in still air at an ambient		
	temperature at 45 Deg C		
11	Temperature rise for the above current	Required	
12	Short Circuit current rating of ACSR	Required	
	Conductor for 1sec		
13	Module of elasticity of complete	79	

	Conductor		
14	Coefficient of linear expansion of	19.1x10^6	
	complete conductor		
15	Cross sectional area	Required	
16	Nominal aluminium area	Required	
16.1	Conductivity and Grade of Al	61% EC Grade	
16.2	% Composition of steel wire	As Per spec	
17	Chemical composition certificate from NABL approved lab	Required	
18	Minimum breaking load		
18.1	Aluminum strand (After Stranding)	Required	
18.2	Galvanised steel wire (After Stranding)	Required	
19	Total Conductor	Required	
20	Max.Working tension of conductor	75% of UTS	
21	Resistance of Al conductor at 20Deg	Required	
	C(Max)		
22	Weight		
22.1	Aluminium strand	Required	
22.2	Steel Strand	Required	
22.3	Conductor without insulation	Required	
22.4	Conductor with insulation	Required	
23	Purity of AL.rod in %age	Required	
24	Zinc coating on steel wire		
24.1	Grade of Zinc	Electrolytic High Grade Zinc not less Than 99.95% purity as per IS209-1992	
24.2	Min wt of Zinc Coating	Required	
24.3	No.& duration of dips of Zinc coating (Before Stranding)	Required	
25	Type of Insulation	XLPE Type as per IS 7098	
25.1	Nominal thickness of XLPE insulation	1.6	
25.2	Min thickness of XLPE insulation	1.5	
25.3	Color of XLPE insulation	Black	
25.4	Tensile strength of Insulation (Min)	12.5	
25.5	Percentage elongation at break of Insulation(Min)	200	
25.6	Insulation resistance test (Volume resistivity) Min	1x10^14 at 27deg C 1x10^12 at 90deg C	

26	Chemical composition test certificate of XLPE insulation material	Required, shall be weather proof and have property of protection against ultraviolet light having 2.5% black carbon content	
27	Drum	Required	
27.1	Ref IS	IS-1778-1980	
27.2	Gross weight of drum including weight of Conductor	Required	
27.3	Standard length of each piece of Conductor	3Km	
27.4	Non standard length	length	
28	Order quantity tolerance	(+/-)2%	Yes/No
29	Embossing	Name of manufacturer, Manufacture year, Manufacturing month, Type of conductor, BSES, P.o no & date	

BSES

TECHNICAL SPECIFICATION

OF

PIN AND DISC INSULATOR

SPECIFICATION NO.- BSES-TS-130-PDI-R0

Rev:		0
Date:		20 Sep 2022
Pages:		8
Prepared by	Shweta Dixit	
	Vani Sood/Rohit Patil	
Reviewed by	Puneet Duggal	
	Amit Tomar	
Approved by	Gaurav Sharma	
	Gopal Nariya	

Table of Contents

1. Scope of supply

The subject document is intended to specify technical as well various other requirements of (11kV/33kV) Pin Insulators and Disc Insulator. The Insulator shall be porcelain type pin insulator.

The supplier shall provide items to conforming to the subject specification. The materials offered shall be complete with all component and accessories which are necessary or usual for their efficient performance and satisfactory maintenance.

2. Codes & standards

All Material against this specification shall conform in all respect to the relevant Indian standard specification /International Standard Specification, with latest amendments from time to time, thereof, some of which are listed below:

Sr. No.	Standard	Title of the Standard
2.1	IS - 731	Porcelain insulators for overhead power lines with a nominal voltage greater than 1000 V
2.2	IS 2486	Metal fittings of insulators for overhead power lines with nominal voltage greater than 1000 V
2.3	IS 2629	Recommended Practice for hot dip galvanizing of iron and steel
2.4	IS: 2071	Methods of High Voltage Testing
2.5	IS: 2486-1989	Dimensional Requirements for Insulators fittings
2.6	IEC - 60815	Selection and dimensioning of High voltage insulators for use in polluted conditions

3. Service Conditions

3.1	Average grade atmosphere :	Heavily polluted, dry
3.2	Maximum altitude above sea level	1000 M
3.3	Design ambient temperature	50 deg C
3.4	Relative Humidity	90 % Max
3.5	Seismic Zone	4
3.6	Rainfall	750 mm concentrated in four months
3.7	Wind Pressure	195 Kg/m^2 up to 90m elevation as per IS 875-1975

4. Major Design Criteria

S.No.	Description	Requirement / Rating
4.1	Nominal system Voltage	11 kV , 33 kV
4.2	Corresponding highest system Voltage	12 kV , 36 kV
4.3	Frequency	50HZ ± 5%

4.4	No. of Phase	3
4.5	Fault level	31.5 kA for 3 Seconds

5. Insulator Features

5.1	General Requirement	i. The porcelain shall be free from defects, thoroughly vitrified and smoothly glazed. ii. The design of Insulator should be such that, stresses due to expansion or contraction in any part of the insulator shall not lead to its deterioration. The porcelain shall not engage directly with hard metal. iii. The glaze shall be Brown in colour –except for the screw threads and the top portion on which the conductor is supported during firing which may be left unglazed, all other surfaces of the insulator shall be effectively glazed. iv. The insulator shall be in one piece. v. The design of the fittings and the insulators shall be such that there is no local corona formation or discharges likely to cause the interference to either sound or vision transmission. vi. Cement used in construction of insulators shall not cause fraction by expansion or loosening by construction and propose care must be taken in “Curing”. The cement used shall not give rise to Chemical Reaction with the metal Fittings and its thickness shall be uniform as possible.
5.2	Pin Insulator	i. The Pin Insulators shall be so designed that the porcelain part should not directly come in contact with any hard material. ii. For this purpose the pin insulators shall be fitted with a Zinc/Lead thimble designed to fit with the small / large steel head of the pin

5.3	Disc Insulator	i. The Insulator discs shall be Cap and Ball Pin type with Ball and Socket coupling suitable for use in suspension or tension strings. ii. The disc insulators shall be of Ball & Socket type. iii. The cap of disc insulators shall be of Malleable Cast Iron whereas the ball pins shall be of Forged steel. iv. All metal parts shall be of Hot dip galvanized as per IS: 2633.

S.No.	Type of Insulator	Minimum Creepage Distance	Mechanical Failing Load
5.4	11 kV Pin Insulator	320 mm	10 KN
5.5	33 kV Pin Insulator	840 mm	10 KN
5.6	11kV Disc Insulator	380 mm	90KN
5.7	11kV Disc Insulator	380 mm	120 KN
5.8	11kV Disc Insulator	380 mm	160 KN

6. Marking

	Marking	The material shall be marked with the following description with indelible ink:
6.1		I. Manufacture's name or trade mark II. ISI mark with Certificate of Manufacturing License no.(CM/L) III. Purchase Order Number and date IV. The manufacturer's identification symbol V. BSES logo VI. Month and year of manufacturing VII. Minimum failing load in Newtons

7. Inspection &Testing

S.No.	Type Test	Type test of each rating of Pin/disc insulator shall be conducted from CPRI / ERDA lab. The Type test report

		shall not be more than 5 years old. Tests are as below – i. Visual examination. ii. Verification of dimensions. iii. Visible discharge test. iv. Impulse voltage withstand test (+ve wave & -ve wave) v. Impulse voltage flashover test (+ve wave & -ve wave) vi. Dry and wet power frequency voltage withstands test. vii. Dry and wet power frequency flashover voltage test. viii. Temperature Cycle test. ix. Mechanical failing load test. x. Puncture test. xi. Porosity test. xii. Galvanizing test.
7.1	Acceptance and Routine Tests:	I. Verification of dimensions and Visual examination. II. Temperature cycle test. III. Mechanical failing load test IV. Puncture test. V. Porosity test. VI. Galvanizing test. VII. Electromechanical failing load test. (for Disc. Insulator String only).

8. Packing & Delivery

8.0.0	Packing	
8.1.1	Packing protection	Against corrosion , dampness, heavy rains, breakage and vibration
8.1.2	Packing for accessories and spares	Robust wooden nonreturnable packing case with all the above protection and identification labels.
8.1.3	Packing identification label	In each packing case, following details are required: i) Individual serial number ii) Purchaser's name iii) PO number (along with SAP item code , if any)

		& date iv) Equipment Tag no. (if any) v) Destination vi) Manufacturer / Supplier's name vii) Address of manufacturer's / supplier's its agent viii) Description and quantity ix) Country of origin x) Month and year of manufacturing xi) Case measurement xii) Minimum failing load in kg xiii) Gross and net weight in kilograms xiv) All necessary slinging and stacking instructions.
8.1.4	Shipping	i) The bidder shall ascertain at an early date and definitely before the commencement of manufacture, any transport limitations such as weights, dimensions, road culverts, overhead lines, free access etc. from the manufacturing plant to the project site, and furnish to the purchaser confirmation that the proposed packages can be safely transported, as normal or oversize packages, upto the plant site. Any modification required in the infrastructure and cost thereof in this connection shall be brought to the notice of the Purchaser. ii) The seller shall be responsible for all transit damage due to improper packing.
8.1.5	Handling and Storage	Manufacturer instruction shall be followed. Detail handling & storage instruction sheet / manual need to be furnished before commencement of supply.

9. Deviation

Deviations from this Specification shall be stated in writing with the tender by reference to the Specification clause/GTP. In absence of such a statement, requirements of the specification shall be met without exception.

Annexure A Guaranteed Technical Particulars of Insulator:

Bidder to submit hard copy duly filled & signed along with techno commercial offer.

S No.	Characteristics	Vendor Data
1	Manufacture Name and Address	
2	Type of Insulator offered	
3	Minimum failing Load (kN)	
4	Standards according to which the material shall confirm	
5	Type of Glaze	
6	Dimension (mm)	
a.	Over all height	
b.	Max. Dia of Insulator	
c.	Top	
d.	Neck	
7	Minimum Creepage Distance (mm)	
8	Working Voltage	
9	Dry Power Frequency 1 Min. Withstand Voltage	
10	Wet Power Frequency 1 Min. Withstand Voltage	
11	Dry Power Frequency Flashover Voltage	
12	Wet Power Frequency Flashover Voltage	
13	Power Frequency puncher withstand Voltage	
14	Impulse flash over Voltage	
a.	positive KV	
b.	negative KV	
	Impulse withstand	
15	Visible discharge test Voltage	
16	No of threads per mm	
17	Type of threads	
18	Thimble	
a.	Type of material	
b.	Type	
19	Net weight of insulator	
20	Packing details	
	Marking details Min. failing load	
a.	Type of packing	
b.	No. of insulator/ Crate	
c.	Weight of each packing approx in Kg	
21	Marking details	
22	Furnished drawing No./relevant information if any	

CONTROLLED COPY

Reliance Energy
A Dhirubhai Ambani Enterprise

Specifications

Lightning Arrestor

(66 & 33 KV)

Specification no. : SP-LALU-01-R0

Prepared By		Reviewed By		Approved By		Revision	Date
Name	Sign.	Name	Sign.	Name	Sign.		
AAG		HPB		DG		0	29-Jan-2005

Index

General Specification

1.0.0 Codes & Standards

Materials, equipment and methods used in the manufacture of Lightning Arresters shall conform to the latest edition of following –

National Standards

Standard Code	Standard Description
	Indian Electricity Rules
	Indian electricity act
	CBIP manual
IS : 3070 – Part 3	Lightning Arresters for Alternating Current Systems
IS : 2071 - Part I	Method of high voltage testing
IS : 2629 - 1985	Recommended Practice for Hot-Dip Galvanizing of Iron and Steel
IS : 5621 - 1980	Hollow insulators for use in electrical equipment
IS : 6639 - 1972	Specification for Hexagon Bolts for Steel Structures

International Standards

Standard Code	Standard Description
IEC 60099-4-2001	Metal-Oxide Surge Arresters without gaps for AC Systems

Important Note :

In the event of direct conflict between various order documents, the precedence of authority of documents shall be as follows –

i. Specification including applicable codes, standards
ii. Guaranteed Technical Particulars (GTP)
iii. Approved Vendor Drawings

Sr. No.	Description	Requirement / Rating
2.0.0	**Design Features**	Common for both 66KV and 33 KV Lightning Arresters
2.1.0	Application	To be used for protection of transformers, circuit breakers and other sub-station equipment against lightning and switching surges.
2.2.0	Type of Lightning Arrester	Gap-less metal oxide type (ZnO Type).
2.3.0	Pressure relief device	Pressure relief device of class 40 KA shall be provided.
2.4.0	Accessories	Refer Annexure-A : Scope of Supply.
2.5.0	Mounting	LA mounting vertically on steel structures with insulating bases. Surge counters in weather proof enclosures suitable for mounting on structure of lightning arrester.
2.6.0	Line side Terminal Connectors	Suitable for ACSR Zebra/ Goat conductor (Refer GTP)
2.7.0	Ground Terminal Connectors	Suitable for 50x6 mm GS flat
2.8.0	Surge Counter	Non-resettable type
2.9.0	Name plate Marking	Following minimum information must be marked – i) Name of the manufacturer ii) Type and serial No. iii) Model No. iv) Rated voltage v) Max. continuous Operating Voltage vi) Nominal discharge current vii) Pr. Relief Class viii) Identification mark on each separately housed unit to enable it to be replaced in correct position after the multiunit arrester has been dismantled.
3.0.0	**Approved Make of Components**	Common for both 66KV and 33 KV Lightning Arresters
3.1.0	Insulators	JSI / WSI/ BHEL/ Modern/ Saravana

Sr. No.	Description	Requirement / Rating
4.0.0	**Testing & Inspection**	
4.1.0	Internal Test	Manufacturer shall carry out comprehensive inspection and testing during manufacture of the equipment.
4.2.0	Type test	The product must be of type tested quality. Type test reports shall be submitted for the type, size & rating of equipment offered along with bid. If the manufacturer's lab is accredited by govt./ authorised body then it shall be acceptable for type testing.
4.3.0	Routine test	As per relevant IS / IEC.
4.4.0	Acceptance test	As per relevant IS / IEC.
4.5.0	Test Witness	
4.5.1		The Buyer reserves the right to witness all tests specified on completed product.
4.5.2		The Buyer reserves the right to inspect the product at the Sellers works at any time prior to dispatch, to verify compliance with the specifications.
4.5.3		In-process and final inspection call intimation shall be given in advance to purchaser.
4.6.0	Tests on fitting and Accessories	As per Manufacturer's Standards and relevant IS / IEC.
5.0.0	**Drawing, Data & Manuals**	
5.1.0	To be submitted along with bid	The seller has to submit :
	i)	Tentative GA / cross sectional drawing of product showing all the views / sections.
	ii)	Detailed reference list of customers already using the offered product during the last 5 years with particular emphasis on units of similar design and rating.
	iii)	Completely filled GTP
	iv)	Deviations from this specification. Only deviations approved in writing before award of contract shall be accepted.
	v)	Details of manufacturer's quality assurance standards and program and ISO 9000 series or equivalent national certification.

Sr. No.	Description	Requirement / Rating
	vi)	Type test reports shall be submitted for the type, size & rating of product / equipment offered along with bid. In case the type test report for identical product is not available then type test report of nearby size/ rating shall be submitted for review. They shall be considered valid for 5 years from date of test performed on product /equipment.
	vii)	Complete product catalogue and Manual along with the bid.
	viii)	Recommended spare parts and consumable items for five years of operation with prices and spare parts catalogue with price list for future requirements
	ix)	Bill of material with make, model & quantity of items.
5.2.0	To be submitted after award of contract	The seller has to submit : for buyer's Approval (A) / Reference (R)
	i)	Program for production and testing (A)
	ii)	Guaranteed Technical Particulars (A)
	iii)	Calculations to substantiate choice of electrical, structural, mechanical component size / ratings (A)
	iv)	a) Detailed dimension drawing for all components, ge b) Drawings of major components (A) c) Rating and diagram plate (R)
	v)	Detailed loading drawing to enable the buyer to design and construct foundations (as applicable) (R)
	vi)	Transport / Shipping dimensions with weights (R)
	vii)	Detailed Bill of Materials for all fittings and accessories with their make, model & tag no. etc. (A)
	viii)	Detailed installation and commissioning instructions (R)
	ix)	Quality plan (A)
5.3.0	Submittals required prior to dispatch	The seller has to submit :
	i)	Inspection and test reports, carried out in manufacturer's works (R)
	ii)	Test certificates of all bought out items
	iii)	Operation and maintenance Instruction as well as trouble shooting charts/ manuals
5.4.0	Drawing and document sizes	Standard size paper A0, A1, A2, A3, A4
5.5.0	No of drgs. / Documents required at different stages	As per Annexure- A

Sr. No.	Description	Requirement / Rating
6.0.0	**Packing**	
6.1.0	Packing Protection	Against corrosion, dampness, heavy rains, breakage and vibration
6.2.0	Packing for accessories and spares	Robust wooden non returnable packing case with all the above protection & identification Label
6.3.0	Packing Identification Label	In each packing case, following details are required :
	i)	Individual serial number
	ii)	Purchaser's name
	iii)	PO number (along with SAP item code, if any) & date
	iv)	Equipment Tag no. (if any)
	v)	Destination
	vi)	Manufacturer / Supplier's name
	vii)	Address of Manufacturer / Supplier / it's agent
	viii)	Description and Quantity
	ix)	Country of origin
	x)	Month & year of Manufacturing
	xi)	Case measurements
	xii)	Gross and net weights in kilograms
	xiii)	All necessary slinging and stacking instructions
7.0.0	**Shipping, Handling & Storage**	
7.1.0	Shipping Information	The seller shall give complete shipping information concerning weight, size etc. of each package.
7.2.0	Shipping Constraints	The seller shall ascertain at an early date before the commencement of manufacture, any transport limitations such as weights, dimensions, road culverts, overhead lines, free access etc. from the manufacturing plant to the project site. Bidder shall furnish the confirmation that the proposed packages can be safely transported, as normal or oversize packages, upto the site. Any modifications required in the infrastructure and cost thereof in this connection shall be brought to the notice of the Purchaser.
7.3.0	Transit Damage	The seller shall be responsible for any transit damage due to improper packing.
7.4.0	Handling & Storage	Manufacturer's instructions shall be followed. Detail handling & storage instruction sheet / manual needs to be furnished before commencement of supply.

Sr. No.	Description	Requirement / Rating
8.0.0	**Quality Assurance**	
8.1.0	Vendor quality plan	To be submitted for purchaser approval
8.2.0	Inspection points	To be mutually identified & agreed in quality plan
9.0.0	**Progress Reporting**	
9.1.0	Outline Document	To be submitted for purchaser approval for outline of production, inspection, testing, inspection, packing, dispatch, documentation program
9.2.0	Detailed Progress report	To be submitted to Purchaser once a month containing
	i)	Progress on material procurement
	ii)	Progress on fabrication (As applicable)
	iii)	Progress on assembly (As applicable)
	iv)	Progress on internal stage inspection
	v)	Reason for any delay in total program
	vi)	Details of test failures if any in manufacturing stages
	vii)	Progress on final box up
	viii)	Constraints / Forward path
10.0.0	**Deviations**	
	i)	Deviations from this Specification are only acceptable where the Seller has listed in his quotation the requirements he can't or does not wish to comply with and the buyer has accepted in writing the deviations before the order is placed.
	ii)	In the absence of a list of deviations, it will be assumed by the Buyer that the Seller complies fully with this specification.

Annexure – A

1.0 Scope

Sr. No.	Description	Requirement / Rating
1.0.0	**Scope**	
1.1.0	Main Equipment	Design, manufacture, assembly & testing at manufacturer's works before dispatch, packing & delivery of Lightning Arresters rated up to 66 kV.
1.2.0	Accessories	
	i)	Supporting insulators for LA.
	ii)	Line terminal connectors.
	iii)	Surge counter with leakage current ammeter.
	iv)	Grounding terminal bracket
	v)	Necessary flanges alongwith all stainless steel hardware like nut bolts/ washers etc. for mounting of LA & surge Counter
	vi)	Suitably sized Cu flat or insulated copper cable for connection between LA and surge counter
	vii)	Any other item necessary or usual for efficient performance and satisfactory maintenance under the various operating and atmospheric conditions
1.3.0	Documentation	Submission of all drawings & documents pertaining to the equipment.
1.4.0	Site Supervision	Supervision of testing & commissioning of equipment at site.
1.5.0	Bill of Materials	Complete bill of materials shall be submitted in the following format.

Sr. No.	Purchaser Equipment Tag No. / Sap Code	Equipment Description	Location / Substation Name	Unit	Quantity
			e.g. Santacruz	Nos.	e.g. 1
			e.g. Alaknanda	Nos.	e.g. 6

2.0.0 Document Submission

Submission of drawings, calculations, catalogues, manuals, test reports shall be as follows :

Item Description	Along with offer	For Approval after award of contract	Final after approval	Remarks
Drawings	3 copies (Typical drgs)	4 copies + 1 Soft Copy	6 copies + 1 soft copy in CD	See Clause 5.0.0 for various drawings required
Calculations	3 copies (Typical)	4 copies + 1 Soft Copy	6 copies + 1 soft copy in CD	See Clause 5.0.0 for details
Catalogues	1 copy		6 copies + 1 soft copy in CD	
Instruction manual	1 copy		6 copies + 1 soft copy in CD	
Test Report	2 copies		6 copies + 1 soft copy in CD	Type test and routine test reports

3.0.0 Delivery Schedule

Sr. No.	Description	Requirement / Rating
i)	Delivery period start date	From date of purchase order
ii)	Delivery period end date	As agreed with supplier
iii)	Material dispatch clearance	After inspection by purchaser

Annexure – B

Ambient Conditions :

A) Mumbai

a)	Average grade atmosphere	Heavily polluted , salt Laden, dusty, humid with possibility of condensation
b)	Maximum altitude above sea level	1000 M
c)	Ambient Air temperature	Highest 45 deg C, Average 35 deg C
d)	Minimum ambient air temperature	20 deg C
e)	Relative Humidity	100 % Max
f)	Thermal Resistivity of Soil	150 Deg. C cm/W
g)	Seismic Zone	3
h)	Rainfall	3000 mm concentrated in four months

B) Delhi

a)	Average grade atmosphere	Heavily polluted, dry
b)	Maximum altitude above sea level	1000 M
c)	Ambient Air temperature	Highest 50 deg C, Average 40 deg C
d)	Minimum ambient air temperature	0 Deg C
e)	Relative Humidity	100 % Max
f)	Thermal Resistivity of Soil	150 Deg. C cm/W
g)	Seismic Zone	4
h)	Rainfall	750 mm concentrated in four months

Annexure – C1

Guaranteed Tech. Particulars for 66KV Lightning Arrester

Sr. No.	Description	Data By Purchaser	Data by Supplier
1	Name of manufacturer		
2	Type	Gapless, ZnO type, single pole, heavy duty, station class, pedestal mounted	
3	Model		
4	No. of units.		
5	Installation	Outdoor	
6	Application	Protection of Transformers, circuit breakers, lines and other outdoor S/S equipment.	
7	LA connection to system	Phase to earth	
8	Type of Conductor	ACSR Zebra / Goat	
9	Construction	Single Phase	
10	Rated voltage of arrester (KVrms)	60 KV	
11	Nominal discharge current (Amps) (8x20 micro sec. wave) peak value	10KA	
12	System Particulars		
i)	Highest System Voltage	72.5 KV	
ii)	Frequency	50HZ ± 5%	
iii)	System neutral	Solidly earthed	
iv)	Max. value of temporary over voltage & its max. duration		
	- Insulation level of equipment to be protected	325 KVp	
	- System short circuit level	31.5KA for 3 seconds.	
13	Maximum continuous operating voltage (MCOV)	52KV	
14	Impulse withstand current	100KAp	
15	Long Duration discharge class	3	
16	Minimum single impulse energy capability		
17	Maximum residual voltage at switching impulse current of 1KAp (30/60 micro sec. wave)	136 KVp	

Sr. No.	Description	Data By Purchaser	Data by Supplier
18	Max. residual voltage (1x20 micro sec. wave)		
i)	At 05 KAp		
ii)	At 10 KAp		
iii)	At 20 KAp		
19	Minimum creepage distance	31 mm/KV	
20	Pressure relief class	40KA	
21	Reference current (mA)		
22	Leakage current at COV (mA)		
	Resistive		
	Capacitive		
23	Dry and wet power frequency withstand voltage of arrester insulation (KVrms)		
24	Virtual steepness for front of wave for above (KV/micro sec.)		
25	Ratio of system voltage withstand level to protection level of surge arrester		
26	High current impulse withstand 4/10 micro second peak value (KV)		
27	Long duration current Impulse		
i)	Current peak.		
ii)	Virtual duration.		
28	Temporary Over Voltage Capacity (KVp)		
i)	At 0.1 Sec.		
ii)	At 1.0 Sec.		
iii)	At 10.0 Sec.		
iv)	At 100.0 Sec.		
29	Weight of complete unit (Kg)		
30	Height of complete unit from base to the line side (mm)		
31	Minimum recommended spacing between arresters Centro to Centro (mm)		
32	Clearance required from ground equipment at various heights of arresters unit (mm)		

Sr. No.	Description	Data By Purchaser	Data by Supplier
33	Earthing arrangement provided for earthing side of arresters.		
34	Mounting flanges dimensional details.		
35	Type and range of milli-ampere meter.		
36	Type and specifications of the surge connecters.		
37	Surge counter min. current for recording a lightning stroke	200 Amp	
38	Surge counter max. disch. Current withstand	100KA peak for 4/10 wave shape.	
39	Range of continuous leakage current at rated voltage with variation due to change in temperature & frequency		
40	Size and length of flexible Cu cable for connection between LA & surge counter		
41	Voltage time curve for thermal stability of LA after a stroke	To be provided	
42	Paint shade of surge counter housing	Polyurethane, 692 of IS-5	

Annexure – C2

Guaranteed Tech. Particulars for 33KV Lightning Arrester

Sr. No.	Description	Data By Purchaser	Data by Supplier
1	Name of manufacturer		
2	Type	Gapless, ZnO type, single pole, heavy duty, station class, pedestal mounted	
3	Model		
4	No. of units.		
5	Installation	Outdoor	
6	Application	Protection of Transformers, circuit breakers, lines and other outdoor S/S equipment.	
7	LA connection to system	Phase to earth	
8	Type of Conductor	ACSR Zebra / Goat	
9	Construction	Single Phase	
10	Rated voltage of arrester (KVrms)	30 KV	
11	Nominal discharge current (Amps) (8x20 micro sec. wave) peak value	10KA	
12	System Particulars		
i)	Highest System Voltage	36 KV	
ii)	Frequency	50HZ ± 5%	
iii)	System neutral	Solidly earthed	
iv)	Max. value of temporary over voltage & its max. duration		
	- Insulation level of equipment to be protected	170 KVp	
	- System short circuit level	26.3KA for 3 seconds.	
13	Maximum continuous operating voltage (MCOV)	25KV	
14	Impulse withstand current	100KAp	
15	Long Duration discharge class	3	
16	Minimum single impulse energy capability		
17	Maximum residual voltage at switching impulse current of 1KAp (30/60 micro sec. wave)	70 KVp	

Sr. No.	Description	Data By Purchaser	Data by Supplier
18	Max. residual voltage (1x20 micro sec. wave)		
i)	At 05 KAp		
ii)	At 10 KAp		
iii)	At 20 KAp		
19	Minimum creepage distance	31 mm/KV	
20	Pressure relief class	40KA	
21	Reference current (mA)		
22	Leakage current at COV (mA)		
	Resistive		
	Capacitive		
23	Dry and wet power frequency withstand voltage of arrester insulation (KVrms)		
24	Virtual steepness for front of wave for above (KV/micro sec.)		
25	Ratio of system voltage withstand level to protection level of surge arrester		
26	High current impulse withstand 4/10 micro second peak value (KV)		
27	Long duration current Impulse		
i)	Current peak.		
ii)	Virtual duration.		
28	Temporary Over Voltage Capacity (KVp)		
i)	At 0.1 Sec.		
ii)	At 1.0 Sec.		
iii)	At 10.0 Sec.		
iv)	At 100.0 Sec.		
29	Weight of complete unit (Kg)		
30	Height of complete unit from base to the line side (mm)		
31	Minimum recommended spacing between arresters Centro to Centro (mm)		
32	Clearance required from ground equipment at various heights of arresters unit (mm)		

Sr. No.	Description	Data By Purchaser	Data by Supplier
33	Earthing arrangement provided for earthing side of arresters.		
34	Mounting flanges dimensional details.		
35	Type and range of milli-ampere meter.		
36	Type and specifications of the surge connecters.		
37	Surge counter min. current for recording a lightning stroke	200 Amp	
38	Surge counter max. disch. Current withstand	100KA peak for 4/10 wave shape.	
39	Range of continuous leakage current at rated voltage with variation due to change in temperature & frequency		
40	Size and length of flexible Cu cable for connection between LA & surge counter		
41	Voltage time curve for thermal stability of LA after a stroke	To be provided	
42	Paint shade of surge counter housing	Polyurethane, 692 of IS-5	

Annexure – D

Recommended spares (Data by supplier)

List of recommended spares shall be submitted as follows –

Sr. No.	Description of spare part	Unit	Quantity
1		Nos.	
2		Nos.	
3			
4			
5			
6			

TECHNICAL SPECIFICATION

FOR

SITC of 33 and 66 kV Steel Monopole including ACSR Conductor and Accessories

Specification No. – SP-MP-172-R0

Prepared by		Reviewed by		Approved by		Rev	Date
Name	Sign	Name	Sign	Name	Sign		
Abhishek Vashistha		Gaurav Sharma		Ashwani Agarwal		R0	20.11.19

INDEX

1. SCOPE

This specification covers the requirement of Supply, Erection, Testing and Commissioning of 66 kV O/H Double circuit Monopole with associated works including all equipments/materials.

Detailed scope shall be as below:

1.1. Route Survey, Profiling and Monopole spotting and submission of detailed drawing.

1.2. Design, manufacture, testing at manufacturer's works (before dispatch), supply of Monopoles as specified.

1.3. Supply of Other Line items/ Accessories such as ACSR Goat conductor, Insulator strings, vibration dampers, hardware, earthing material, earth wire with accessories etc.

1.4. Bidder shall supply this material from BYPL approved vendors.

1.5. Erection of supplied steel tubular monopoles (including civil work) along with all related accessories as per the approved Monopole spotting/ alignment.

1.6. Erection of other Line items/ accessories such as ACSR conductor, Insulator strings, vibration dampers, hardwares, earthing material, earth wire with accessories etc.

1.7. Provision of Earthing of monopole and earth wire.

1.8. Testing and commissioning of 33/66KV lines on rated voltage.

1.9. Dismantling of existing Tower line structure and transport to scrap store of BYPL.

Any item, which may not have been mentioned herein, but necessary for the satisfactory SITC of monopoles shall be deemed to be part of the requirements. The material shall have all essential features prescribed in relevant IS/International or equivalent Standards referred in this specification.

2. STANDARDS & CODES

Indian Standards	IS 5613 -for determining the clearance diagrams for the pole IS 802 - for sag tension and loading calculation IS 875- CEA Safety Regulation 2010
ASTM – American Society for Testing and Materials	A 36 /36 M Standard Specification for Structural Steel, Book 01.04 A 123 Specification for Zinc (Hot-Dip Galvanized) Coatings on iron and Steel Products, Book 01.06, 15.08 A 153 Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware, Book 01.06.15.08 A 572/572M Specification for High-Strength Low Alloy Columbium Vanadium Steels of Structural Quality A 780 Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
AWS – American	D1.1-92 Structural Welding Code – Steel. Specification for Carbon Steel Covered Arc-Welding Electrodes A5.17-89. Specification for Carbon Steel Electrodes and Fluxes for

Welding Society	Submerged Arc- Welding
American Society of civil engineers	ASCE SEI 48-05 - Design of Steel Transmission Pole Structures.
ISO – International Standards Organization	ISO 9001-Quality System Model for Quality Assurance in Design/Development, Manufacture and Testing ISO 9002-Quality System Model for Quality Assurance in Production, installation and Servicing
Full scale testing	IEC 60652 – 2002

These codes and standards set forth the minimum requirements which may be exceeded by vendor if, in vendor's judgment and with purchaser's acceptance, superior designs and materials are available for successful and continuous operation of equipment as required by this specification.

3. SERVICE CONDITIONS

Monopole to be supplied against this specification shall be suitable for satisfactory operation under the following conditions-

3.1	Average grade atmosphere	Heavily polluted, Dry
3.2	Maximum altitude above sea level	1000M
3.3	Relative Humidity	100%
3.4	Ambient air temperature	Highest 50 Deg C Average 40 Deg C Minimum 0 Deg C
3.5	Operating temperature	0 Deg C - 50 Deg C
3.6	Rainfall	750mm concentrated in four months
3.7	Seismic Zone	4

4. DESIGN REQUIREMENT

The designs of multi circuit and double circuit steel monopole towers and their extensions should be conforming to the design parameter specified herein. The scope of supply of towers also includes supply of design calculations and test reports for towers and extensions including detailed structural/shop drawings of towers, extensions and stub-setting templates and design

and drawings of foundations in various types of soil, sag templates, sag tension chart for conductor and ground wire etc.

The fabricated steel poles shall include base plate with its required accessories, monopole body (including extensions, if required), Cross Arms. Monopole shall be joined with friction clip or Flanged joint. Cross Arms shall be Polygonal with structural jointing arrangement. The accessories shall include strain plates, D-shackles with nuts, bolts and washers, U-Bolts with nuts and washers, space washers, links for providing attachment to the Earth Wire and Conductor, anti climbing devices and any other equipment/ material / article to complete the works as per the scope given in this specification.

The monopoles shall be fully galvanized. Provision will be made at the Cross Arm level for fixing phase plates and Bird guards. The holes for fixing the Earthing bonds at the peak and for grounding the monopoles at bottom or any other holes, which the purchaser may require, shall be provided at the convenient locations on the monopoles.

4.1. TYPE OF MULTI CIRCUIT AND DOUBLE CIRCUIT STEEL MONOPOLE

The multi circuit monopole will have four circuits (twelve cross arms), self-supporting, designed for the specified loading conditions. There will generally be following type of towers:-

Monopole type MP0: Tangent type tower with maximum line deviation up to 2° to be used with Single/ Double suspension insulator strings.
Monopole type MP30: Medium angle tower to be used for line deviation from 2° to 30° with Single/Double tension insulator strings.
Monopole type MP60: Heavy angle tower to be used for line deviation from 30° to 60° and also as dead end tower with Single/Double tension insulator strings.
The double circuit Monopole will have two circuits (six cross arms), self-supporting, designed for the specified loading conditions. There will generally be following type of towers:-

Monopole type MP0: Tangent type tower with maximum line deviation up to 2° to be used with Single/Double suspension insulator strings.
Monopole type MP30: Medium angle tower to be used for line deviation from 2° to 30° with Single/Double tension insulator strings.
Monopole type MP60: Heavy angle tower to be used for line deviation from 30° to 60° and also as dead end tower with Single/Double tension insulator strings.

The bidder may also quote for up gradation work using the categories of Monopole available with him. In such case the bidder will have to indicate the type of monopoles and extensions proposed to be used by him for up gradation work.

4.2. EXTENSIONS

Monopole shall be designed and provided with extension of 3M height for use with all type of towers.

DESIGN: 33/66 KV as per ASCE-48-05

The bidder will furnish a design as per ASCE-48-05 for each of the offered monopoles with extensions based on the loading conditions indicated herein. The suspension monopoles shall be designed with using `I' suspension string.

Please note that in case of suspension monopole, full wind condition is to be considered in the design in case of security requirement i.e. transverse load due to wind action on tower structure, conductors, ground wire and insulators shall be computed as per clause 12.1.1(i), page 10 of IS 802 (Part-1) 1995 or its latest. The mechanical tension of conductor/ground wire is the tension corresponding to 100% design wind pressure at everyday temperature or 36% design wind pressure at minimum temperature after accounting for drag coefficient and gust response factor as defined in clause 11.3.2.1 page 10 of IS 802 (Part-1) 1995 or its latest. The longitudinal loads shall correspond to 50% of mechanical tension of conductor as per clause 11.3.2.1, page 10 of IS 802 (Part-1):1995 or its latest.

The monopole to be designed considering Goat ACSR one conductor per phase (although bidder need to supply ACSR) in vertical formation and one ground-wire of (7/3.15mm) galvanized stranded steel wire of 95kg/sq.mm grade placed on the top of the monopole. The conductor and ground-wire particulars are given in following sections.

The ground-wire at its suspension point shall provide a shielding angle of 30° with respect to the top most conductors. The drop of ground-wire suspension assembly should be taken into account so as to determine the shielding angle.

The minimum mid-span vertical clearance between Ground-wire and Conductor in still air shall be as per relevant standards.

Note: The Monopoles shall be designed as per site requirements and following the guidelines of statutory clearances, CEA's Regulations, 2010.

4.3. DESIGN SPANS:

The wind span for the purpose of computing the wind load on conductors and ground-wire shall be indicated in the offer. Similarly the weight span shall also be indicated.

4.4. WIND LOAD:

The wind load on conductors, earth wire, towers and insulator strings shall be taken as per recommendations of IS: 802 (Part-I) -1995 or its latest with latest revision thereof, for following conditions:-

4.4.1. Wind zone - 4 (47mtrs/sec)

4.4.2. Reliability level –

4.4.2.1. 1.0 (one) for Double circuit monopoles

4.4.2.2. 2.0 (Two) for Multi circuit monopoles.

4.4.2.3. Terrain category - 2 (two)

4.5. TEMPERATURE VARIATION:

The maximum working tension of conductor and ground-wire and the uplift conditions shall correspond to the minimum temperature of 0° C. The maximum conductor sag and ground clearance beneath should correspond to the maximum working temperature of 75° C. The Maximum ground-wire temperature shall be taken as 53°C.

4.6. STRUCTURAL STEEL:

Structural steel shall be conforming to IS: 2062 Grade E-355 JR and weld able quality and plates less than 6mm thickness (to be used for pack plate and pack washer) shall be as per IS: 1079.

Permissible stresses in the design of self-supporting steel monopole tower shall conform to ASCE: 48-05 latest edition or equivalent code of latest edition. The sheets/plates of monopole shall be from TATA/SAIL/JSW/ESSAR.

4.7. LOADS ON MONOPOLES:

Transmission lines are subjected to various loads during their life time. These loads are classified into three distinct categories, namely

4.7.1. Climatic Loads: related to the reliability requirements.

These are random loads imposed on monopole, insulator string; conductor & ground wire due to action of wind on transmission line & do not act continuously. Climatic loads shall be determined under either of the following climatic conditions whichever is more stringent:

100 percent design wind pressure at every day temperature 32°C)

or

36 percent design wind pressure at minimum temperature (0°C)

4.7.2. Failure containment Loads: related to security requirements.

4.7.2.1. Anti-Cascading Loads:

Cascade failure may be caused by failure of items such as insulators, hardware, joints failures of major components such as monopoles, foundations, conductor due to defective material or Workman ship or from climatic overloads sometimes from casual events such as misdirected aircraft, avalanches, sabotage etc. The security measures

adopted for containing cascade failures in the line is to provide angle monopoles at specific intervals which shall be checked for Anti-cascading loads.

4.7.2.2. Anti-cascading checks:

4.7.2.2.1. Suspension monopoles shall be checked for narrow front wind with a wind speed of 2.0 of basic wind speed.

4.7.2.2.2. Angle monopoles shall be checked for the following anti cascading conditions with all the conductors & ground wire intact only on one side of the monopole.

4.7.2.3. Transverse load: These loads shall be taken under no wind condition.

4.7.2.4. Vertical Load: These loads shall be the sum of weight of conductor/ground wire as per weight span of intact conductor/ground wire, weight of insulator strings and accessories.

4.7.2.5. Longitudinal Loads: These loads shall be the pull of conductor/ground wire at every day temperature & no wind applied simultaneously at all points on one side with zero degree line deviation.

4.7.2.6. Torsional & Longitudinal Loads:

These loads are caused by breakage of conductors and/or ground wire. All the monopoles shall be designed for these loads for the number of conductor(s) and or ground wire considered broken as per provisions of this specification.

4.7.3. Construction & Maintenance Loads: related to safety requirements.

These are loads that are imposed on monopoles during constructions & maintenance of transmission lines.

Computation of Loads & loading combinations: The computation of loads is to be done in line with relevant provisions/ sections of IS 802- 1992 (latest amendment)

4.7.4. Tension Limits:

Conductor/ground wire tension at everyday temperature & without external load, should not exceed the following percentage of the ultimate tensile strength of the conductor:

Initial unloaded tension 22 percent, Final unloaded tension 25 percent provided that the ultimate tension under everyday temperature & 100 percent design wind pressure or

minimum temperature & 36 percent design wind pressure does not exceed 70 percent of the ultimate tensile strength of the conductor/ground wire.

4.7.5. TRANSVERSE LOADS

The transverse loads due to wind on conductors and ground-wire shall be calculated

4.7.5.1. The normal span for normal Multi-circuit monopoles (i.e. upto +6m Extension) shall be 200m

4.7.5.2. The wind span is the sum of the two half spans adjacent to the support under consideration. For normal horizontal spans this equal to normal ruling span.

4.7.5.3. The weight span shall be shown in the design report of monopoles. The horizontal distance between the lowest point of the conductors on the two spans adjacent to the tower. The weight spans considered for design of monopoles is as below.

Under broken wire conditions 50% of the intact span and 10% of the broken span shall be assumed as wind span. In addition to this, transverse loads due to line deviation, wind on towers, and wind on insulator strings should also have to be taken into consideration in the design of the towers.

4.8. CONDUCTOR AND GROUND-WIRE SAG:

The maximum sag for the conductor should be calculated for 75° C and no wind with an allowance of 3% of maximum sag to allow for plotting and sagging errors.

4.9. BROKEN WIRE CONDITIONS:

Following broken wire conditions should be assumed in the design of towers:

4.9.1. Suspension monopole- Any one of power conductor broken or ground-wire broken which ever condition is more stringent for design.

4.9.2. Angle Monopole for 2° to 30° deviation - Any two of power conductors broken on the same side and on the same span or any one of the power conductor broken and ground-wire broken on the same span whichever combination constitutes the most stringent condition for design of a particular member.

4.9.3. Angle Monopole for 30° to 60° deviation - Any Three power conductors broken on the same side and on the same span or any two of the power conductor broken and ground-wire broken on the same side and same span which ever combination constitutes the most stringent condition for design. Further this monopole shall also be designed for dead end condition i.e. all conductors and ground wire broken on the same side and same span.

In all type of monopoles, the power conductor's supports and ground-wire supports should be designed for broken wire conditions also.

4.10. FACTORS OF SAFETY FOR MONOPOLES:

The factors of safety for design of monopoles shall be as under:

4.10.1. Normal condition – 1.5.

4.10.2. Broken wire condition – 1.5

4.10.3. DEFLECTION CRITERIA: 1.5% of the height under safety normal condition and 5% of height under ultimate wind for both suspension and tension poles.

4.11. BOLTS, NUTS AND WASHERS:

The design of the monopoles should be based on use of HRH mild steel hot dip galvanized bolts having grade 6.8(for foundation bolts)/8.8(for connection bolts). The connections shall be designed on the basis of use of 24 mm dia bolts. The spring washers shall be provided for insertion under all nuts. These washers shall be of steel, electro galvanized, and positive lock type and of minimum 3.5mm thickness.

The nuts shall be forged and tapped after galvanizing and then lubricated. The nuts shall be chamfered on one face only, the other face shall be machined.

The bolts and nuts shall be free from forging and threading defects such as cuts, splits, burrs, bulging, taper, eccentricity, loose fit etc.

The bolts shall be threaded up to standard length only as per relevant Indian Standard and not to full length.

The bolts and nuts shall confirm to IS 1367-1971 Part-III and Part-IV, IS 12427, IS 1363-92, IS 1367 Part-XIII with latest amendment.

The spring washers after coiling shall be suitably heat treated so as to result in the finished washer having hardness 43 to 50 HRC when tested in accordance with IS 1586- 1968.

The surface of the washers shall be free of scales and burrs. The washers shall be coiled without any kinks (except for the shape with turned-up ends). The ends of the washer shall not about when the washers are compressed. The ends shall be so served as to prevent tangling.

4.12. LOAD ON FOUNDATIONS:

The foundations shall withstand the ultimate loads on the superstructure as specified in this specification, for the full footing reactions along the stub angle slopes obtained from the structural stress analysis.

The reactions on the footing shall be composed of the following types of loads for which they shall be required to be checked.

4.12.1. Maximum tension or uplift.

4.12.2. Maximum compression or down-thrust.

4.12.3. Maximum horizontal shear or side thrust.

The additional weight of concrete in the footing below ground level over the earth weight and full weight of concrete above the ground level in the footing and embedded steel parts will also be taken into account adding to the down-thrust.

4.13. STABILITY ANALYSIS:

The following primary types of soil resistances shall be assumed to act in resisting the loads imposed on the footings in earth:

4.13.1. Resistance against uplift:

The uplift loads will be assumed to be resisted by weight of earth in an inverted frustum of a conical pyramid of earth on the footings pad whose sides make an angle equal to the angle of repose of the earth with the vertical in average soil. The weight of concrete embedded in earth and that above the ground will also be considered for resisting the uplift. In case where the frustum of earth pyramids of two adjoining legs super-impose each other, the earth frustum will be assumed truncated by a vertical plane passing through the centre line of the tower base.

4.13.2. Resistance against down-thrust:

The down -thrust loads combined with the additional weight of concrete above earth will be resisted by bearing strength of the soil assumed to be acting on the total area of the bottom of the footings.

4.13.3. Resistance against side thrust:

The bidder shall describe in detail the methods followed by them to check the stability of foundations for horizontal shears.

OR

Side-thrust along with the relevant reference (IS or other standard) in support of their contentions.

In addition to the strength design, stability analysis of the foundation shall be done to check the possibility of failure by over-turning, uprooting, sliding and tilting of the foundation.

4.14. DESIGN OF FOUNDATIONS:

The bidder is requested to submit the design of foundations. It is recommended to give Single Pile Foundation.

4.15. FACTORS OF SAFETY FOR FOUNDATION:

The minimum factors of safety/overload factor based on the ultimate strength of the foundation material when the monopoles are under full working loads under various conditions of loadings combined with the other loads specified for the foundations shall be as given below:-

4.15.1. Normal condition - 1.5

4.15.2. Broken wire condition - 1.5

5. TESTING AND INSPECTION:

All routine & acceptance tests shall be witnessed by the purchaser/his authorized representative.

5.1. Routine Test:

The bidder shall provide material wise routine test reports conducted at their work along with the standards application in their bid.

5.2. Acceptance tests:

Acceptance test shall be carried out as per technical specification and relevant standard.

Following compulsory acceptance test shall be carried out on all items before the supply of material:

5.2.1. Visual Inspection

5.2.2. Physical verification

5.2.3. Dimensional checks

5.3. Type Test

The bidder shall furnish the type test certificates from CPRI/ERDA for suspension & angle Monopoles, as per relevant standards and specification.
The bidder shall furnish the type test certificates from CPRI/ERDA for ACSR conductor, Earth wires, Insulators and All hardware fittings and other accessories as per relevant standards and Technical specification.
Type tests should have been conducted in certified Test laboratories not exceeding 5 years from the date of opening the bid, In the event of any discrepancy In the test reports, i.e. any test report not acceptable, same shall be carried out without any cost implication to the Purchaser.

6. DRAWINGS, DATA & MANUALS SUBMISSION

7.1	Documents	copy of signed documents also shall be part of entire soft file (e-file) or CD.)
7.2	Along with the Bid	Vendor shall submit signed 3 sets (plus 1 set of soft copy) of following documents: a) GTP (duly filled-in) (as per Annexure - A). b) Cross-sectional drawings for components Assembly c) Type Test Certificates d) Complete Catalogue and Instructions. e) Any other document.
7.3	After Award of Contract	Vendor shall submit signed 2 sets (plus 1 set of soft copy) of above mentioned documents within 15 days, for Purchaser's approval.
7.4	"As-Built" documents	Final signed "As-built" documents for the equipment in 3 sets (hardcopy), 1 no. soft copy and 1 no. CD. These documents shall include signed Routine & Acceptance Test Certificates also.
7.5	Packing, Marking, Shipping, Handling and Storage	Every component/kit/box shall be properly sealed/ packed for protection against damage.
7.6	Transit damage	The seller shall be responsible for any transit damage due to improper packing.
Refer Annexure 5 for list of drawing submission		

7. Quality Assurance (QA)

8.1	Vendor's Quality Plan (QP)	To be submitted for Purchaser's approval as well along the bid.
8.2	Sampling Method	Sampling Method for quality checks shall be as per

		manufacturer's standard practice / ESI guidelines and Purchaser's prior approval shall be taken for the same.
8.3	Inspection Hold-Points	To be mutually identified, agreed and approved in Quality Plan.

8. Deviations

9.1	Deviations	A) Deviations from this specification can· be acceptable, only where the Seller has listed in his quotation the requirements he cannot, or does not, wish to comply with and which deviations the Buyer has agreed to in writing, before any order is placed. B) In the absence of any list of deviations from the Seller, it will be assumed by the Buyer that the Seller complies with the Specification fully

ANNEXURE-1

GURANTEED TECHNICAL PARTICULARS of ACSR Conductor (SEPARATE DATA SHEET SHALL BE SUBMITTED FOR EACH TYPE OF CONDUCTOR)

SI.NO.	DESCRIPTION	BYPL Requirement	PARTICULARS
1.	Name of the material offered	ACSR GOAT	
2.	Maker's Name	Required	
3	Address and Phone No.		
4	Reference Standards	IS-398 Pt-3, IS-7098 Pt-1, IS 17778-80	
5	No. of strands/diameter of Galvanized steel wire/Al strand	Required	
6	Apporx. Dia over covered conductor		
7	Minimum Ultimate Tensile Strength of Conductor		
8	Direction Of Lay	Successive layers shall have opposite directions of lay outermost layer being Right Handed	
9	Lay ratio of Aluminum wire		
10	Continuous max.current rating of Conductor in still air at an ambient temperature at 45 Deg C	Required	
11	Temperature rise for the above current	Required	
12	Short Circuit current rating of ACSR	Required	

	Conductor for 1sec		
13	Module of elasticity of complete conductor		
14	Coefficient of linear expansion of complete conductor		
15	Cross sectional area	Required	
16	Nominal aluminum area	Required	
16.1	Conductivity and Grade of Al	61% EC Grade	
16.2	% Composition of steel wire	As Per spec	
17	certificate Chemical composition from NABL approved lab	Required	
18	Minimum breaking load		
18.1	Aluminum strand (After Stranding)	Required	
18.2	Galvanized steel wire (After Stranding)	Required	
19	Total Conductor	Required	
20	Max.Working tension of conductor	75% of UTS	
21	Resistance of Al conductor at 20Deg C(Max)	Required	
22	Weight		
22.1	Aluminum strand	Required	
22.2	Steel Strand	Required	
22.3	Conductor without insulation	Required	
22.4	Conductor with insulation	Required	
23	Purity of AL.rod in %age	Required	
24	Zinc coating on steel wire		
24.1	Grade of Zinc	Electrolytic High Grade Zinc not less than 99.95% purity as per IS209-1992	
24.2	Min wt of Zinc Coating	Required	
24.3	No.& duration of dips of Zinc coating (Before Stranding)	Required	
25	Drum type		
25.1	Ref IS	IS-1778-1980	
25.2	Gross weight of drum including weight of conductor	Required	
25.3	Standard length of each piece of conductor	3Km	
25.4	Non standard length	1% of the ordered quantity & no length less than 50% of the standard length	

ANNEXURE-2

GUARANTEED TECHNICAL PARTIULAR of POLYMERIC INSULATORS

Sl. No.	Descriptions	Unit	Data to be filled by Manufacturer
1	Name & address of manufacture		
2	Weight of single unit	Kg	
3	Size and designation of ball & socket assembly	mm	
4	Core diameter	mm	
5	Tolerance on core diameter	±mm	
6	Nominal length (section length)	mm	
7	Tolerance on Nominal length	±mm	
8	Dry arcing distance	mm	
9	Number of sheds	nos	
10	Sheds profile (type)		
11	Shed spacing	mm	
12	Sheds profile (regular alternating)		
13	Shed diameter	mm	
14	Tolerance on shed diameter	±mm	
15	Minimum creepage distance	mm	
16	Tolerance on creepage distance	±mm	
17	Guaranteed mechanical strength	KN	
18	Routine mechanical load	KN	
19	Materials		
a	FRP Rod		
b	Weather sheds with % contents of silicon		
c	Housing		
d	End Fitting		
e	Grading Ring		
20	Minimum thickness of sheath covering over the core	mm	
21	Power frequency withstand voltage of single unit		
a	Dry	KV (rms)	
b	Wet	KV (rms)	
22	Power frequency flashover voltage of single unit		
a	Dry	KV (rms)	
b	Wet	KV (rms)	
23	Impulse withstand voltage of single unit (dry)		
a	Positive	KV (peak)	
b	Negative	KV	

		(peak)	
24	Impulse flashover voltage of single unit (dry)		
a	Positive	KV (peak)	
b	Negative	KV (peak)	
25	Purity of zinc used for galvanizing end fittings	%	
26	Number of dips which the end fittings can withstand in standard preece test	Nos.	
27	Certified test report of accelerated ageing test of 5000 hours (enclosed) (appendix-C of IEC-61109)	Yes/No	
28	Drawings Enclosed	Yes/No	

ANNEXURE – 3

GUARANTEED TECHNICAL PARAMETERS OF HTGS EARTH WIRE

Sl No.	Particulars	Data to be filled by Vendor
1	Particulars of single steel wire before stranding	
a)	No. of wires	
b)	Diameter (mm)	
c)	Tolerance	
d)	Minimum elongation in 100 mm length	
e)	Breaking load (Kg.)	
f)	Minimum ultimate tensile stress (Kg/mm2)	
g)	D.C. resistance at 20 deg. C (Ohm/Km)	
2	Stranded Wire	
a)	Length of lay (Max-Min)	
b)	Overall diameter of Earth wire(mm)	
c)	Area of cross section of Earth wire	
d)	Breaking load (Kg.)	
e)	Resistance in Ohms per Km. at 20 deg. C.	
f)	Modulus of elasticity of Earth Wire(Kg/cm2)	
g)	Weight of Earth wire (Kg/Km)	
h)	Co-efficient of linear expansion (per deg. C)	
3	Quality of zinc used (Specify the grading and percentage)	
4	Coating of zinc on wires In Gms. Per sq. mtrs	
5	Standard Length	

ANNEXURE-4

GUARANTEED TECHNICAL PARTICULARS OF HARDWARE FITTINGS FOR ACSR GOAT CONDUCTOR AND EARTH WIRE FOR LINE

GTP of Hardware fittings to be provided by vendors

ANNEXURE-5

LIST OF DRAWINGS TO BE SUBMITTED for APPROVAL

S.No	Document / drawing description
1	Dimensional Drawing of offered monopole with design calculation
2	Route map of proposed 33/66KV line to be diverted and associated work of 33/66KV line
3	Details of earthing arrangement.
4	Number plate
5	Circuit plate
6	Phase plate
7	Danger Board
8	Bird guard
9	Anti climbing device
10	Flexible Bond for earth wire.
11	Cross sectional drwg for Conductor
12	Cross sectional drwg for earth wire
13	33/66KV Single & Double suspension insulator string hardware for ACSR conductor
14	33/66KV Single & Double tension insulator string hardware for ACSR conductor
15	Hardware fittings for Earth wire
16	Mid span compression joint for ACSR Conductor
17	Vibration damper for ACSR Conductor
18	Repair sleeve for ACSR conductor
19	Mid span compression joint for earth wire(if any)
20	Vibration damper for earth wire(if any)
21	Repair sleeve for earth wire(if any)
22	Polymeric Insulators
23	Design calculations & drawing of earthing for monopole and earthwire