PQR (Pre- Qualification Requirement)

1. The party should be manufacturer of HT/LT Aerial Bunched Cables or their authorized distributor/ dealer/ supplier.
2. The party should provide last three year ITR/Balance sheet ending March 2017.
3. The party shall have the experience for HT/LT Aerial Bunched Cables supply to any Govt./PSU /Private Organization and provide the supporting documents of the same (The copy of PO/ Work Order. The PO/Work Order must not be older than 03 Years from the date of opening of tender).
4. PO/Work Order submitted should be in name of manufacturer/ distributor/ dealer/ supplier.
5. Authorized distributor/dealer/supplier of HT/LT Aerial Bunched Cables shall submit authorization letter from concerned manufacturer.
6. Authorization latter submitted should not be later than enquiry floating date of BHEL

Note: BHEL reserves the right to verify the submitted certificate from issuing authority at any stage of tender.

TECHNICAL SPECIFICATIONS FOR X-LINKED POLYETHYLENE INSULATED L.T. (1.1KV) AERIAL BUNCHED CABLES

1.0 SCOPE:

This specification covers design, manufacture, testing at manufacturer's works before despatch, transportation, supply and delivery of ISI marked 1100 V grade XLPE insulated, LT Aerial Bunched Cables for overhead lines.

2.0 COMPOSITION OF THE CABLE:

The composite cable shall comprise three single-core Power cables with one street lighting core twisted over an insulated messenger wire for use as overhead distribution feeders, suitable for use on 3-Phase AC System conforming to IS-14255/1995 with up to date amendments.

Each single-core Power cables should be XLPE insulated stranded compacted circular aluminium conductors.
Street lighting core (if any) should be XLPE insulated stranded compacted circular aluminium conductor.
Messenger Conductor should be stranded compacted circular aluminium alloy conductor & will carry the weight of the cable.

3.0 APPLICABLE STANDARDS:

Unless otherwise stipulated in this specification, the following standard with latest amendment shall be applicable:

IS 14255-1995 and its amendments	Specification for Aerial Bunched Cables for working Voltage up to & including 1100 Volts.
IS : 8130-1984 and its Amendments	Specification for Conductors for Insulated Electric Cables and flexible Cords.
IS : 398 (Part-IV)-1994 and its amendments	Specification for Aluminium Conductors for overhead transmission purposes: Aluminium Alloy Stranded Conductors (Aluminium- Magnesium – Silicon type).
IS:10418:1982 and its amendments	Specification for Drums for Electric Cables

4.0 RATED VOLTAGE:

The rated voltage of the cables shall be 660 V/1100 V.

5.0 DESCRIPTION OF THE CABLE

Description	
1100V Grade L.T. Aerial Bunched Cable with 3(three) Power Cores (Black coloured XLPE insulated Stranded, compacted Circular Aluminium Conductor, Core identification by one, two and three ridges) and one Neutral-cum-Messenger Core (Black coloured XLPE insulated stranded compacted circular Aluminium Alloy wire, Core identification by four ridges), with one street lighting core (XLPE insulated stranded compacted circular aluminium conductor without any identification mark) conforming to IS: 8130-1984, IS: 398(Part-IV)-1994 and IS:14255-1995 with latest amendments, if any.	1. LT AB Cable of size 3x95+1x16+1x70 sq. mm

6.0 GENERAL TECHNICAL REQUIREMENTS:

6.1 DETAILS OF PHASE/STREET LIGHT CONDUCTORS

The Aluminium Conductors shall be H4 grade class 2 complying with the requirements as specified in IS-8130-1984 **with latest amendments.** The phase and street light conductors shall be of multi stranded aluminium of compacted circular cross section. The aluminium shall comply with IS: 8130 with its amendments. The conductor shall be clean & reasonably uniform in size and shape and its surface shall be free from sharp edges.

6.1.1 INSULATION OF XLPE

The Conductor (with protective barrier, wherever applied) shall be provided with d r y c u r e d cross linked polyethylene (XLPE) conforming to the standard Specification as per IS: 14255/95 **with latest amendment**, when the cables are suitable for use where the combination of ambient temperature and temperature rise due to load, including temperature on exposure to direct sunlight results in conductor temperature not exceeding the following:

Normal continuous Operation	Short circuit Operation
90oC	250oC

The insulation shall be so applied that it fits closely on the conductor (or barrier, if any) and it shall be possible to remove it without damaging the conductor.

Average thickness of insulation shall not be less than the nominal value shown below in tabular form:

Nominal are of conductor (mm2)	Nominal thickness (ti)
16	1.2
25	1.2
35	1.2
50	1.5
70	1.5
95	1.5

The smallest of measured value of thickness shall not fall below the nominal value(ti) specified in above table by more than 0.1mm +0.1(ti)

Upper surface of Cable insulation material shall be black and suitable to Ultra Violet Ray resistant, salt laden sprays, chemical pollution, ageing effects, abrasion and mechanical & electrical stress at temperature upto 90oC in normal operation and 250oC under short circuit condition. The Carbon black content in XLPE insulation shall be 2.5%+0.5%.

6.1.2 DIMENSIONAL AND ELECTRICAL DATA

The standard sizes and technical characteristics for Single Core Power Cable is given below:

Nominal Cross sectional Area of Al. Conductor (sq. mm)	Maximum DC resistance at 20oC (ohm/km)	Minimum No. of Strand	Nominal Insulation Thickness (mm.)
16	1.91	6	1.2
25	1.2	6	12
35	0.868	6	1.2
50	0.641	6	1.5
70	0.443	12	1.5
95	0.32	15	1.5

Note : The resistance values given in the Table are the max. permissible one.

6.2 DETAILS OF MESSENGER-CUM-NEUTRAL WIRE :

The Messenger Conductor should be multi stranded Heat treated Aluminium Magnesium-Silicon Alloy Wires containing approximate 0.5% magnesium and 0.5% silicon conforming to IS-398 (Part- IV)/1984 **with latest amendment**.

The insulated messenger wire shall be of Stranded compacted Circular.

Messenger wire shall be suitably compacted to have smooth round surface to avoid damage to the other insulating sheath of phase conductor twisted around the messenger.

The technical characteristics of the messenger wire shall be as follows:

Nominal Cross sectional Area of Phase Conductor (sq. mm)	Nominal Area of Messenger Wire (sq. mm)	No. of Strand & Strand dia. (No./mm)	Dia. of Compacted Conductor (mm)	Maximum DC resistance at 20oC (ohm/km)
16	25	7/2.13	5.64	1.38
25	25	7/2.13	5.64	1.38
35	25	7/2.13	5.64	1.38
50	35	7/2.52	6.68	0.986
70	50	7/3.02	7.98	0.689
95	70	7/3.57	9.44	0.492

6.3 SPLICING IN WIRES:
Splices in wires shall generally comply with the requirements of IEC 1089. The Aluminium Alloy rods may be spliced by cold pressure butt welding before drawing provided the manufacturer can guarantee that the splice can develop 90% of the tensile strength of the spliced rod. Wires which breaks during stranding may be spliced by cold pressure butt welding provided that:

no two splices with completed conductor occur within 15 m of each other and no two splices in any individual wires are less than 150 m apart.

The finished splice shall be smooth and at no point shall the cross sectional area be less than that of un spliced wire. Splicing of the alloy wires on the stranding machine in order to utilise lengths of wires on reels shall not be permitted

6.4 DESIGNATION AND PARAMETERS OF FINISHED CABLES:
The designation and parameters of finished cables are given in the following table:

Sl. No.	Designation
1.	LT AB Cable of size 3x95+1x16 +1x70 sq. mm

7.0 LAYING UP :
Three Power Cores and one street lighting Core should be twisted over insulated messenger wire with right hand direction of lay. Lay ratio shall be as specified in IS:14255/1995
with latest amendment.

8.0 CORE IDENTIFICATION
Three Power Cores should be identified by Ridges one, two and three. Bare messenger wire should be identified by four ridges. Street lighting Core should be without any ridges.

9.0 CABLE IDENTIFICATION
Cables with XLPE insulation shall be identified throughout the length of the Cable by the legend "XLPE 90"and year of manufacture by a printed tape.

10.0 SEQUENTIAL MARKING :
Marking of the sequential length shall be provided on any one of phase cores by printing/ engraving. Weight of cable need not be provided on the core.

11.0 PACKING & MARKING :
The Cable shall be supplied on suitable sized wooden non-returnable drum of robust construction for each length of Cables as per IS: 10418. Manufacture will provide the Multiplying Factor considering the Lay Ratio of the cable to measure the length of cable in a drum. Sequential length of the core & the declared cable length shall be marked on the cable drum. Net weight & Gross weight shall be provided on the drum.
The standard Drum Length will be 500 mtrs. in each Drum for all sizes subject to a tolerance of +/- 5%.

TECHNICAL SPECIFICATIONS FOR X-LINKED POLYETHYLENE INSULATED AND PVC SHEATHED H.T. (11KV) AERIAL BUNCHED CABLES

1.0 SCOPE:
This specification covers design, manufacture, testing at manufacturer's works before despatch, transportation, supply and delivery of 11 KV grade XLPE insulated, screened all Aluminium conductor and PVC sheathed Power Cables, manufactured with dry cure technology with CCV system HT Aerial Bunched Cables for overhead lines.

2.0 COMPOSITION & DESCRIPTION OF THE CABLE:
The composite cable shall comprise three single-core Power cables twisted around Aluminium Alloy a bare messenger wire, which will carry the weight of cable.

Single-core Power cables should consists of stranded compacted Circular Aluminium Conductor screened with Black extruded semi-conducting Compound, natural coloured XLPE insulated core screened with Black extruded semi-conducting compound and one layer of copper tape and covered with Black extruded PVC.
Bare Messenger Conductor shall be stranded compacted Circular aluminium alloy conductor & will carry the weight of the cable. It shall be suitably compacted to have small surface to avoid damage to the outer insulating sheath of single core phase cables twisted around the messenger.

Aluminium Alloy wires shall be tested as per IS: 398(Part-IV)/1994.

3.0 DESCRIPTION OF THE CABLE

Description	
11KV (E) Grade Aerial Bunched Cable with 3(three) Power Cores {Stranded, compacted Circular Aluminium Conductor screened with Black extruded semi-conducting Compound, natural coloured XLPE insulated core screened with Black extruded semi-conducting compound and one layer of copper tape and covered with Black extruded PVC (Core identification by colour tape marking red, yellow & blue)} and one bare Messenger wire shall be Stranded compacted circular Aluminium Alloy conductor. The Cable should conform to IS: 8130-1984, IS:398(Part-IV)-1994, IS:7098(Part-II)-2011 & IS: 5831-1984 with up to date amendments, if any.	3x150+1x148 sq mm

4.0 RATED VOLTAGE:
The rated voltage of the cables shall be 6.35KV/11KV and the maximum operating voltage shall be 12 KV.

5.0 APPLICABLE STANDARDS:
Unless otherwise stipulated in this specification, the following standard with **latest amendment** shall be applicable:

IS:7098 (Part-II)-2011 and its amendment	Specification for Cross linked polyethylene insulated thermoplastic sheathed Cables- for working voltages from 3.3 KV up to and including 33 KV.
IS : 8130-1984 and its amendment	Specification for Conductors for Insulated Electric Cables and flexible Cords.
IS : 398 (Part-IV)-1994 and its amendment	Specification for Aluminium Conductors for overhead Transmission purposes: Aluminium Alloy Stranded Conductors (Aluminium-Magnesium- Silicon type)
IS:10418-1982 and its amendment	Specification for Drums for Electric Cables
IS: 5831-1984 and its amendment	Specification for PVC insulation and Sheath of Electric Cables.

6.0 GENERAL TECHNICAL REQUIREMENTS:

6.1 DETAILS OF SINGLE-CORE POWER CABLE

The cable conductors shall be H4 grade class 2 Aluminium Conductors complying with the requirements as specified in IS-8130-1984 **with latest amendments.**

The conductor shall be stranded compacted circular. Conductor shall be clean & reasonably uniform in size and shape and its surface shall be free from sharp edges.

Not more than two joints shall be allowed in any of the wires forming every complete length of conductor and no joint shall be within 300 mm. of any other joint in the same layer. Joints shall be brassed, silver soldered or electric or gas welded. No joint shall be made in the conductor, once it has been stranded.
Three Power Cores should be identified by colour tape marking (Red, Yellow & blue)

6.2 Conductor Screen

The conductor screen shall be non metallic & shall consists of a layer of extruded semi-conducting cross linked polyethylene (XLPE) compound of thickness not less than 0.5 mm.

6.3 Insulation of XLPE

The insulation shall be of cross linked polyethylene (XLPE) of nominal insulation thickness 3.6 mm. conforming to the physical, electrical and ageing properties of IS: 7098 (Part-II).

Cross-linking should be done by exposure to peroxide with **Nitrogen Curing CCV Line only** method with intention to ensure lowest tree formation. Only natural unfilled compound shall be used for insulation.

XLPE insulation shall be done by method of extrusion. The insulation shall be so applied that it fits closely on the conductor (or conductor screening or barrier, if any) and it shall be possible to remove it without damaging the conductor.

Normal continuous Operation	Short circuit Operation
900C	2500C

6.4 Insulation Screen

The insulation screening shall consist of two parts; namely metallic & non metallic.

Non metallic part shall consist of a layer of extruded semi-conducting compound and shall be applied directly over the insulation of each core. Thickness of non-metallic part should be 0.6 mm.

The metallic part shall be non magnetic and shall be applied over the non-metallic part of insulation screening of individual core. Metallic screening material shall be annealed Copper tape. Thickness of Copper tape should be minimum 0.06 mm.

6.5 Outer Sheath

Over the metallic screen the Cable shall be provided with extruded PVC outer sheath. The composition of the PVC compound for outer sheath shall be Type ST2 of IS-5831-1984 **with latest amendments**. The colour of the outer sheath shall be black. The nominal & minimum thickness of the sheath shall not be less than the standard values specified in the table No. 7 of IS-7098(Part-II)/1985. Outer surface of the Cable shall be ultra-violet Ray resistant.

7.0 Dimensional And Electrical Data

The standard sizes and technical characteristics for Single Core Power Cable is given below:

Nominal Cross sectional Area of Al. Conductor (sq. mm)	Maximum DC resistance at 200C ohm/km	Minimum no. of Strand	Nominal thickness of insulation (mm)	Max. Short Circuit Current for 1 sec. (KA)
35	0.868	6	3.6	3.4

50	0.641	6	3.6	4.72
70	0.443	12	3.6	6.7
95	0.32	15	3.6	8.96
120	0.253	15	3.6	11.32
150	0.206	15	3.6	14.16

Note : The resistance values given in the Table are the max. permissible one.

8.0 DETAILS OF MESSENGER (NEUTRAL CONDUCTOR)

Bare Messenger Conductor shall consist of aluminium alloy wires. Aluminium Alloy Wires shall be tested as per IS:398(Part-IV) /1994 **with latest amendments.**

Messenger Conductor shall be Stranded Circular & shall be suitably compacted to have smooth round surface to avoid damage to the outer insulating sheath of single core phase cables twisted around the messenger.

There shall be no joints in any wire of the stranded messenger conductor except those made in the base rod or wires before finally drawing.

The technical characteristics of the messenger wire shall be as follows:

Nominal Cross sectional Area of Phase Conductor (sq. mm)	Messenger Conductor (Stranded Al Alloy IS 398 Part-4)			Maximum DC resistance at 20oC (ohm/km)
	Nominal Area of Aluminium Alloy in Messenger Wire (sq. mm)	No. of Strand of Aluminium Alloy	Strand dia. of Aluminium Alloy (mm)	
35	70	7	3.57	0.48
50	70	7	3.57	0.48
70	70	7	3.57	0.48
95	70	7	3.57	0.34
120	125	19	2.89	0.27
150	148	19	3.15	0.23

9.0 LAYING UP :

Three Power Cores **having colour tape marking** shall be twisted over bare messenger wire with right hand direction of lay. This will from the Aerial Bunched Cable.

10. SEQUENTIAL MARKING :

Supplier shall provide non-erasable sequential marking of length on any one of phase cores by printing/engraving for each meter of length with sequential marking machine having automatic length measuring meter. The Cable supplied without sequential marking will not be accepted and no deviation shall be allowed under any circumstances

11. PACKING & MARKING :

The Cable shall be supplied in suitable non-returnable wooden drums of suitable size in standard lengths subject to a tolerance of +/- 5%. The ends of the Cable shall be sealed by means of non-hygroscopic sealing material.
The standard Drum Length will be 500 mtrs. in each Drum for all sizes subject to a tolerance of +/- 5%.