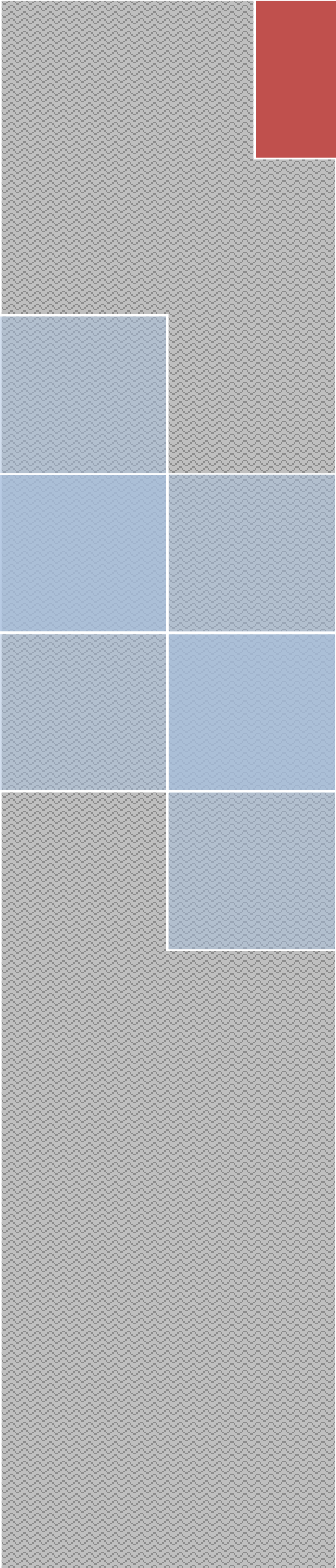


**TECHNICAL SPECIFICATIONS FOR PROCUREMENT OF
52,000 METERS LT XLPE ARMOURED CABLES AND 3,000 METERS HT XLPE
ARMOURED CABLES FOR 3X800 MW MEJA STPP, STAGE-II, BHEL MEJA SITE.**

Schedule no.	S. no.	Description of Item	Quantity	UoM
Schedule 1 (FOR LT CABLE)	1	3.5C x 185 sqmm ALUMINIUM LT XLPE ARMOURED POWER CABLE	3000	MTR
	2	3.5C x 70 sqmm ALUMINIUM LT XLPE ARMOURED POWER CABLE	2500	MTR
	3	3.5C x 25 sqmm ALUMINIUM LT XLPE ARMOURED POWER CABLE	5500	MTR
	4	3C x 2.5 sqmm COPPER LT XLPE ARMOURED POWER CABLE	4000	MTR
	5	1Cx10 sqmm Armoured copper PVC/XLPE insulated Power Cable	1000	MTR
	6	2Cx2.5sqmm size Armoured CU PVC/XLPE insulated Power Cable	10000	MTR
	7	2C x 6 sqmm ALUMINIUM LT XLPE ARMOURED POWER CABLE	19000	MTR
	8	3.5C x 35 sqmm ALUMINIUM LT XLPE ARMOURED POWER CABLE	3500	MTR
	9	3.5C x 95 sqmm ALUMINIUM LT XLPE ARMOURED POWER CABLE	3500	MTR
		TOTAL LT CABLES IN MTR.	52000	
Schedule 2 (FOR HT CABLE)	1	3C x 95 sqmm 11 KV UE XLPE ARMOURED CABLE IS 7098 PART-2 HT XLPE	3000	MTR
		TOTAL HT CABLES IN MTR.	3000	

Note:-

- 1) VOL I - TECHNICAL SPECIFICATIONS FOR LT CABLES → Pg. no. 2-15
- 2) VOL II – TECHNICAL SPECIFICATIONS FOR HT CABLES → Pg. no. 16-28



TECHNICAL CONDITIONS OF CONTRACT (TCC)

TECHNICAL SPECIFICATIONS FOR LT XLPE
ARMOURED CABLE (52000 MTR.) FOR 3X800 MW
MEJA STPP, STAGE-II, BHEL MEJA SITE.

BHARAT HEAVY ELECTRICALS LIMITED



VOL-I

TECHNICAL SPECIFICATIONS FOR LT XLPE ARMoured CABLE (52000 MTR.) FOR 3X800 MW MEJA STPP, STAGE-II, BHEL MEJA SITE.

S. No.	DESCRIPTION	Chapter
Volume-IA.3	Part-I: Contract specific details	
1	Project Information	Chapter-I
2	Scope of Works for LT Cables	Chapter-II
3	Standards Applicable for LT Cables	Chapter-III
4	General	Chapter-IV
5	Technical Specification for LT Cables	Chapter-V

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - I: Project Information

1.0 PROJECT INFORMATION

PROJECT: 3 X 800 MW MEJA STAGE-II

MEJA URJA NIGAM (P) LIMITED has awarded the work for 3x800 MW (Stage-II) on EPC basis.

Project Information and Scope is as follows:

Design, Engineering, Manufacture, Supply, Construction, Erection, Testing & Commissioning works for the EPC Package for Meja Super Thermal Power Project Stage-II (3 X 800 MW)

Particular	Details
Project Name	Meja Super Thermal Power Project – Stage-II
Project Capacity	3 × 800 MW = 2,400 MW (Supercritical Coal-Based Thermal Power Plant)
Owner	Meja Urja Nigam Private Limited
Joint Venture	50:50 Joint Venture of NTPC Limited and Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited
Location	Meja Thermal Power Project
District	Prayagraj
State	Uttar Pradesh
Fuel	Domestic Coal
Technology	Supercritical Steam Cycle
Cooling System	Closed Cycle Cooling with Cooling Towers
Project Type	Expansion of existing Stage-I (2 × 660 MW)

Note: - The bidder is advised to visit and examine the site of WORKS and its surroundings and obtain for himself on his own responsibility all information that may be necessary for preparing the bid and entering into the CONTRACT. All costs for and associated with site visits shall be borne by the bidder.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - II: Scope of Work for LT Cables

2.01 SCOPE OF WORK:

- a) This specification covers the design, manufacture, testing & inspection at manufacturer's works, proper packing, transportation, insurance during transit, delivery to site/ BHEL store of following cables as mentioned in different sections of this specification for the project as indicated in Project Information:

3.5Cx185 sqmm aluminium LT XLPE ARMOURED POWER CABLE
3.5Cx70 sqmm aluminium LT XLPE ARMOURED POWER CABLE
3.5Cx25 sqmm aluminium LT XLPE ARMOURED POWER CABLE
3C x 2.5 sq. mm COPPER LT XLPE ARMOURED POWER CABLE
1Cx10sqmm Armoured copper PVC/XLPE insulated Power Cable
2Cx2.5sqmm size Armoured copper PVC/XLPE insulated Power Cable

2Cx6 sqmm Aluminium LT XLPE ARMOURED POWER CABLE
3.5Cx35 sqmm Aluminium LT XLPE ARMOURED POWER CABLE
3.5Cx95 sqmm Aluminium LT XLPE ARMOURED POWER CABLE

Above cable is (As per relevant IS).

XLPE Insulated PVC Sheathed LT POWER CABLES as mentioned in different sections of this specification for the project as indicated in Project Information.

- b) This document covers the technical specification of cross-linked polyethylene (XLPE) insulated and PVC sheathed power cables for three phase system up to 1100 Volts.
c) The cables mentioned herein are four cores (three phase cores and one reduced neutral core) armoured cables.
d) Four core cables shall be acceptable if 3.5 core cables are not available.

2.02 CONDUCTOR

- a) The conductors shall be composed of aluminium wires complying with **IS: 8130: 1984** or latest amendments thereof (for aluminium conductor).
b) A protective barrier may be applied between the conductor and insulation. Such barriers when used shall be compatible with insulating material and suitable for the operating temperature of the cable.
c) Cables with reduced neutral conductor shall have sizes as given in Table 2 of **IS: 7098: 1988 (part-I)** or latest amendment thereof.

2.03 INSULATION

- a) The insulation shall be of cross-linked polyethylene conforming to the requirements given in Table 1 of **IS: 7098: 1988 (Part-I)** or latest amendment thereof.
b) The method of application of cross-linked polyethylene insulation shall be extrusion.
c) The average thickness of insulation shall not be less than the nominal value specified in Table 3 of **IS: 7098: 1988 (Part-I)** or latest amendment thereof.
d) The insulation shall be so applied that it fits closely on the conductor (or the barrier if any) and it shall be possible to remove it without damaging the conductor.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - II: Scope of Work for LT Cables

- e) The smallest of measured values of thickness of insulation shall not fall below the nominal value specified in Table 3 of **IS: 7098: 1988 (Part-I)** or latest amendment thereof by more than $0.1\text{mm} + 0.1 \times \text{nominal value}$.

2.04 CORE IDENTIFICATION

- a) Cores shall be identified as specified below for 3.5Core cables:
Red, blue, and yellow colouring of XLPE insulation for three phase conductors and black colouring of XLPE insulation for reduced neutral conductor.

2.05 FILLERS AND INNER SHEATH

- a) The fillers and inner sheath shall be of the following:
 - i. Vulcanized or un-vulcanized rubber, or
 - ii. Thermoplastic materials.
- b) Vulcanized or un-vulcanized rubber or thermoplastic material used for inner sheath shall not be harder than XLPE and PVC used for insulation and outer sheath respectively. Fillers and inner sheath materials shall be so chosen as to be compatible with the temperature ratings of the cable and shall not have deleterious effect on any other component of the cable.
- c) The inner sheath shall be applied by extrusion. It shall be ensured that it is as circular as possible.
- d) The inner sheath shall be so applied that it fits closely on the laid up cores and it shall be possible to remove it without damaging the insulation.
- e) The thickness of inner sheath shall be as given in Table 5 of **IS: 7098: 1988 (Part-I)** or latest amendment thereof.

2.06 ARMOURING

- a) Armouring shall be of Galvanized round steel wire.
- b) The galvanized steel wires shall comply with the requirements of **IS: 3975: 1979** or latest amendments thereof.
- c) Armouring shall be applied over the inner sheath.
- d) The galvanized round steel wire of the armouring shall be applied as closely as practicable.
- e) A binder tape may be provided on the armour.
- f) The dimensions of galvanized round steel wire shall be as specified in Table 6 of **IS: 7098: 1988 (Part-I)** or latest amendment thereof.
- g) The joints in armour wire shall be made by brazing or welding and the surface irregularities shall be removed. A joint in any wire shall be at least 300 mm from the nearest joint in any other armour wire in the completed cable.

2.07 OUTER SHEATH

- a) The outer sheath shall be of polyvinyl chloride (PVC) compound conforming to the requirements of Type ST2 of **IS: 5831: 1984** or latest amendments thereof.
- b) The outer sheath shall be applied over the armouring.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - II: Scope of Work for LT Cables

- c) The outer sheath shall be applied by extrusion.
- d) The outer sheath shall be of black colour.
- e) The thickness of outer sheath shall be not less than the minimum values specified in col 5 of Table 8 or latest amendments thereof of IS: 7098: (Part-I)/ 1988 Clause 14.3.2 Armoured Cables.
- f) The minimum thickness of PVC outer sheath shall not fall below the nominal value specified in Table 8 of **IS: 7098: 1988 (Part-I)** by more than $0.2\text{mm} + 0.2 \times \text{nominal value}$.

2.08 TESTS

- a) **Type Tests**
 - i. All cables to be supplied shall conform to type tests as per relevant standards and proven type.
 - ii. The bidder shall furnish the reports of all the type tests listed hereunder carried out within last seven years of the date of bid opening. These reports should be for the tests conducted either in government approved third party laboratory or witnessed by client (such as major utilities/ industries) on identical/ similar cables to those ordered under this contract.
 - iii. In case bidder is not able to submit report of type test(s) conducted in last seven years, or in case type tests report(s) are not found to be meeting the specification/ relevant standard requirements, then all such tests shall be conducted under this contract (at a third party laboratory or witnessed by BHEL) by the bidder free of cost to BHEL, and reports shall be submitted for approval. No charges shall be paid for testing under such circumstances.
 - iv. The type test of similar type higher rating cable shall be accepted for lower rating also.
 - v. The report of following type test will be submitted:

S. No.	Type Tests	Requirements of tests	Test Method
1	Test on Conductor		
a	Tensile test (for aluminium)	IS: 8130: 1984	IS: 10810: 1984 (Part-II)
b	Wrapping test (for aluminium)	IS: 8130: 1984	IS: 10810: 1984 (Part-III)
c	Resistance test	IS: 8130: 1984	IS: 10810: 1984 (Part-V)
2	Tests for Round steel wire (Armour)		
a	Dimensions	16.3 of IS: 692: 1994	IS : 10810: 1984 (Part-XXXVI)
b	Physical tests on round/formed wire:		
i	Tensile strength	16.6(a) of IS: 692: 1994	IS: 10810: 1984 (Part-XXXVII)
ii	Elongation at break	16.6(b) of IS: 692: 1994	IS: 10810: 1984 (Part-XXXVII)
iii	Torsion test for round wires	16.6(c) of IS: 692: 1994	IS: 10810: 1984 (Part-XXXVIII)

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - II: Scope of Work for LT Cables

iv	Winding test for formed wires	16.6(d) of IS: 692: 1994	IS: 10810: 1984 (Part-XXXIX)
v	Uniformity of zinc coating	16.6(e) of IS: 692: 1994	IS: 10810: 1984 (Part-XL)
vi	Mass of zinc coating	16.6(f) of IS: 692: 1994	IS: 10810: 1984 (Part-XLI)
vii	Resistivity	16.6(g) of IS: 692: 1994	IS: 10810: 1984 (Part-XLII)
3	Test for thickness of insulation and sheath	Clauses 9, 12, and 14, Tables 2, 4, & 6 of IS: 7098: 1988 (Part-I)	IS: 10810: 1984 (Part-VI)
4	Physical tests for insulation		
a	Tensile strength and elongation at break	Table 1 of IS: 7098: 1988 (Part-I)	IS: 10810: 1984 (Part-VII)
b	Ageing in air oven	Table 1 of IS: 7098: 1988 (Part-I)	IS: 10810: 1984 (Part-XI)
c	Hot test	Table 1 of IS: 7098: 1988 (Part-I)	IS: 10810: 1984 (Part-XXX)
d	Shrinkage test	Table 1 of IS: 7098: 1988 (Part-I)	IS: 10810: 1984 (Part-XII)
e	Water absorption (gravimetric)	Table 1 of IS: 7098: 1988 (Part-I)	IS: 10810: 1984 (Part-XXXIII)
5	Physical test for outer sheath		
a	Tensile strength and elongation at break	IS: 5831: 1984	IS: 10810: 1984 (Part-VII)
b	Ageing in air oven	IS: 5831: 1984	IS: 10810: 1984 (Part-XI)
c	Shrinkage test	IS: 5831: 1984	IS: 10810: 1984 (Part-XII)
d	Hot deformation	IS: 5831: 1984	IS: 10810: 1984 (Part-XV)
e	Loss of mass in air oven	IS: 5831: 1984	IS: 10810: 1984 (Part-X)
f	Heat shock	IS: 5831: 1984	IS: 10810: 1984 (Part-XIV)
g	Thermal stability	IS: 5831: 1984	Appendix B of IS: 5831: 1984
6	Insulation resistance (volume resistivity test)	Table 1 of IS: 7098: 1988 (Part-I)	IS: 10810: 1984 (Part-XLIII)
7	High voltage test	16.2 of IS: 7098: 1988 (Part-I)	IS: 10810: 1984 (Part-XLV)
8	Flammability test	16.3 of IS: 7098: 1988 (Part-I)	IS: 10810: 1984 (Part-LIII)

b) Routine and Acceptance Tests

- i. Routine testing shall be conducted in line with the applicable standards for every lot offered for inspection.
- ii. Acceptance tests shall be conducted on every lot offered for inspection.
- iii. Cost of conduction of routine and acceptance testing shall be deemed to have been included in the quoted supply prices.
- iv. The following shall constitute acceptance tests:
 - Tensile test (for aluminium),
 - Wrapping test (for aluminium),
 - Conductor resistance test,
 - Test for thickness of insulation and sheath,

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - II: Scope of Work for LT Cables

- Hot set test for insulation,
 - Tensile strength and elongation at break test for insulation and sheath,
 - High voltage test, and
 - Insulation resistance (volume resistivity) test.
- v. The following shall constitute routine tests:
- Conductor resistance test and
 - High voltage test.
- c) Cost of cables consumed for testing shall be to bidder's account.

2.09 PACKAGING AND FORWARDING

Cables shall be supplied in non-returnable heavy construction drums as per **IS: 10418: 1982** or latest amendment thereof. The ends of the cable shall be sealed by means of non-hygroscopic sealing material. All wooden parts shall be manufactured from seasoned wood treated with copper naphthenates/ zinc naphthenates (**IS: 401: 2001**). All ferrous parts shall be treated with suitable rust protective finish or coating to avoid rusting during transit and storage. BIS certification mark shall be stamped on each cable drum.

2.10 TRANSPORTATION

The transportation and freight insurance from work of the bidder to the site mentioned is in the scope of the supplier.

2.11 GUARANTEE

The equipment supplied should be guaranteed for 12 months from the date of commissioning or 18 months from the date of supply at site whichever is earlier.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-III: LIST OF STANDARDS APPLICABLE FOR LT XLPE CABLES

1	IS: 4826: 1979	Specification For Hot-Dipped Galvanized Coatings On Round Steel Wires
2	IS: 8130: 1984	Conductors For Insulated Electric Cables And Flexible Cords
3	IS: 7098: 1988: (Part-I)	Cross-linked Polyethylene Insulated PVC Sheathed Cables Part 1 For Working Voltages up to and Including 1100V
4	IS: 5831: 1984:	PVC Insulation And Sheath Of Electric Cables
5	IS: 3975: 1999	Mild Steel Wires, Formed Wires And Tapes For Armouring Of Cables
6	IS: 10418: 1982	Drums For Electric Cables
7	IS: 401: 2001	Preservation Of Timber - Code Of Practice
8	IS: 10810: 1984 (Part- 0)	Methods Of Test For Cables General
9	IS: 10810: 1984 (Part- II)	Methods Of Test For Cables Part 2 Tensile Test For Aluminium Wires
10	IS: 10810: 1984 (Part- III)	Methods Of Test For Cables Part 3 Wrapping Test-For Aluminium Wires
11	IS: 10810: 1984 (Part- V)	Methods Of Test For Cables Part 5 Conductor Resistance Test
12	IS: 10810: 1984 (Part- XXXVI)	Methods Of Test For Cables Part 36 Dimensions Of Armouring Material
13	IS: 10810: 1984 (Part- XXXVII)	Methods Of Test For Cables Part 37 Tensile Strength And Elongation At Break Of Armouring Materials
14	IS: 10810: 1984 (Part- XXXVIII)	Methods Of Test For Cables Part 38 Torsion Test On Galvanized Steel Wires For Armouring
15	IS: 10810: 1984 (Part- XXXIX)	Methods Of Test For Cables Part 39 Winding Test On Galvanized steel Strips For Armouring
16	IS: 10810: 1984 (Part- XL)	Methods Of Test For Cables Part 40 Uniformity Of Zinc Coating On Steel Armour
17	IS: 10810: 1984 (Part- XLI)	Methods Of Test For Cables Part 41 Mass Of Zinc Coating On Steel Armour
18	IS: 10810: 1984 (Part- XLII)	Methods Of Test For Cables Part 42 Resistivity Test Of Armour Wires And Strips And Conductance Test Of Armour (Wires/Strips)
19	IS: 10810: 1984 (Part- VI)	Methods Of Test For Cables Part 6 Thickness Of Thermoplastic And Elastomeric Insulation And Sheath
20	IS: 10810: 1984 (Part- VII)	Methods Of Test For Cables Part 7 Tensile Strength And Elongation At Break Of Thermoplastic And Elastomeric Insulation And Sheath
21	IS: 10810: 1984 (Part- XI)	Methods Of Test For Cables Part 11 Thermal Ageing In Air
22	IS: 10810: 1984 (Part- XII)	Methods Of Test For Cables Part 12 Shrinkage Test
23	IS: 10810: 1984 (Part- XXX)	Methods Of Test For Cables Part 30 Hot Set Test

TECHNICAL CONDITIONS OF CONTRACT (TCC)
Chapter-III: LIST OF STANDARDS APPLICABLE FOR LT XLPE CABLES

24	IS: 10810: 1984 (Part- XXXIII)	Methods Of Test For Cables Part 33 Water Absorption Test (Gravimetric)
25	IS: 10810: 1984 (Part- XV)	Methods Of Test For Cables Part 15 Hot Deformation Test
26	IS: 10810: 1984 (Part- X)	Methods Of Test For Cables Part 10 Loss Of Mass Test
27	IS: 10810: 1984 (Part- XIV)	Methods Of Test For Cables Part 14 Heat Shock Test
28	IS: 10810: 1984 (Part- XLVIII)	Methods Of Test For Cables Part 48 Partial Discharge Test
29	IS: 10810: 1984 (Part- L)	Methods Of Test For Cables Part 50 Bending Test
30	IS: 10810: 1984 (Part- XLIII)	Methods Of Test For Cables Part 43 Insulation Resistance
31	IS: 10810: 1984 (Part- XLVII)	Methods Of Test For Cables Part 47 Impulse Test
32	IS: 10810: 1984 (Part- XLV)	Methods Of Test For Cables Part 45 High Voltage Test
33	IS: 10810: 1984 (Part- XLII)	Methods Of Test For Cables Part 53 Flammability Test

NOTE: This list of standards applicable is indicative in nature and cannot be taken as a comprehensive list. All the other standards which are applicable as per the statutory rules and regulations are applicable to this scope.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-IV: GENERAL

GENERAL REQUIREMENTS – COMMON TO ALL WORKS

- 4.1 The intent of specification is to provide services according to the most modern and proven techniques and codes. The omission of specific reference to any method, equipment or material necessary for proper and efficient execution of this work shall not relieve the Contractor of the responsibility of providing such facilities to complete the work without any extra compensation.
- 4.2 All necessary certificates and licenses, permits & clearances required to carry out this work from the respective statutory/ local authorities are to be arranged by the Contractor at his cost in time to ensure smooth progress of work.
- 4.3 Supply period shall not be extended as per the requirement.
- 4.4 Quality items should be used for manufacturing the items.
- 4.5 It is not the intent to specify herein all the details of design & manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing in continuous commercial operation up to bidder's guarantee.
- 4.6 The general terms and conditions, instructions to bidders and other attachment referred to elsewhere be hereby made part of technical specification.
- 4.7 The bidders shall be responsible for and governed by all requirements stipulated hereinafter.
- 4.8 Requirements of the specification including the QP shall be agreed upon for total compliance by Bidders without any deviations.
- 4.9 Price offers of only those bidders complying with the requirements mentioned in this document shall be acceptable.
- 4.10 The documents shall be in English language and MKS system of units.

TECHNICAL CONDITIONS OF CONTRACT (TCC)
CHAPTER V – TECHNICAL SPECIFICATION FOR LT CABLE

Technical Specification

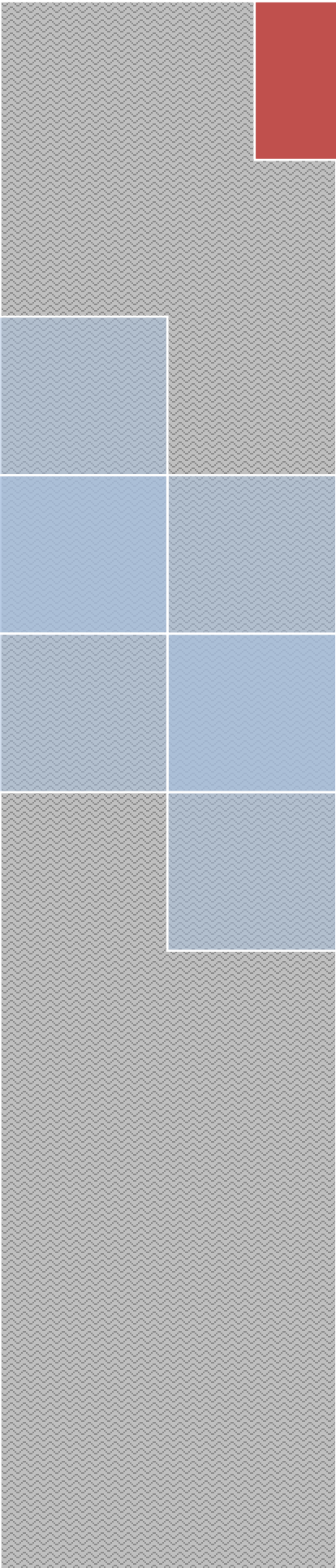
S. No.	Description	References
1	Type of Cable	XLPE Insulated PVC sheathed Cables
2	Standard applicable in general	IS: 7098 (Part-I)
3	Voltage Grade	1100 Volts
4	Number of cores, cross sectional area of conductors.	3.5Cx185 sqmm aluminium LT XLPE ARMOURED POWER CABLE
		3.5Cx70 sqmm aluminium LT XLPE ARMOURED POWER CABLE
		3.5Cx25 sqmm aluminium LT XLPE ARMOURED POWER CABLE
		3C x 2.5 sq. mm COPPER LT XLPE ARMOURED POWER CABLE
		1Cx10sqmm Armoured copper PVC/XLPE insulated Power Cable
		2Cx2.5sqmm size Armoured copper PVC/XLPE insulated Power Cable
		2Cx6 sqmm Aluminium LT XLPE ARMOURED POWER CABLE
		3.5Cx35 sqmm Aluminium LT XLPE ARMOURED POWER CABLE
		3.5Cx95 sqmm Aluminium LT XLPE ARMOURED POWER CABLE
5	CONDUCTOR	
(a)	Material	Aluminium/ Copper
(b)	Standard Applicable	IS: 8130
(c)	Shape	Compacted Sector shaped, stranded
(d)	Min. number of strands	As per Table-2 of IS: 8130
6	INSULATION	
(a)	Material	Extruded XLPE
(b)	Standard Applicable	IS:7098 Part-I
(c)	Continuous withstand temperature	90°C
(d)	Short-circuit withstand temperature	250°C
7	EXTRUSION (Insulation)	
(a)	Process	Extrusion
(b)	Method of Curing	As per relevant IS.

TECHNICAL CONDITIONS OF CONTRACT (TCC)
CHAPTER V – TECHNICAL SPECIFICATION FOR LT CABLE

8	CORE IDENTIFICATION	Core Identification as per Clause 10 of IS: 7098: 1988 (Part-I) or latest amendments
9	INNER SHEATH	
(a)	Material	As per IS:5831.
(b)	Colour	Black
(c)	Whether FRLS	NO
(d)	Fillers	Acceptable
(e)	Material of fillers (if permitted)	Same as inner sheath (Material of filler to be compatible with that of inner sheath)
(f)	Method of application	
(i)	With fillers	Pressure/Vacuum extruded
(ii)	Without fillers	Pressure extruded
10	ARMOUR	
(a)	Material:	Galvanized round steel wire armour conforming to: Table 6 of IS: 7098: 1988 (part-I) and IS: 3975: 1999
(b)	Minimum Coverage	90%
(c)	Gap between armour wires	Shall not exceed one armour wire space (No cross-over/overriding)
(d)	Breaking load of joint	95% of normal armour
11	OUTERSHEATH	
(a)	Material	PVC Type ST2 as per IS: 5831
(b)	Colour	Black
(c)	Whether FRLS	NO
(d)	Method of application	Extruded
(e)	Marking	Owner's identification mark i.e. "BHEL-PSNR", Manufacturer's name and /or trade mark, voltage grade, year of manufacture, Type of insulation, No. of cores and Size of cables, IS Number @ 5m throughout the cable (by embossing). Progressive length marking @ 1m (by embossing/printing)
12	TOLERANCE ON OUTER DIAMETER	(±) 2mm. Over the declared value in Data sheet
13	STANDARD DRUM LENGTH	500m or 1000m (± 5% tolerance) and as specified in BOQ
14	CABLE DRUM	
(a)	Material	The cables shall be supplied in non-returnable packing Wooden/steel drum.

TECHNICAL CONDITIONS OF CONTRACT (TCC)
CHAPTER V – TECHNICAL SPECIFICATION FOR LT CABLE

(b)	Drum Marking	Owner's identification mark i.e. "BHEL-PSNR" , Manufacturer's name and /or trade mark, Type of Cable & Voltage Grade, year of manufacture, Type of insulation, No. of core & Cable size, cable code, length of cable on drum, No. of length on drum (if more than one), direction of rotation(by arrow), approx. gross mass, IS/IEC number and ISI mark.
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TECHNICAL CONDITIONS OF CONTRACT (TCC)

**TECHNICAL SPECIFICATIONS FOR HT XLPE
ARMoured CABLE (3000 MTR.) FOR 3X800 MW
MEJA STPP, STAGE-II, BHEL MEJA SITE.**

BHARAT HEAVY ELECTRICALS LIMITED



VOL-II

TECHNICAL SPECIFICATIONS FOR HT XLPE ARMoured CABLE (3000 MTR.) FOR 3X800 MW MEJA STPP, STAGE-II, BHEL MEJA SITE.

S. No.	DESCRIPTION	Chapter
Volume-IA.1	Part-I: Contract specific details	
1	Project Information	Chapter-I
2	Scope of Works for HT Cables	Chapter-II
3	Standards Applicable for HT Cables	Chapter-III
4	General	Chapter-IV
5	Technical Specification for HT Cables	Chapter-V

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - I: Project Information

1.0 PROJECT INFORMATION

PROJECT: 3 X 800 MW MEJA STAGE-II

MEJA URJA NIGAM (P) LIMITED has awarded the work for 3x800 MW (Stage-II) on EPC basis.

Project Information and Scope is as follows:

Design, Engineering, Manufacture, Supply, Construction, Erection, Testing & Commissioning works for the EPC Package for Meja Super Thermal Power Project Stage-II (3 X 800 MW)

Particular	Details
Project Name	Meja Super Thermal Power Project – Stage-II
Project Capacity	3 × 800 MW = 2,400 MW (Supercritical Coal-Based Thermal Power Plant)
Owner	Meja Urja Nigam Private Limited
Joint Venture	50:50 Joint Venture of NTPC Limited and Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited
Location	Meja Thermal Power Project
District	Prayagraj
State	Uttar Pradesh
Fuel	Domestic Coal
Technology	Supercritical Steam Cycle
Cooling System	Closed Cycle Cooling with Cooling Towers
Project Type	Expansion of existing Stage-I (2 × 660 MW)

Note: - The bidder is advised to visit and examine the site of WORKS and its surroundings and obtain for himself on his own responsibility all information that may be necessary for preparing the bid and entering into the CONTRACT. All costs for and associated with site visits shall be borne by the bidder.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - II: Scope of Work for HT Cable

2.01 SCOPE OF WORK:

- 2.01.1 This specification covers the design, manufacture, testing & inspection at manufacturer's works, proper packing, transportation, insurance during transit, delivery to site/ BHEL store of 3Cx 95 sq.mm AL 11 KV Unearthed, ARMOURED **XLPE POWER CABLES** as mentioned in different sections of this specification for the project as indicated in Project Information.
- 2.01.2 This document covers the technical specification of cross-linked polyethylene (XLPE) insulated and PVC sheathed power cables for three phase 11kV Unearthed system.

2.02 CONDUCTOR

The conductors shall be composed of aluminium wires complying with **IS: 8130: 1984** or latest amendments thereof.

2.03 INSULATION

The insulation shall be of cross-linked polyethylene conforming to the requirements given in Table 1 of **IS: 7098: 2011 (Part-II)** or latest amendment thereof.

2.04 INSULATION SCREENING

The insulation screening shall consist of two parts:

- a) Non-Metallic Screening
Non-metallic part shall be applied directly over the insulation of each core and shall consist of either a semi-conducting tape or extruded semi-conducting compound or a combination of the two or either material with a semi-conducting coating. Minimum thickness should be 0.3 mm.
- b) Metallic Screening
Metallic screening shall be helical wrapped Copper tape.

2.05 FILLERS AND INNER SHEATH

- a) The Inner Sheath shall be of polyvinyl chloride (PVC) compound conforming to the requirements of Type ST1 of **IS: 5831: 1984** or latest amendments thereof.
- b) The colour of the inner sheath should be black.
- c) The filler material is to be compatible with that of inner sheath.
- d) The filler material will be same as inner sheath.
- e) The method of application for inner sheath with filler material shall be Pressure/Vacuum extruded and for inner sheath without filler material shall be Pressure extruded.

2.06 SCREENING

All cables shall be provided with conductor screening. Conductor screening shall be provided over the conductor by applying non-metallic semi-conducting tape or by extrusion of semiconducting compound or a combination of the two.

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2.07 ARMOURING

- a) Armouring shall be applied over the insulation or protective barrier or non-metallic part of insulation screening.
- b) A binder tape may be applied on the armour.
- c) Armouring shall be of Galvanized round steel wire conforming to: Table 6 of **IS: 7098: 2011 (part-II)** and **IS: 3975: 1999**.
- d) The armour shall be applied as closely as practicable.
- e) The minimum coverage of armouring shall be 90%.
- f) The gap between armour wires shall not exceed one armour wire space with no cross-over/overriding.
- g) The breaking load of joint shall be 95% of normal armour.

2.08 OUTER SHEATH

- a) The outer sheath shall be applied by extrusion over the armouring.
- b) The outer sheath shall be of polyvinyl chloride (PVC) compound conforming to the requirements of Type ST2 of **IS: 5831: 1984** or latest amendments thereof.
- c) The thickness of outer sheath shall be not less than the minimum value specified in col 6 of Table 7 of **IS: 7098: 2011: (Part-II)**

2.09 TESTS

2.09.1 Type Tests

- a) All cables to be supplied shall conform to type tests as per relevant standards and proven type.
- b) The bidder shall furnish the reports of all the type tests listed hereunder carried out within last ten years of the date of bid opening. These reports should be for the tests conducted either in government approved third party laboratory or witnessed by client (such as major utilities/ industries) on identical/ similar cables to those ordered under this contract.
- c) In case bidder is not able to submit report of type test(s) conducted in last ten years, or in case type tests report(s) are not found to be meeting the specification/ relevant standard requirements, then all such tests shall be conducted under this contract (at a third party laboratory or witnessed by BHEL) by the bidder free of cost to BHEL, and reports shall be submitted for approval. No charges shall be paid for testing under such circumstances.
- d) The type test of similar type higher rating cable shall be accepted for lower rating also.
- e) The report of following type test will be submitted:

S. No.	Type Tests	Requirements of tests	Test Method
1	Test on Conductor		
a	Tensile test (for aluminium)	IS: 8130: 1984	IS: 10810: 1984 (Part-II)
b	Wrapping test (for	IS: 8130: 1984	IS: 10810: 1984 (Part-III)

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	aluminium)		
c	Resistance test	IS: 8130: 1984	IS: 10810: 1984 (Part-V)
2	Test for armouring wires	Clause 7, Table 6 of IS: 7098: 2011 (Part-II) and IS: 3975	IS : 10810: 1984 (Part-XXXVI to XLII)
3	Test for thickness of insulation and sheath	Clauses 11 & Tables 4, 5, & 7 and Annex A of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-VI)
4	Physical tests for insulation		
a	Tensile strength and elongation at break	Table 1 of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-VII)
b	Ageing in air oven	Table 1 of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-XI)
c	Hot set test	Table 1 of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-XXX)
d	Shrinkage test	Table 1 of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-XII)
e	Water absorption (gravimetric)	Table 1 of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-XXXIII)
5	Physical test for outer sheath		
a	Tensile strength and elongation at break	IS: 5831: 1984	IS: 10810: 1984 (Part-VII)
b	Ageing in air oven	IS: 5831: 1984	IS: 10810: 1984 (Part-XI)
c	Shrinkage test	IS: 5831: 1984	IS: 10810: 1984 (Part-XII)
d	Hot deformation	IS: 5831: 1984	IS: 10810: 1984 (Part-XV)
e	Loss of mass in air oven	IS: 5831: 1984	IS: 10810: 1984 (Part-X)
f	Heat shock	IS: 5831: 1984	IS: 10810: 1984 (Part-XIV)
g	Thermal stability	IS: 5831: 1984	IS: 10810: (Part-LX)
6	Partial discharge test	19.2 of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-XLVI)
7	Bending test	19.3 of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-L)
8	Dielectric power factor test as a function of voltage	19.4 of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-XLVIII)
9	Dielectric power factor test as a function of temperature	19.4 of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-XLVIII)
10	Insulation resistance (volume resistivity) test	Table 1 of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-XLIII)
11	Heat cycle test	19.5 of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-XLIX)
12	Impulse withstand test	19.6 of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-XLVII)
13	High voltage test	19.7 of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-XLV)
14	Flammability test	19.8 of IS: 7098: 2011 (Part-II)	IS: 10810: 1984 (Part-LIII)

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2.09.2 Routine and Acceptance Tests

- a) Routine testing shall be conducted in line with the applicable standards for every lot offered for inspection.
- b) Acceptance tests shall be conducted on every lot offered for inspection.
- c) Cost of conduction of routine and acceptance testing shall be deemed to have been included in the quoted supply prices.
- d) The following shall constitute acceptance tests:
 - i. Tensile test (for aluminium),
 - ii. Wrapping test (for aluminium),
 - iii. Conductor resistance test,
 - iv. Test for thickness of insulation and sheath,
 - v. Hot set test for insulation,
 - vi. Tensile strength and elongation at break test for insulation and outer sheath,
 - vii. Partial discharge test,
 - viii. High voltage test, and
 - ix. Insulation resistance (volume resistivity) test.
 - x. Test for cross linking for extruded semi-conducting screen.
- e) The following shall constitute routine tests:
 - i. Conductor resistance test,
 - ii. Partial discharge test, and
 - iii. High voltage test.

2.09.3 Cost of cables consumed for testing shall be to bidder's account.

2.10 PACKAGING AND FORWARDING

Cables shall be supplied in non-returnable heavy construction drums as per **IS: 10418: 1982** or latest amendment thereof. The ends of the cable shall be sealed by means of non-hygroscopic sealing material. All wooden parts shall be manufactured from seasoned wood treated with copper naphthenates/ zinc naphthenates (**refer IS: 401**). All ferrous parts shall be treated with suitable rust protective finish or coating to avoid rusting during transit and storage. BIS certification mark shall be stamped on each cable drum.

2.11 TRANSPORTATION

The transportation and freight insurance from work of the bidder to the site mentioned is in the scope of the supplier.

2.12 GUARANTEE

The equipment supplied should be guaranteed for 12 months from the date of commissioning or 18 months from the date of supply at site whichever is earlier.

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Chapter-III: LIST OF STANDARDS APPLICABLE FOR HT CABLES

1	IS: 4826: 1979	Specification For Hot-Dipped Galvanized Coatings On Round Steel Wires
2	IS: 8130: 1984	Conductors For Insulated Electric Cables And Flexible Cords
3	IS: 7098: 2011: (Part-II)	Cross-linked Polyethylene Insulated PVC Sheathed Cables Part 2 For Working Voltages From 3.3 kV up to And Including 33 kV
4	IS: 5831: 1984:	PVC Insulation And Sheath Of Electric Cables
5	IS: 3975: 1999	Mild Steel Wires, Formed Wires And Tapes For Armouring Of Cables
6	IS: 10418: 1982	Drums For Electric Cables
7	IS: 401: 2001	Preservation Of Timber - Code Of Practice
8	IS: 10810: 1984 (Part- 0)	Methods Of Test For Cables General
9	IS: 10810: 1984 (Part- II)	Methods Of Test For Cables Part 2 Tensile Test For Aluminium Wires
10	IS: 10810: 1984 (Part- III)	Methods Of Test For Cables Part 3 Wrapping Test-For Aluminium Wires
11	IS: 10810: 1984 (Part- V)	Methods Of Test For Cables Part 5 Conductor Resistance Test
12	IS: 10810: 1984 (Part- XXXVI)	Methods Of Test For Cables Part 36 Dimensions Of Armouring Material
13	IS: 10810: 1984 (Part- XXXVII)	Methods Of Test For Cables Part 37 Tensile Strength And Elongation At Break Of Armouring Materials
14	IS: 10810: 1984 (Part- XXXVIII)	Methods Of Test For Cables Part 38 Torsion Test On Galvanized Steel Wires For Armouring
15	IS: 10810: 1984 (Part- XXXIX)	Methods Of Test For Cables Part 39 Winding Test On Galvanized steel Strips For Armouring
16	IS: 10810: 1984 (Part- XL)	Methods Of Test For Cables Part 40 Uniformity Of Zinc Coating On Steel Armour
17	IS: 10810: 1984 (Part- XLI)	Methods Of Test For Cables Part 41 Mass Of Zinc Coating On Steel Armour
18	IS: 10810: 1984 (Part- XLII)	Methods Of Test For Cables Part 42 Resistivity Test Of Armour Wires And Strips And Conductance Test Of Armour (Wires/Strips)
19	IS: 10810: 1984 (Part- VI)	Methods Of Test For Cables Part 6 Thickness Of Thermoplastic And Elastomeric Insulation And Sheath
20	IS: 10810: 1984 (Part- VII)	Methods Of Test For Cables Part 7 Tensile Strength And Elongation At Break Of Thermoplastic And Elastomeric Insulation And Sheath
21	IS: 10810: 1984 (Part- XI)	Methods Of Test For Cables Part 11 Thermal Ageing In Air
22	IS: 10810: 1984 (Part- XII)	Methods Of Test For Cables Part 12 Shrinkage Test
23	IS: 10810: 1984 (Part- XXX)	Methods Of Test For Cables Part 30 Hot Set Test

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Chapter-III: LIST OF STANDARDS APPLICABLE FOR HT CABLES

24	IS: 10810: 1984 (Part- XXXIII)	Methods Of Test For Cables Part 33 Water Absorption Test (Gravimetric)
25	IS: 10810: 1984 (Part- XV)	Methods Of Test For Cables Part 15 Hot Deformation Test
26	IS: 10810: 1984 (Part- X)	Methods Of Test For Cables Part 10 Loss Of Mass Test
27	IS: 10810: 1984 (Part- XIV)	Methods Of Test For Cables Part 14 Heat Shock Test
28	IS: 10810: 1984 (Part- XLVIII)	Methods Of Test For Cables Part 48 Partial Discharge Test
29	IS: 10810: 1984 (Part- L)	Methods Of Test For Cables Part 50 Bending Test
30	IS: 10810: 1984 (Part- XLIII)	Methods Of Test For Cables Part 43 Insulation Resistance
31	IS: 10810: 1984 (Part- XLVII)	Methods Of Test For Cables Part 47 Impulse Test
32	IS: 10810: 1984 (Part- XLV)	Methods Of Test For Cables Part 45 High Voltage Test
33	IS: 10810: 1984 (Part- XLIII)	Methods Of Test For Cables Part 53 Flammability Test

NOTE: This list of standards applicable is indicative in nature and cannot be taken as a comprehensive list. All the other standards which are applicable as per the statutory rules and regulations are applicable to this scope.

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Chapter-IV: GENERAL

GENERAL REQUIREMENTS – COMMON TO ALL WORKS

- 4.1 The intent of specification is to provide services according to the most modern and proven techniques and codes. The omission of specific reference to any method, equipment or material necessary for proper and efficient execution of this work shall not relieve the Contractor of the responsibility of providing such facilities to complete the work without any extra compensation.
- 4.2 All necessary certificates and licenses, permits & clearances required to carry out this work from the respective statutory/ local authorities are to be arranged by the Contractor at his cost in time to ensure smooth progress of work.
- 4.3 Supply period shall not be extended as per the requirement.
- 4.4 Quality items should be used for manufacturing the items.
- 4.5 It is not the intent to specify herein all the details of design & manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing in continuous commercial operation up to bidder's guarantee.
- 4.6 The general terms and conditions, instructions to bidders and other attachment referred to elsewhere be hereby made part of technical specification.
- 4.7 The bidders shall be responsible for and governed by all requirements stipulated hereinafter.
- 4.8 Requirements of the specification including the QP shall be agreed upon for total compliance by Bidders without any deviations.
- 4.9 Price offers of only those bidders complying with the requirements mentioned in this document shall be acceptable.
- 4.10 The documents shall be in English language and MKS system of units.

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CHAPTER V – TECHNICAL SPECIFICATION for HT Cable

Technical Specification

S. No.	Description	References
1	Type of Cable	XLPE Insulated PVC sheathed Cables
2	Standard applicable in general	IS: 7098: 2011 (Part-II)
3	Voltage Grade	11kV(Unearthed)
4	Number of cores, cross sectional area of conductors.	3Cx 95 sq.mm Al (11kV Unearthed, ARMOUR ED)
5	CONDUCTOR	
(a)	Material	Aluminium, Grade: H2, Class 2
(b)	Standard Applicable	IS: 8130
(c)	Shape	Compacted Circular, stranded
(d)	Min. number of strands	As per Table-2 of IS: 8130
(e)	Conductor screen	
(i)	Material	Extruded Semi-conducting compound
(ii)	Minimum thickness	0.3 mm
6	INSULATION	
(a)	Material	Extruded XLPE
(b)	Standard Applicable	IS:7098: 2011 (Part-II)
(c)	Continuous withstand temperature	90°C
(d)	Short-circuit withstand temperature	250°C
7	INSULATION SCREEN	
(a)	Non-Metallic	
(i)	Material	Non-metallic part shall be applied directly over the insulation of each core and shall consist of either a semi-conducting tape or extruded semi-conducting compound or a combination of the two or either material with a semi-conducting coating.
(ii)	Minimum Thickness	0.3 mm
(b)	Metallic	
(i)	Material	Metallic screening shall be helical wrapped Copper tape.
(ii)	Type	Tape
(iii)	Size	Nominal thickness 0.1mm with tolerance (±) 10%
(iv)	Minimum Overlap	10%

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CHAPTER V – TECHNICAL SPECIFICATION for HT Cable

(c)	Earth fault current withstand capacity	0.3kA, 2 sec.
		(Screen of each core shall be rated individually for the above value).
8	EXTRUSION (Insulation and Screens)	
(a)	Process	Triple Extrusion
		(Extruded semi-conducting compound conductor screen and insulation screen shall be applied along with XLPE insulation in a single operation by triple extrusion process).
(b)	Method of Curing	Dry Curing (CCV) process using pressurised Nitrogen
9	CORE IDENTIFICATION	Core Identification as per Clause 14 of IS: 7098: 2011 (Part-II) or latest amendments
10	INNER SHEATH	
(a)	Material	PVC Type ST1 as per IS: 5831
(b)	Colour	Black
(c)	Whether FRLS	NO
(d)	Fillers	Acceptable
(e)	Material of fillers (if permitted)	Same as inner sheath (Material of filler to be compatible with that of inner sheath)
(f)	Method of application	
(i)	With fillers	Pressure/Vacuum extruded
(ii)	Without fillers	Pressure extruded
11	ARMOUR	
(a)	Material:	Galvanized round steel wire armour conforming to: Table 6 of IS: 7098: 2011 (part-II) and IS: 3975: 1999
(b)	Minimum Coverage	90%
(c)	Gap between armour wires	Shall not exceed one armour wire space (No cross-over/ overriding)
(d)	Breaking load of joint	95% of normal armour
12	OUTERSHEATH	
(a)	Material	PVC Type ST2 as per IS: 5831
(b)	Colour	Black
(c)	Whether FRLS	NO
(d)	Method of application	Extruded

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CHAPTER V – TECHNICAL SPECIFICATION for HT Cable

(e)	Marking	Owner's identification mark i.e. "BHEL-PSNR", Manufacturer's name and /or trade mark, voltage grade, year of manufacture, Type of insulation, No. of cores and Size of cables, IS Number @ 5m throughout the cable (by embossing). Progressive length marking @ 1m (by embossing/ printing)
13	TOLERANCE ON OUTER DIAMETER	(±) 2mm. Over the declared value in Data sheet
14	STANDARD DRUM LENGTH	500m or 1000m (± 5% tolerance) and as specified in BOQ
15	CABLE DRUM	
(a)	Material	The cables shall be supplied in non-returnable packing Wooden/Steel drum.
(b)	Drum Marking	Owner's identification mark i.e. "BHEL-PSNR", Manufacturer's name and /or trade mark, Type of Cable & Voltage Grade, year of manufacture, Type of insulation, No. of core & Cable size, cable code, length of cable on drum, No. of length on drum (if more than one), direction of rotation (by arrow), approx. gross mass, IS/IEC number and ISI mark.