

4 X 270 MW BHADRADRI TPP


VOLUME : IIB

**TECHNICAL SPECIFICATION FOR
LT XLPE POWER CABLES**

SPECIFICATION NO.: PE-TS-411-507-E002, Rev. 0



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR, PROJECT ENGINEERING MANAGEMENT
NOIDA 201301


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		Volume IIB	Section
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	TOTAL NO. OF SHEETS	= 37

IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT THERE ARE NO TECHNICAL DEVIATIONS.

 BIDDER'S STAMP & SIGNATURE
 (REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')

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PREAMBLE

1 The Tender documents contain three (3) volumes. The bidder shall meet the requirements of all three volumes.

1.1 **VOLUME - I** **CONDITIONS OF CONTRACT**

This consists of four parts as below:

Volume – IA This part contains Instructions to bidders for making bids to BHEL.

Volume – IB This part contains General Commercial Conditions of the Tender & includes provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.

Volume – IC This part contains Special Conditions of Contract.

Volume – ID This part contains Commercial Conditions for Erection & Commissioning site work, as applicable.

1.2 **VOLUME – II** **TECHNICAL SPECIFICATIONS**

Technical requirements are stipulated in Volume – II, which comprises of:-

Volume – IIA General Technical Conditions.

Volume – IIB Technical Specification including Drawings, if any.

1.3 **VOLUME – IIB**

This volume is sub-divided in to following sections:-

Section – A: This section outlines the Intent of Specification.

Section – B : This section provides “Project Information”.

Section – C: This section indicates Technical Requirements specific to Contract, not covered in Section – D.

Section – D: This section comprises of Technical Specifications of equipment complete with Data Sheets A and C.


Data Sheet-A: Specific data and other requirements pertaining to the equipments.

Data sheet-C: Indicates data / documents to be furnished after the award of Contract as per agreed schedule by the vendor (as applicable)

1.4 **VOLUME – III** **TECHNICAL SCHEDULES (If Applicable)**

This volume contains Technical Schedule and Data Sheets–B, which are to be duly filled by bidder and the same shall be furnished with the technical bid.

2.0 This requirements mentioned in Section – C followed by those of Data Sheet – A shall prevail in case of conflict between the stipulations of Section-C, Datasheet-A and Section-D.

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INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. Two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
 - a. Unpriced BOQ-Cum-Price Schedule (“Quoted” words against items”) with bidder’s signature and company stamp.
 - b. A copy of this sheet (“Instructions to Bidders for Preparing Technical Offer”)
 - c. A copy of previous sheet (“List of Contents”), with bidder’s signature and company stamp.
 - d. A copy of “Quality Plan including Annexure to QAP” sheet, with bidder’s signature and company stamp.


2. No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.

3. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.


4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder’s covering letter shall not be considered by BHEL, and bidder’s offer shall be construed to be in conformance with the specification.

5. Any changes made by the bidder in the price schedule with respect to the cable description/ quantities, notes etc. from those given in Annexure-A to Section-C of specification [Bill Of Quantities cum price schedule] shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).

 BIDDER’S STAMP & SIGNATURE


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SECTION-A
SCOPE OF ENQUIRY


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SCOPE OF ENQUIRY

- 1.0 This specification covers the design, manufacture, inspection and testing at manufacturer's works, proper packing and delivery to site of **LT XLPE POWER CABLES** as mentioned in different sections of this specification for **4 x 270 MW BHADRADRI TPP**.
- 2.0 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.
- 3.0 The general terms & condition, instructions to bidders & other attachment referred to elsewhere are hereby made part of technical specification.
- 4.0 The bidders shall be responsible for and governed by all requirements stipulated hereinafter.
- 5.0 Requirements of the specification including the QP shall be agreed upon for total compliance by bidders without any deviations. Price offers of only those bidders complying with the above requirement shall be acceptable.
- 6.0 The documents shall be in English language and MKS system of units.

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SECTION – B
(PROJECT INFORMATION)

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INTRODUCTION

4x270 MW Bhadradi TPS is being set up by Telangana State Electricity Corporation Limited (TSGENCO) at Manuguru in the district of Khammam, Telangana, India.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on BHEL/Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

APPROACH TO SITE


The distance from Manuguru to Major cities in state: Hyderabad-345KM, Warangal-180km, Bhadrachalam-38km, Kothagudem-70km and Khammam-130km, Vijayawada-195km.

District: KHAMMAM

State: TELANGANA

Nearest Airport: The nearest airport is Vijayawada Airport but the most used airport is the Hyderabad International Airport.


Nearest Railway Station: Manuguru railway station is 10KM from nearby town. However Warangal/Vijayawada railway Station is major railway station near to Manuguru.

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1. Owner TSGENCO
2. Owner Consultant DESEIN PRIVATE LIMITED, NEW DELHI
3. Project Title 4X270 MW Bhadradi TPS
4. Location 16 Km from Manuguru Railway station
5. Nearest Railway Stn. Manuguru
6. Temperature
 - a. Mean daily minimum ambient temperature during oldest month of the year=11.5 Deg.C
 - b. Mean daily minimum ambient temperature during hottest month of the year=45.1 Deg.C
7. Rainfall

Intensity of rainfall @ 80 mm/hr considering heaviest fall in 24 hrs
8. Wind Data
 - a) Basic wind speed at 10m height 44 m/sec
 - b) Wind pressure As per IS: 875 Part III- 1987
9. Seismic Zone: Zone III as defined in IS:1893 (part-1)-2002 according to Indian Standard Seismic Zoning Map
10. Power supply :


The power supplies for distribution and auxiliaries shall be as under:	
a) In plant generation	16.5kV $\pm 5\%$, 3ph, 50Hz $\pm 5\%$, high resistance earthed.
b) MV distribution	6.6kV $\pm 6\%$, 3ph, 3w , 50 Hz, + 5 % to - 5%, Non-effectively earthed
c) LT distribution	415V $\pm 10\%$, 3ph, 4W, 50Hz + 5% to - 5%, Effectively earthed
d) Motor rated above 160kW	6.6kV $\pm 6\%$, 3 ph 50Hz +5% to -5%.
e) Motor rated 160kW and below all motorized actuators.	415V $\pm 10\%$, 3 ph, 50Hz +5% to -5%.
f) For motors equal and below 30kW winding heating	24V AC $\pm 10\%$, 50 Hz %, [to be generated in 415V switchgear by vendor]
g) DC Motors	220V DC + 10% to - 15%, 2 wire ungrounded system
h) Control supply for relay panel/ 6.6kV breakers/415V	220V DC + 10% to - 15%, 2 wire

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	breakers and DC emergency lighting.	ungrounded system
	i) UPS for instrumentation & Control system	240V AC $\pm 1\%$, 1 ph, 50Hz $\pm 0.5\%$ 2 Wire AC system
	j) Control supply for 415V Motor contactors/AC Control circuits [to be generated in MCC /panel by vendor]	110V AC $\pm 10\%$, 50Hz + 5% to -5%.
	k) Diesel Generator emergency supply	415V $\pm 10\%$, 3ph, 3W, 50Hz +5% to -5%.
11.0	Fault levels	
	a) 400kV	40kA rms for 1 sec
	b) 6.6kV	44 kA rms for 1 sec.
	c) 415V	50 kA rms for 1 sec.
	d) DC Supply	25 kA

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SECTION – ‘C’
SPECIFIC TECHNICAL REQUIREMENTS

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1.0 SCOPE OF ENQUIRY

- 1.1 This enquiry covers the supply of LT power cables conforming to this specification as detailed below.
- 1.2 General technical requirements of the cables are indicated in Section-D and Data sheet-A. Project specific technical/ quality requirements/ changes are listed below.
- 1.3 Cables shall conform in all respects to the requirements stipulated in all the above parts of the specification.
- 1.4 The stipulations of Section-C, followed by those of Data sheet-A shall prevail in case of any conflict between the stipulations of Section-C, Data sheet-A and Section-D.

2.0 BILL OF QUANTITIES:


- 2.1 Quantity requirements shall be as per Annexure-A (BOQ cum price schedule) to section-C enclosed.
- 2.2 Delivery schedule of LOT-1 and subsequent lots shall be as per NIT.

3.0 SPECIFIC TECHNICAL REQUIREMENTS

- 3.1 Specific technical requirements shall be as listed below :

3.1.1 Technical:

S. No.	Reference Clause No. of Section D (if any)	Specific Requirement/ Change
1	2.4.1 b, c & d	May be read as 2.4.1 (b) "The type tests are required to be conducted as indicated in Annexure to QAP and the same shall be offered for inspection (conduction of type tests shall be witnessed by BHEL). Bidder to indicate unit price of cables inclusive of type test charges. No separate charges shall be payable for type tests.
2	2.4.1 e	Refer Sl. No. 1 above
3	4.1	Two signed and stamped copies of the following shall be furnished by all bidders as technical offer: (i) BOQ cum Unpriced Price Schedule (Annexure-A to Section-C, as enclosed with the specification) with bidder's signature and company stamp. (ii) A copy of "Instructions to Bidders for Preparing Technical Offer" sheet, with bidder's signature and company stamp. (iii) A copy of "List Of Contents" sheet, with

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	<p>bidder's signature and company stamp.</p> <p>(iv) A copy of "Quality Plan including Annexure to QAP" sheet, with bidder's signature and company stamp.</p> <p><u>No other documentation is required to be submitted as technical offer. Any information contained in other parts of the offer (e.g. covering letter, annexures, etc.) which is deviating from specification requirements in any way shall not be considered by BHEL as part of offer.</u></p>
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3.1.2 Quality/ Inspection:

S. No.	Reference Clause No. of Section D (if any)	Specific Requirement/ Change
1.	2.2	QP (Including Annexure to QAP) enclosed with spec. shall be stamped and signed by bidders as token of acceptance. The QP shall be submitted during contract stage for customer/BHEL approval without any commercial implications to BHEL.
2.	2.4.1.(d)	All Tests shall be conducted as per contract. Conduction of Testing requirements mentioned in datasheet-A & Annexure to QAP.


3.1.3 The successful bidder shall submit the standard list of raw material suppliers/ sub-vendors for approval without any commercial implications. Changes to the same for specific projects, if proposed by any bidder, shall be to BHEL approval.

3.1.4 Quality Plan applicable for project:

BHEL Standard Quality Plan no. PE-QP-999-507-E002, R 00 (enclosed with specification).

3.1.5 Nos. OF DRAWINGS/ DOCUMENTS REQUIRED FROM VENDOR:


Document distribution schedule for the project shall be as below. No. of prints to be submitted by vendor after award of contract shall be as under :

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S. No.	Drawings and documents	Soft and Hard Prints
1.0	DRAWING FOR APPROVAL	
A	For approval	Soft+2 Hard Print
B	For customer approval	Soft+2 Hard Print
C	For final distribution	Soft+2 CD +5 Hard Print
2.0	DRAWING FOR REFERENCE	
A	For reference	Soft+2 Hard Print
B	For final distribution	Soft+2 CD+5 Hard Print
3.0	CERTIFICATE, REPORTS ETC.	Soft+2 Hard Print
4.0	AS BUILT DRAWINGS (IF REQUIRED)	Soft+2 CD+8 Hard Print
5.0	O&M MANUAL	
A	Draft for approval	Soft +3 CD+ 5 Hard Print
B	For final distribution	Soft +3 CD + 8 Hard Print
6.0	QUALITY PLAN / Field quality plan / PG test	Soft + 2 Hard Print

3.1.6 List of drawings / documents required to be furnished by successful bidder after award of contract shall be as below:

SL. No.	DOCUMENT TITLE	DWG. / DOCUMENT No.	SUBMISSION SCHEDULE
1	Data Sheet for LT XLPE Power cables	PE-V0-411-507-E111	Within Two weeks from the date of LOI
2	Cross-sectional Drawings for LT XLPE Power cables	PE-V0-411-507-E112	Within Two weeks from the date of LOI
3	Quality Plan for LT XLPE Power cables	PE-V0-411-507-E913	Within Two weeks from the date of LOI
4	Type Test Reports for Tests conducted for this contract	PE-V0-411-507-E114	Within a week from the date of conduction of Type Test

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ANNEXURE-A TO SECTION – C
(BOQ-CUM-PRICE SCHEDULE)


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1) 1.1 kV / Aluminium conductor/ XLPE insulated / Innersheath PVC Type ST2/ Non-magnetic Hard drawn aluminium single round wire H4 grade for single core cables OR Galvanised steel round steel wire/formed wire armour for multicore cables/Outersheath Extruded FRLS PVC Type ST2 cables

Sl. No.	Cable Sizes	Total Quantity (meters)	LOT-1 Quantity (meters)	Drum Length (meters)	Supply price (Ex-works)		Remarks
					Unit Price	Total Price	
1	1C - 630	43000	30000	500			
2	1C-400	40000	28000	500			
3	1C -120	6000	4000	500			
4	1C -35	24000	17000	500			
5	2C - 185	4000	3000	500			
6	2C-95	2000	1500	500			
7	2C -25	41000	29000	500			
8	3C - 240	12000	8500	500			
9	3C - 185	6000	4000	500			
10	3C-95	19000	13000	500			
11	3C -50	27000	19000	500			
12	3C -25	49000	34000	500			
13	3C -16	12000	8500	500			
14	3C -10	98000	69000	500			
15	3.5C -25	13000	9000	500			
16	3.5C-50	48000	34000	500			
17	3.5C-95	1000	500	500			


2) 1.1 kV / Copper conductor/ XLPE insulated / Innersheath PVC Type ST2/ Galvanised steel round steel wire/formed wire armour /Outersheath Extruded FRLS PVC Type ST2 armoured cables

Sl. No.	Cable Sizes	Total Quantity	LOT-1 Quantity	Drum Length	Supply price (Ex-works)		Remarks
					Unit Price	Total Price	
1	2C -2.5	210000	147000	1000			
2	3C-2.5	323000	226000	1000			
3	2C-6	17000	12000	500			

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Notes:

1. The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ-Cum-Price Schedule. The unit prices shall apply for adjustment of variation in quantity as stipulated above.
2. Lot-I quantities indicated above (in case the cable quantities are to be released for manufacture in more than one lot), or Order Quantity (in case the quantities are cleared for manufacture in one lot only) shall be cleared for manufacturing along with LOI. However, manufacturing of the cables shall be taken up by the successful bidder only after approval of technical and quality documentation. Subsequent lots shall be cleared for manufacture based on progress of engineering and site requirements.
3. Delivery schedule of LOT-1 and subsequent lots shall be as per NIT.
4. The standard drum length for control cables shall not be less than mentioned against each cable size above. The length per drum shall be subjected to a maximum tolerance of +/- 5% of the standard drum length.
5. Overall tolerance on total dispatched quantity of each size shall be (-) 2% and (+) 0% Cables consumed for testing and inspection shall be to bidder's account.
6. For each individual cable size except for size 3.5C-95sq.mm., one short length of not less than 200m may be accepted only in the final drum length to complete the supply. The overall tolerance limits stipulated above shall continue to apply (in case short lengths are accepted).
7. Bidder shall indicate unit price of cables inclusive of type test charges. No separate charges shall be payable for type tests.
8. In case the quantities cleared by BHEL for manufacturing (in a lot) are manufactured and offered for inspection by successful bidder in more than one batch, BHEL reserves the right to witness type testing on all batches without any price implication.

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SECTION – ‘D’

STANDARD TECHNICAL SPECIFICATION

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1.0 TECHNICAL REQUIREMENTS

1.1 Technical requirements for 1.1 kV XLPE power cables shall be as indicated in this section, in addition to those specified in Section-C and Datasheet-A as attached for project specific requirements.

2.0 QUALITY ASSURANCE REQUIREMENTS

2.1 Bidder shall confirm compliance with the BHEL Quality Plan as attached with the specification without any deviations. Minor changes in Quality Plan (which shall be to customer approval during contract stage) shall be without any commercial implication.


2.2 In the event of BHEL Quality Plan not being applicable for a project (as indicated in section-C of the project specification), the successful bidder shall submit the Manufacturing Quality Plan (MQP) for approval by BHEL/ Owner (as applicable) during detailed engineering stage without any commercial implications.

2.3 Bidders shall submit the list of proven sub-vendors for raw materials, which will be subject to BHEL/ customer approval.

2.4 Type testing requirements and routine/ acceptance testing requirements shall be as detailed below.

2.4.1 Type Tests on Cables

- 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 in Annexure to QAP (enclosed with quality plan) carried out in within last five 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 five 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 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. BHEL reserves the right to witness the testing for which due notice shall be given by the vendor.
- d. Irrespective of the bidder furnishing type test report as indicated above, BHEL may get type tests conducted as indicated in Annexure to QAP (enclosed with quality plan) and the same shall be offered for inspection (conduction of type tests shall be witnessed by BHEL). Separate price shall be quoted for the conduction of type testing per lot, which shall be used for cost comparison. A maximum of three lots shall be considered for price comparison purposes on account of type testing. However, type-testing charges shall be paid as per type test conducted.

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- e. Minor changes in the final Type Test Procedures (which shall be to approval during contract stage) shall be without any commercial implication.

2.4.2 Routine and Acceptance Tests

- a. Routine testing shall be conducted in line with the applicable standards and as per the Manufacturing Quality Plan approved for the project for every lot offered for inspection.
- b. Acceptance tests shall be conducted on every lot offered for inspection as per details indicated in Annexure to QAP (enclosed with quality plan).
- c. Cost of conduction of routine and acceptance testing shall be deemed to have been included in the quoted supply prices.

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

3.0 PACKING

- 3.1 Cables shall be supplied in non-returnable heavy construction drums. 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.


4.0 PROJECT SPECIFIC TECHNICAL AND QUALITY DOCUMENTATION TO BE SUBMITTED

4.1 By All Bidders

As technical offer:

- a) A copy of "Instruction to bidder's for preparing technical offer" as enclosed with enquiry with bidder's signature and company seal.
- b) A copy of "List of contents" as enclosed with enquiry with bidder's signature and company seal.
- c) A copy of Annexure-A (BOQ-Cum-Price schedule) as enclosed with enquiry with bidder's signature and company seal.
- d) A copy of Datasheet-A as enclosed with enquiry with bidder's signature and company seal.
- e) A copy of Quality Plan(including Annexure to QAP) as enclosed with enquiry with bidder's signature and company seal.

No other documentation is required to be submitted as technical offer. Any information contained in other parts of the offer (e.g. covering letter, annexures, etc.) which is deviating from specification requirements in any way shall not be considered by BHEL as part of offer.

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- 4.2 By Successful Bidder (for approval during contract stage)
- Datasheet C and derating factors in the format provided to the successful bidder along with LOI.
 - Cross-section drawings of the cables
 - Manufacturing Quality Plan in case BHEL SQP is not applicable.
 - List of sub-vendors/ suppliers of raw materials
 - Type Test Procedure
 - Field Quality Plan
 - Technical catalogues/ literature for the cables.
- 4.3 Two copies of the above documentation shall be submitted for first review. Number of copies to be submitted for second and subsequent submissions (till Cat-I approval is accorded), and those for final distribution prints of approved documentation and test certificates shall be as indicated separately in section C.
- 4.4 Wherever required, soft copy of all approved technical/ quality documentation shall be submitted as specified without any additional commercial implication. Soft copies may be required both in native file format (e.g. MS Word/ MS Excel) as well as PDF files.



DOCUMENT TITLE

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FOR LT XLPE POWER CABLES**

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QUALITY PLAN

		STANDARD QUALITY PLAN		CUSTOMER : OPGCL		PROJECT:		SPECIFICATION			
		SHEET 1 OF 9		BIDDER/ VENDOR SYSTEM		QUALITY PLAN NUMBER: PE-QP-999-507-E002, R0 ITEM: LT XLPE Power Cables		NUMBER PE-TS-411-507-E002			
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	VOLUME III	REMARKS
1	2	3	4	5	6	7	8	9	P W V	10	11

Instructions:

- Cable manufacturer to maintain records to show co-relation of raw materials to finished cables i.e. raw material batch/ lot no. should be traceable to the final cable drum number or batch no.
- Cable manufacturer to maintain all quality records identified as per all QP stages enumerated below whether it is identified for BHEL verification or witness or not.

1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
1.1	Aluminium Rods (Conductor/ Armour Wire)	GENERAL : 1. Physical properties 2. Elec. Properties	MA MA	Physical Tests Electrical Tests	Sample/ Batch Sample/ Batch	IS:7098-I,IS:5082, IS:5484, IS:8130 & Appd Datasheet -do-	IS:7098-I,IS: 5082, IS:5484, IS:8130 & Appd Datasheet -do-	Log book/ Test Cert. -do-	3/2 3/2	- -	1/2 1/2		
		SPECIFIC CHECKS : a) Make b) Grade c) Resistivity	MA MA MA	Verify -do- Electrical Tests	100% -do- Manufacturer std.	Manufacturer approved source IS 8130, IS 5082/ Approved datasheet IS 8130, IS 5082	Manufacturer approved source IS 8130, IS 5082/ Approved datasheet IS 8130, IS 5082	Log book/ Test Cert. -do- -do-	3/2 3/2 3/2	- - -	1 1 1		
1.2	XLPE Compound for Insulation	GENERAL : 1. Physical properties 2. Elec. Properties	MA MA	Physical Tests Electrical Tests	Sample/ Batch Sample/ Batch	IS 7098-I & Mfs Std./ Approved datasheet -do-	IS 7098-I & Mfs Std./ Approved datasheet -do-	Log book/ Test Cert. -do-	3/2 3/2	- -	1/2 1/2		
		SPECIFIC CHECKS : a) Make b) Type/ Grade c) Shelf life/ Storage condition	MA MA MA	Verify -do- -do-	100% -do- -do-	Manufacturer approved source Mfr. Std/ Approved datasheet Compound Manufacturer std.	Manufacturer approved source Mfr. Std/ Approved datasheet Compound Manufacturer std.	Log book/ Test Cert. -do- -do-	3/2 3/2 3/2	- - -	1 1 1		
BHEL			PARTICULARS			BIDDER/VENDOR							
			NAME										
			SIGNATURE										
			DATE										
												BIDDER'S/VENDORS COMPANY SEAL	

STANDARD QUALITY PLAN		CUSTOMER : OPGCL		PROJECT:		4 X 270MW BHADRADRI TPP		SPECIFICATION		
BIDDER/ VENDOR		SYSTEM		REFERENCE DOCUMENT		ACCEPTANCE NORM		NUMBER PE-TS-411-507-E002		
SHEET 2 OF 9		CAT.		EXTENT OF CHECK		FORMAT OF RECORD		SPECIFICATION TITLE		
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	4	5	6	7	8	9	10	11
				TYPE/ METHOD OF CHECK					AGENCY P W V	REMARKS
1.3	PVC Compound (for sheath)	GENERAL : 1. Physical properties 2. Elec.Properties 3. FRLS Properties (as applicable) SPECIFIC CHECKS : a) Make b) Type/ Grade c) Shelf life/ Storage condition	MA MA CR	Physical Tests Electrical Tests Chemical/ Environ.	Sample/ Batch Sample/ Batch Sample/ Batch	IS 7098-I, IS 5831& Mfr. Std./ Approved datasheet -do- -do-	IS 7098-I, IS 5831& Mfr. Std./ Approved datasheet -do- -do-	Log book/ Test Cert. -do- -do-	3/2 - 3/2 - 3/2 -	1/2 1/2 1/2
1.4	Fillers (as applicable)	1. Make 2. Type/ Grade	MA MA	Verify -do- -do- Verify -do-	100% -do- -do- 100% -do-	Manufacturer approved source Approved datasheet Compound Manufacturer std. Manufacturer approved source Approved datasheet	Manufacturer approved source Approved datasheet Compound Manufacturer std. Manufacturer approved source Approved datasheet	Log book/ Test Cert. -do- -do- Log book/ Test Cert. -do-	3/2 - 3/2 - 3/2 - 3/2 - 3/2 -	1 1 1 1 1
BHEL PARTICULARS NAME SIGNATURE DATE BIDDER/VENDOR										
BIDDER/ VENDORS COMPANY SEAL										



Fillers material chosen shall be compatible with the temperature rating of the cable and shall have no deleterious effect on any other component of the cable)




STANDARD QUALITY PLAN

SHEET 3 OF 9

CUSTOMER : OPGCL		PROJECT:		SPECIFICATION			
BIDDER/ VENDOR		TITLE		NUMBER PE-TS-411-507-E002			
SYSTEM		QUALITY PLAN		SPECIFICATION :			
CAT.		REFERENCE DOCUMENT		TITLE			
CHARACTERISTIC CHECK		ACCEPTANCE NORM		SECTION			
COMPONENT/ OPERATION		EXTENT OF CHECK		AGENCY			
2		5		P W V			
3		6		10			
4		7		11			
5		8		REMARKS			
6		9		VOLUME III			
1.5	Galvanised steel wire/strip for Armour (as applicable)	GENERAL : 1. Make 2. Dimension 3. Phy.and Elec. Properties 4. Galvanization Quality	Verify Measurement Physical & Electrical Tests Galv. Tests	Manufacturer approved std. -do- Sample* -do-	Manufacturer approved source IS 7098-1, IS 3975 & Approved datasheet -do- IS 3975 & Mfr. Std.	3/2 - 1 3/2 - 2 3/2 - 2 3/2 - 2	* Sample from each armour size/ Batch / Lot
1.6	Wooden Drum	1. Phy. & Constructional checks 2. Anti termite treatment	Visual Chem.	Mfr's Plant Std. Mfr's Plant Std.	IS 10418 Mfr's Plant Std.	3/2 - 1 3/2 - 1	
1.7	Steel Drum #	1. Dimension 2. Surface finish	Meas. Meas.	Mfr's Plant Std. -do-	Mfr's Plant Std. Surface shall be smooth	3/2 - 1 3/2 - 1	# (If Applicable)
BHEL		PARTICULARS		BIDDER/VENDOR			
		NAME					
		SIGNATURE					
		DATE					
						BIDDER'S/VENDORS COMPANY SEAL	



STANDARD QUALITY PLAN		CUSTOMER : OPGCL				PROJECT			SPECIFICATION :	
		BIDDER/ VENDOR				TITLE			NUMBER PE-TS-411-507-E002	
SHEET 4 OF 9		SYSTEM				ITEM : LT XLPE Power Cables			TITLE	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS
									P W V	
1	2	3	4	5	6	7	8	9	10	11
2.0	IN PROCESS									
2.1	Wire Drawing	1. Size 2. Surface finish 3. % of Elongation	MA MA MA	Dimensional Visual Mechanical	Plant Mfg. Std. -do- -do-	IS 8130 & Appd. Datasheet Surface shall be smooth IS 8130 & Appd. Datasheet	IS 8130 & Appd. Datasheet Surface shall be smooth IS 8130 & Appd. Datasheet	Log Book -do- -do-	2 - 1 2 - 1 2 - 1	
2.2	Stranding of wires	1. No. of wires 2. Resistance 3. Sequence, lay length & Direction 4. Surface Finish 5. Dimension	MA CR MA MA MA	Counting Electrical Visual, Meas. Visual Measurement	Plant Mfg. Std. -do- One Sample of each size/lot 100% One Sample of each size/lot	IS 8130 & Appd. Datasheet -do- Mfrs Std. / Appd. Datasheet Surface shall be smooth IS 8130 & Appd. Datasheet	IS 8130 & Appd. Datasheet -do- Mfrs Std. / Appd. Datasheet Surface shall be smooth IS 8130 & Appd. Datasheet	Log Book -do- -do- -do- -do-	2 - - 2 - - 2 - - 2 - - 2 - -	
2.3	Core Insulation (XLPE) (No repair permitted)	1. Surface finish 2. Eccentricity & Ovality # 3. Insulation Thickness 4. Dia over insulation 5. Tensile Strength & % Elongation 6. Spark Test or Water immersion test	MA CR CR MA MA CR	Visual Measurement Measurement Measurement Mechanical Electrical	100% One Sample of each size/lot -do- -do- 100% 100%	Free from bulging, burnt particles, lumps, cuts & scratches IS 7098-I & Appd. Datasheet -do- -do- -do- Mnfr's Std	Free from bulging, burnt particles, lumps, cuts & scratches IS 7098-I & Appd. Datasheet -do- -do- -do- Mnfr's Std	Log Book -do- -do- -do- -do-	2 - 1 2 - - 2 - - 2 - - 2 - 1	# To be checked at starting & finished end of extruded length.
BHEL		PARTICULARS				BIDDER/VENDOR				
		NAME								
		SIGNATURE								
		DATE								
BIDDER'S/VENDORS COMPANY SEAL										

STANDARD QUALITY PLAN		CUSTOMER : OPGCL			PROJECT TITLE			SPECIFICATION :			
		4 X 270MM BHADRADRI TPP			NUMBER PE-TS-411-507-E002			SPECIFICATION :			
		QUALITY PLAN			TITLE			SECTION			
SHEET 5 OF 9		BIDDER/ VENDOR SYSTEM			NUMBER: PE-QP-999-507-E002, R0			VOLUME III			
CHARACTERISTIC CHECK		REFERENCE DOCUMENT			ACCEPTANCE NORM			REMARKS			
SL. NO.	COMPONENT/OPERATION	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	7	8	9	10	11		
1	2	3	4	5	6	7	8	9	10	11	
2.4	Core Laying	1. Dia over laid up core 2. Sequence of lay & direction 3. Lay Length	MA MA MA	Measurement Visual & Meas. Measurement	One Sample of each size/ lot -do- -do-	IS 7098-I & Appd. Datasheet IS 7098-I & Mfr. Std. -do-	IS 7098-I & Appd. Datasheet IS 7098-I & Mfr. Std. -do-	Log Book -do- -do-	2 2 2	- - -	- - -
2.5	Inner Sheath Extrusion (as applicable)	1. Surface finish 2. Thickness 3. Dia over inner sheath	MA CR MA	Visual Measurement -do-	100% One Sample of each size/ lot -do-	Surface shall be smooth IS 7098-I & Appd. Datasheet -do-	Surface shall be smooth IS 7098-I & Appd. Datasheet -do-	Log Book -do- -do-	2 2 2	- - -	- - -
2.6	Armour (as applicable)	1. No. of wires/Strips 2. Lay length & Direction 3. Dia over armouring 4. Coverage	MA MA MA MA	Counting Visual & Meas. Measurement Measurement	At the start of the process -do- -do- -do-	IS 7098-I & Appd. Datasheet IS 7098-I & Mfr. Std. IS 7098-I & Appd. Datasheet -do-	IS 7098-I & Appd. Datasheet IS 7098-I & Mfr. Std. IS 7098-I & Appd. Datasheet -do-	Log Book -do- -do- -do-	2 2 2 2	- - - -	- - - -
2.7	Outer Sheath Extrusion (No repair permitted)	1. Surface finish 2. Sheath Thickness 3. Dia over outer sheath 4. Embossing/ Sequential Marking	MA CR MA MA	Visual Measurement -do- Visual	100% One Sample of each size/ lot -do- 100%	Surface shall be smooth IS 7098-I & Appd. Datasheet -do- Approved data sheet	Surface shall be smooth IS 7098-I & Appd. Datasheet -do- Approved data sheet	Log Book -do- -do- -do-	2 2 2 2	- - - -	- - - -
BHEL		PARTICULARS			BIDDER/VENDOR						
		NAME									
		SIGNATURE									
		DATE									
										BIDDERS/VENDORS COMPANY SEAL	



DOCUMENT TITLE

SPECIFICATION NO. PE-TS-411-507-E002

TECHNICAL SPECIFICATION
FOR LT XLPE POWER CABLES

VOLUME II B

SECTION

4 x 270 MW Bhadradri TPP

REVISION 0

DATE: 02.06.15

ANNEXURE TO QAP

SHEET 29

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TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS

A. Type Test Conduction:

1. Tests for which "T" is indicated in the 'Test Conduction Required As' column below shall be conducted as Type Test.
2. Sampling:
 - a) Type test to be conducted on one size/ lot
 - b) Flammability Test to be conducted only on one sample/ lot.

B. Acceptance Test Conduction:

1. Tests for which "A" is indicated in the 'Test Conduction Required As' column below shall be conducted as Acceptance tests.
2. Sampling:
Sampling for acceptance tests shall be as per Appendix-B (Clause 15.2.2) of IS: 7098 Part-I.
3. Flammability Test to be conducted only on one sample/ lot.

C. Routine Test Conduction:

1. Tests for which "R" is indicated in the 'Test Conduction Required As' column below shall be conducted as Routine tests.

D. Tests listed in S.No-7.0 & 8.0 shall be conducted only on one sample / lot.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
1.0	Tests for Conductor				
I.	Annealing test	For copper conductor only	T, A	IS 10810 Pt 1	<i>Internal in process Test Report to be furnished for acceptance test</i>
II.	Tensile test	For aluminium conductor only	T, A	IS 10810 Pt 2	
III.	Wrapping test	For aluminium conductor only	T, A	IS 10810 Pt 3	
IV.	Resistance test	For Al/Cu	T, A, R	IS 10810 Pt 5	
2.0	Tests for Armour Wires/Strips				
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	T, A	IS 10810 Pt 36	
II.	Tensile test	Applicable for Aluminium wire & GS wire/Strip	T, A	IS 10810 Pt 37	



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S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
III.	Elongation at break test	Applicable for GS wire/Strip only	T, A	IS 10810 Pt 37	
IV.	Torsion test	For GS round wire only	T, A	IS 10810 Pt 38	
V.	Winding test	For GS strip only	T, A	IS 10810 Pt 39	
VI.	Resistivity test	Applicable for Aluminium wire & GS wire	A	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	A	IS 10810 Pt 40	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	A	IS 10810 Pt 41	
IX.	Wrapping Test	For Aluminium wires only	A	IS 10810 Pt 3	
3.0	<u>Physical Tests for XLPE Insulation & PVC sheath</u>				
I.	Test for thickness	Applicable for XLPE insulation, PVC inner sheath & PVC outer sheath	T, A	IS 10810 Pt 6	
II.	Tensile strength and elongation test at break	Applicable for XLPE insulation & PVC outer sheath			
(a)	Before ageing		T, A	IS 10810 Pt 7	
(b)	After ageing		T, A	IS 10810 Pt 7	
III.	Ageing in air oven	Applicable for XLPE insulation & PVC outer sheath	T	IS 10810 Pt 11	
IV.	Loss of mass in air oven test	For PVC outer sheath only	T	IS 10810 Pt 10	
V.	Hot deformation test	For PVC outer sheath only	T	IS 10810 Pt 15	
VI.	Heat shock test	For PVC outer sheath only	T	IS 10810 Pt 14	
VII.	Shrinkage test	For XLPE insulation & PVC outer sheath only	T	IS 10810 Pt 12	
VIII.	Thermal stability test	For PVC outer sheath only	T	IS 10810 Pt 60	
IX.	Hot set test	For XLPE insulation only	T, A	IS 10810 Pt 30	
X.	Water absorption (gravimetric) test	For XLPE insulation only	T	IS 10810 Pt 33	
4.0	<u>Improved Fire performance (FR-LS) Tests</u>				
I.	Oxygen index test	For PVC outer sheath only	T, A	IS 10810 Pt 58 / ASTMD 2863	Applicable for Inner Sheath also, if the same is indicated in Datasheet-A
II.	Smoke density test	For PVC outer sheath only	T, A	IS 10810 Pt 63 / ASTMD 2843	
III.	Acid gas generation test	For PVC outer sheath only	T, A	IS 10810 Pt 59 / IEC-754-1	
IV.	Temperature Index Test	For PVC outer sheath only	T	IS 10810 Pt 64 / ASTMD 2863	
5.0	<u>Flammability Tests</u>				



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S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
I.	Flammability test for bunched cables	For complete cable	T	IS 10810 Pt 62/ IEC-60332 (Part-3-23-Cat-B/Cat-A,	Test & Category applicable as indicated in Datasheet-A
II.	Flammability test for single cable	For complete cable	T,A	IS: 10810 Pt 61 / IEC:60332 Part-1	
III.	Swedish chimney test	For complete cable	A	SEN SS 424 1475 (Class F3)	
IV.	Flammability test	For complete cable	A	IEEE: 60383	
6.0	Electrical Tests				
I.	High Voltage Test	For complete cable	T, A, R	IS 10810 Pt 45	
II.	Insulation Resistance Test (Volume resistivity method)	For complete cable	T, A	IS 10810 Pt 43	
7.0	Anti-rodent and Termite Repulsion test	For PVC outer sheath only	A	--	Test applicable if indicated in Datasheet-A
8.0	Anti-Fungal Test	For PVC outer sheath only	A	--	
9.0	Special Tests				
I.	Hydrolytic Stability Test	For complete cable	**	ASTM D 3137:81	Test applicable if indicated in Datasheet-A
II.	Ultraviolet Radiation Test	For complete cable	**	BS EN ISO 4892-2	

**** These tests shall be conducted on one sample for the entire contract and duration of these tests shall be 14 days.**



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DATA SHEET - A



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I. SPECIFIC TECHNICAL REQUIREMENTS

1.0	Type of Cable	LT XLPE POWER CABLE OF FRLS TYPE
2.0	Standard applicable in general	IS: 7098 PART (I)
3.0	Voltage Grade	1.1kV
4.0	Number of cores, cross sectional area of conductors	As per Annexure-A (BOQ cum price schedule)
5.0	Formula for calculating short circuit current for different durations	$I_{sh} = k A / \sqrt{t}$ where, I_{sh} = Short circuit current in kA t = Fault clearing time in sec. K = a constant = 0.094 for Aluminium conductor XLPE insulation = 0.141 for copper conductor XLPE insulation
6.0	Installation Conditions for specified current rating	
(a)	Ambient air temperature	40 deg. C
(b)	Ambient temp. for underground cable	30 deg. C
(c)	Thermal resistivity of soil	150 deg. C cm/W
7.0	CONDUCTOR	
(a)	Material	Aluminium Copper
	Grade and Class	For Aluminium Cable: STRANDED COMPACTED PLAIN Aluminium OF H2 GRADE & CLASS 2. For Copper Cable : Stranded (untinned), Annealed high conductivity Class -2
(b)	Standard Applicable	IS: 8130
	Shape	Circular / shaped as per IS
(d)	Min. number of strands	As per Table-2 of IS: 8130
8.0	INSULATION	
(a)	Material	XLPE
(b)	Standard Applicable	IS: 7098 Part-I
(c)	Continuous withstand temperature	90°C
(d)	Short-circuit withstand temperature	250°C
(e)	Method of application	By extrusion; sleeve extrusion not permitted.
9.0	CORE IDENTIFICATION	Colour coding as per IS.
10.0	INNER SHEATH	
(a)	Material	PVC Type ST2 as per IS: 5831



DOCUMENT TITLE TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES 4 x 270 MW Bhadradri TPP	SPECIFICATION NO. PE-TS-411-507-E002	
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	SECTION	
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(b)	Colour	<i>Black</i>
(c)	Whether FRLS	<i>No</i>
(d)	Fillers	<i>Acceptable</i>
(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	
(1)	Multi-core cables:	
(i)	With fillers	<i>Pressure/Vacuum extruded</i>
(ii)	Without fillers	<i>Pressure extruded</i>
11.0	ARMOUR (where applicable)	
(a)	Material:	
(i)	Single core cables	Non-magnetic Hard drawn aluminium single round wire H4 grade, as per IS: 8130 with max resistivity of 0.028264 ohm sq.mm./mtr at 20 deg. C.
(ii)	Multi-core cables	Galvanised steel round steel wire/formed wire armour conforming to IS 3975
(b)	Minimum Coverage	90%
(c)	Gap between armour wires	Shall not exceed one armour wire space
(d)	Breaking load of joint	95% of normal armour
12.0	OUTERSHEATH	
(a)	Material	Extruded FRLS PVC Type ST2 as per IS: 5831
(b)	Colour	<i>Black</i>
(c)	Whether FRLS	<i>Yes</i>
(d)	Method of application	<i>Extruded</i>
(e)	Marking	Manufacturer's name and /or trade mark year of manufacture, Type of insulation, IS Number(s) Cable size (cross section area of conductor and no. of cores) – (To be embossed) voltage grade -(To be embossed) Word "FRLS" @ 5m (by embossing) 'BHEL-PEM' & 'TSGENCO' @5m (by embossing) Progressive Sequential marking of length of the cable in metres at every one meter (by embossing/printing)
13.0	TEST CONDUCTED	
(a)	Oxygen index test	Min 29(As per ASTM D2863 ,IS 10810 part-58
(b)	Temperature index test	Minimum 250°C at oxygen index 21 (ASTM-D-2863)
(c)	Acid gas generation test	Max. 20% (as per IEC-754-1)
(d)	Smoke density rating test	Max.60% (As per ASTM-D-2843)
(e)	Flammability Test	As per IEC: 332-III CAT-B, IEC: 60332-I, IEEE: 383 & SS:



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		424:1475 (Class-F3), IS: 10810.
14.0	TOLERANCE ON OUTER DIAMETER	Upto 30 mm - ± 1.5 mm Above 30 mm - ± 2 mm or $\pm 5\%$ whichever is less
15.0	TEST MINIMUM BENDING RADIUS	
(a)	Single core cables	15 x O.D.
(b)	Multi core cables	12 x O.D.
16.0	SAFE PULLING FORCE	
(a)	Aluminium conductor cable	30 N/ sq. mm.
(b)	Copper conductor cable	50 N/ sq. mm.
17.0	CABLE DRUMS	
(a)	Type & construction	Wooden drum ,As per IS 10418
(b)	Standard drum length	500m (\pm) 5% / 1000m (\pm) 5%. (as specified in BOQ)
(c)	Marking on Cable drums	Manufacturer's name or trade mark, purchaser's name, address and contract number, item number & type of cable & voltage grade, year of manufacture, type of insulation/sheath, no. of core and size of cables, cable code, length of cable on drum, direction of rotation (by arrow), approx. net gross weight. A tag containing same information shall be attached to the leading end of the cable.

	DOCUMENT TITLE	SPECIFICATION NO. PE-TS-411-507-E002	
	TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES	VOLUME II B	
		SECTION	
	4 x 270 MW Bhadradri TPP	REVISION 0	DATE: 02.06.15
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DATA SHEET- C
GUARANTEED TECHNICAL PARTICULARS
(TO BE SUBMITTED BY SUCCESSFUL BIDDER)

- 1.1 Name of manufacturer :
- 1.2 Place of Manufacture :
- 2.1 Current rating of cables conforms to :
- 2.2 Short circuit rating conforms to :
- 3.1 Formula for calculating short circuit current for
different durations as per Clause-5 of Data Sheet-A
OR
Whether curve for short time current v/s time
for different cables enclosed :
- 4.0 INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE**
- 4.1 No. of cores x size :
- 4.2 Base current ratings (*) based on Clause 6.0 of Data Sheet-A
- a) In air : Amp
- b) In ground : Amp
- c) ducts : Amp
- 4.3 Short circuit rating : kA, sec.
- 4.4 a) D.C. resistance of conductor at
20 deg. C : ohm/km
- b) A.C. resistance of conductor at
90 deg. C : ohm/km
- c) Reactance of cable
at normal frequency : ohm/km
- 4.5 CONDUCTOR**
- a) Material type & grade :
- b) No & dia of wires in each core
before stranding : no x mm
- 4.6 XLPE INSULATION**
- a) Minimum & Nominal thickness of insulation : mm
- 4.7 PVC ST2 INNERSHEATH**
- a) Thickness (min.) : mm



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b) Method of application

1) Multi-core cables

i) With fillers :

ii) With out fillers :

Pressure Extruded

c) Type of fillers (if used) :

PVC type ST2 as per IS 5831

Shape of fillers (if used) :

d) Colour :

4.8 ARMOUR

a) Material

i) Single core cables :

ii) Multi-core cables :

b) Size/ dimensions :

c) Minimum no. of wires :

d) Maximum resistivity of GS wire :

e) Maximum resistivity of Aluminium round wire :

4.9 PVC ST2 FRLS OUTERSHEATH

a) Minimum thickness of outer sheath :

mm

b) Colour :

4.10 Diameters

a) Diameter of insulated conductor :

mm

b) Cable diameter under armour :

mm

c) Cable diameter over armour :

mm

d) Overall diameter of cable :

mm

4.11 Weight of cable :

kg./km

4.12 Dimension of drum :

mm

4.13 Shipping weight :

kg.

(*) For single core cables, the continuous current rating shall be furnished separately for armour earthed at one end and at both ends.