


## NTPC LTD


### CPG-1/VDC Raipur


**1. Sub: Qualifying Requirement (QR) for Vendor Enlistment for Supply of LT PVC/XLPE Insulated Power Cables**


A)	MEG DETAILS		
	1.0	MEG DESCRIPTION	LT PVC/XLPE INSULATED POWER CABLES
	2.0	MEG RESPONSEBILITY	VDC
B)	<p><b>Technical Criteria of QR:</b> The bidder should have manufactured and supplied during last five years from the date of application:</p> <ul style="list-style-type: none"> <li>a) Atleast 1 km of aluminum conductor, XLPE insulated PVC sheathed power cable of 1.1 KV or higher grade.</li> <li>b) Atleast 1 km of aluminum conductor, PVC insulated, PVC sheathed power cable of 1.1 KV or higher grade</li> <li>c) Atleast one (1) km of Flame retardant low smoke cables.</li> <li>d) 1.1 KV or higher-grade power cable of minimum 630 SQMM conductor size.</li> </ul>		
Of	<p><b>Documents required in support of meeting QR :</b></p> <ol style="list-style-type: none"> <li>1. Latest annual report OR NSIC / SSI / MSME registration certificate / BIS license / ISO certificate / Certificate of registration from the concerned excise department / any other statutory document as a proof of being manufacturer of the LT power cables. Brief details of manufacturing facilities or Standard published catalogue for LT power cables also to be given.</li> <li>2. The PO in support of award and completion certificate/copies of invoice to establish successful execution of the supply of LT power cables as per QR.</li> </ol> <p><b>Documents to be submitted to find executed value of orders :</b> In addition to the documents required in support of meeting technical requirements as stated above, following documents are required to be submitted by the Applicants applying for enlistment:-</p> <ol style="list-style-type: none"> <li>1. Three (3) POs of the highest executed values of similar work (see definition at point E:Note- 1 below) during previous five (5) years from the date of application. Copy of Invoice / Completion certificate from the concerned buyer/s in support of successful execution of supply against the POs to be submitted. These will be required for calculation of execution capability.</li> <li>2. Audited balance sheet including Profit &amp; Loss statement for the previous three (3) completed financial year's reckoned from the date of application. In case where the audited results for the last financial years as on the date of application are not available, the financial result certified by a practicing Chartered accountant shall be considered acceptable.</li> <li>3. GSTIN certificate ,PAN ,Power of attorney, Letter of undertaking ,works information etc. as mentioned in enlistment application pages of website <a href="http://www.vendor.ntpc.co.in">www.vendor.ntpc.co.in</a></li> <li>4. NTPC can request for other documents as necessary during the course of evaluation.</li> </ol>		
E)	NOTE-1	Similar works means: "Supply of 1.1 KV LT XLPE/PVC Power cables.	


	NOTE-2	The executed value means Basic value of quantity of similar works executed/supplied against thereference PO (also applicable to partly executed POs as on date of application).Where PO value is composite(i.e. including Taxes etc.),the applicant to give item-wise break-up of Composite PO value mentioning Basic Value, Taxes etc.


CLAUSE NO.	TECHNICAL REQUIREMENTS		
1.00.00	<b>CODES &amp; STANDARDS</b>		
1.01.00	<p>All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:</p> <p>IS :1554 - I                      PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.</p> <p>IS : 3961                              Recommended current ratings for cables</p> <p>IS : 3975                              Low carbon galvanized steel wires, formed wires and tapes for armouring of cables.</p> <p>IS : 5831                              PVC insulation and sheath of electrical cables.</p> <p>IS:7098 (Part -I)                      Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.</p> <p>IS : 8130                              Conductors for insulated electrical cables and flexible cords.</p> <p>IS : 10418                              Specification for drums for electric cables.</p> <p>IS : 10810                              Methods of tests for cables.</p> <p>ASTM-D -2843                      Standard test method for density of smoke from the burning or decomposition of plastics.</p> <p>IEC-754 (Part-I)                      Tests on gases evolved during combustion of electric cables.</p> <p>IEC-332                              Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).</p>		
2.00.00	<b>TECHNICAL REQUIREMENTS</b>		
2.01.00	The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.		
2.02.00	All cables including EPR cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.		
		<b>TECHNICAL SPECIFICATION LT POWER CABLES</b>	<b>PAGE 1 OF 6</b>

CLAUSE NO.	TECHNICAL REQUIREMENTS	
2.03.00	Aluminium conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be stranded.	
2.04.00	XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C. PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.	
2.05.00	The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS : 5831.	
2.06.00	For single core armoured cables, armouring shall be of aluminium wires/ formed wires. For multicore armoured cables, armouring shall be of galvanized steel as follows :	
	Calculated nominal dia. of cable under armour	Size and Type of armour
	Upto 13 mm	1.4mm dia GS wire
	Above 13 & upto 25mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire
	Above 25 & upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire
	Above 40 & upto 55mm	1.4 mm thick GS formed wire /2.5mm dia GS wire
	Above 55 & upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire
Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire	
2.06.01	The aluminium used for armouring shall be of H4 grade as per IS: 8130 with maximum resistivity of 0.028264 ohm mm <sup>2</sup> per meter at 20 deg C. The sizes of aluminium armouring shall be same as indicated above for galvanized steel.	
2.06.02	The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface of G.S.wire/ formed wire.	
2.07.00	Outer sheath shall be of PVC as per IS: 5831 & black in colour. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties.	
	(a.) Oxygen index of min. 29 (as per IS 10810 Part-58).	
	(b.) Acid gas emission of max. 20% (as per IEC-754-I).	
	(c.) Smoke density rating shall not be more than 60 % (as per ASTMD-2843).	
2.08.00	Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted:	
	<b>TECHNICAL SPECIFICATION LT POWER CABLES</b>	<b>PAGE 2 OF 6</b>

CLAUSE NO.	TECHNICAL REQUIREMENTS	
	1 core - Red, Black, Yellow or Blue 2 core - Red & Black 3 core - Red, Yellow & Blue 4 core - Red, Yellow, Blue and Black	
2.09.00	For reduced neutral conductors, the core shall be black.	
2.10.00	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath.  (a.) Cable size and voltage grade - To be embossed (b.) Word 'FRLS' at every 5 metre - To be embossed (c.) Sequential marking of length of the cable in metres at every one metre -To be embossed / printed  The embossing shall be progressive, automatic, in line and marking shall be legible and indelible. For EPR cables identification shall be printed on outer sheath.	
2.11.00	All cables shall meet the fire resistance requirement as per Category-B of IEC 332 Part-3.	
2.12.00	Allowable tolerances on the overall diameter of the cables shall be $\pm 2$ mm maximum, over the declared value in the technical data sheets.	
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.	
2.14.00	Cable selection & sizing	
2.14.01	Cables shall be sized based on the following considerations:  (a) Rated current of the equipment  (b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage  (c) Short circuit withstand capability  This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the let-out energy of the fuse. For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time.	
2.14.02	Derating Factors  Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes:  a) Variation in ambient temperature for cables laid in air	
	<b>TECHNICAL SPECIFICATION LT POWER CABLES</b>	<b>PAGE 3 OF 6</b>

CLAUSE NO.	TECHNICAL REQUIREMENTS	
<p>b) Grouping of cables</p> <p>c) Variation in ground temperature and soil resistivity for buried cables.</p> <p>2.14.03 Cable lengths shall be considered in such a way that straight through cable joints are avoided.</p> <p>2.14.04 All Cables shall be of armoured type.</p> <p>2.14.05 Same cable sizes to be used for same type &amp; rating of motor i.e if there are three pumps for one application, all three pumps motor should be provided with same cables sizes.</p> <p><b>3.00.00</b></p> <p><b>CONSTRUCTIONAL FEATURES</b></p> <p>3.01.00</p> <p>1.1 KV Grade Power Cables</p> <p>(a) 1.1 KV grade XLPE power cables shall have compacted aluminium conductor, XLPE insulated, PVC inner-sheathed (as applicable), armoured, PVC outer-sheathed conforming to IS:7098. (Part-I).</p> <p>(b) 1.1KV grade PVC power cables shall have aluminium conductor(compact type for sizes above 10 sq.mm), PVC Insulated, PVC inner sheathed (as applicable) armoured, PVC outer-sheathed conforming to IS:1554 (Part-I).</p> <p>(c) 1.1 KV grade Trailing cables shall have tinned copper(class 5)conductor, insulated with heat resistant elastomeric compound based on Ethylene Propylene Rubber(EPR) suitable for withstanding 90 deg.C continuous conductor temperature and 250deg C during short circuit, inner-sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer-sheathed with heat resistant, oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968.</p> <p><b>4.00.00</b></p> <p><b>CABLE DRUMS</b></p> <p>(a) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.</p> <p>(b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stencilled on both sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.</p> <p>(c.) The standard drum length of LT power cable with a maximum tolerance of +/- 5% may be decided by the bidder subject to condition that there shall not be any joint in cable, where application length of cable is up to &amp; including 1000 meter for single core cable excluding 630 sqmm size, and 750 meter for multicore cable &amp; single core 630 sqmm. One drum length of each cable size can be of non-standard length (not less than 250 meter) so as to match the ordered quantity Subject to condition that there shall not be any joint in cable,</p>		
	<p align="center"><b>TECHNICAL SPECIFICATION</b> <b>LT POWER CABLES</b></p>	<p align="right"><b>PAGE</b> <b>4 OF 6</b></p>

CLAUSE NO.	TECHNICAL REQUIREMENTS																																									
5.00.00	<p><b>TESTS</b></p> <p>1.0 All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.</p> <p>2.0 However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval.</p> <p>3.0 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.</p> <p>4.0 The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.</p>																																									
5.01.00	<p><b>Type Tests</b></p>																																									
5.01.01	<p>The reports for the following type tests shall be submitted for one size each of LT XLPE and LT PVC Power cables. Size shall be decided by the employer during detailed engineering:</p> <table border="1" data-bbox="391 1129 1422 1808"> <thead> <tr> <th data-bbox="391 1129 553 1157">S.No.</th> <th data-bbox="553 1129 1008 1157">Type test</th> <th data-bbox="1008 1129 1422 1157">Remarks</th> </tr> </thead> <tbody> <tr> <td colspan="3" data-bbox="602 1171 781 1199"><b>For Conductor</b></td> </tr> <tr> <td data-bbox="391 1213 423 1241">1.</td> <td data-bbox="602 1213 781 1241">Resistance test</td> <td></td> </tr> <tr> <td data-bbox="391 1255 423 1283">2.</td> <td data-bbox="602 1255 781 1283">Tensile test</td> <td data-bbox="1032 1255 1422 1325">For circular non-compacted conductors only</td> </tr> <tr> <td data-bbox="391 1339 423 1367">3.</td> <td data-bbox="602 1339 781 1367">Wrapping test</td> <td data-bbox="1032 1339 1422 1367">For circular non-compacted only</td> </tr> <tr> <td colspan="3" data-bbox="602 1381 1000 1409"><b>For Armour Wires/ Formed Wires</b></td> </tr> <tr> <td data-bbox="391 1423 423 1451">4.</td> <td data-bbox="602 1423 927 1451">Measurement of Dimensions</td> <td></td> </tr> <tr> <td data-bbox="391 1465 423 1493">5.</td> <td data-bbox="602 1465 748 1493">Tensile Test</td> <td></td> </tr> <tr> <td data-bbox="391 1507 423 1535">6.</td> <td data-bbox="602 1507 773 1535">Elongation test</td> <td></td> </tr> <tr> <td data-bbox="391 1549 423 1577">7.</td> <td data-bbox="602 1549 740 1577">Torsion test</td> <td data-bbox="1032 1549 1422 1577">For round wires only</td> </tr> <tr> <td data-bbox="391 1640 423 1667">8.</td> <td data-bbox="602 1640 764 1667">Wrapping test</td> <td data-bbox="1032 1640 1422 1709">For aluminium wires / formed wires only.</td> </tr> <tr> <td data-bbox="391 1724 423 1751">9.</td> <td data-bbox="602 1724 781 1751">Resistance test</td> <td></td> </tr> <tr> <td data-bbox="391 1766 456 1793">10(a)</td> <td data-bbox="602 1766 886 1793">Mass of zinc coating test</td> <td data-bbox="1032 1766 1422 1793">For GS Formed wires/wires only</td> </tr> </tbody> </table>			S.No.	Type test	Remarks	<b>For Conductor</b>			1.	Resistance test		2.	Tensile test	For circular non-compacted conductors only	3.	Wrapping test	For circular non-compacted only	<b>For Armour Wires/ Formed Wires</b>			4.	Measurement of Dimensions		5.	Tensile Test		6.	Elongation test		7.	Torsion test	For round wires only	8.	Wrapping test	For aluminium wires / formed wires only.	9.	Resistance test		10(a)	Mass of zinc coating test	For GS Formed wires/wires only
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	<p><b>TECHNICAL SPECIFICATION LT POWER CABLES</b></p>		<p><b>PAGE 5 OF 6</b></p>																																							

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	10(b)	Uniformity of zinc coating	For GS Formed wires /wires only
	11.	Adhesion test	For GS Formed wires/wires only
		<b>For PVC/XLPE insulation &amp; PVC Sheath</b>	
	12.	Test for thickness	
	13.	Tensile strength & elongation tests	before ageing and after ageing
	14.	Ageing in air oven	
	15.	Loss of mass test	For PVC insulation and sheath only
	16.	Hot deformation test	For PVC insulation and sheath only
	17.	Heat shock test	For PVC insulation and sheath only
	18.	Shrinkage test	
	19.	Thermal stability test	For PVC insulation and sheath only
	20.	Hot set test	For XLPE insulation only
	21.	Water absorption test	For XLPE insulation only
	22.	Oxygen index test	For outer sheath only
	23.	Smoke density test	For outer sheath only
	24.	Acid gas generation test	For outer sheath only
		<b>For completed cables</b>	
	25.	Insulation resistance test (Volume resistivity method)	
	26.	High voltage test	
	27.	Flammability test as per IEC-332 Part-3 (Category-B)	
		Indicative list of tests/checks, Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of LT power cables enclosed.	
		TECHNICAL SPECIFICATION LT POWER CABLES	PAGE 6 OF 6



Sl. No		Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
1		2	3	4	5	M	C/N	7	8	9	D*	M	C	N	11
		Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)				QP. NO. 0000-999- QOE-S-041 REV-01 DATE: 29/11/2018 Page 1 of 9	REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR		APPROVED BY K K OJHA				
<b>Instructions:</b> 1) 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 cable drum. 2) Cable manufacturer to maintain all quality control records identified as per all QP stages enumerated below whether it is identified for NTPC verification or witness or not.															
<b>A Raw material/ Brought out Items</b>															
1.01	Aluminum	1.Make	MA	Verify	100%	--		MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	QCR		V	--	--	
		2. Resistivity	MA	Elect	As per Cable Mnfr Std.	--		IS5082	IS5082	-do-		P	--	--	
1.02	PVC / XLPE/compound for insulation	1. Make	MA	Verify	--do--	100%		MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	--do--		V	V	--	
		2. Type/ Grade	MA	Verify	100%	100%		NTPC ADS	NTPC ADS	--do--		V	V	V	
		3. All acceptance test as per manufacturer norms including thermal stability test for PVC insulation	MA	Verify	As per manufacturer norms	As per manufacturer norms		NTPC ADS	NTPC ADS	--do--		V	V	V	Refer note 1
1.03	PVC Compound for Inner sheath	1. Make	MA	Verify	--do--	--do--		MANUFACTURER APPROVED sources	MANUFACTURER APPROVED sources	--do--		V	V	V	
		2. Type/ Grade	MA	Verify	--do--	--do--		NTPC ADS	NTPC ADS	--do--		V	V	V	
1.04	Steel wire / Formed Wire ( As applicable )	1. Make	MA	Verify	--do--	--do--		MANUFACTURER APPROVED sources	MANUFACTURER APPROVED sources	--do--		V	V	V	
		2. Dimension	MA	Meas	1 sample from each size / lot	--		NTPC APPROVED DATA SHEET & IS 3975	NTPC APPROVED DATA SHEET & IS 3975	--do--		P	--	--	
		3. All acceptance tests as per IS 3975	MA	Verify	As per IS 3975	--		IS 3975	IS 3975	Supplier TC		V	V	--	
1.05	PVC compound for Sheath	1. Make	MA	Verify	As per manufacturer norms	100%		MANUFACTURER APPROVED sources	MANUFACTURER APPROVED sources	QCR		V	V	--	
		2. Type / Grade	MA	Verify	100%	100%		NTPC ADS	NTPC ADS	QCR		V	V	V	

LEGEND:- \*RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

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Sl. No		Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
1		2	3	4	5	M	C/N	7	8	9	D*	M	C	N	11
			3. All acceptance test as per manufacturer norms	MA	Verify	As per manufacturer norms	As per manufacturer norms	NTPC ADS	NTPC ADS	QCR		V	V	V	Refer note 1
			4. Thermal Stability	MA	Chem	One sample / Batch	--	NTPC ADS	NTPC ADS	QCR		P	--	--	
			5. Oxygen Index	MA	Chem	--do--	--	NTPC ADS/ IS 10810 Part 58	NTPC ADS/ IS 10810 Part 58	--do--		P	--	--	
			6. Acid Gas Emission	MA	Chem	One sample / Batch	--	NTPC ADS / IEC60754	NTPC ADS / IEC60754	QCR		P	--	--	
1.06	Wooden Drum	1. Dimension	MI	Meas	Manuf. Std.	--	--	IS 10418	IS10418	--do--		P	--	--	
		2. Anti termite treatment	MI	Chem	Cable manuf. std	--	--	CABLE MANUF. STD.	CABLE MANUF. STD.	COC		V	V	V	COC from drum manuf.
1.07	Steel Drum	1. Dimension	MI	Meas	--do--	--	--	--do--	--do--	QCR		P	--	--	
		2. Surface finish	MI	Meas	--do--	--	--	--do--	--do--	--do--		P	--	--	
<b>B Process &amp; Stage Inspection</b>															
2.01	Wire Drawing	1. Surface finish	MA	Visual	One sample/Settling of each size	--	--	SHOULD BE SMOOTH & FREE FROM SCRATCHES	SHOULD BE SMOOTH & FREE FROM SCRATCHES	QCR		P	--	--	
		2. Wire Diameter	MA	Meas	--do--	--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		3. Tensile test	CR	Mech	--do--	--do--	--do--	--do--	--do--	--do--		P	V	V	Refer Sl. No.3.03(iii)
		4. Wrapping test	CR	Mech	--do--	--do--	--do--	--do--	--do--	--do--		P	V	V	--do--
2.02	Bunching / stranding	1. No. of wires	MA	Meas	--do--	--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		2. Dia of wire	MA	Meas	--do--	--	--	--do--	--do--	--do--		P	--	--	
		3. Dimension of Conductor	MA	Meas	--do--	--	--	--do--	--do--	--do--		P	--	--	
		4. Direction of lay	MA	Visual	--do--	--	--	--do--	--do--	--do--		P	--	--	
		5. Records of strand breakage / welding during conductor stranding	MA	Verify	--do--	--	--	IS 8130	IS8130	--do--		P	--	--	
		6. Surface finish	MA	Visual	--do--	--	--	--do--	--do--	--do--		P	--	--	
		7. DC Resistance	CR	Meas	--do--	--	--	IS8130/NTPC ADS	IS8130/ NTPC ADS	--do--		P	--	--	
2.03	Insulation extrusion	1. Surface finish	MA	Visual	One sample/Settling of each size	--	--	NTPC spec	SHOULD BE SMOOTH. NO POROSITY IS PERMITTED.	QCR		P	--	--	XLPE/ PVC compound shall be preferably loaded in to extruder by suction method.

LEGEND:- \*RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W" FORMAT NO:QS-01-QAI-P-10/F3-R1

Sl. No		Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
						M	C/N				D*	M	C	N	
1		2	3	4	5	6		7	8	9	10				11
1		2.Colour of cores	MA	Visual	One sample/Settling of each size	-		NTPC ADS	NTPC ADS	QCR		P	--	--	
		3.Thickness	CR	Meas	--do--	--		NTPC ADS	NTPC ADS	--do--		P	--	--	
		4.Spark Test	CR	Elect	100%	100%		CABLE MANUF. STD.	No FAILURE	--do--		P	V	V	1.Spark test failure record is to be verified. 2.Core repairing not permitted
		5. Hot Set	CR	Mech	One sample/Settling of each size	--		IS 7098- Part I	IS 7098- Part I	--do--		P	--	--	Sample is to be taken from both top & bottom end
2.04	Laying up	1. Core sequence	MA	Visual	--do--	--		IS 1554 (Part I) & IS 7098- Part I	IS 1554 (Part I) & IS 7098- Part I	--do--		P	--	--	
		2. Direction of lay	MA	Visual	--do--	--		--do--	--do--	--do--		P	--	--	
		3. Dia over laid up core	MA	Meas	--do--	--		NTPC ADS	NTPC ADS	--do--		P	--	--	
2.05	Inner Sheath	1.Colour	MA	Visual	-do--	-		--do--	--do--	--do--		P	--	--	
		2. Surface Finish	MA	Visual	100%	-		NTPC SPECIFICATION	FISH EYE, BLOW HOLE NOT PERMITTED	--do--		P	--	-	
		3.Thickness	MA	Meas	One sample/Settling of each size	-		NTPC ADS	NTPC ADS	--do--		P	--	--	
		4.Dia over inner sheath	MI	Meas	--do--	-		--do--	--do--	--do--		P	--	--	
2.06	Armouring (As Applicable)	1.Dimension	MA	Meas	--do--	-		--do--	--do--	--do--		P	--	--	
		2.No. of wires / strip	MA	Meas.	--do--	-		--do--	--do--	--do--		P	--	--	
		3. Direction of lay	MA	Visual	--do--	--		IS 1554 (Part I) & IS 7098- Part I	IS 1554 (Part I) & IS 7098- Part I	QCR		P	--	--	

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-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W" FORMAT NO:QS-01-QA1-P-10/F3-R1

Sl. No		Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
1		2	3	4	5	6		7	8	9	D*	M	C	N	11
			4.Coverage & Quality of armouring	MA	Meas.	100%	--	Min. area of coverage of armouring shall be 90%. The gap between amour wires / formed wires shall not exceed one amour wire/ formed wire space & there shall be no cross over/ over riding of amour wire / formed wire. Zn rich paint shall be applied on amour joint surface of G.S. Wire /formed wire. The breaking load of amour wire joint shall not be less than 95% of that amour wire / formed wire. (As per NTPC specification)		QCR		P	--	--	
			5 Dia over armouring	MA	Meas.	One sample/Settng of each size	--	NTPC ADS		--do--		P	--	--	--
2.07	Outer Sheath	1. Surface finish	MA	Visual	100%	--		Pimple, Fish Eye, Burnt particles, Blow Hole not permitted. Repairing on outer sheath not permitted. (As per NTPC specification)		--do--		P	--	--	PVC FRLS compound shall be preferably loaded in to extruder by suction method.
		2.Colour of sheath	MA	Visual	One sample/Settng of each size	--		NTPC ADS	NTPC ADS	--do--		P	--	--	
		3. Dia over outer sheath	MA	Meas	--do--	--		NTPC ADS	NTPC ADS	--do--		P	--	--	
		4.Thickness of outer sheath	CR	Meas	--do--	-		--do--	--do--	--do--		P	--	--	
		5. Embossing quality	MA	Visual	100%	-		Drum No.,IS1554-I & IS7098-1,Cable size, Voltage grade & Words "FRLS" at every 5 meter is to be embossed. Embossing shall be automatic, in line & marking shall be legible & indelible. (As per NTPC specification)		--do--		P	--	--	Drum No. on Cable may be embossed/printed
		6. Sequential marking	MA	Visual	Full length	--		Sequential marking of length of cable in meter at every one meter is to be embossed / printed. Embossing / printing shall be progressive, automatic, in line & marking shall be legible & indelible. ( A s per NTPC specification ) In addition, Drum No. is also to be embossed/printed on full cable length		--do--		P	--	--	
<b>C</b>		<b>Finished Cables</b>													
3.01	Type test reports clearance from NTPC	All type tests as per NTPC specification	CR	Doc.	100%	100%		NTPC SPECIFICATION / NTPC ADS / IS 1554 (Part) & IS 7098- Part I	NTPC SPECIFICATION / NTPC ADS / IS 1554 (Part) & IS	--do--	✓	P	V	V	

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Engineering		Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)		QP. NO. 0000-999- QOE- S-041 REV-01 DATE : Page 5 of 9		7098- Part I REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR		APPROVED BY K K OJHA				
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
3.02	Routine Tests	1.High Voltage test at room temperature	CR	Elect	100%	100%	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	Test certificate	✓	P	W	V	Refer note 2
		2.Conductor Resistance	CR	Elect	100%	100%	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	Test certificate	✓	P	W	V	Refer note 2
<b>3.03 Acceptance Tests</b>														
3.03 (i)	Construction of finished Cable	1. OD of Cable	MA	Meas.	Each type & size of cables as per sampling plan of IS 1554 ( Part I) & IS 7098- Part I		NTPC ADS	NTPC ADS	--do--	✓	P	W	W	
		2. Laying of core	CR	Visual	--do--		NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	--do--	✓	P	W	W	
		3. Core Identification	CR	Visual	--do--		--do--	--do--	--do--	✓	P	W	W	
		4. Colour of outer sheath	MA	Visual	Each type & size of cables as per sampling plan of IS 1554 ( Part I) & IS 7098- Part I		NTPC ADS	NTPC ADS	--do--	✓	P	W	W	
		5. Inner sheath thickness	CR	Meas	- do -		--do--	--do--	--do--	✓	P	W	W	
		6. Inner sheath colour	MA	Visual	- do -		- do -	- do -	- do -	--do--	✓	P	W	W
3.03 (ii)	Armour wires/ Formed wires ( if applicable)	1.Dimensions	CR	Meas	--do--		NTPC ADS /IS1554(PartI)/IS3975	NTPC ADS /IS1554(PartI) /IS3975	--do--	✓	P	W	W	
		2. No. of wires/ formed wire	CR	Mech	-- do --		--do--	--do--	--do--	✓	P	W	W	
		3. Tensile test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	V	V	
		4. Elongation test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	V	V	
		5.Torsion test ( for round wires only)	CR	Mech	Each type & size of cables as per sampling plan of IS 1554 ( Part I) & IS 7098- Part I		--do--	--do--	--do--	✓	P	V	V	
		6. Wrapping test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	V	V	
		7. Resistance test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	V	V	

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FORMAT NO:QS-01-QAI-P-10/F3-R1

Sl. No		Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
						M	C/N				D*	M	C	N	
1			8.Mass of Zinc coating	CR	Meas	--do--		--do--	--do--	--do--	✓	P	V	V	11
			9. Uniformity of Zinc Coating	CR	Chem.	Each type & size of cables as per sampling plan of IS 1554 ( Part 1) & IS 7098-Part I		NTPC ADS /IS1554(PartI)/IS3975	NTPC ADS /IS1554(PartI) /IS3975	Test certificate	✓	P	V	V	
			10.Adhesion test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	V	V	
			11.Freedom from defects	CR	Visual	--do--		--do--	--do--	--do--	✓	P	V	V	
3.03 (iii)		Conductor	1.Resistance Test	CR	Elect	--do--		--do--	--do--	--do--	✓	P	W	W	
			2.Tensile test ( For aluminum conductor only )	CR	Mech	Each type & size of cables as per sampling plan of IS 1554 (Part I)/7098(Part-1)		NTPC ADS/ IS 8130	NTPC ADS/ IS 8130	--do--	✓	P	W	W	Test report of manufacturer to be reviewed as per Sl. No. 2.01 for Tensile test & wrapping test ( for Aluminum ) in case this test is not applicable for cable under inspection as per IS 8130 cl. 6.2
			3.Wrapping test (For aluminum conductor only)	CR	Mech	--do--		--do--	--do--	--do--	✓	P	P	W	--do--
3.03 (iv)		PVC / XLPE Insulation & PVC Sheath	1.Thickness of insulation & sheath	CR	Meas.	--do-		NTPC ADS/ IS 1554(PartI) & IS 7098-Part I	NTPC ADS/ IS 1554(PartI) & IS 7098-Part I	--do--	✓	P	W	W	

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FORMAT NO:QS-01-QAI-P-10/F3-R1

Sl. No		Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
1		2	3	4	5	M	C/N	7	8	9	D*	M	C	N	11
			2. Tensile strength & elongation at break of insulation & outer sheath	CR	Mech	Each type & size of cables as per sampling plan of IS 1554 (Part 1)/IS7098(Part-1)		NTPC ADS/ IS 1554(Part I) & IS 7098 Part I	NTPC ADS/ IS 1554(Part I) & IS 7098 Part I	Test Certificate	✓	P	W	W	
			3. Tensile strength & elongation of PVC at break of insulation & outer sheath (Ageing Test)	CR	Mech	One sample per batch of offered lot irrespective of sizes		--do--	--do--	--do--	✓	P	V	V	MTR for Ageing Test of the offered lot shall be verified
			3a. Tensile strength & elongation of XLPE at break of insulation (Ageing Test)	CR	Mech	--do--		NTPC ADS/ IS 7098 Part I	NTPC ADS/ IS 7098 Part I	--do--	✓	P	V	V	MTR for Ageing Test of the offered lot shall be verified
			4. Insulation resistance (Volume resistivity method)	CR	Elect	Each type & size of cables as per sampling plan of IS 1554 ( Part 1) & IS 7098- Part I		--do--	NTPC ADS/ IS 1554(Part I) & IS 7098 Part I	--do--	✓	P	W	W	
			5. High voltage test at room temperature	CR	Elect	Each type & size of cables as per sampling plan of IS 1554 ( Part 1) & IS 7098- Part I		--do--	--do--	--do--	✓	P	W	W	
			6. Thermal stability on PVC Insulation and outer sheath	CR	Chem	One sample of each offered lot of all offered sizes		--do--	--do--	--do--	✓	P	W	W	
			7. Hot Set Test (for XLPE Insulation only)	CR	Elect	Each type & size of cables as per sampling plan of IS 1554 ( Part 1) & IS 7098- Part I		NTPC ADS/ IS 1554(Part I) & IS 7098 Part I	--do--	--do--	✓	P	W	W	
			8. Oxygen index Test on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS / IS10810 Part 58	NTPC A.D.S / IS10810 Part 58	Test certificate	✓	P	W	W	Refer Note 3

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FORMAT NO: QS.01.QALP.10/E3.P1

Sl. No		Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
1		2	3	4	5	6		7	8	9	D*	M	C	N	11
						M	C/N								
			9.Smoke density rating test on outer sheath	CR	Chem	--do--		NTPC ADS & ASTMD2843	NTPC ADS	--do--	✓	P	W	W	
			10.Acid gas generation test on outer sheath	CR	Chem	--do--		NTPC ADS & IEC 60754-1	'NTPC ADS	Test Certificate	✓	P	W	W	Refer Note 3 Refer Note 3
			11.Flammability test on completed cable	CR	Chem	Refer Note 4	Refer Note 4	NTPC ADS & IEC 60332 Part-3 (Category-B)	NTPC ADS	--do--	✓	P	W	W	
			12.Surface finish & length measurement.	CR	Visual & Meas	100% (COC from Manufacturer to be submitted for surface finish as per specification's requirement)	one length of each offered lot of 50 drums of all sizes	(1) IS1554-I & IS7098-1, Cable size, Voltage grade & Words "FRLS" at every 5 meter is to be embossed. Embossing shall be automatic, in line & marking shall be legible & indelible. (2) Sequential marking of length of cable in meter at every one meter is to be embossed / printed. Embossing / printing shall be progressive, automatic, in line & marking shall be legible & indelible	--do--	✓	P	W	W	Pimple, Fish Eye, Burnt particles, Blow Hole etc. not permitted. Repairing on outer sheath not permitted.	
			13. Sequence of cores armour coverage, gap between two consecutive armour/ formed wire	CR	Visual & Meas	One length of each size	One length of each size	Min. area of coverage of armouring shall be 90%. The gap between armour wires / formed wires shall not exceed one armour wire/ formed wire space & there shall be no cross over/ over riding of armour wire / formed wire. Zn rich paint shall be applied on armour joint surface of G.S. Wire /formed wire	--do--	✓	P	W	W		
4	Packing	1. Sealing		MA	Visual	100%	100%	(1)IS1554(Part-1) & IS 7098-Part 1 (2) The surface of the drum and the outer most cable layer shall be covered with water proof cover. (3) Both the ends of cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by "U" nails.	QCR	✓	P	--	--		
4.01	Identification	NTPC Sealing		MA	Visual	100%	100%	Sealing shall be visible	QCR	✓	P	V	V		

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		<b>Item: 1.1 KV Power (XLPE &amp; PVC) Insulated FRLS cables</b>		<b>STANDARD QUALITY PLAN</b> (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)			QP. NO. 0000-999- QOE- S-041 REV-01 DATE : Page 9 of 9		REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR		APPROVED BY  K.K. OJHA Approved Dt. ....			
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11

**Notes:**

- If the compound manufacturer is carrying out Ageing test, test report of compound manufacturer is to be reviewed. If the compound manufacturer is not carrying out ageing test, then cable manufacturer is to carry out ageing test & test report is to be reviewed ( quantum of ageing test sample shall be one sample /batch)
- 2(a) **In case of manufacturers / supplier who have supplied cables in the past through Corporate Centre:-** Routine Test of manufacturer internal test report are to be verified by NTPC at the time of final inspection.

2(b) **In case of manufacturers / supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre:-** Routine Test are to be witnessed by Main Contractor on 100% basis. This is in addition to manufacturer internal test report to be verified by NTPC at the time of final inspection. Same is to be verified by NTPC
1. For Smoke Density rating test: if the test result without conditioning is within (-)10% of the maximum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection.

2. For Acid Gas Generation test: if the test result without conditioning is within (-)10% of the maximum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection.

3. For Oxygen Index test: if the test result without conditioning is within (+)7% of the minimum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection.

4. In case the test results without conditioning donot meet the maximum/minimum specified value, the manufacturer may exercise the option of retesting the samples after conditioning as per standard.
- For PVC insulated LT power cable :- For cables with OD less than equal to 30 mm, any size of cable may be clubbed together. For cables where OD is more than 30 mm, clubbing to be done for cables having similar ODs.  
For XLPE insulated LT Power cable: Clubbing to be done for cables having similar ODs.

**LEGEND:** **NTPC ADS:** NTPC approved data sheet, **QCR:** quality control records of cable manufacturer, **CABLE MANUF**  
**STD-** cable manufacturer's internal plant standard, **MI:** minor, **MA:** major, **CR:** critical,  
**COC-** certificate of conformance