

**TELENGANA SUPER THERMAL POWER
PROJECT PHASE-I**

2 X 800 MW KARIMNAGAR TPS

TECHNICAL SPECIFICATION

FOR

LT PVC CONTROL CABLES

SPECIFICATION NO: *PE-TS-424-507-E015*

REVISION: 0



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UP (INDIA) – 201301**



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VOLUME II

REVISION 0

DATE: 29.09.2017

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COMPLIANCE CERTIFICATE

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same
2. There are no deviation with respect to specification other than those furnished in the 'schedule of deviations'
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
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 description/ quantities from those given in 'BOQ-Cum-Price schedule' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

BIDDER'S STAMP & SIGNATURE



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SECTION - I

SPECIFIC TECHNICAL REQUIREMENTS



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1.0 SCOPE OF ENQUIRY

- 1.1 Design, Manufacture, Inspection and Testing at Manufacturer's works, proper packing and delivery to site of LT PVC Control cables conforming to this specification.
- 1.2 General technical requirements of the LT PVC Control cables are indicated in Section-II. Project specific technical/ quality requirements / changes are listed in Section-I.
- 1.3 The stipulations of Section-I, followed by those of Data Sheet-A shall prevail in case of any conflict between the stipulations of Section-I, Data Sheet - A & Section-II.
- 1.4 The documents shall be in English Language and MKS system of units.

2.0 BILL OF QUANTITIES:

- 2.1 Quantity requirements shall be as per 'BOQ-cum-price schedule' as part of NIT.

3.0 SPECIFIC TECHNICAL REQUIREMENTS

<u>S.No.</u>	<u>Reference Clause No. of Section- II</u>	<u>Specific Requirement/ Change</u>
1	3.1	The standard quality plan no. shall be read as 0000-999-QOE-S-040 in place of PE-QP-999-507-E003.
2	3.3	Shall be read as "Type test report requirements, routine / acceptance testing and special testing requirements shall be as per Annexure –A to Section-I. 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.
3	3.4	This clause is null & void.
4	3.6 (clause is added)	All equipment to be supplied shall be of type tested design. During detailed engineering, the successful bidder shall submit for BHEL/NTPC 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 process plant/refinery/power plant/nuclear plant client or client's representatives.
5	3.7 (clause is added)	However if the successful bidder 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 successful bidder shall conduct all such tests under this contract at no additional cost to the BHEL either at third party lab or in presence of BHEL/NTPC and submit the reports for approval.
6	3.8 (clause is added)	The type test reports (for type tests carried out within last ten years from the date of bid opening) once approved for any project of NTPC shall be treated as reference. For Karimnagar TPS, an endorsement sheet will be furnished by the manufacturer confirming similarity and



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		"No design Change". Minor changes if any shall be highlighted on the endorsement sheet.
7	3.9 (clause is added)	If a cable drum fails in site testing then that drum shall be supplied again by vendor free of cost to BHEL.

4.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED

4.1 Following documents/drawings shall be submitted after placement of order for BHEL & customer's approval:-

Sl. No.	Drawings/Document Description	Drawings / Document Number
1.	Technical Data sheet - LT PVC Control cables	PE-V0-424-507-E131
2.	Cross-sectional Drgs.- LT PVC Control Cables	PE-V0-424-507-E133
3.	Quality Plan - LT PVC Control Cables	PE-V0-424-507-E915*
4.	Steel drum drawing - LT PVC Control Cables (if applicable)	PE-V0-424-507-E135
5.	Type Test Reports - LT PVC Control Cables	PE-V0-424-507-E134

Note:

* Standard Quality Plan as enclosed in the technical specification is to be appended with cover sheet bearing document number and description as stated above. The signed and stamped copy of the same shall be submitted to BHEL without making any changes in the contents of the document.



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ANNEXURE-A TO SECTION I

	The reports for the following type tests shall be submitted for one size of control cables. Size shall be decided by the employer during detailed engineering		
	S. No.	Type Test	Remarks
	For Conductor		
	1.	Resistance test	
	For Armour Wires / Formed Wires (If applicable)		
	2.	Measurement of Dimensions	
	3.	Tensile Test	
	4.	Elongation test	
	5.	Torsion test	For round wire only
	6.	Wrapping test	For aluminium wires / formed wires only.
	7.	Resistance test	
	8(a).	Mass of zinc Coating test	For GS wires/formed wires only
	8(b).	Uniformity of zinc coating	For GS wires/formed wires only
	9.	Adhesion test	For GS wires/formed wires only
	For PVC insulation & PVC Sheath		
	10.	Test for thickness	
	11.	Tensile strength and elongation test	before ageing and after ageing
	12.	Ageing in air oven	
	13.	Loss of mass test	For PVC insulation and sheath only
14.	Hot deformation test	For PVC insulation and sheath only	
15.	Heat shock test	For PVC insulation and sheath only	
16.	Shrinkage test		
17.	Thermal stability test	For PVC insulation and sheath only	
18.	Oxygen index test	For outer sheath only	

	S. No. 19. 20. For completed cables 21. 22. 23.	Type Test Smoke density test Acid gas generation test Insulation resistance test(Volume resistivity method) High voltage test Flammability test as per IEC-332 Part-3 (Category-B)	Remarks For outer sheath only For outer sheath only

CLAUSE NO.



Control Cables

Attributes / Characteristics Item / Components / Sub System Assembly	Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test(as applicable)	Electrical properties	Lay length & Sequence	Armour coverage, cross over, looseness, gap between two	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability	Anti termite coating on wooden	Constructional requirements feature as per NTPC specification	Routine & Acceptance Tests as per relevant standard & NTPC	FRLS Tests
Copper (IS-8130)	Y	Y	Y	Y		Y									
PVC insulation Compound (IS: 5831)	Y		Y			Y				Y	Y				
FRLS PVC Compound (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1)	Y		Y							Y	Y				Y
Extrusion & curing /Manufacturing of Core		Y			Y						Y				
Core Laying							Y								
Armour wire/strip	Y	Y	Y												
Inner sheath	Y	Y													
Armouring		Y						Y							
Outer Sheathing		Y							Y						
Finished Cable (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1, IEC 60332 part III cat B)							Y	Y	Y	Y	Y		Y	Y	Y
Wooden drum(IS-10418) /Steel Drum		Y										Y	Y		

Notes:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Make of all major Bought out items will be subject to NTPC approval.

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ROUTINE TESTS	Following routine tests shall be carried out on each drum of finished cables for all sizes.	
1)	Conductor Resistance test	
2)	High voltage test	
ACCEPTANCE TESTS	Following Acceptance tests shall be carried out on each size of cables, in the offered lot.	
A) For Conductor (as per sampling plan mentioned in IS: 1554)		
	1)	Annealing test (Copper)
	2)	Resistance test
B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IS: 1554)		
	1.	Measurement of Dimensions
	2.	Tensile Tests
	3.	Elongation Test
	4.	Torsion Test For Round wires only
	5.	Wrapping Test
	6.	Resistance Test
	7.	Mass of Zinc coating test For G S wires / Formed wires only
	8.	Uniformity of Zinc coating For G S wires / Formed wires only
	9.	Adhesion test For G S wires / Formed wires only
	10.	Freedom from surface defects
c) For PVC insulation & PVC Sheath (as per sampling plan mentioned in IS: 1554)		
	1)	Test for thickness
	2)	Tensile strength & Elongation before ageing (for tests after ageing see “D”)

D) Ageing test:

	Criteria	Condition	Test Requirements	Remarks
PVC insulation & outer sheath:	Samples as per relevant IS, from each size of cables in the offered lot, shall be tested for tensile strength & elongation (before ageing). Tensile & elongation testing shall preferably be done with a computerized machine. The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/- 15% of the corresponding values of Type Test report. (Please note that test values should be more than the minimum values indicated in relevant standard).	All sizes which meet the criteria	The size which has maximum negative deviation from type test report values will be put on accelerated ageing test. The samples shall be aged in air oven at temperature of 130°C +/- 2°C for 5 hours and tested for TS & elongation. Acceptance norms shall be as per IS.	In case the size does not meet the requirement in accelerated ageing test then all sizes (which had met the criteria) will be put on ageing test as per IS.
		Sizes which do not meet the criteria	Every size will be put on ageing test as per IS.	----

E) Following tests will be carried out on completed cables as per IS on each size:

	1)	Insulation resistance test (Volume resistivity method)
	2)	High voltage test

F) Following tests shall be carried out on only one size of offered lot (comprising of all sizes):

	1)	Thermal stability test on PVC insulation and outer sheath
	2)	Oxygen index test on outer sheath
	3)	Smoke density rating test on outer sheath
	4)	Acid gas generation test on outer sheath

G) Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cable will be carried out as per following sampling plan:

		This test will be carried out using composite sampling i.e. irrespective of size; cables of one particular type (i.e. armoured, unarmoured) will be bunched together, as per calculations in line with the IEC. All sizes of armoured & unarmoured cables shall be covered.
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H) Following tests shall be carried on one length of each size (armoured & unarmoured) of offered lot:

	1)	Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, drum / outer sheath extrusion's batch number marking
	2)	Measurement of Eccentricity & Ovality



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DATA SHEET A

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DATASHEET-A

1.0	Type of Cable	Flame Retardant Low Smoke (FR-LSH)
2.0	Standard applicable in general(Latest amendment to be referred if any)	IS:1554 (Part-1), IS:8130, IS:5831, IS:10810, IS:3975, ASTM D:2843, ASTM D:2863, ASTM D 3137:81, IEC-754-1, IEC:60332 Part-3-23,IS-10418
3.0	Voltage Grade	1.1kV
4.0	Number of cores, cross sectional area of conductors and quantities	As per Annexure-C
5.0	CONDUCTOR	
(a)	Material	Copper
	Grade and Class	Stranded, annealed plain high conductivity, Class 2
(b)	Standard Applicable	IS: 8130
(c)	Shape	Circular
(d)	Min. number of strands	7
6.0	INSULATION	
(a)	Material	PVC TYPE-A
(b)	Standard Applicable	IS: 5831
(c)	Continuous withstand temperature	70°C
(d)	Short-circuit withstand temperature	160°C
(e)	Method of application	By extrusion; sleeve extrusion not permitted.
(f)	Nominal Thickness of insulation	As per Table-2 of IS: 1554 (Part-1)
7.0	CORE IDENTIFICATION	
(a)	Control Cables up to 5 core	Cores of the cables of upto 5 cores shall be identified by colouring of insulation. Following colour scheme shall be adopted. 1 core - Red, Black, Yellow or Blue 2 core - Red & Black 3 core - Red, Yellow & Blue 4 core - Red, Yellow, Blue and Black 5 core - Red, Yellow, Blue, Black and Grey
(b)	Control Cables above 5 cores	For cables having more than 5 cores, core identification shall be done by numbering the insulation of cores sequentially, starting by number 1 in the inner layer (e.g. say for 10 core cable, core numbering shall be from 1 to 10). The number shall be printed in Hindu- Arabic numerals on the outer surfaces of the cores. All the numbers shall be of the same colour, which shall contrast with the colour of insulation. The colour of insulation for all the cores shall be grey only. The numerals

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		shall be legible and indelible. The numbers shall be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is a single numeral, a dash shall be placed underneath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecutive numbers shall not exceed 50 mm.
8.0	INNER SHEATH	
(a)	Material	PVC Type ST-1
(b)	Standard Applicable	IS: 5831
(c)	Colour	Black
(d)	Whether FR-LSH	NO
(e)	Thickness of inner sheath	As per Table-4 of IS: 1554 (Part-1)
(f)	Fillers	Acceptable
(g)	Material of fillers (if permitted)	Same as inner sheath (Material of filler to be compatible with that of inner sheath)
(h)	Method of application	
(1)	Multi-core cables:	
(i)	With fillers	Pressure/Vacuum extruded
(ii)	Without fillers	Pressure extruded
9.0	ARMOUR	
(a)	Applicable	NA
(b)	Material:	
(i)	Multi-core cables	
(ii)	Standard Applicable	
(c)	Minimum Coverage	
(d)	Gap between armour wires	
(e)	Breaking load of joint	
10.0	OUTERSHEATH	
(a)	Material	PVC Type ST1
	Standard Applicable	IS: 1554 (Part-1) & IS: 5831
(b)	Colour	Grey
(c)	Whether FR-LSH	Yes
(d)	Method of application	Extruded
(e)	Thickness of outer sheath	As per Table-7 of IS: 1554 (Part-1)
(f)	Marking	Cable size (cross section area and no. of cores) and voltage grade @ 5m (by embossing) Word "PVC", "FRLSH" @ 5m (by embossing) Manufacturer's name and/ or trade name, and year of manufacture @ 5m (by embossing) 'BHEL-PEM' and 'NTPC' Name @5m (by embossing) Progressive sequential marking @ 1m (by embossing/ printing)
11.0	FR-LSH CHARACTERISTICS	
(a)	Oxygen index	Min 29 (As per IS 10810 Part-58)
(b)	Temperature index	Min. 250°C(As per ASTM D 2863)
(c)	Acid gas generation	Max. 20% by weight (As per IEC-754-1)

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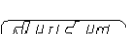
(d)	Smoke density rating	Max. 60% (As per ASTM D 2843)
(e)	Flammability Test	
(i)	Flammability test for all cables	As per: IEC-60332 Part-3, CAT-B
13.0	TOLERANCE ON OUTER DIAMETER	+ 2mm.
14.0	MINIMUM BENDING RADIUS	
(a)	Multi core cables	12 x O.D.
15.0	SAFE PULLING FORCE	
(a)	Copper conductor cable	50 N/ sq. mm.
16.0	CABLE DRUMS	
(a)	Type of Drum	Wooden as per IS 10418. OR Steel drum.
(b)	Standard drum length	1000m (±) 5%.
(c)	Painting	Entire surface to be painted
(d)	Wooden Drum	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.
(e)	Particular information on Drum	Each drum shall carry manufacturer's name, purchaser's name, address and contract no., item no. & type, size & length of cable and net gross weight stencilled on both sides of drum. A tag containing same information shall be attached to the leading end of the cable. An arrow & suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

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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 :
- 2.0 **INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE**
- 2.1 No. of cores x size :
- 2.2 Current rating of cable confirms to :
- 2.3 Short circuit rating of cable confirms to :
- 2.4 **CONDUCTOR**
- a) Material type & grade :
- b) No. & dia of wires in each core : no x mm
before stranding
- 2.5 **PVC INSULATION**
- a) Type :
- b) Minimum & Nominal thickness of insulation : mm
- 2.6 **PVC ST1 INNERSHEATH**
- a) Thickness (min.) : mm
- b) Method of application
- 1) Multi-core cables
- i) with fillers
- ii) without fillers :

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

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- c) Type of fillers (if used) :
Shape of fillers (if used) :

2.7 ARMOUR

- a) Material :
i) Multi-core cables
- b) Size / dimensions :
- c) Minimum no. of wires :
- d) Maximum resistivity of GS wire :
- e) Maximum resistivity of Aluminium round wire :

2.8 PVC ST1 FRLS OUTERSHEATH

- a) Minimum thickness of outer sheath : mm
- b) Colour :

2.9 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

2.10 Weight of cable : kg./km

2.11 Dimension of drum : mm

2.12 Shipping weight : kg.

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			



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1.0 TECHNICAL REQUIREMENTS

- 1.1 Technical requirements for LT PVC CONTROL CABLES shall be as indicated in this section, in addition to those specified in Section I & Datasheet-A.
- 1.2 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 at site conditions.

2.0 CODES & STANDARDS

- 2.1 The design, material, construction, manufacture, inspection, testing and performance of LT PVC CONTROL CABLES shall conform to the latest revision of relevant standards and codes of practices mentioned in Data Sheet - A.
- 2.2 In case of conflict between the applicable reference standard and this specification, this specification shall govern.

3.0 QUALITY ASSURANCE REQUIREMENTS

- 3.1 Bidder shall confirm compliance with the BHEL Standard Quality Plan (PE-QP-999-507-E003) as attached with the specification without any deviations. At contract stage, the successful bidder shall submit the same QP for BHEL/ultimate customer's approval. In case bidder has reference QP agreed with ultimate customer, same can be submitted for specific project after award of contract for BHEL/ultimate customer's approval. There shall be no commercial implication to BHEL on account of minor changes in QP during contract stage.
- 3.2 All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved Quality Plan.
- 3.3 Type testing requirements, routine / acceptance testing and special testing requirements shall be as per Annexure –A to QAP. Charges for all these tests for all the equipments & components shall be deemed to be included in the bid price (except UV Radiation & Hydraulic Stability test).
- 3.4 The charges of UV Radiation test & Hydrolytic Stability test (if applicable) shall be reimbursed extra at actual against original money receipt of Govt. Lab. (CPRI/ ERDA etc).
- 3.5 Cost of cables consumed for testing shall be to bidder's account.

4.0 Packing

- 4.1 Cables shall be supplied in non-returnable drums. Material of cable drums shall be as specified in Datasheet-A.
- 4.2 In case of wooden drums, all wooden parts shall be manufactured from seasoned wood treated with copper naphthenates / zinc naphthenates (refer IS: 401). Dimensions of wooden drums shall be as per IS 10418. 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.
- 4.3 In case of Steel drums, New or practically new cable drums made of steel and painted with epoxy resin paint are to be used. Cable ends are carefully protected before packing. Over the cables polyethylene sheet shall be wrapped and then sealed properly. For Typical details of Steel drums, Annexure-A to Section-II, may be referred by the bidder. Bidder may modify, to choose appropriate dimensions of steel drums to suite various sizes/weight/ lengths of LT PVC CONTROL CABLES.



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QUALITY PLAN



Item: 1.1 KV PVC Insulated FRLS Control cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)					Q.P. NO. 0000-999- QOE- S-040 REV-00 DATE: 25-11-11 Page 1 of 9		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY A.K. Garg		
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	N	
1	2	3	4	5	6		7	8	9	10			11
Instructions: 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.													
A Raw material/ Brought out Items													
1.01	Copper	1. Make	MA	Verify	100%	--	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	QCR		V	--	
		2. Resistivity	MA	Elect	As per cable Mnfr Std.	--	IS 613	IS 613	--do--		P	--	
1.02	PVC compound for insulation	1. Make	MA	Verify	--do--	100%	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	--do--		V	V	
		2. Type/ Grade	MA	Verify	100%	As per manufacturer norms	NTPC ADS	NTPC ADS	--do--		V	V	
		3. All acceptance test as per manufacturer norms including Thermal Stability test	MA	Verify	As per manufacturer norms	--do--	--do--	--do--	--do--		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	
		2. Type/ Grade	MA	Verify	--do--	--do--	NTPC ADS	NTPC ADS	--do--		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	
		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	--do--		V	V	
		3. All acceptance test as per manufacturer norms	MA	Verify	As per manufacturer norms	As per manufacturer norms	--do--	--do--	--do--		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	--do--		P	--	

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



Item: 1.1 KV PVC Insulated FRLS Control cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)				QP. NO. 0000-999- QOE- S-040 REV-00 DATE: 25-11-11 Page 2 of 9 VALID UP TO: 24-11-14 Reference Document		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG Acceptance Norms		REMARKS			
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Remarks			
1	2	3	4	5	M	C/N	7	8	9	11			
1.06	Wooden Drum	6. Acid Gas Emission	MA	Chem	One sample / Batch		NTPC ADS / IEC60754	NTPC ADS	QCR				
		1. Dimension	MI	Meas	Manuf. Std.		IS 10418	IS10418	-do-				
		2. Anti termite treatment	MI	Chem	Cable manuf. std		CABLE MANUF. STD.	CABLE MANUF. STD.	COC				
1.07	Steel Drum	1. Dimension	MI	Meas	-do-		-do-	-do-	QCR				
		2. Surface finish	MI	Meas	-do-		-do-	-do-	-do-				
B	Process & Stage Inspection												
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				
		2. Wire Diameter	MA	Meas	-do-		NTPC ADS	NTPC ADS	-do-				
		3. Annealing Test	CR	Mech	-do-		IS8130/NTPC ADS	IS8130/NTPC ADS	-do-				
2.02	Bunching / stranding	1. No. of wires	MA	Meas	-do-		NTPC ADS	NTPC ADS	-do-				
		2. Dia of wire	MA	Meas	-do-		-do-	-do-	-do-				
		3. Dimension of Conductor	MA	Meas	-do-		-do-	-do-	-do-				
		4. Direction of lay	MA	Visual	-do-		-do-	-do-	-do-				
		5. Records of strand breakage / welding during conductor stranding	MA	Verify	-do-		IS 8130	IS8130	-do-				
		6. Surface finish	MA	Visual	-do-		-do-	-do-	-do-				
		7. DC Resistance	CR	Meas	-do-		IS8130/NTPC ADS	IS8130/NTPC ADS	-do-				
2.03	Insulation extrusion	1. Surface finish	MA	Visual	-do-		NTPC spec	SHOULD BE SMOOTH. NO POROSITY IS PERMITTED.	-do-				
		2. Colour of cores	MA	Visual	-do-		NTPC ADS	NTPC ADS	-do-				

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



Item: 1.1 KV PVC Insulated FRLS Control cables

STANDARD QUALITY PLAN
(CONFORMING TO CODE: IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)

QP. NO. 0000-999- QOE- S-040
REV-00 DATE: 25-11-11
Page 3 of 9
VALID UP TO: 24-11-14

REVIEWED BY
INDERJIT SINGH
VIKRAM TALWAR
RAJEEV GARG

APPROVED BY
Dt. A.K. Garg
NTPC, NOIDA

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					11
		3 Core identification	MA	Visual	One sample/Setting of each size	--	NTPC ADS	NTPC ADS	QCR		P	--	--	Core printing shall be legible & indelible
		4. Thickness	CR	Meas	--do--	--	--do--	--do--	--do--		P	--	--	
		5. 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
2.04	Laying up	1. Core sequence	MA	Visual	One sample/Setting of each size	--	IS 1554 (Part I)	IS 1554 (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/Setting 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	--	--	

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

Item: 1.1 KV PVC Insulated FRLS Control cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)				Q.P. NO. 0000-999- QOE- S-040 REV-00 DATE: 25-11-11 Page 4 of 9		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY Dt... A. K. Garg			
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Record Format	D*	M	C	N	Remarks
1	2	3	4	5	6	7	8	9			10		11
		3. Direction of lay	MA	Visual	One sample/Setting of each size	IS 1554 (Part 1)	IS 1554 (Part 1)	QCR		P			
		4. Coverage & Quality of armouring	MA	Meas.	100%		Min. area of coverage of armouring shall be 90%. The gap between amours / 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)	--do--		P			
		5 Dia over armouring	MA	Meas.	One sample/Setting 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/Setting of each size		NTPC ADS	--do--		P			
		3. Dia over outer sheath	MA	Meas	--do--		--do--	--do--		P			
		4. Thickness of outer sheath	CR	Meas	--do--		--do--	--do--		P			
		5. Embossing quality	MA	Visual	100%		Drum no., IS1554 Part -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.

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FORMAT NO:QS-01-QA1-P-10/F3-R1

Item: 1.1 KV PVC Insulated FRLS Control cables										STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)					Q.P. NO. 0000-999- QOE- S-040 REV-00 DATE : 25-11-11 Page 5 of 9 VALID UP TO: 24-11-14 Reference Document				REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG Acceptance Norms				APPROVED BY 377 Approved Dt. A.K. Garg																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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Item: 1.1 KV PVC Insulated FRLS Control cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)					QP. NO. 0000-999- QOE- S-040 REV-00 DATE: 25-11-11 Page 6 of 9 VALID UP TO: 24-11-14	REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG	APPROVED BY A.K. Garg				
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	
1	2	3	4	5	6		7	8	9		10	11	
		4. Elongation test	CR	Mech	Each type & size of cables as per sampling plan of IS 1554 (Part 1)		NTPC ADS /IS1554(Part1)/IS3975	NTPC ADS /IS1554(Part1)/IS3975	Test certificate	✓	P W	W	
		5. Torsion test (for round wires only)	CR	Mech	--do--		--do--	--do--	--do--	✓	P W	W	
		6. Wrapping test	CR	Mech	--do--		--do--	--do--	--do--	✓	P W	W	
		7. Resistance test	CR	Mech	--do--		--do--	--do--	--do--	✓	P W	W	
		8. Mass of Zinc coating	CR	Meas	--do--		--do--	--do--	--do--	✓	P W	W	
		9. Uniformity of Zinc Coating	CR	Chem.	--do--		--do--	--do--	--do--	✓	P W	W	
		10. Adhesion test	CR	Mech	--do--		--do--	--do--	--do--	✓	P W	W	
		11. Freedom from defects	CR	Visual	--do--		--do--	--do--	--do--	✓	P W	W	
3.03 (iii)	Conductor	1. Annealing Test	CR	Mech	--do--		NTPC ADS/ IS 8130	NTPC ADS/ IS 8130	--do--	✓	P V	V Refer Sl. No. 2.01	
		2. Resistance Test	CR	Elect	--do--		--do--	--do--	--do--	✓	P W	W	
3.03 (iv)	PVC Insulation & PVC Sheath	1. Thickness of insulation & sheath	CR	Meas.	--do--		NTPC ADS/ IS 1554(Part1)	NTPC ADS/ IS 1554(Part1)	--do--	✓	P W	W	
		2. Tensile strength & elongation at break of insulation & outer sheath (before ageing)	CR	Mech	--do--		--do--	--do--	--do--	✓	P W	W Refer Note 3 also	
		3. Tensile strength & elongation at break of insulation & outer sheath (after Ageing)	CR	Mech	Refer Note 3		NTPC ADS/ IS 1554(Part1)	NTPC ADS/ IS 1554(Part1)	--do--	✓	P W	W Refer Note 3	
		4. Insulation resistance (Volume resistivity method)	CR	Elect	Each type & size of cables as per sampling plan of IS 1554 (Part 1)		--do--	--do--	--do--	✓	P W	W	
		5. High voltage test at room temperature	CR	Elect	--do--		--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. Oxygen index Test on outer sheath	CR	Chem	--do--		NTPC ADS / IS10810 Part 58	NTPC A.D.S	--do--	✓	P W	W	
		8. Smoke density rating test on outer sheath	CR	Chem	--do--		NTPC ADS & ASTM D2843	NTPC ADS	--do--	✓	P W	W	

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FORMAT NO:QS-01-QA1-P-10/F3-R1

Item: 1.1 KV PVC Insulated FRLS Control cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)				Q.P. NO. 0000-999- QOE- S-040 REV-00 DATE : 25-11-11 Page 7 of 9 VALID UP TO: 24-11-14 Reference Document		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJNEE GARG		APPROVED BY A.K. Garg				
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
		9. Acid gas generation test on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS & IEC 60754-1	NTPC ADS	Test certificate	✓	P	W	W	
		10. 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	
		11. Surface finish & length measurement.	CR	Visual & Meas	One length of each size	One length of each size	(1) Drum no. (2) IS 1554 -Part-1 (3) 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. (4) 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	W	Pimple, Fish Eye, Burnt particles, Blow Hole etc. not permitted. Repairing on outer sheath not permitted.
		12. 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	W	
4	Packing	1. Sealing	MA	Visual	100%	100%	(1) IS1554(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	Sealing shall be visible	--do--	✓	P	V	V	V

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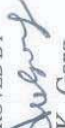
-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"
FORMAT NO:QS-01-QAI-P-10/F3-R1

		Item: 1.1 KV PVC Insulated FRLS Control cables	STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1 AND NTPC TECHNICAL SPECIFICATION)	QP. NO. 0000-999- QOE- S-040 REV-00 DATE: 25-11-11 Page 8 of 9 VALID UP TO: 24-11-14 Reference Document	REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG	APPROVED BY  A.K. Garg				
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Record Format	Agency	Remarks
Notes:										
1)		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/ Regional Offices :- 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/ Regional Offices, :- Routine Test are to be witnessed by Main Contractor & NTPC. This is in addition to manufacturer internal test report to be verified by NTPC at the time of final inspection.								
3)		Refer table on page 8 of 8 for Sampling & Acceptance criteria.								
4)		The test shall be carried out on every size & type of control cable offered for inspection as an acceptance test. This test will be carried out using composite sampling i.e. irrespective of sizes of cables of a particular type, may be tested together as per calculations in line with the IEC (all sizes will be covered)								
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								

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FORMAT NO:QS-01-QA1-P-10/F3-R1

		Item: 1.1 KV PVC Insulated FRLS Control cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART I AND NTPC TECHNICAL SPECIFICATION)		QP. NO. 0000-999- QOE- S-040 REV-00 DATE: 25-11-11 Page 9 of 9 VALID UP TO: 24-11-14 Reference Document	REVIEWED BY INDERJIT SINGH VIKRAM TALWALKAR RAJEEV GARG Acceptance Norms Record Format	APPROVED BY  A.K. Garg
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Agency	Remarks

SAMPLING & ACCEPTANCE CRITERIA

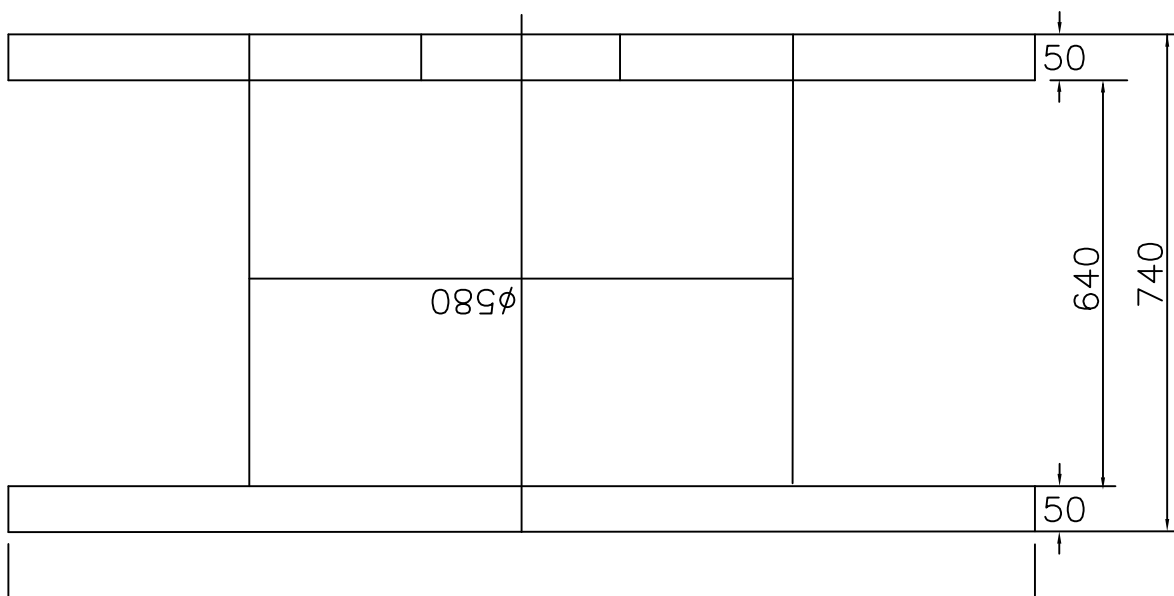
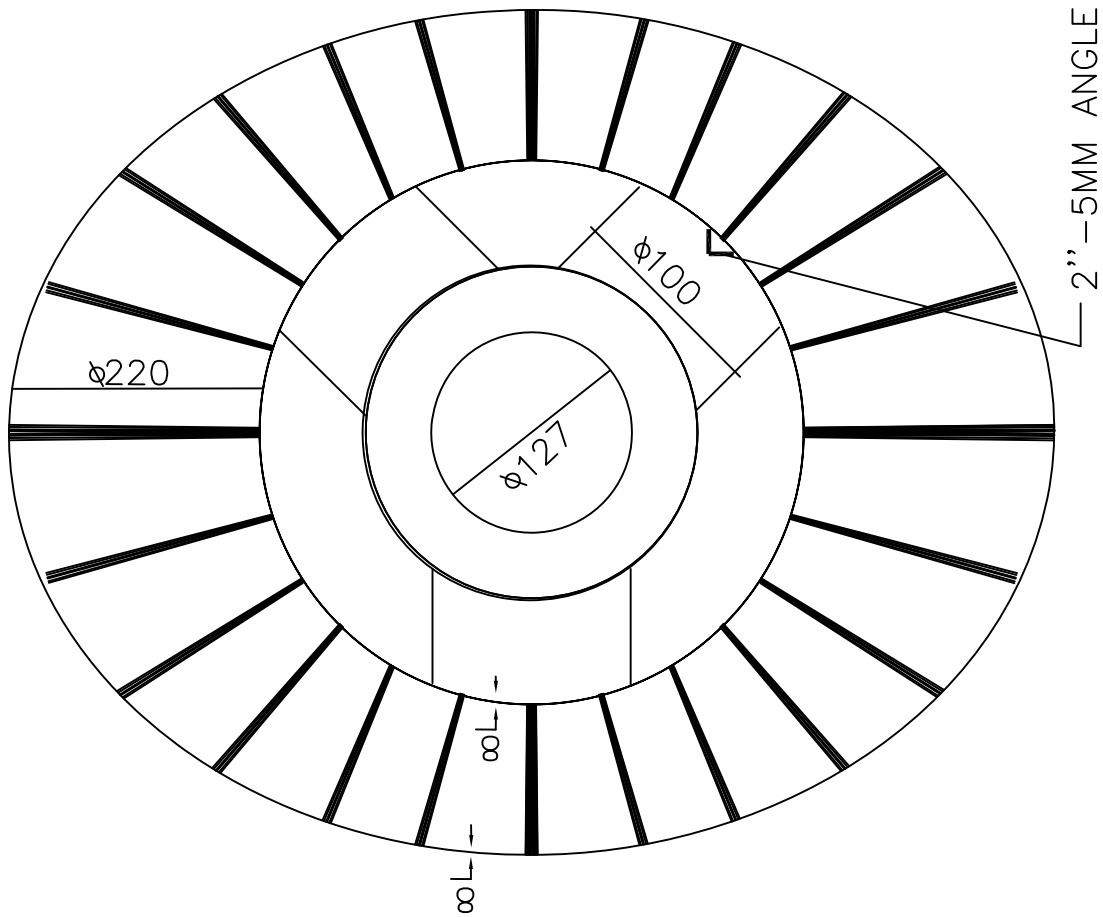
Criteria	Manufacturer experience prerequisite	Condition	Testing procedure	Remarks
Samples as per relevant IS from every size of cable in the offered lot shall be tested for Tensile Strength & Elongation (before ageing). The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/- 15% tolerance (final values should be more than the minimum values indicated in relevant standard) of the Type Test report	In case of Manufacturers/ Supplier who have supplied cables in the past through Corporate Centre / Regional offices	In case of sizes which meet the criteria	1 Sample per type out of sizes which have met the criteria, will be put on accelerated ageing test (refer IRS specification no. IRS: S-63/2007 Rev 3.0). The samples shall be aged in air oven at temperature of 130°C +/- 20°C for 5 hours. After wards the samples shall be tested for Tensile Strength & Elongation. Acceptance norms shall be as per relevant IS. This test shall be witnessed by NTPC.	In case the samples do not meet the requirement in accelerated ageing test then 1 sample of that size will be put on ageing test as per IS.
		In case of size which do not meet the criteria	Particular size will be put on ageing test as per IS. This test shall be witnessed by NTPC.	----
	In case of Manufacturers/ Supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre / Regional offices	In case of size which meet the criteria	1 Sample per type out of all sizes which have met the criteria, will be put on aging test and witnessed by NTPC as per relevant IS	----
		In case of size which do not meet the criteria	Particular size will be put on ageing test as per IS. This test shall be witnessed by NTPC	----

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-QA1-P-10/F3-R1

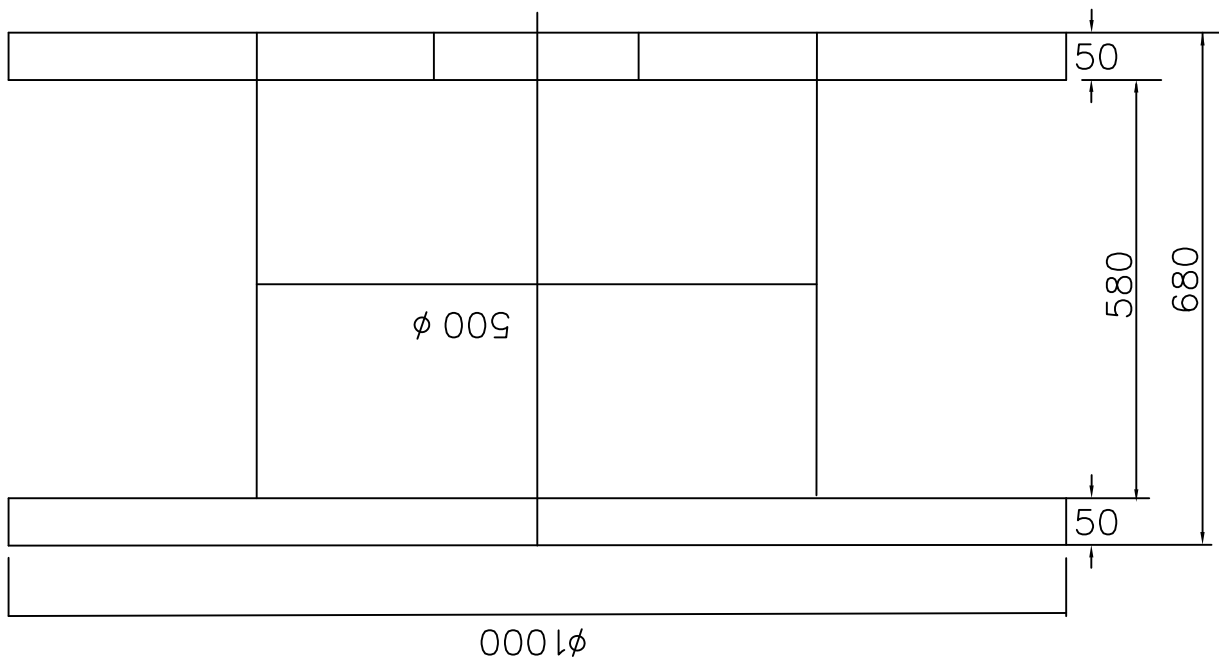
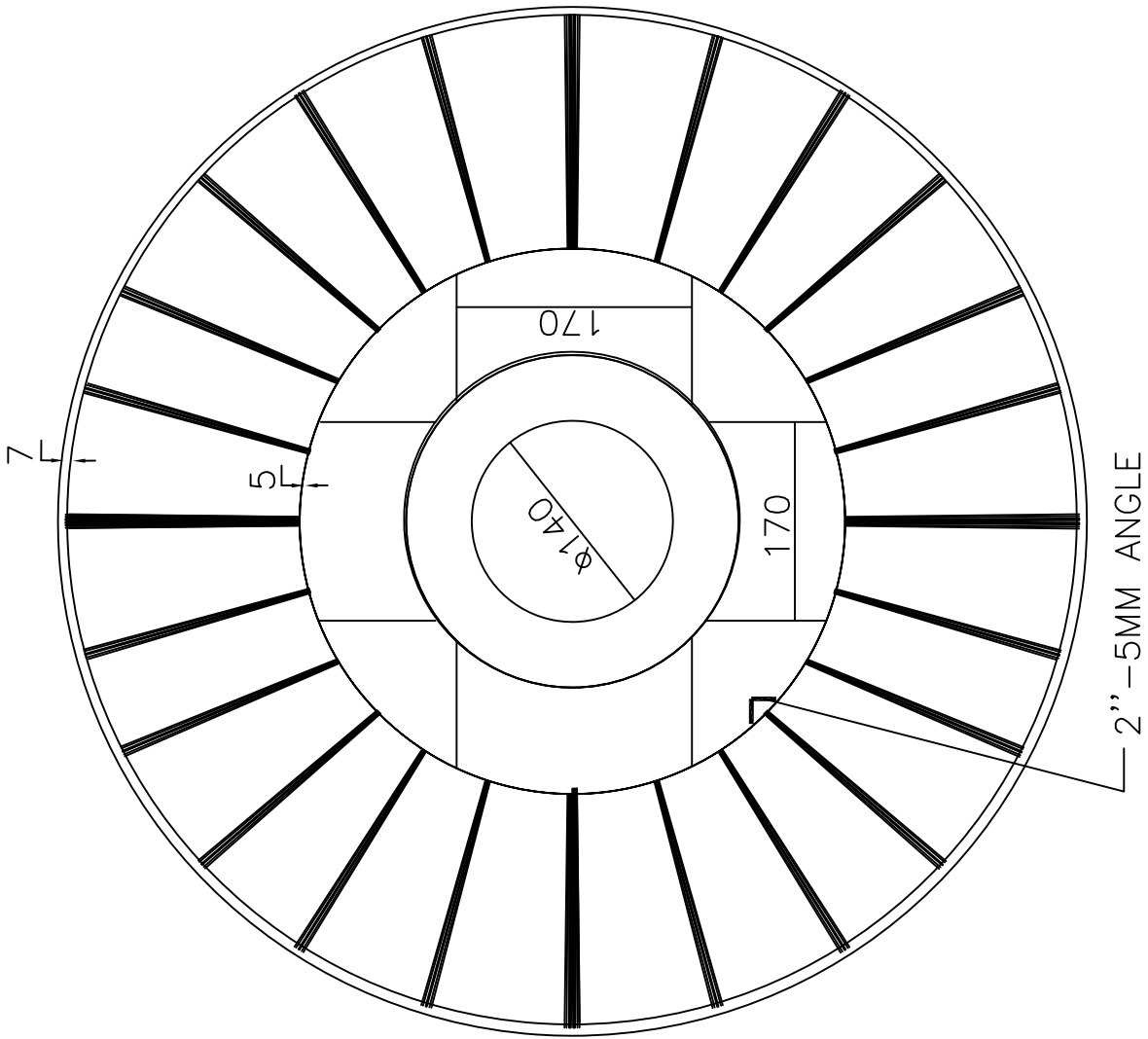
ANNEXURE A TO SECTION II

(Sheet 1 of 2)



DIMENSION in mm

ANNEXURE A TO SECTION II



DIMENSION in mm