

3 X 800 MW PATRATU STPS EXPANSION PH-I

TECHNICAL SPECIFICATION

FOR

LT PVC CONTROL CABLES

SPECIFICATION NO: *PE-TS-434-507-E015*

REVISION: 0



BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

NOIDA, UP (INDIA) – 201301



3 X 800 MW PATRATU STPS

**TECHNICAL SPECIFICATION FOR
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SPECIFICATION NO. PE-TS- 434-507-E015

VOLUME II

REVISION 0

DATE: 16.05.2019

SHEET

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	(INCLUDING COVER/ SEPARATOR SHEETS)	



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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	BHEL Standard Quality Plan (PE-QP-999-507-E003) shall be read as "QP. NO. 0000-999-QOE-S-040, REV-00". Additionally, The QP. NO. 0000-999-QOE-S-040 REV-00 shall be read in conjunction with Annexure C (Quality Assurance & Inspection). However Type testing on cables shall be conducted as per attached BHEL QP along with Annexure-A..

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-V0-434-507-E131
2.	Cross-sectional Drgs.- LT PVC Control Cables	PE-V0-434-507-E133
3.	Quality Plan - LT PVC Control Cables	PE-V0-434-507-E915*

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Sl. No.	Drawings/Document Description	Drawings / Document Number
4.	Steel drum drawing - LT PVC Control Cables (if applicable)	PE-V0-434-507-E135
5.	Type Test Reports - LT PVC Control Cables	PE-V0-434-507-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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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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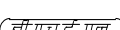
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		shall be legible and indelible. The numbers shall be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is a single numeral, a dash shall be placed underneath it. If the number 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	Only for one size
(b)	Material:	Galvanised steel round/formed wire (IS: 3975)
(i)	Multi-core cables	
(ii)	Standard Applicable	IS 1554 (part-1) & IS: 3975
(c)	Minimum Coverage	90%
(d)	Gap between armour wires	shall not exceed one armour wire space(no cross over/ overriding)
(e)	Breaking load of joint	95% normal armour wire
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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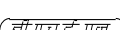
(d)	Smoke density rating	Max. 60% (As per ASTM D 2843)
(e)	Flammability Test	
(i)	Flammability test for all cables	As per: IEC-60332 Part-3, CAT-B
13.0	TOLERANCE ON OUTER DIAMETER	+ 2mm.
14.0	MINIMUM BENDING RADIUS	
(a)	Multi core cables	12 x O.D.
15.0	SAFE PULLING FORCE	
(a)	Copper conductor cable	50 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 before stranding : no x mm
- 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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SECTION - II

GENERAL TECHNICAL SPECIFICATION



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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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VOLUME II-B

SECTION II

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DATE: 16.05.2019

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)										QP 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	C		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	V	Refer note 1																					
		3. All acceptance test as per manufacturer norms including Thermal Stability test	MA	Verify	As per manufacturer norms	--do--	--do--	--do--	--do--		V	V	V																						
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	--do--		V	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	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	--	--																						

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

ofc



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		APPROVED BY N.T.P.C. 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
		6. Acid Gas Emission	MA	Chem	One sample / Batch		NTPC ADS / IEC60754	NTPC ADS	QCR	P	--	--	
1.06	Wooden Drum	1. Dimension 2. Anti termite treatment	MI MI	Meas Chem	Manuf. Std. Cable manuf. std		IS 10418 CABLE MANUF. STD.	IS10418 CABLE MANUF. STD.	--do-- COC	P V	-- V	-- V	COC from drum manuf.
1.07	Steel Drum	1. Dimension 2. Surface finish	MI MI	Meas Meas	--do-- --do--		--do-- --do--	--do-- --do--	QCR --do--	P P	-- --	-- --	
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	P	--	--	
		2. Wire Diameter	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--	P	--	--	
		3. Annealing Test	CR	Mech	--do--	Same as 6M	IS8130/NTPC ADS	IS8130/NTPC ADS	--do--	P	V	V	Refer Sl. No. 3.03(iii).
2.02	Bunching / stranding	1. No. of wires 2.Dia of wire 3. Dimension of Conductor 4.Direction of lay 5.Records of strand breakage / welding during conductor stranding 6.Surface finish 7. DC Resistance	MA MA MA MA MA MA CR	Meas Meas Meas Visual Verify Visual Meas	--do-- --do-- --do-- --do-- --do-- --do-- --do--	-- -- -- -- -- -- -	NTPC ADS --do-- --do-- --do-- IS 8130 --do-- IS8130/NTPC ADS NTPC spec	NTPC ADS --do-- --do-- --do-- IS8130 --do-- IS8130/NTPC ADS SHOULD BE SMOOTH. NO POROSITY IS PERMITTED.	--do-- --do-- --do-- --do-- --do-- --do-- --do--	P P P P P P P	-- -- -- -- -- -- --	-- -- -- -- -- -- --	PVC compound shall be preferably loaded in to extruder by suction method.
2.03	Insulation extrusion	1. Surface finish 2.Colour of cores	MA MA	Visual Visual	--do-- --do--	- -	NTPC ADS	NTPC ADS	--do--	P	--	--	

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



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
Reference Document

REVIEWED BY
INDERJIT SINGH
VIKRAM TALWAR
RAJEEV GARG
Acceptance Norms

APPROVED BY
Approved by
Dt. 01/11/11
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	--	--	

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



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 INDEXIT 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	3. Direction of lay	3	4	5	6	7	8	9			10		11
	3. Direction of lay	3	MA	Visual	One sample/Settling 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/Settling 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/Settling 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 I AND NTPC TECHNICAL SPECIFICATION)				Q.P. NO. 0000-999- QOE- S-040 REV-00 DATE : 25-11-11 Page 5 of 9		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY 377 A.K. Garg		
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Record Format	D*	M	N	Remarks
					M	C/N						
1	2	3	4	5	6	7	8	9				11
		6. Sequential marking	MA	Visual	Full length	Sequencial 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)		QCR				
C	Finished Cables											
3.01	Type test reports clearance from NTPC Engineering Routine Tests	All type tests as per NTPC specification	CR	Doc.	100%	100%	NTPC SPECIFICATION / NTPC ADS / IS 1554 (Part I)	-do--	✓	P	V	V
3.02		1.High Voltage test at room temperature	CR	Elect	100%	100%	NTPC ADS / IS 1554 (Part I)	Test certificate	✓	P	W	W
		2.Conductor Resistance	CR	Elect	100%	100%	NTPC ADS / IS 1554 (Part I)	-do--	✓	P	W	W
3.03	Acceptance Tests											
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)	NTPC ADS	NTPC ADS	-do--	✓	P	W	W
		2. Laying of core	CR	Visual	--do--	IS 1554 (Part I)	NTPC ADS / IS 1554 (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	--do--	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--	✓	P	W	W
3.03 (ii)	Armour wires/ Formed wires (if applicable)	1 Dimensions	CR	Meas	Each type & size of cables as per sampling plan of IS 1554 (Part I)	NTPC ADS /IS1554(Part I)/IS3975	NTPC ADS /IS1554(Part I)/ 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	W	W

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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)					Q.P. 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	D*	Agency		Remarks
1	2	3	4	5	M	C/ N	7	8	9		M	C	N
		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
		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
		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
		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)				QP. 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 RAJNEEV 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	

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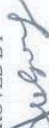
-M-MANUFACTURER/SUPPLIER, C-MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"
FORMAT NO:QS-01-QAI-P-10/F3-R1

		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 Acceptance Norms Record Format	APPROVED BY  A.K. Garg
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		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. Refer table on page 8 of 8 for Sampling & Acceptance criteria.							
3)								
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	----

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

BHEL QP APPLICABLE FOR
TYPE TEST

		QUALITY PLAN		CUSTOMER :		PROJECT : 3X800 MW PATRATU STPS			SPECIFICATION :			
				BIDDER/ VENDOR :		TITLE			NUMBER :			
				SHEET 5 of 8		QUALITY PLAN NUMBER PE-QP-999-507-E003, R-1			SPECIFICATION TITLE TECHNICAL SPECIFICATION FOR LT PVC CONTROL CABLE			
		SYSTEM		ITEM :LT PVC CONTROL CABLE			SECTION			VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS 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
3.0	Final Inspection	6. Type Tests (Refer Note-A)	CR	Phy & Elect. Tests FRLS Tests	Sample#	BHEL Specn. Apprpd.Data Sheet	BHEL Specn. Apprpd.Data Sheet	Test Report	2	1	-	# Refer Annexure -A to QAP enclosed.
NOTES:- (A) FOR LISTS OF ROUTINE TESTS , ACCEPTANCE TESTS & TYPE TESTS REFER ANNEXURE TO QAP. LEGEND : P : PERFORMER W: WITNESSER V: VERIFIER 1- BHEL 2-VENDOR 3- SUB VENDOR CHP: CUSTOMER HOLD POINT WHICH WILL BE DECIDED AT CONTRACT STAGE.												
			PARTICULARS		BIDDER/VENDOR			BIDDER'S/VENDORS COMPANY SEAL				
BHEL			NAME									
			SIGNATURE									
			DATE									

	ANNEXURE TO QP	CUSTOMER:	PROJECT TITLE	SPECIFICATION NUMBER: PE-TS-434-507-E015
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E003, R1	SPECIFICATION TITLE:
	SHEET 6 OF 8	SYSTEM	ITEM: LT PVC CONTROL CABLE	DOC. NO.

TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS

A. Type Test Conduction:

- Tests for which "T" is indicated in the 'Test Conduction Required As' column below shall be conducted as Type Test.
- Sampling:
 - Type test to be conducted on one size of cable for every lot of cable.
 - FRLS & Flammability Test to be conducted only on one sample/ lot.

B. Acceptance Test Conduction:

- Tests for which "A" is indicated in the 'Test Conduction Required As' column below shall be conducted as Acceptance tests.
- Sampling:

Sampling for acceptance tests shall be as per Appendix-B of IS: 1554 Part-I (control cable).
- Flammability Test to be conducted only on one sample/ lot.

C. Routine Test Conduction:

- 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.

NOTE

LOT shall be defined as per IS: 1554 Part-I (control cable).

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
1.0	Tests for Conductor				
I.	Annealing test	For copper conductor	T, A	IS 10810 Pt 1	In process records shall be furnished to inspector at the time of inspection.
II.	Resistance test	For copper conductor	T, A, R	IS 10810 Pt 5	
2.0	Tests for Armour Wires/Strips				
I.	Measurement of dimensions	Applicable for GS wire/Strip	T,A	IS 10810 Pt 36	
II.	Tensile test	Applicable for GS wire/Strip	T, A	IS 10810 Pt 37	
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 / Adhesion Test	For GS strip only	T, A	IS 10810 Pt 39	

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S / VENDORS COMPANY SEAL

	ANNEXURE TO QP	CUSTOMER:	PROJECT TITLE	SPECIFICATION NUMBER: PE-TS-434-507-E015
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E003, R1	SPECIFICATION TITLE:
	SHEET 7 OF 8	SYSTEM	ITEM: LT PVC CONTROL CABLE	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
VI.	Resistivity test	Applicable for GS wire/Strip	T, A	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 40	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 41	
IX.	Wrapping Test	For G. S. wires/Strip only	A	IS 10810 Pt 3	
3.0	<u>Physical Tests for PVC Insulation & PVC sheath</u>				
I.	Test for thickness	Applicable for PVC insulation, PVC inner sheath & PVC outer sheath	T, A	IS 10810 Pt 6	
II.	Tensile strength and elongation test at break	Applicable for PVC 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 PVC insulation & PVC outer sheath	T	IS 10810 Pt 11	
IV.	Loss of mass in air oven test	Applicable for PVC insulation & PVC outer sheath	T	IS 10810 Pt 10	
V.	Hot deformation test	Applicable for PVC insulation & PVC outer sheath	T	IS 10810 Pt 15	
VI.	Heat shock test	Applicable for PVC insulation & PVC outer sheath	T	IS 10810 Pt 14	
VII.	Shrinkage test	Applicable for PVC insulation & PVC outer sheath	T	IS 10810 Pt 12	
VIII.	Thermal stability test	Applicable for PVC insulation & PVC outer sheath	T	IS 10810 Pt 60	
4.0	<u>Improved Fire performance (FR-LSH) Tests</u>				
I.	Oxygen index test	For PVC outer sheath only	T, A	IS 10810 Pt 58 / ASTM D 2863	<u>Applicable for Inner Sheath also, if the same is indicated in Datasheet-A</u>
II.	Smoke density test	For PVC outer sheath only	T, A	IS 10810 Pt 63 / ASTM D 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 / ASTM D 2863	
5.0	<u>Flammability Tests</u>				
I.	Flammability test for bunched cables	For complete cable	T	IS 10810 Pt 62/ IEC-60332 (Part-3-23-Cat-B)	<u>Test & Category applicable</u>

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S / VENDORS COMPANY SEAL

	ANNEXURE TO QP	CUSTOMER:	PROJECT TITLE	SPECIFICATION NUMBER: PE-TS-434-507-E015
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E003, R1	SPECIFICATION TITLE:
	SHEET 8 OF 8	SYSTEM	ITEM: LT PVC CONTROL CABLE	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
II.	Flammability test for single cable	For complete cable	T,A	IS: 10810 Pt 61 / IEC:60332 Part-1	as indicated in Datasheet-A
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 (Water immersion test)	On cores	T	IS 10810 Pt 45	
II.	High Voltage Test at room temperature	For complete cable	T, A, R	IS 10810 Pt 45	
III.	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	Refer Note	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.**

Note: A few chipping of the PVC compound is slowly ignited on a porcelain dish or cubicle in a muffle furnace at about 60-degree C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). Place a drop of aqueous sodium sulphide solution on a thick filter paper and allow soaking. Touch the spot with a drop of above extract. A black spot indicates the presence of lead, the anti-termite and rodent compound.

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S / VENDORS COMPANY SEAL

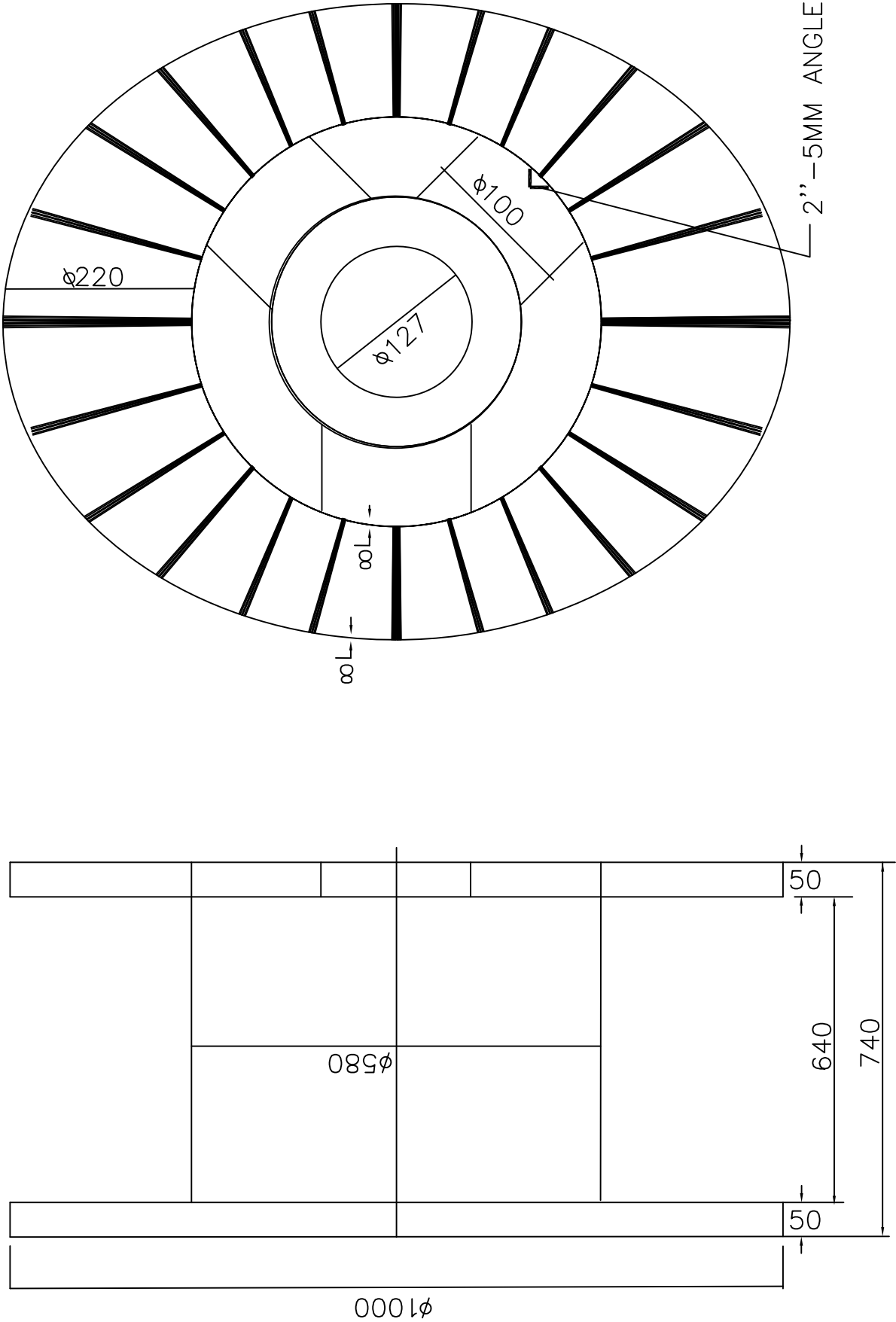
CLAUSE NO.	TECHNICAL REQUIREMENTS			
	S. No.	Type Test	Remarks	
		For Conductor		
	1.	Resistance test		
		For Armour Wires / Formed Wires (If applicable)		
	2.	Measurement of Dimensions		
	3.	Tensile Test		
	4.	Elongation test		
	5.	Torsion test	For round wire only	
	6.	Wrapping test	For aluminium wires / 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	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS- 9585-001-2	SUB-SECTION-B-21 LT CONTROL CABLES	PAGE 5 OF 6

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
5.02.00	S. No.	Type Test	Remarks	
	18.	Oxygen index test	For outer sheath only	
	19.	Smoke density test	For outer sheath only	
	20.	Acid gas generation test	For outer sheath only	
	For completed cables			
	21.	Insulation resistance test(Volume resistivity method)		
	22.	High voltage test		
	23.	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 Control Cables enclosed.			
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS- 9585-001-2	SUB-SECTION-B-21 LT CONTROL CABLES

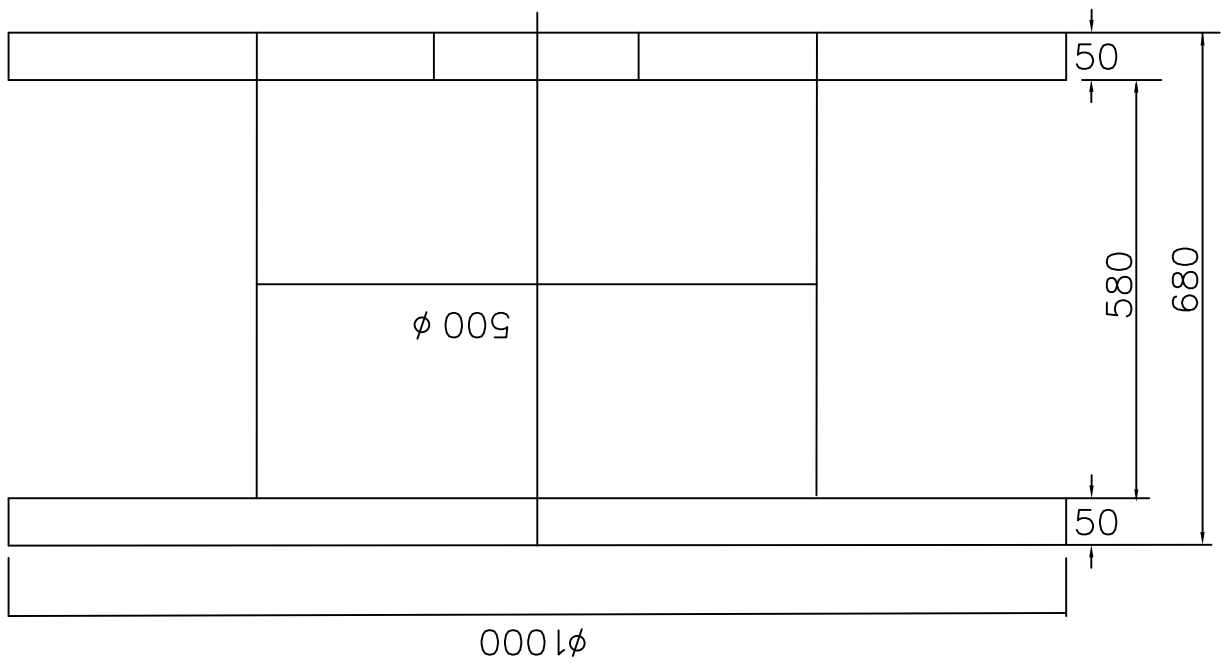
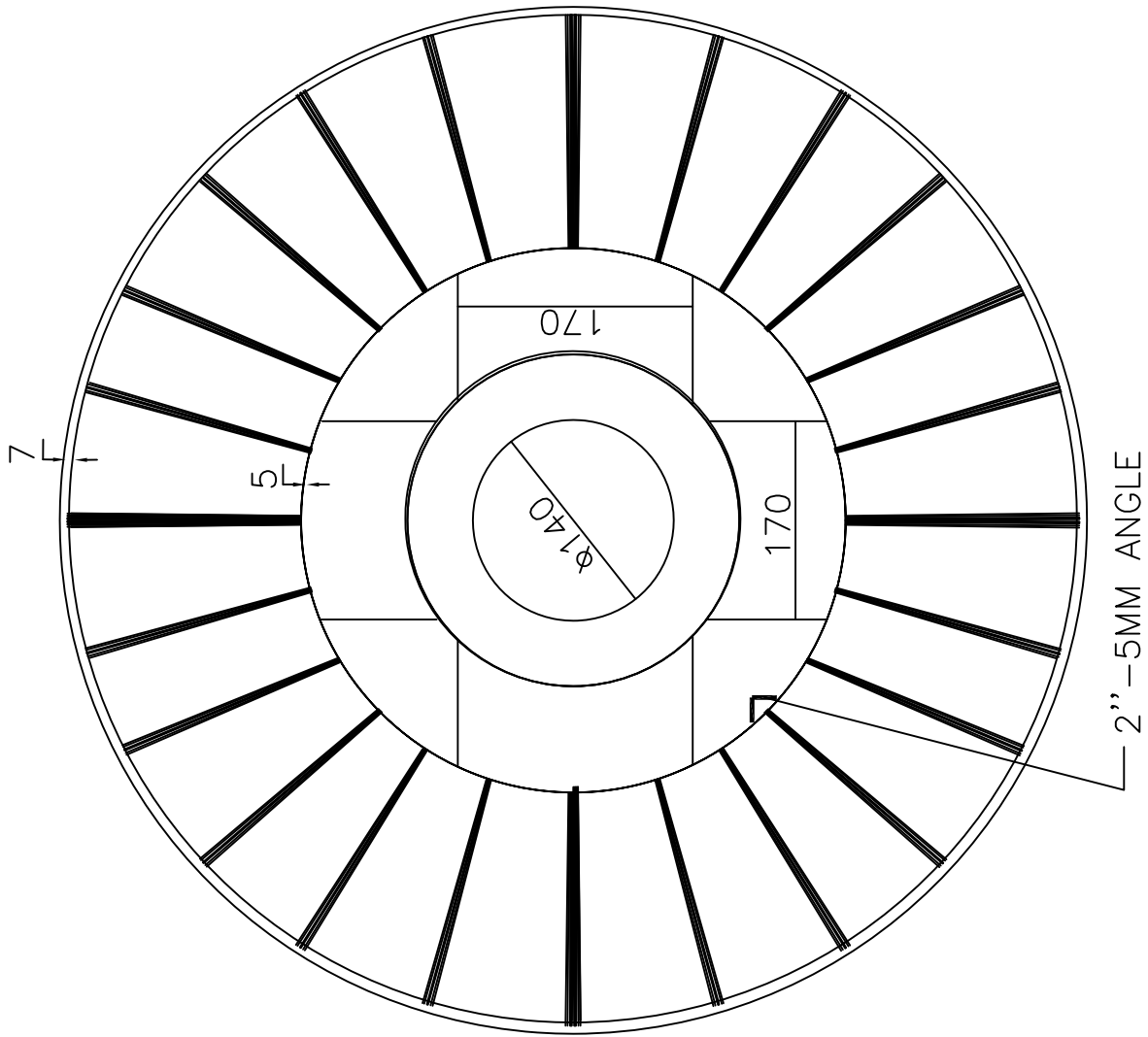
STEEL DRUM DRAWING (TYPICAL)

ANNEXURE B TO SECTION II

(Sheet 1 of 2)



ANNEXURE B TO SECTION II



DIMENSION in mm

CLAUSE NO.

QUALITY ASSURANCE



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.

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”)

CLAUSE NO.		QUALITY ASSURANCE			
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.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-9585-001-2		SUB-SECTION-E-49 CONTROL CABLE	
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CLAUSE NO.

QUALITY ASSURANCE



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