RATE CONTRACT FOR ADANI PROJECTS

TECHNICAL SPECIFICATION
FOR
LT PVC CONTROL CABLE

SPECIFICATION No. **PE-TS-999-507-E003A**
REV NO. 00

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

INDEX

SCOPE

SCOPE OF THIS PACKAGE COVERS THE FOLLOWING:

SL.NO	PARAMETERS	REQUIREMENT
1	Supply Including Design, Engineering, Manufacturing of LT XLPE Power cable	YES
a)	Main Supply	YES
b)	Commissioning Spares	NO
2	Painting	NO
3	Inspection & Testing	YES
4	Packing	YES
5	Transportation & Delivery To Site	YES
6	Erection & Commissioning	NO
7	Supervision of Erection & Commissioning	NO
8	Mandatory Spares	NO
9	O & M Service	NO
10	O & M Spares	NO

	GENERAL TECHNICAL REQUIREMENT
1	It is not the intent to specify herein all the details of design and manufacturing. Bidder shall ensure that the offered equipment confirms in all respects to high standards of design, engineering and workmanship.
2	Bidder shall also ensure that the offered equipment shall comply with all applicable statutory and regulatory requirements.
3	In the event of any conflict between the requirements of two clauses of this specification, documents or requirements of different codes and standards specified, the more stringent requirement as per the interpretation of the owner shall apply.
4	Drawings/ documents submitted by vendor at any stage shall be complete in all respects. Any incomplete drawing submitted shall be treated as non- submission with delays attributable to vendor. For any clarification/ discussion required to complete the drawings, the bidder shall depute his personnel to BHEL / Customer's Office as per the requirement for across the table submission/ finalizations of drawings.
5	Latest codes and standards shall be complied.
6	Bidder shall furnish Type Test Certificate of specified Type Test as per quality plan which has been conducted within last 5 years from 30.11.2024 , i.e. from 01/12/2019 to 30/11/2024.These reports should be for the tests conducted on 1.1 KV LT PVC Control cable identical in all respects to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. In absence of valid Type Test report vendor to conduct the same without any commercial & delivery implication to BHEL. List of Type test for which type test reports are to be submitted are specified in Annexure-A to QAP.
7	Bidder shall confirm compliance with the Quality Plan attached with the specification without any deviations. At contract stage, the Quality Plan as enclosed in the technical specification is to be appended with cover sheet bearing document number and description. The signed and stamped copy of the same shall be submitted to BHEL without making any changes in the contents of the document. There shall be no commercial implication to BHEL on account of minor changes in QP during contract stage.
8	Equipment must be safe, reliable and easy to maintain at all operating condition.

	TECHNICAL SPECIFICATION LT PVC CONTROL CABLE RATE CONTRACT FOR ADANI PROJECTS	PE-TS-999-507-E003A
		Issue No: 01
		Rev. No. 00
		Date : 28.03.2025

TECHNICAL DATA - PART - A			
SL.NO	**DESCRIPTION**	**UOM**	**DETAIL**
1.0	**DESIGN CODES & STANDARDS**		
1.1	Standard applicable in general (Latest amendment to be referred if any)		IS:1554 (Part-1)
1.2	Current rating of cables		As per IS:3961 (P-2)
1.3	Short circuit rating		IEC 60949
1.4	Conductor		IS: 8130
1.5	PVC Insulation		IS 1554 (Part-1)
1.6	Inner sheath		IS 1554 (Part-1)
1.7	Outer sheath		IS 1554 (Part-1)
1.8	Core Identification (Upto 5 core)		Colour coding as per IS 1554 (Part-1)
1.9	Core Identification (Above 5 core)		By numbering as per IS 1554 (Part-1). Insulation to have black colour.
1.10	Armour		Galvanised Steel Round Wire/ Galvanised Steel Formed Wire Conforming to : (i) Type 'b' as per Table-5 of IS 1554-I and (ii) IS 3975; as per project requirements.
2.0	**DESIGN /SYSTEM PARAMETERS**		
2.1	Type of Cable		Flame Retardant-Low Smoke (FR-LSH) LT CABLE
2.2	Voltage Grade		1.1 kV
2.3	INSTALLATION CONDITIONS AT SITE		
2.3.1	Ambient air temperature	deg. C	50
2.3.2	Ground temperature	deg. C	30
3.0	**CONSTRUCTION FEATURES**		
3.1	CONDUCTOR		
3.1.1	Material type		Annealed Bare Copper (ABC)
3.1.2	Grade		Annealed high conductivity
3.1.3	Class		Class 2 (Stranded)
3.1.4	Shape		Circular
3.1.5	Compaction		Non-Compacted
3.1.6	Cable Size	sq.mm	As per unpriced 'price schedule'

3.2	PVC INSULATION		
3.2.1	Nominal thickness of insulation	mm	As per IS: 1554 (Part-1) Table-2
3.2.2	Material		Extruded PVC Type-A
3.2.3.1	Continuous withstand temperature	deg. C	70
3.2.3.2	Short-circuit withstand temperature	deg. C	160
3.2.4	Volume Resistivity	ohm cm	$1X10^{13}$ ohm cm at 27 deg C $1X10^{10}$ ohm cm at 70 deg C
3.3	Extrusion		Sleeve extrusion not permitted.
3.3.1	Method of extrusion		Pressure Extruded / Vacuum Extruded
3.4	CORE IDENTIFICATION		As per IS
3.5	INNERSHEATH		
3.5.1	Thickness of inner sheath		As per IS 1554 (Part-1) Table-4
3.5.2	Material		Extruded PVC Type ST-1
3.5.3	Colour		Black
3.5.4	Whether FR-LSH		NO
3.5.5	Material of fillers (for multicore cables)		Same as inner sheath
3.5.6	Method of application		Extrusion
3.5.6.1	Multi-core cables:		Pressure extruded / Vacuum extruded
3.6	Armour		
3.6.1	Dimension		As per IS: 1554 Part-1 and tolerance as per IS:3975
3.6.2	Material		
3.6.2.2	Multi core		Galvanised steel round wire / Galvanised steel formed wire
3.6.3	Gap between armour wire		Not more than one armour wire space (No cross over / No over riding)
3.6.4	Paint on joint		Zinc rich paint shall be applied on armour joint surface of G.S.wire / formed wire
	Minimum Coverage		90%
3.6.5	Breaking load of Joint		95% of normal armour
3.7	OUTERSHEATH		
3.7.1	Thickness of outer sheath		As per Table-7 of IS: 1554 (Part-1)
3.7.2	Material		Extruded PVC Type ST1 as per IS: 5831.
3.7.3	Colour		Black
3.7.4	Whether FR-LSH		YES
3.7.5	Method of application		Extruded

3.7.6	Marking/ Embossing on Outer sheath		
3.7.6.1	At every 1 meters (by Embossing)		(i) Owner's Name (project specific) (ii) Manufacturer's name and trade mark (iii) Year of manufacture (iv) Type of cable and voltage class (v) Nominal cross section area of conductor and no. of cores (vi) 'BHEL-UNIT NAME' (Shall be informed during detailed engineering) (vii) 'FRLS'/ FRLSH
3.7.6.2	At every 1 Meters by embossing/ printing		Progressive Sequential length.Drum no. shall also be embossed/ printed.
3.8	FR-LSH CHARACTERISTICS		
3.8.1	Oxygen index		Minimum 29 as per ASTMD 2863
3.8.2	Temperature index		Minimum 250º C as per ASTMD 2863
3.8.3	Acid gas generation		Maximum 20% by weight as per IEC 60754-1
3.8.4	Smoke density rating		Maximum 60% as per ASTMD 2863
3.8.5	Flame retardance test for single cable (for cable OD ≤ 35mm)		As per IS 10810 Part 61
3.8.6	Flame retardance test for bunched cables		As per IS 10810 Part 62/ IEC-332 Part-3 (Category -B)
3.9	DIAMETERS		
3.9.1	Tolerance on overall diameter	mm	(±) 2 mm over the declared value
3.10	CABLE DRUM DETAILS		
3.10.1	Type		NON RETURNABLE WOODEN DRUM / STEEL DRUM
3.10.2	Standard drum length		1000m
3.10.3	Tolerance on drum length		(±) 5%
3.10.4	Details of marking on Drum		a) Manufacturer's name or trade make, address & contract no. b) Type of cable & voltage grade. c) Year of manufacture. d) Type of insulation. e) No. of core and sizes of cables. f) Cable code - FRLS. g) Single length of cable on drum. h) Direction of rotation, by arrow. i) Approx. gross mass.(on both sides of drum) j) Drum no. k) 'BHEL-UNIT NAME' (Shall be informed during detailed engineering)

4.0	**INSPECTION/TESTING**	
4.1	Type test conduction required	No* (* : Refer Sl. No. 4.2 below)
4.2	Validity of type test report	As per Quality Plan vendor to furnish Type Test Certificate of specified Type Test which has been conducted within last 5 years from 30.11.2024 , i.e. from 01/12/2019 to 30/11/2024.These reports should be for the tests conducted on 1.1 KV LT PVC Control cable identical in all respects to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. In absence of valid Type Test report vendor to conduct the same without any commercial & delivery implication to BHEL. List of Type test for which type test reports are to be submitted are specified in Annexure-A to QAP.
4.3	Acceptance & Routine test	All acceptance and routine tests as per Quality plan shall be carried out. Charges for these shall be deemed to be included in the cable price.

	TECHNICAL SPECIFICATION LT PVC CONTROL CABLE RATE CONTRACT FOR ADANI PROJECTS	PE-TS-999-507-E003A Issue No: 01 Rev. No. 00 Date :

TECHNICAL DATA - PART - B (SUPPLIER DATA TO BE FURNISHED AFTER AWARD OF CONTRACT)

SL.NO		UOM	DETAIL
	The following technical data shall be submitted by the manufacturer for each type and size of the cable for Employer's approval.		
1.1	Make		
1.2	Country of manufacturer		
1.3	Type designation		
1.4	Cable size	No. of Cores x mm2	
1.5	Rated Voltage	kV	
1.6	Base current ratings (*) based on Clause No. 3.0		
1.6.1	In air (Amp)	Amps	
1.6.2	In ground (Amp)	Amps	
1.6.3	ducts (Amp)	Amps	
2.1	CONDUCTOR		
2.1.1	Nominal cross sectional area	Sq. mm	
2.1.2	No. of wires (min.)	Nos.	
2.1.3	Dia of wires	mm	
2.1.6	Approximate Diameter over conductor	mm	
2.1.7	Direction of lay of stranded layers		
2.1.8	Conductor resistance (DC) At 20 deg C(max.)	Ohm/K m	
2.1.9	Conductor resistance (AC)		
2.1.9.1	at 20 deg. C (Approx.)	ohm/K m	
2.1.9.2	at 90 deg. C (Approx.)	ohm/K m	
2.1.10	Reactance per phase at 50 Hz	ohm/K m	
2.2	PVC INSULATION		
2.2.1	Nominal thickness of insulation	mm	
2.3	INNERSHEATH		
2.3.1	Thickness of sheath	mm	
2.3.2	Approximate diameter over the laid up cores	mm	
2.3.3	Thickness of sheath (Min)	mm	
2.4	ARMOUR		
2.4.1	Type of material of armour		
2.4.2	Shape (Formed wire / Round wire)		
2.4.5	Dimension of formed wire / round wire	mm	
2.4.6	No. of armour formed wires / round wires	Nos.	
2.5	OUTERSHEATH		
2.5.1	Thickness of sheath	mm	
2.6	FINISHED CABLE DETAILS		
2.6.1	Overall diameter of cable	mm	
2.6.2	Tolerance on overall diameter	mm	
2.6.5	Weight per 1000 mtrs	kg	
2.6.6	Recommended min installation bending radii	mm	
2.6.6	Safe pulling force when pulled by pulling eye on the conductor	kg	
2.7	CABLE DRUM DETAILS		
2.7.1	Dimensions (Approx.)		
2.7.1.1	Flange diameter	mm	
2.7.1.2	Barrel diameter	mm	
2.7.1.3	Traverse	mm	
2.7.2	Weight of cable drum with Cables	kgs	

QUALITY PLAN

STANDARD QUALITY PLAN

ITEM : LT PVC INSULATED POWER & CONTROL CABLE

SQP NO: ADANI/QA/SQP/E/007
REV. NO.:01
DATE: 01.04.2015

Approved by QA

SL No.	COMPONENT/ OPERATION	CHARACTERISTICS	CATEGORY OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		INSPECTION AGENCY			REMARKS
					M	C/A					M	C	A	
1	2	3	4	5	6		7	8	9	*D	**10			11
1. Raw Material														
1.1	Aluminium/ Copper Rod	Surface	Major	Visual	Each Coil	Each Coil	Conductor shall be smooth	Conductor shall be smooth	MTC	√	P	V	V	
		Chemical Composition	Major	Chemical	IS: 613-Cu IS: 5484-Al	IS: 613-Cu IS: 5484-Al	IS: 613 - Cu IS: 5484 - Al	IS: 613-Cu IS: 5484-Al		√	P	V	V	
		Resistivity / Conductivity	Critical	Electrical						√	P	V	V	
		Tensile strength	Major	Physical						√	P	V	V	
		Elongation at break	Major	Physical						√	P	V	V	
		Diameter	Major	Dimensional						√	P	V	V	
1.2	PVC Compound	Density	Major	Measurement	1 sample from a lot of 2 MT or part there of each Lot	1 sample from a lot of 2 MT or part there of each Lot	IS: 5831	IS: 5831	MTC	√	P	V	V	
		Thermal stability	Major	Thermal			IS: 5831			√	P	V	V	
		Tensile strength	Major	Physical			IS:10810			√	P	V	V	
		Elongation at break	Major	Physical			IS:10810			√	P	V	V	
		Volume resistivity	Major	Electrical			IS:10810-P 60			√	P	V	V	
		Anti Termite & Rodent	Critical	Thermal			Presence of Lead	Presence of Lead		√	P	V	V	
		Tests for FRLS (For FRLS Cable only)												
		Smoke density	Critical	Optical	1 sample from a lot of 2 MT or part there of each Lot	1 sample from a lot of 2 MT or part there of each Lot	ASTMD-2843	Max 60%	MTC	√	P	V	V	
		Oxygen index	Critical	Thermal			ASTMD-2863	Min. 29%		√	P	V	V	
		Temperature index	Critical	Thermal			ASTMD-2863	Min 250°C		√	P	V	V	
		HCL Test	Critical	Chemical			IS 10810/ IEC-754-1	Max 20% by Weight		√	P	V	V	
1.3	GI Armour Flat / Wire	Dimensions	Major	Dimensional	IS 3975	IS 3975	IS:3975	IS:3975	MTC	√	P	V	V	
		Tensile strength	Major	Mechanical						√	P	V	V	
		Elongation at Break	Major	Mechanical						√	P	V	V	
		Resistivity	Minor	Electrical						√	P	V	V	
		Torsion Test (For Round Wire Only)	Major	Mechanical						√	P	V	V	
		Wrapping Test	Major	Mechanical						√	P	V	V	
		Adhesion Test	Major	Chemical						√	P	V	V	
		Mass of zinc Coating	Major	Chemical			IS:4826	IS:4826		√	P	V	V	
		Uniformity of Zinc	Major	Chemical			IS 2633	IS 2633		√	P	V	V	

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SL No.	COMPONENT/ OPERATION	CHARACTERISTICS	CATEGORY OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		INSPECTION AGENCY			REMARKS
					M	C/A					M	C	A	
1	2	3	4	5	6		7	8	9	*D	**10			11
1.4	Wooden drums	Dimensions of drum	Major	Dimensional	20%	One sample / size / lot	IS:10418	IS:10418	MTC/ITR		P	V	V	
		Thickness of flange	Major	Dimensional			IS:10418	IS:10418			P	V	V	
		Number of tie rods	Major	Count			IS:10418	IS:10418			P	V	V	
		Size of tie rods	Major	Dimensional			IS:10418	IS:10418			P	V	V	
		Diameter of centre hole	Minor	Dimensional			IS:10418	IS:10418			P	V	V	
		Visual	Major	Visual			IS:10418	IS:10418			P	V	V	
2. IN PROCESS														
2.1	Wire Drawing (Al / Cu)	Surface finish	Major	Visual	Each setting & one sample per Lot	Each setting & one sample per Lot	IS:8130	IS:8130	MTC/ITR		P	V	V	
		Diameter	Minor	Dimensional			Data Sheet	Data Sheet			P	V	V	
		Tensile strength	Major	Mechanical			IS:10810Pt 2	IS:8130			P	V	V	
		Wrapping test (applicable for Al. only)	Major	Mechanical			IS:10810Pt 3	IS:8130			P	V	V	
		Annealing Test (applicable for Cu only)	Major	Mechanical			IS: 10810 Pt 1	IS:8130			P	V	V	
		Resistivity/Conductivity	Critical	Electrical			IS:10810Pt 5	IS:5484			P	V	V	
2.2	Stranding	No. of wires	Major	Count	Each setting & Twice in shift	Each setting & Twice in shift	Mfg Plant Std/ Data Sheet/ IS: 8130	Mfg Plant Std/ Data Sheet/ IS: 8130	ITR		P	V	V	
		Wire diameter	Minor	Dimensional							P	V	V	
		Lay Direction	Major	Visual							P	V	V	
		Cond. Dia/height	Major	Dimensional							P	V	V	
		Cond. Resistance	Critical	Electrical							P	V	V	
		Surface	Major	Visual							P	V	V	
2.3	Insulation	Type of compound	Major	Visual	Each setting & Twice in shift	Each setting & Twice in shift	Mfg Plant Std / Data Sheet / IS:1554	Mfg Plant Std / Data Sheet / IS:1554	ITR		P	V	V	
		Insulation thickness	Major	Dimensional							P	V	V	
		Surface finish	Major	Visual							P	V	V	
		Colour/Core Identification	Major	Visual							P	V	V	
		Porostiy	Major	Visual	100%	100%								
		Spark Test	Major	Electrical							P	V	V	
		Continuity of Conductor	Major	Visual							P	V	V	
2.4	Laying up	Sequence of cores	Major	Visual	Each setting & Twice in a Shift	Each setting & Twice in a Shift	Mfg Plant Std / Data Sheet / IS:1554	Mfg Plant Std / Data Sheet / IS:1554	ITR		P	V	V	
		Direction of lay	Major	Visual							P	V	V	
		Laid up diameter	Major	Dimensional							P	V	V	
		Circularity	Major	Visual							P	V	V	

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SL No.	COMPONENT/ OPERATION	CHARACTERISTICS	CATEGORY OF CHECK	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		INSPECTION AGENCY			REMARKS
					M	C/A					M	C	A	
1	2	3	4	5	6		7	8	9	*D	**10			11
2.5	Inner sheath	Type of compound	Major	Visual	Each setting & at the end of Each Drum Length	Each setting & at the end of Each Drum Length	Mfg Plant Std/ Data Sheet/ IS:1554	Mfg Plant Std/ Data Sheet/ IS:1554	ITR		P	V	V	
		Sheath thickness	Major	Dimensional							P	V	V	
		Surface finish	Major	Visual							P	V	V	
		Dia over sheath	Major	Dimensional							P	V	V	
2.6	Armour	No. of wires	Major	Count	Each setting & at the end of Each Drum Length	Each setting & at the end of Each Drum Length	Mfg Plant Std/ Data Sheet/ IS 3975 / IS:1554	Mfg Plant Std/ Data Sheet/ IS 3975 / IS:1554	ITR		P	V	V	
		Dimensions of wire	Major	Dimensional							P	V	V	
		Lay direction	Major	Visual							P	V	V	
		Dia over armour	Major	Dimensional							P	V	V	
2.7	Outer sheath	Type of compound	Major	Visual	Each setting & Twice in a Shift	Each setting & Twice in a Shift	Mfg Plant Std/ Data Sheet/ IS:1554	Mfg Plant Std/ Data Sheet/ IS:1554	ITR		P	V	V	
		Sheath thickness	Major	Dimensional							P	V	V	
		Surface finish	Major	Visual							P	V	V	
		Dia over sheath	Major	Dimensional							P	V	V	
		TS & Elongation	Major	Dimensional							P	V	V	
		Embossing/Printing/ Seq. Marking	Major	Visual							P	V	V	
3. Finished Cable														
3.1	Routine test	High Voltage test	Critical	Electrical	100%	100%	IS:10810 Pt-45	3kV for 5 Min. Witstood	IR	√	P	V	V	**NOTE 1:** Type Test Certificate not ealier than five Years from the date of award duly reviewed & accepted by Owners Engineering for similar type, Size & rating of cable shall be submitted alongwith inspection call. In case the type test is specially required as per the technical specification, same shall be witnessed. **NOTE 2:** Dimensional verification shall includes:
		Conductor resistance test	Critical	Electrical			IS:10810 Pt-5	IS:8130		√	P	V	V	
3.2	Acceptance test	High Voltage test	Critical	Electrical	Sampling as per IS 1554-1	Sampling as per IS 1554-1	IS:10810 Pt-45	3kV for 5 Min. Witstood	IR	√	P	H	H	
		Conductor resistance test	Critical	Electrical			IS:10810 Pt-5	IS:8130		√	P	H	H	
		Volume resistivity	Critical	Electrical			IS:10810 Pt-43	As per IS-5831		√	P	H	H	
		Thickness of insulation	Major	Dimensional			IS:10810 Pt-6	IS:1554 Pt1		√	P	H	H	
		Thickness of inner sheath	Major	Dimensional			IS:10810 Pt-6	IS:1554 Pt1		√	P	H	H	
		Thickness of outer sheath	Major	Dimensional			IS:10810 Pt-6	IS:1554 Pt1		√	P	H	H	
		Tensile strength of insulation	Major	Physical			IS:10810 Pt-7	As per IS-5831		√	P	H	H	

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					M	C/A					M	C	A	
1	2	3	4	5	6		7	8	9	*D	**10			11
3.2	Acceptance test	Elongation at break of insulation	Major	Physical	Sampling as per IS 1554-1	Sampling as per IS 1554-1	IS:10810 Pt-7	As per IS-5831	IR	√	P	H	H	a) Over all Dia. Of Cable. b) No. of Conductor & Armour c) Dim. Conductor/ Armour d) Size of Cu. Screen & Overlapping. (if applicable) **NOTE 3:** 3.1. Rewinding of Cable Drum shall be carried out to check the following: a) Sequntial Marking on outer sheath of cable as per IS either by Embossing or Lazer Printing. b) Total Length Verification. c) Surface Defect 3.2. Different cable size drum shall be selected for rewinding. **NOTE 4:** Cable Identification for outersheath marking shall be done as per approved datasheet.
		Tensile strength of outer sheath	Major	Physical			IS:10810 Pt-7	As per IS-5831		√	P	H	H	
		Elongation at break of outer sheath	Major	Physical			IS:10810 Pt-7	As per IS-5831		√	P	H	H	
		Core Identification of Cable	Major	Physical			As per Data Sheet /IS 1554-I	As per Data Sheet /IS 1554 P-I		√	P	H	H	
		Dimensional Verification (Note 2)	Major	Measurement			Data Sheet	Data Sheet		√	P	H	H	
		Rewinding of Drum (Note 3)	Major	Visual	10% of total Lot offered for inspection	10% of total Lot offered for inspection	Data Sheet/ Declared length	Data Sheet/ Declared length		√	P	H	H	
		Cable Identification (Note 4)	Critical	Visual			Data Sheet	Data Sheet		√	P	H	H	
		Anti Termite & Rodent	Critical	Thermal	01 Sample/ Size/ Lot	01 Sample/ Size/ Lot	Presence of Lead	Presence of Lead		√	P	H	H	
		Tests for FRLS (For FRLS Cable only)								√	P	H	H	
		Smoke density	Critical	Optical	01 Sample /Size/Lot offered for inspection (Note 5)	01 Sample /Size/Lot offered for inspection (Note 5)	ASTMD-2843	Max 60%		√	P	H	H	
		Oxygen index	Critical	Thermal			ASTMD-2863	Min. 29%		√	P	H	H	
		Temperature index	Critical	Thermal			ASTMD-2863	Min 250°C		√	P	H	H	
		HCL Test	Critical	Chemical			IS 10810/ IEC-754-1	Max 20% by Wt.		√	P	H	H	
		Flamability Test	Critical	Thermal			IEC-332-1	Min 50 MM unaffected		√	P	H	H	

LEGEND:- D* Records identified with tick (√) shall be essentially included by supplier & manufacturer in Quality Documentation package.
** M: Manufacturer / Sub-Supplier, C: Main Supplier , A: **Adani** or their authorized representative.
Use the following term as appropriate in columns 10. **P**: Perform, **V**: verification and **H**: Customer Hold Point to be witnessed and work shall not proceeded till it is witnessed and cleared in writing.
Format of Record: MTC: Manufacturer/Sub-supplier Test Certificate, ITR: Inprocess Test Report/Record, IR: Inspection Report

NOTE 5: For FRLS Tests 01 Sample/Lot shall be consider only after tracebility of FRLS material Lot, i.e. outer sheath is made from same batch of FRLS material. Same shall be verified at the time of inspection.

GENERAL NOTE:-
- Manufacturer should have all the in house testing (Acceptance & Type Test) facilities for LT Cable.
- Testing Instruments used during Inspection must be calibrated from NABL accredited lab only. Instruments used during testing should be within valid calibration date.

TYPE TEST REPORT REQUIREMENTS-

1. Type Tests for which Type Test report is required are listed in table below.
2. Type test report are to be submitted for one size for each type (Al/Cu conductor) of cable in line with the requirements of note no. 2, clause no. 2.2 of IS 1554 part-1 (as per amendment no. 5 of 2012).
3. FRLS & Flammability Test report to be submitted only on one sample.

S. No.	TEST	APPLICABLE FOR	REFERENCE STANDARD	REMARKS
1.0	**Tests for Conductor**			
I.	Annealing test	For copper conductor only	IS 10810 Pt 1	
II.	Tensile test	For aluminium conductor only (Not applicable for compacted circular or shaped conductor)	IS 10810 Pt 2	
III.	Wrapping test	For aluminium conductor only (Not applicable for compacted circular or shaped conductor)	IS 10810 Pt 3	
IV.	Resistance test	For Al/Cu	IS 10810 Pt 5	
2.0	**Tests for Armour Wires/Strips**			
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	IS 10810 Pt 36	
II.	Tensile test	Applicable for Aluminium wire & GS wire/Strip	IS 10810 Pt 37	
III.	Elongation at break test	Applicable for GS wire/Strip only	IS 10810 Pt 37	
IV.	Torsion test	For GS round wire only	IS 10810 Pt 38	
V.	Winding / Adhesion Test	For GS strip only	IS 10810 Pt 39	
VI.	Resistivity test	Applicable for Al wire & GS wire	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	IS 10810 Pt 40	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	IS 10810 Pt 41	
3.0	**Physical Tests for PVC Insulation & PVC sheath**			
I.	Test for thickness	Applicable for PVC insulation, PVC inner sheath & PVC outer sheath	IS 10810 Pt 6	
II.	Tensile strength and elongation test at break	Applicable for PVC insulation & PVC outer sheath		

S. No.	TEST	APPLICABLE FOR	REFERENCE STANDARD	REMARKS
(a)	Before ageing		IS 10810 Pt 7	
(b)	After ageing		IS 10810 Pt 7	
III.	Ageing in air oven	Applicable for PVC insulation & PVC outer sheath	IS 10810 Pt 11	
IV.	Loss of mass in air oven test	For PVC outer sheath only	IS 10810 Pt 10	
V.	Shrinkage test	Applicable for PVC insulation & PVC outer sheath only	IS 10810 Pt 12	
VI.	Hot deformation test	For PVC outer sheath only	IS 10810 Pt 15	
VII.	Heat shock test	For PVC outer sheath only	IS 10810 Pt 14	
VIII.	Thermal stability test	For PVC insulation & PVC outer sheath only	IS 10810 Pt 60	
4.0	**Improved Fire performance (FR-LSH) Tests**			
I.	Oxygen index test	For PVC outer sheath only	IS 10810 Pt 58 / ASTMD 2863	
II.	Smoke density test	For PVC outer sheath only	IS 10810 Pt 63 / ASTMD 2843	
III.	Acid gas generation test	For PVC outer sheath only	IS 10810 Pt 59 / IEC-754-1	
IV.	Temperature Index Test	For PVC outer sheath only	IS 10810 Pt 64 / ASTMD 2863	
5.0	**Flammability Tests**			
I.	Flammability test for bunched cables	For complete cable	IS 10810 Pt 62/ IEC-60332 (Part-3-23-Cat-B)	
II.	Flammability test for single cable	For complete cable	IS: 10810 Pt 61 / IEC:60332 Part-1	
6.0	**Electrical Tests**			
I.	High Voltage Test (Water immersion test)	On cores	IS 10810 Pt 45	
II.	High Voltage Test at room temperature	For complete cable	IS 10810 Pt 45	
III.	Insulation Resistance Test (Volume resistivity method)	For complete cable	IS 10810 Pt 43	

PACKING REQUIREMENT

Sl.no	DESCRIPTION
1	**Type of Packing (Wood/ Steel): Wood**
	Wood:
1.1	Item shall be fully covered with multi layered cross laminated colourless polyethylene sheet of at least 100 GSM and shall be packed inside wooden drum as per IS 10418.
1.2	Both the end of cables shall be properly sealed with heat shrinkable seal secured by 'U' nails so as to eliminate ingress of water during transportation, storage & erection.
1.3	A tag containing same information shall be attached to the leading end of the cable.
2	**Quality of wood:**
	As per IS 10418 for wooden drums
3	**Cushioning material and moisture absorber:**
	Not applicable
4	**Packing slip & holder:**
4.1	Packing slip kept in polyethylene bag shall be placed inside the cable drum at appropriate place.
4.2	One copy of packing slip wrapped in polyethylene bag covered in galvanized iron tin sheet/ aluminium packing slip holder shall be fixed on the external surface the cable drum.

DOCUMENTATION REQUIREMENT

DRAWINGS & DOCUMENTS TO BE SUBMITTED BY ALL THE BIDDERS ALONG WITH THE BID	
Sl. No.	**DOCUMENT TITLE**
1	PQR CREDENTIALS
2	COMPLIANCE SHEET

DRAWINGS & DOCUMENTS TO BE SUBMITTED BY SUCCESSFUL BIDDER AFTER AWARD OF CONTRACT ALONG WITH SUBMISSION SCHEDULE					
Sl. No.	**DOCUMENT TITLE**	**SUBMISSION SCHEDULE**			
		Vendor submission (Days)*	**BHEL Comment (Days)**	**Vendor submission (Days)#**	**BHEL & Customer comment/ approval (Days)**
I	**Primary documents**				
1	Datasheet and Cross Section Drawings for LT PVC Control Cable	7	3	2	18
2	QAP for LT PVC Control cables	7	3	2	18
II	**Secondary documents**				
1	Type Test Report for LT PVC Control cable	7$	3	2	18
NOTES:					
a) * 1st submission within indicated days from date of purchase order.					
b) # Submission (within indicated days) after incorporating all BHEL comments.					
c) Primary documents shall be considered for Delay analysis					
d) $: 1st submission within indicated days from the date of purchase order (in case Type Test reports are available)/ from the date of conduction of test.					

DRAWINGS & DOCUMENTS TO BE SUBMITTED AS FINAL/AS-BUILT DOCUMENT	
Sl. No.	**DOCUMENT TITLE**
1	APPROVED DOCUMENTS
2	APPROVED QUALITY PLAN.
3	ALL TEST CERTIFICATES

COMPLIANCE CERTIFICATE	
1	It is hereby confirm that the technical specification (sheet 1 to 24) has been read, understood. We confirm compliance to the tender specification including any clarification and amendments without any deviation.
2	It is hereby declared that any technical submittals which was not specifically asked for in NIT shall stand withdrawn.

Signature of authorised Representative

Name and Designation :

Name & Address of the Bidder

Date

	TECHNICAL SPECIFICATION LT PVC CONTROL CABLE RATE CONTRACT FOR ADANI PROJECTS	PE-TS-999-507-E003A Rev. No. 00

UNPRICED SCHEDULE

Sr. No.	Item code	Item description	Unit	Order Quantity (metres)	Drum Length (Meters)	UNIT PRICE (EX-WORKS) (Rs)	TOTAL PRICE (EX-WORKS) (Rs)	REMARKS
1.0	507-0300043-00-A	2C - 1.5- ARMOURED	MTR	28000	1000	0.008*X/28000	0.008*X	
2.0	507-0300005-00-A	19C - 1.5- ARMOURED	MTR	20000	1000	0.031*X/20000	0.031*X	
3.0	507-0300013-00-A	2C - 2.5- ARMOURED	MTR	308000	1000	0.13*X/308000	0.13*X	
4.0	507-0300017-00-A	3C - 2.5- ARMOURED	MTR	198000	1000	0.091*X/198000	0.091*X	
5.0	507-0300021-00-A	5C - 2.5- ARMOURED	MTR	116000	1000	0.081*X/116000	0.081*X	
6.0	507-0300061-00-A	9C - 2.5- ARMOURED	MTR	110000	1000	0.129*X/110000	0.129*X	
7.0	507-0300003-00-A	12C - 2.5- ARMOURED	MTR	342000	1000	0.53*X/342000	0.53*X	

Notes

1	Bidder has to quote only Total Value 'X'. Based on this price, unit price shall be derived for all items as per formula indicated above.
2	The standard drum length shall be 1000 meters as indicated above. Tolerance on individual drum length shall be ±5%.
3	Overall tolerance on total dispatched quantity of each size shall be (-) 2% and (+) 0% except where the total ordered quantity is one single drum length of 1000m, in which case it shall be -5% to 0%. Cables consumed for testing and inspection shall be to bidder's account.
4	For each individual cable size, one short length of not less than 500m may be accepted only in the final drum length to complete the supply (except where the total ordered quantity is one single drum length of 1000m). The overall tolerance limits stipulated above shall continue to apply (in case short lengths are accepted).
5	For type test requirement please refer clause no. 4.2 of Technical Data -Part-A of technical specication.
6	For PVC formulae & Indices; please refer "https://ieema.org/wp-content/uploads/2020/07/Cable-2017_Revised-PVClause_low-res.pdf" or latest amendment (if any) with upper ceiling limit of 20% & no negative ceiling limit.

PRE QUALIFICATION REQUIREMENT (TECHNICAL)

BHEL	**PRE-QUALIFICATION REQUIRMENTS OF LT PVC CONTROL CABLE FOR RATE CONTRACT FOR ADANI PROJECTS**	PE-PQ-RC-507-E015A REVISION NO. 00 DATE 27.03.2025 SHEET NO. 1 OF 1

ITEMS : LT PVC CONTROL CABLE **SCOPE:** Supply: YES; Erection & Commissioning: NO;	
1.0	Vendor should be a manufacturer of LT control cables.
2.0	Availability of test reports of tests of LT PVC/HRPVC FRLS control cables to establish in- house capability to carry out all routine, type & acceptance tests as per relevant IS/ International Standards (except UV radiation & hydrolytic stability test which can be conducted at Govt. Lab/ Govt. approved Independent lab).
3.0	Capacity of manufacturing 200 km of LT Control cables per month.
4.0	Manufactured and supplied at least one (1) km of FRLS cables.
5.0	Manufactured and supplied LT control cables upto 12 cores.
6.0	Manufactured & supplied at least 500 km of LT control cables of min. 1.5 sq. mm. in one or more orders and at least 100 km of LT control cables of min. 1.5 sq. mm. in one single order.
7.0	Minimum two (2) nos. purchase orders for LT PVC / HRPVC control cables shall be submitted which should not be more than five (5) years old from the date of techno- commercial bid opening for establishing continuity in business.

NOTES:

1. Consideration of offer shall be subject to customer's approval of bidder, if applicable.
2. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.
3. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.
4. After satisfactory fulfillment of all the above criteria/ requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.
5. Attached annexure (**Annexure-I**) to be filled by the bidder on quality & general terms. Requisite Documents (like factory registration certificate, R&D set-up details etc.) asked in Annexure-I, shall also be attached as Annexure-F2.1 to Annexure- F2.17 along with the filled response in the Annexure-I.

PREPARED BY	CHECKED BY	REVIEWED BY	APPROVED BY
Shweta Gaba 27/03/25	27/3/25	28/3/2025	29/3/25
NAME: SHWETA GABA DESIGNATION: MANAGER	NAME:KHUSHBU AGRAWAL DESIGNATION: SR. MANAGER	NAME: PRAVEEN DUTTA DESIGNATION: AGM	NAME: DEBASISA RATH DESIGNATION: DH-ELECT(GM)

ANNEXURE-1

SUB-VENDOR QUESTIONNAIRE

i.	*Item/Scope of Sub-contracting*	
ii.	*Address of the registered office*	*Details of Contact Person (Name, Designation, Mobile, Email)*
iii.	*Name and Address of the proposed Sub-vendor's works where item is being manufactured*	*Details of Contact Person: (Name, Designation, Mobile, Email)*
iv.	*Annual Production Capacity for proposed item/scope of sub-contracting*	
v.	*Annual production for last 3 years for proposed item/scope of sub-contracting*	
vi.	***Details of proposed works***	
1.	*Year of establishment of present works*	
2.	*Year of commencement of manufacturing at above works*	
3.	*Details of change in Works address in past (if any)*	
4.	*Total Area*	
	Covered Area	
5.	*Factory Registration Certificate*	*Details attached at Annexure – F2.1*
6.	*Design/ Research & development set-up (No. of manpower, their qualification, machines & tools employed etc.)*	*Applicable / Not applicable if manufacturing is as per Main Contractor/purchaser design) Details attached at Annexure – F2.2 (if applicable)*
7.	*Overall organization Chart with Manpower Details (Design/Manufacturing/Quality etc)*	*Details attached at Annexure – F2.3*
8.	*After sales service set up in India, in case of foreign sub-vendor (Location, Contact Person, Contact details etc.)*	*Applicable / Not applicable Details attached at Annexure – F2.4*
9.	*Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any*	*Details attached at Annexure – F2.5*
10.	*Sources of Raw Material/Major Bought Out Item*	*Details attached at Annexure – F2.6*
11.	*Quality Control exercised during receipt of raw material/BOI, in-process, Final Testing, packing*	*Details attached at Annexure – F2.7*

ANNEXURE-1

SUB-VENDOR QUESTIONNAIRE

12.	*Manufacturing facilities* *(List of machines, special process facilities, material handling etc.)*	*Details attached at Annexure – F2.8*
13.	*Testing facilities* *(List of testing equipment)*	*Details attached at Annexure – F2.9*
14.	*If manufacturing process involves fabrication then-* *List of qualified Welders* *List of qualified NDT personnel with area of specialization*	*Applicable / Not applicable* *Details attached at Annexure – F2.10* *(if applicable)*
15.	*List of out-sourced manufacturing processes with Sub-Vendors' names & addresses*	*Applicable / Not applicable* *Details attached at Annexure. –F2.11* *(if applicable)*
16.	*Supply reference list including recent supplies*	*Details attached at Annexure – F2.12* *(as per format given below)*

Project/ package	*Customer Name*	*Supplied Item (Type/Rating/Model /Capacity/Size etc)*	*PO ref no/date*	*Supplied Quantity*	*Date of Supply*

17.	*Product satisfactory performance feedback letter/certificates/End User Feedback*	*Attached at annexure - F2.13*
18.	*Summary of Type Test Report (Type Test Details, Report No, Agency, Date of testing) for the proposed product (similar or higher rating)* *Note:- Reports need not to be submitted*	*Applicable / Not applicable* *Details attached at Annexure – F2.14* *(if applicable)*
19.	*Statutory / mandatory certification for the proposed product*	*Applicable / Not applicable* *Details attached at Annexure – F2.15* *(if applicable)*
20.	*Copy of ISO 9001 certificate* *(if available)*	*Attached at Annexure – F2.16*
21.	*Product technical catalogues for proposed item (if available)*	*Details attached at Annexure – F2.17*

Name:		*Desig:*		*Sign:*		*Date:*	

Company's Seal/Stamp:-