



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS HVDC ENGINEERING & SYSTEMS

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TYPE OF DOC.	TECHNICAL SPECIFICATION	SIGN						
TITLE		NAME	NS	SKS	AG			
	1.1 kV Aux Power and Control Cables	DATE	16/07/19	16/07/19	16/07/19			
		GROUP	HVDC	W.O. No	87009			
CUSTOMER	Patratu Vidyut Utpadan Nigam Ltd. (PVUNL) (A Subsidiary of NTPC in Joint Venture with JBVNL)							
PROJECT	400kV GIS at Patratu Super Thermal Power Project Expansion Phase-I (3 X 800 MW)							
NOA NO.	01/PVUNL-CS-9585-001-2/NOA-FC Dated 08-Mar-2018 01/PVUNL-CS-9585-001-2/NOA-SC Dated 08-Mar-2018 01/PVUNL-CS-9585-001-2/NOA-TC Dated 08-Mar-2018							
Station	Patratu, Jharkhand							
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SECTION-1

Scope, Bill of Quantity, Specific Technical Requirements & Qualifying Requirement

1.1 Scope

This technical specification covers the requirements of design, manufacture, testing at works, packing, supply and delivery at site of flame retardant, low smoke type, armoured, 1.1 kV Aux Power & Control Cables as listed under this specification.

This section covers the specific technical requirements of 1.1 kV Aux Power & Control Cables. This constitutes minimum technical parameters for the above item as specified by the customer.

The offered equipment shall also comply with the General Specification for the project as detailed under section-3 of this specification.

No deviation from the requirements specified in various clauses of this specification shall be allowed.

The equipment is required for the following project:

Name of the customer : **Patratu Vidyut Utpadan Nigam Ltd. (PVUNL)**
(A Subsidiary of NTPC in Joint Venture with JBVNL)

Name of the project : **400kV GIS at Patratu Super Thermal Power Project**
Expansion Phase –I (3X800 MW)

Site : **Patratu, Jharkhand**

***Note: The terms used in this specification namely, “Employer/Purchaser” refers to PVUNL , “Contractor” refers to BHEL.**

Refer section-3 of this document for project details and general specification.

In case of any conflict among the various sections of this specification, the order of precedence shall be section 1, section 2 & the section 3.



1.2 Bill of Quantities

SN	Item Description	Unit	Quantity
A	XLPE Auxiliary Power Cables		
1	1C X 630 sq mm XLPE/Aluminium, FRLS, Armoured Auxiliary Power Cable	km	5
2	3.5C X 300 sq mm XLPE/Aluminium, FRLS, Armoured Auxiliary Power Cable	km	2
3	3.5C X 150 sq mm XLPE/Aluminium, FRLS, Armoured Auxiliary Power Cable	km	1
4	1C X 150 sq mm XLPE/Aluminium, FRLS, Armoured Auxiliary Power Cable	km	1
B	PVC Auxiliary Power Cables		
5	3.5 C X 70 sq mm PVC/Aluminium, FRLS, Armoured Auxiliary Power Cable	km	3
6	3.5 C X 35 sq mm PVC/Aluminium, FRLS, Armoured Auxiliary Power Cable	km	1
7	4 C X 16 sq mm PVC/Aluminium, FRLS, Armoured Auxiliary Power Cable	km	5
8	4 C X 6 sq mm PVC/Aluminium, FRLS, Armoured Auxiliary Power Cable	km	1
9	2 C X 6 sq mm PVC/Aluminium, FRLS, Armoured Auxiliary Power Cable	km	3
C	PVC Control Cables		
10	19 C X 2.5 sq mm PVC/Copper, FRLS, Armoured Control Cables	km	21
11	14 C X 2.5 sq mm PVC/Copper, FRLS, Armoured Control Cables	km	26
12	10 C X 2.5 sq mm PVC/Copper, FRLS, Armoured Control Cables	km	41
13	5 C X 2.5 sq mm PVC/Copper, FRLS, Armoured Control Cables	km	35
14	2 C X 2.5 sq mm PVC/Copper, FRLS, Armoured Control Cables	km	5
15	4 C X 10 sq mm PVC/Copper, FRLS, Armoured Control Cables	km	5



Note:

1. The quantity for individual items may vary up to any extent, however total quantity may vary $\pm 40\%$ during contract execution stage.
2. All power and control cables shall be supplied in drum length of 1000m, unless otherwise specified.
3. However for cable size of *1C X 630 sq mm, 3.5C X 300, 3.5C X 150 standard drum length shall be 750 meters.
*For 1C X 630 sq mm final drum length shall be confirmed during contract execution.
4. Owner shall have the option of rejecting cable drums with shorter lengths. The cable length per drum is allowed a tolerance of $\pm 5\%$. However, the total quantity of cables after taking into consideration of all cable drums for each size shall be within the tolerance of $\pm 2\%$.

1.3 Specific Technical Requirements

Refer section 2.

1.4 Qualifying Requirement

1.4.1 Qualifying Requirements for Power Cable:

The bidder should have manufactured and supplied the following:

- a. Atleast 100 km of aluminium conductor, XLPE insulated, PVC sheathed power cables of 1.1kV or higher grade in one single contract.
- b. Atleast 100 km of aluminium conductor, PVC insulated, PVC sheathed power cables of 1.1kV or higher grade in one single contract.
- c. Atleast one (1) km of flame retardant low smoke cables.
- d. 1.1kV or higher grade power cable of minimum 630 sq.mm. conductor size.

1.4.2 Qualifying Requirements for Control Cable:

The bidder should have manufactured and supplied the following:

- a. Atleast 300 km of PVC insulated, PVC sheathed stranded copper conductor 1.1kV grade cables in one single contract.
- b. Atleast one (1) km of flame retardant low smoke cables.

Note: Bidder to fill up QR details in the attached format “Annexure 3K”.

1.4 Type Tests

- a. All equipments to be supplied shall be of type tested design. During detailed engineering, the bidder shall submit for Owner's approval the reports of all the type tests as listed in this



specification and carried out within last ten years from the date of bid opening i.e. 03-Mar-2017. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

- b. However if the 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 bidder shall conduct all such tests under this contract at no additional cost to the Owner/BHEL either at third party lab or in presence of client /owners representative and submit the reports for approval.
- c. 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
- d. The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet.

For details of tests, please refer section 2.

1.5 Quality Plan

Bidder to follow valid NTPC approved quality plan at contract stage. In case the bidder does not have NTPC approved QP, it will be the bidder’s responsibility to get its QP approved from NTPC.

1.6 Deviations

The bidder shall list all the deviation from the specification separately. Offers without specific deviation will be deemed to be totally in compliance with the specification and NO DEVIATION on any account will be entertained at a later date.

Sub : Sub-Qualifying Requirement for Control Cables

In support of supplier experience as indicated in Technical Specification, clause 5.9 of Sub-Section-IA, Part-A, Section-VI, we declare that the supplier/sub-vendor have manufactured and supplied the following cables

- (a) Atleast 300 Kms of PVC insulated, PVC sheathed stranded copper conductor 1.1 kV grade cables in one single contract.
- (b) Atleast one (1) km of flame retardant low smoke cables.
- (i) The details of above cables at (a) are given as under :

Sl.No.	Particulars	
1.	Client name and its address, fax no. & telephone no.	
2.	Name & Designation of the responsible person in client's organisation	
3.	Name, Address, telephone no. & fax no. of the user of the cables	
4.	Name & designation of the responsible person in user's organisation	
5.	Contract No. and date	
6.	Details of Stranded copper conductor, PVC insulated, PVC sheathed control cables of 1.1 KV grade	
(i)	Manufactured	Yes/No
(ii)	Supplied	Yes/No
(iii)	Voltage grade of cable	 KV
(iv)	Type of Cable	
(v)	Total Quantity in one single contract	

Signature of authorized signatory.....

Sl.No.	Particulars
--------	-------------

7. User's Certificate of Cable enclosed

(ii) The details of above cables at (b) are given as under :

1. Client name and its address, fax no. & telephone no.
2. Name & Designation of the responsible person in client's organisation
3. Name, Address, telephone no. & fax no. of the user of the cables
4. Name & designation of the responsible person in user's organisation
5. Contract No. and date
6. Details of Flame Retardant Low Smoke cables
 - (i) Manufactured Yes/No
 - (ii) Supplied Yes/No
 - (iii) Type of Cable
 - (iv) Total Quantity supplied Km

7. User's Certificate of Cable enclosed

Date : (Signature).....

Place : (Printed Name).....

(Designation).....

Signature of authorized signatory.....

(Common seal).....

Note :

1. Continuation sheets of like size and format may be used as per the Sub-vendor's requirement and shall be annexed to this Attachment-3K.
2. Sub-vendor is required to attach necessary documents like copies of work order, completion certificates, agreements, drawings etc. in support of the details furnished above.

Signature of authorized signatory.....

Sub : Sub-Qualifying Requirement for 1.1kV Power Cables

In support of supplier experience as indicated in Technical Specification clause 5.10 of Sub-Section-IA, Part-A, Section-VI, we declare that supplier/sub-vendor have manufactured and supplied the following cables.

- (a) Atleast 100 Kms of aluminium conductor, XLPE insulated, PVC sheathed power cables of 1.1 kV or higher grade in one single contract.
- (b) Atleast 100 km of aluminium conductor, PVC insulated, PVC sheathed power cables of 1.1 kV or higher grade in one single contract.
- (c) Atleast one (1) km of flame retardant low smoke cables.
- (d) 1.1 kV or higher grade power cable of minimum 630 sq.mm. conductor size.
- (i) The details of above cables at (a) are given as under :

Sl.No.	Particulars	
1.	Client name and its address, fax no. & telephone no.	
2.	Name & Designation of the responsible person in client's organisation	
3.	Name, Address, telephone no. & fax no. of the user of the cables	
4.	Name & designation of the responsible person in user's organisation	
5.	Contract No. and date	
6.	Details of aluminium conductor, XLPE insulated, PVC sheathed Power cables of 1.1 KV or higher grade	
(i)	Manufactured	Yes/No
(ii)	Supplied	Yes/No

Signature of authorized signatory.....

Sl.No.	Particulars
(iii)	Voltage grade of cable KV
(iv)	Type of Cable
(v)	Total Quantity supplied Km in our Single Contract.

7. User's Certificate of Cable enclosed

- (ii) The details of above cables at (b) are given as under :

Sl.No.	Particulars
1.	Client name and its address, fax no. & telephone no.
2.	Name & Designation of the responsible person in client's organisation
3.	Name, Address, telephone no. & fax no. of the user of the cables
4.	Name & designation of the responsible person in user's organisation
5.	Contract No. and date
6.	Details of aluminium conductor, PVC insulated, PVC sheathed Power cables of 1.1 KV or higher grade
(i)	Manufactured Yes/No
(ii)	Supplied Yes/No
(iii)	Voltage grade of CableKV
(iv)	Type of Cable

Signature of authorized signatory.....

Sl.No.	Particulars
--------	-------------

(v) Total Quantity supplied
in one single contract Km

7. User's Certificate of Cable enclosed

(iii) The details of above cables at (c) are given as under :

Sl.No.	Particulars
--------	-------------

1. Client name and its address,
fax no. & telephone no.

2. Name & Designation of the responsible
person in client's organisation

3. Name, Address, telephone no. &
fax no. of the user of the cables

4. Name & designation of the responsible
person in user's organisation

5. Contract No. and date

6. Details of Flame Retardant
Low Smoke cables

(i) Manufactured Yes/No

(ii) Supplied Yes/No

(iii) Type of Cable

(iv) Total Quantity supplied
..... Km

7. User's Certificate of Cable enclosed

Signature of authorized signatory.....

(iv) The details of above cables at (d) are given as under :

Sl.No.	Particulars	
1.	Client name and its address, fax no. & telephone no.	
2.	Name & Designation of the responsible person in client's organisation	
3.	Name, Address, telephone no. & fax no. of the user of the cables	
4.	Name & designation of the responsible person in user's organisation	
5.	Contract No. and date	
6.	Details of 1.1 kV or higher grade power cable of minimum 630 sq.mm conductor size	
(i)	Manufactured	Yes/No
(ii)	Supplied	Yes/No
(iii)	Voltage grade of Cable	 kV
(iv)	Conductor Size in Cable	 sq.mm.
7.	User's Certificate of Cable enclosed	

Date :

(Signature).....

Place :

Name).....

(Printed

Signature of authorized signatory.....

(Designation).....

seal)..... (Common

Note :

1. Continuation sheets of like size and format may be used as per the Sub-vendor's requirement and shall be annexed to this Attachment-3K.
2. Sub-vendor is required to attach necessary documents like copies of work order, completion certificates, agreements, drawings etc. in support of the details furnished above.

Signature of authorized signatory.....



SECTION-2

- **NTPC specification for LT CONTROL CABLES, SUB-SECTION – B21 (Page 7) enclosed herein.**
- **NTPC specification for LT POWER CABLES, SUB-SECTION – B20 (Page 7) enclosed herein.**
- **NTPC specification for QA for LT power and control cables (8 Sheets)**

SUB-SECTION – B-21

LT CONTROL CABLES

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.00.00	CODES & STANDARDS			
1.01.00	All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:			
	IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.		
	IS : 3961	Recommended current ratings for cables		
	IS : 3975	Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.		
	IS : 5831	PVC insulation and sheath of electrical cables.		
	IS : 8130	Conductors for insulated electrical cables and flexible cords.		
	IS : 10418	Specification for drums for electric cables.		
	IS : 10810	Methods of tests for cables.		
	ASTM-D –2843	Standard test method for density of smoke from the burning or decomposition of plastics.		
	IEC-754 (Part-I)	Tests on gases evolved during combustion of electric cables.		
	IEC-332	Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).		
2.00.00	TECHNICAL REQUIREMENTS			
2.01.00	The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.			
2.02.00	All cables including EPR cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions as specified elsewhere in this specification.			
2.03.00	Conductor of control cables shall be made of stranded, plain annealed copper.			
2.04.00	PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.			
2.05.00	The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831.			
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 1 OF 6				

CLAUSE NO.	TECHNICAL REQUIREMENTS																		
2.06.00	For multicore armoured cables, the armouring shall be of galvanised steel as follows: <table><thead><tr><th>Calculated nominal dia of cable under armour</th><th>Size and Type of armour</th></tr></thead><tbody><tr><td>Upto 13 mm</td><td>1.4mm dia GS wire</td></tr><tr><td>Above 13 upto 25 mm</td><td>0.8 mm thick GS formed wire / 1.6 mm dia GS wire</td></tr><tr><td>Above 25 upto 40 mm</td><td>0.8mm thick GS formed wire / 2.0mm dia GS wire</td></tr><tr><td>Above 40 upto 55mm</td><td>1.4 mm thick GS formed wire/2.5mm dia GS wire</td></tr><tr><td>Above 55 upto 70 mm</td><td>1.4mm thick GS formed wire / 3.15mm dia GS wire</td></tr><tr><td>Above 70mm</td><td>1.4 mm thick GS formed wire / 4.0 mm dia GS wire</td></tr></tbody></table> The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface.				Calculated nominal dia of cable under armour	Size and Type of armour	Upto 13 mm	1.4mm dia GS wire	Above 13 upto 25 mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire	Above 25 upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire	Above 40 upto 55mm	1.4 mm thick GS formed wire/2.5mm dia GS wire	Above 55 upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire	Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire	
Calculated nominal dia of cable under armour	Size and Type of armour																		
Upto 13 mm	1.4mm dia GS wire																		
Above 13 upto 25 mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire																		
Above 25 upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire																		
Above 40 upto 55mm	1.4 mm thick GS formed wire/2.5mm dia GS wire																		
Above 55 upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire																		
Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire																		
2.07.00	Outer sheath shall be of PVC as per IS: 5831 and grey in colour. In addition to meeting all the requirements of Indian Standards referred to, outer sheath of all the cables shall have the following FRLS properties. (a.) Oxygen index of min. 29. (As per IS 10810 Part-58) (b.) Acid gas emission of max. 20% (As per IEC-754-I) (c.) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTMD-2843.																		
2.08.00	Cores of the cables of upto 5 cores shall be identified by colouring of insulation. Following colour scheme shall be adopted. <table><tbody><tr><td>1 core</td><td>-</td><td>Red, Black, Yellow or Blue</td></tr><tr><td>2 core</td><td>-</td><td>Red & Black</td></tr><tr><td>3 core</td><td>-</td><td>Red, Yellow & Blue</td></tr><tr><td>4 core</td><td>-</td><td>Red, Yellow, Blue and Black</td></tr><tr><td>5 core</td><td>-</td><td>Red, Yellow, Blue, Black and Grey</td></tr></tbody></table>				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
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																	
2.09.00	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 shall be legible and indelible. The numbers shall																		
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 2 OF 6															

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC										
	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.													
2.10.00	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath: (a.) Cable size and voltage grade - To be embossed (b.) Word 'FRLS' at every 5 metre - To be embossed (c.) Sequential marking of length of the cable in metres at every one metre - To be embossed / printed. The embossing / printing shall be progressive, automatic, in line and marking shall be legible and indelible. For EPR cables identification shall be printed on outer sheath.													
2.11.00	All cables shall meet the fire resistance requirement as per Category-B of IEC-332 Part-3.													
2.12.00	Allowable tolerances on the overall diameter of the cables shall be ± 2 mm maximum over the declared value in the technical data sheets.													
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.													
2.14.00	Cable selection & sizing Control cables shall be sized based on the following considerations: (a) The minimum conductor cross-section shall be 1.5 sq.mm. (b) The minimum number of spare cores in control cables shall be as follows: <table><tr><td>No. of cores in cable</td><td>Min. No. of spare cores</td></tr><tr><td>2C, 3C</td><td>NIL</td></tr><tr><td>5C</td><td>1</td></tr><tr><td>7C-12C</td><td>2</td></tr><tr><td>14C & above</td><td>3</td></tr></table>				No. of cores in cable	Min. No. of spare cores	2C, 3C	NIL	5C	1	7C-12C	2	14C & above	3
No. of cores in cable	Min. No. of spare cores													
2C, 3C	NIL													
5C	1													
7C-12C	2													
14C & above	3													
2.14.01	Cable lengths shall be considered in such a way that straight through cable joints are avoided.													
2.14.02	Cables shall be armoured type if laid in switchyard area, CHP area or directly buried.													
3.00.00	CONSTRUCTIONAL FEATURES													
3.01.00	1.1 KV Grade Control Cables shall have stranded copper conductor and shall be multicore PVC insulated, PVC inner sheathed, armoured / unarmoured, FRLS PVC outer sheathed conforming to IS: 1554. (Part-I).													
3.02.00	1.1 KV grade Trailing cables shall have tinned copper(class 5)conductor, insulated with heat resistant elastomeric compound based on Ethylene Propylene Rubber(EPR) suitable for withstanding 90 deg.C continuous conductor temperature and 250deg C during short circuit,													
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 3 OF 6										

CLAUSE NO.	TECHNICAL REQUIREMENTS 		
4.00.00	inner-sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer-sheathed with heat resistant, oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968. Minimum conductor size shall be 2.5 sqmm. CABLE DRUMS (a.) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418. (b.) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stenciled on both the sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled. (c.) The standard drum length for control cables shall not be less than 1000 metres. The length per drum shall be subjected to a maximum tolerance of +/- 5% of the standard drum length. The Employer shall have the option of rejecting cable drums with shorter lengths.		
5.00.00	TESTS All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval. 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 The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.		
5.01.00	TYPE TESTS		
5.01.01	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		
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 4 OF 6

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	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	
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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)		
5.02.00	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	PAGE 6 OF 6