



BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

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TYPE OF DOC.	TECHNICAL SPECIFICATION	NAME	SKS	SKS	AG
220 kV XLPE Cables & Accessories		SIGN	<i>Santaw</i>	<i>Santaw</i>	<i>3127011</i>
		DATE	<i>22/6/18</i>	<i>22/6/18</i>	<i>22/6/18</i>
		GROUP	HVDC		
		W.O. No	87009		

CUSTOMER Patratu Vidyut Utpadan Nigam Limited

PROJECT Patratu Super Thermal Power Station Expansion Phase -I (3X800 MW)

Contents:

Section No.	Description	No of Pages
SECTION-1	SCOPE, SPECIFIC TECHNICAL REQUIREMENTS and QUANTITIES	6
SECTION-2	EQUIPMENT SPECIFICATION	11
SECTION-3	PROJECT DETAILS AND GENERAL SPECIFICATION	31
SECTION-4	GUARANTEED TECHNICAL PARTICULAR	9
SECTION-5	ENCLOSURES TO SPECIFICATION	2
SECTION-6	CHECKLIST	5

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SECTION 1**SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES****1.0 SCOPE**

The scope covers the supply and services required for the comprehensive functional system covering 220 kV XLPE Cables, cable sealing end, cable joints, accessories etc.

This technical specification covers the requirements of design, manufacturing, quality assurance, quality control, shop assembly, testing at works, packing and dispatch, transporting, installation (including laying of cable at site in BHEL provided trench), commissioning, performance and acceptance testing of complete 220kV XLPE Cable system (Cables, cable sealing end, cable joints, earthing, link boxes etc.) complete in all respect along with accessories.

This section covers the specific technical requirements.

1.1 The equipment is required for the following project.

- | | |
|--------------------|--|
| a) Project | : Patratu Super Thermal Power Station Expansion Phase –I
(3X800 MW) |
| b) Customer | : Patratu Vidyut Utpadan Nigam Limited
(A subsidiary of NTPC Ltd in Joint venture with Jharkhand
Bijli Vitran Nigam Ltd) |
| c) Main Contractor | : BHEL |

Refer Section - 3 for Project Details and General Specifications.

1.2 GENERAL PROJECT DETAILS:

- 1.2.1** 220 KV Cables are used for connection between existing 220 KV Switchyard (PKP Mines bay) to 220 KV Transmission line near plant boundary. The distance between Existing 220 KV Switchyard and 220 KV Transmission line is nearly 1000 M.
- 1.2.2** 220 KV Cables are used for connection between existing 220 /132 KV Transformer to nearby gantry in existing switchyard. The distance between 220 /132 KV Transformer to nearby gantry is nearly 90 M.

1.3 QUALIFYING REQUIREMENT:**1.3.1 220 KV Cable**

The bidder should have designed, manufactured and supplied at least 5 Kms of 220 KV or higher grade XLPE insulated cables in one or more order(s) put together.

1.3.2 220 KV Cable Accessories

The bidder should have designed ,manufactured and supplied at least 5 nos. of straight through joints and at least 20 nos. of cables terminations of 220 KV grade or higher which should have been in successful operation for at least two (2) years.

Technical Specification for 220 kV XLPE Power Cables
1.4 QUANTITIES:

Material and Services required for the execution of the job are listed below. All item listed in the following BOQs shall be offered. Any item not appearing herein but required for completeness of the job is deemed to be included in the scope.

1.4.1: SUPPLY ITEMS

Sl. no.	Description	Unit	Total Qty.
	Main Item		
1.	220 kV Cable - 1C X 400 mm ² Copper conductor, extruded Cross-linked polyethylene insulated (XLPE), Extruded semi conducting compound screen, Metallic sheath (Aluminum or lead or lead alloy), Outer sheath of extruded Polyethylene (PE)/ PVC.	M	4x1000 (4 run of 1000 meter)+3x90 (three run of 90 meter) =4270
2.	220 kV cable sealing end (outdoor type) suitable for terminating the cables in the Air insulated switchyard including all accessories like necessary hardware, clamps for fixing the cable on structure etc. (excluding terminal connector)	Nos.	14
3.	220 kV Cable Jointing Kit It shall be complete in all respects.	Lot	01
4.	Single pole link box without SVL including all cable/cable accessories required for the connection	Lot	01
5.	Earthing of above system including earthing & bonding cable	Lot	01
6.	Nonmagnetic, Single type cleats /clamps for fixing of cable (as per requirement)	Lot.	01
7.	Consumables having limited shelf life required during erection, testing and commissioning. (1 lot is for complete package)	Lot	01
8.	Any other item not listed above but are required for completeness of Installation & commissioning of system	Lot	01
	Optional Item		
1	Single pole link box with SVL including all cable/cable accessories required for the connection	Nos.	01

1.4.2: SERVICES:

The specification envisages turnkey execution of a COMPLETE, POINT TO POINT, 220kV CABLE SYSTEM and the scope includes services (including laying, supervision, termination, clamping, testing and commissioning of the cable system) necessary to execute the job to satisfaction of PVUNL and BHEL.

Any other item /service required for the execution for the complete job shall be included in the offer, whether specifically mentioned in the specification or not.

Bids in which only Supplies or only Installation Services are offered shall be rejected.

Technical Specification for 220 kV XLPE Power Cables

Sl. no.	Item Description	Unit	Total Qty.
1.	Installation of 220 kV Cable - 1C X 400 mm ² including laying of cable and fixing of all accessories like cable termination kit, cable jointing kit, Clamps, Cleat clamps etc. as required to complete site work	M	4270
2.	Site Tests- of 220 kV Cable System for items from Sl. No.1 to 8 above (supply items)	Lot	1
3.	Joint Route survey	Lot	1

Notes:

- (1) The un-price BOQ shall be strictly as per cl. No. 1.4.1 of quantities.
- (2) Cable consumed in testing shall be in bidder scope.
- (3) The exact requirement shall also be decided by bidder after visiting site & making precise measurements of cable length. Manufacturing lengths and drum length shall be determined as per the joint route survey with PVUNL/BHEL.
 - a. The Payment of cables length (for supply) will be as per approved quantities after joint survey.
 - b. The Payment of cables length (for installation) will be as per actual measurement at site which shall also include cable sealing end/joints.
- (4) The exact length may vary by $\pm 40\%$ at Contract Stage based on actual measurement at site and calculations submitted by the bidder.
- (5) Earthing of HT cables shall be in bidder scope. Earth mat grid exists and interconnected at both end. The accessories shall necessary include the following but not limited to: Earthing cable, earth continuity cables etc as per the requirements. The complete earthing BOQ items and shall be clearly mentioned in the offer.
- (6) Earthing and Link Box: Design of support structure for link box, earthing cable, installation of link box, installation of earthing cable, connection of bonding cable, etc. to complete the site work shall be in bidder scope.
- (7) Earthing shall be single point bonding.
- (8) The cable racks/ support angles for 220 kV cable trenches will be supplied by BHEL as per bidder recommendation. The trench section design will be given by bidder during detailed engineering. Cable shall be routed through BHEL constructed RCC trench. Refer enclosed drawing (DWG. No. 0000-211-POE-A-052 REV.RA) for tentative 220kV trench section.
- (9) The necessary hole if required for fixing clamps for 220 kV Cable on cable rack assembly shall be done by BIDDER.
- (10) The necessary power supply at site for testing shall be provided by BHEL at one point only.
- (11) Any other tools and tackles and accessories required to complete the cable laying, termination and ETC shall be included in the offer. Please note BHEL shall not provide any equipment, tool and tackles for carrying out any test /or laying of cables.
- (12) Earthing of 220 kV cables shall be in bidder scope. Earth mat grid will available at both end of

Technical Specification for 220 kV XLPE Power Cables

- (12) Earthing of 220 kV cables shall be in bidder scope. Earth mat grid will available at both end of cables.
- (13) Storage, warehouse for material and equipment, office facilities & accommodation for bidder staff, Travel expenses for bidder staff, Transportation of all tools and equipment, Transportation of material, tools and equipment between store /warehouse and switchyard, complete erection shall be in bidder scope.
- (14) Site test- Provision of test engineer, supply of test equipment, cranes for lifting of test equipments etc. for site tests shall be in bidder scope.
- (15) Cable laying- Provision of man power in the grade of Forman and skilled technician, Provision of laying supervisor, Provision of laying tools and equipment, Cable pulling, Cut cable , place cable , Supply of cable cleat, Installation of cable cleat etc. to complete the site work shall be in bidder scope.
- (16) Jointing and terminating- Provision of cable jointer and termination material, tools and Terminating Scaffolding, cranes for lifting the sealing end materials, assemble of sealing ends. Design of support structure for sealing end, etc. to complete the site work shall be in bidder scope.
- (17) Any cable or accessories damage during laying will be replaced by bidder. Cable joints shall not be permitted.
- (18) Bidder will submit detailed bar chart indicating all the milestones from Engineering till manufacturing/testing, dispatch to site and commissioning.
- (19) Bidder to submit list of consumables with shelf life of less than two years. It shall be supplied before erection after clearance from BHEL.
- (20) Store will be provided by BHEL. Bidder to provide their requirement of space in open and closed store during tender stage.
- (21) Office facilities & accommodation for bidder staff, Travel expenses for bidder staff, Transportation of all tools and equipment, Transportation of material tools and equipment between storage/warehouse and complete ETC shall be in bidder scope.
- (22) Support structure and foundation for cable sealing end shall be provided by BHEL based on the input (configuration, loads etc.) provided by bidder.
- (23) Terminal connector for overhead connection with cable sealing end shall be provided by BHEL.
- (24) Any other tools and tackles and accessories required to complete the cable laying, termination and ETC shall be included in the offer. Please note BHEL shall not provide any equipments, tool and tackles for carrying out any test /or laying of cables.

1.5 TYPE TESTS, ROUTINE AND SITE TESTS

As per clause 8.00 of section-2 (NTPC Specification Clause B.28)

1.6 QUALITY PLAN

The bidder shall carry out the works in accordance with sound quality management principles which shall include such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirement shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Bidder shall submit detailed Manufacturing Quality Assurance Plan (MQP) and Field Quality Plan for BHEL / customer's approval.

PROJECT: Patratu Super Thermal Power Station Expansion Phase –I	
CUSTOMER: PVUNL	
Technical Specification of 220 kV Power Cable	TB-397-316-011
Section-2: Equipment specification	REV.00

SECTION 2

EQUIPMENT SPECIFICATION

- NTPC specification for 220KV CABLE – PART-B, SUB-SECTION – B28 (Page 9)
enclosed herein

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC																												
	220KV CABLE																															
1.00.00	CODES AND STANDARDS																															
1.01.00	The design, manufacture, testing and performance of the cables supplied under this specification shall comply with the latest edition of the following Standards, Rules and Acts. IEC Standards <table><tr><td>IEC 62067</td><td>Power cables with extruded insulation and their accessories for rated voltages above 150kv (Um=170kv) upto 500 kv (Um=550kv) Test methods and requirements</td></tr><tr><td>IEC 60540</td><td>Test methods for insulation and sheath of electric cables and cords (Elastomeric and thermoplastic compounds)</td></tr><tr><td>IEC 885</td><td>Electrical test methods for Electric cables.</td></tr><tr><td>IEC 60228</td><td>Conductors of Insulated cables</td></tr><tr><td>IEC 60229</td><td>Tests on cable oversheath which have a special protective function and are applied by extrusion.</td></tr><tr><td>IEC 61462</td><td>Composite Insulators- Hollow insulators for use in outdoor and indoor electrical equipment - Definitions, test methods, acceptance criteria and design recommendations</td></tr><tr><td>IEC 60183</td><td>Guide to the selection of high voltage cables</td></tr><tr><td>IEC 60230</td><td>Impulse tests on cables and their accessories.</td></tr><tr><td>IEC 60270</td><td>High Voltage Test Techniques - Partial discharge measurements</td></tr><tr><td>IEC 60287</td><td>Electric cables - Calculations of the current ratings</td></tr><tr><td>IEC 60811</td><td>Common test methods for insulating and sheathing</td></tr><tr><td>Part-1 to 4</td><td>materials of electric cables</td></tr><tr><td>IEC 60885 Part-3</td><td>Electrical test methods for electric cables -Test methods for partial discharge measurements on lengths of extruded power cables.</td></tr><tr><td>ANSI/ IEEE Std</td><td>Guide Electrical safety and Sub- station grounding 80-1986</td></tr></table>				IEC 62067	Power cables with extruded insulation and their accessories for rated voltages above 150kv (Um=170kv) upto 500 kv (Um=550kv) Test methods and requirements	IEC 60540	Test methods for insulation and sheath of electric cables and cords (Elastomeric and thermoplastic compounds)	IEC 885	Electrical test methods for Electric cables.	IEC 60228	Conductors of Insulated cables	IEC 60229	Tests on cable oversheath which have a special protective function and are applied by extrusion.	IEC 61462	Composite Insulators- Hollow insulators for use in outdoor and indoor electrical equipment - Definitions, test methods, acceptance criteria and design recommendations	IEC 60183	Guide to the selection of high voltage cables	IEC 60230	Impulse tests on cables and their accessories.	IEC 60270	High Voltage Test Techniques - Partial discharge measurements	IEC 60287	Electric cables - Calculations of the current ratings	IEC 60811	Common test methods for insulating and sheathing	Part-1 to 4	materials of electric cables	IEC 60885 Part-3	Electrical test methods for electric cables -Test methods for partial discharge measurements on lengths of extruded power cables.	ANSI/ IEEE Std	Guide Electrical safety and Sub- station grounding 80-1986
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EPC Package for PTPS expansion phase-I		Bid Doc. No.: CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION -VI	PART-B Sub-Section -28 220 KV POWER CABLES																												
Page 1 of 9																																

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	Indian Standards & Rules IS 5216 Guide for safety procedures and practice in electrical works. Indian Electricity Act 1910. Indian Electricity Rules 1956.			
2.00.00	GENERAL FEATURES			
2.01.00	Unless otherwise specified 220 KV cable shall conform to the standards specified above.			
2.02.00	The design ambient air temperature for cable shall be 50 deg C, when laid in air. The design ambient ground temperature for cables shall be 40 deg C. Cables shall be installed in air, in built up concrete trenches and/or directly buried in soil.			
3.00.00	220 KV CABLE			
3.01.00	GENERAL			
3.01.01	The cable shall confirm to IEC-62067. The cable shall consists of single core 400sq.mm stranded copper compacted circular conductor, extruded semi conducting compound conductor screen, cross linked polyethylene (XLPE) dry cured insulation, extruded semi conducting compound insulation screen, bedding of swellable type water blocking semi conducting tape, copper wire screen with copper binder tape(as per requirement), aluminium or lead or lead alloy sheath and extruded Polyethylene (PE)/ PVC outersheath with overall graphite coating.			
3.01.02	The conductor screen, insulation and semiconducting insulation screen shall be extruded in one operation, so as to obtain continuously smooth interfaces. The conductor screen and insulation screen shall be of semiconducting compound. The copper wire/tape screen together with aluminium or lead or lead alloy sheath shall be capable of withstanding the short circuit current of 40KA for one second. The Bidder shall furnish the supporting calculation for screen sizing.			
3.01.03	The cable shall be suitable for use in solidly earthed system.			
3.01.04	The cable shall be suitable for installation in air, in built up concrete trench and/or directly buried in soil with chances of flooding by water. The cable shall withstand all mechanical and thermal stresses under steady state and transient operating conditions.			
3.01.05	Repair to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are also not acceptable.			
EPC Package for PTPS expansion phase-I	Bid Doc. No.: CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION -VI	PART-B Sub-Section -28 220 KV POWER CABLES	Page 2 of 9

CLAUSE NO.	TECHNICAL REQUIREMENTS	एन टी पी सी NTPC		
3.01.06	Cable ends shall be kept sealed by heat shrinkable PVC caps to prevent damage and ingress of moisture.			
3.01.07	Each cable length shall be provided with a pulling socket eye which shall be fitted to the pulling end. Pulling socket eye shall be able to take the pulling force.			
3.01.08	The Eccentricity of the core shall not exceed 10% and Ovality of the core shall not exceed 5%.			
	The Eccentricity shall be calculated as $(t_{max} - t_{min})/t_{max} \leq 0.10$			
	The Ovality shall be calculated as $(d_{max} - d_{min})/d_{max} \leq 0.05$			
	where t_{max}/t_{min} are the maximum/minimum thickness of insulation and d_{max}/d_{min} are the maximum/minimum diameter of the core.			
3.02.00	CONDUCTOR			
	Conductor shall consist of plain annealed copper wires in accordance with IEC-60228 or equivalent and the shape shall be circular and very well compacted to facilitate a smooth interface between conductor screen(shield) and the insulation. The conductor shall have smooth surface with no intermediate joint.			
3.03.00	CONDUCTOR SCREEN (SHIELD)			
	Conductor screen shall consist of extruded semi-conducting compound applied over the conductor, which shall be firmly bonded to the inner surface of the insulation layer. The semi-conducting compound shall be free from any void and protrusion.			
3.04.00	INSULATION			
	Insulation shall be of extruded Cross Linked Polyethylene (XLPE). The insulation shall be free from any void and contaminant. The average thickness of insulation shall not be less than the nominal value guaranteed in the technical particulars.			
3.05.00	INSULATION SCREEN(SHIELD)			
	Insulation screen shall consist of extruded semi-conducting compound and shall firmly be bonded to the insulation. The semi-conducting compound shall be free from any void and protrusion.			
3.06.00	BEDDING			
	Bedding shall consist of layer(s) of swellable semi conducting tape(s) to be applied over the extruded semi-conducting insulation screen with suitable overlap. Semiconducting swelling tape(s) shall also be provided over copper wire screen(if applicable).			
EPC Package for PTPS expansion phase-I	Bid Doc. No.: CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION -VI	PART-B Sub-Section -28 220 KV POWER CABLES	Page 3 of 9

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC	
3.07.00	METALLIC SHEATH The metallic innersheath shall consist of aluminium or lead or lead alloy. The calculations for sizing and short circuit withstand capability of the metallic sheath, alongwith copper wire screen & copper binder tape(if applicable) shall be submitted during detailed design stage. The average thickness of sheath shall not be less than the nominal value specified in guaranteed technical particulars.				
3.08.00	OUTER SHEATH Outer sheath shall consist of extruded black and PE / PVC compound, in accordance with IEC-62067. The average thickness shall not be less than the nominal value specified in the guaranteed technical particulars.				
3.09.00	CABLE IDENTIFICATION/ MARKING Atleast the following clear markings shall be provided over outer sheath of the cable at an interval of five metres throughout the length of the cable by embossing: Rated voltage Conductor size Type of insulation Manufacturer's name Year of manufacture Purchaser's name Sequential marking of length of cable in metres by embossing/printing at every meter. The embossing/printing shall be progressive, automatic, in line and marking shall be legible and indelible.				
4.00.00	CABLE DRUMS				
4.01.00	Cables shall be supplied in steel drums of heavy construction.				
4.02.00	The employer may insist on supply of drums with definite cable lengths (with +/-2 meter tolerance). Drums with shorter lengths shall not be accepted. Contractor shall not be reimbursed for any excess lengths supplied. The exact drum lengths to be supplied shall be advised to the contractor before commencement of manufacturing of the cable.				
5.00.00	CABLE ACCESSORIES The termination and jointing kits shall be suitable for the cable and shall be complete with all accessories including crimping type cable lugs, jointing materials and consumables. Accessories offered shall be of proven design.				
EPC Package for PTPS expansion phase-I		Bid Doc. No.: CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION -VI	PART-B Sub-Section -28 220 KV POWER CABLES	Page 4 of 9

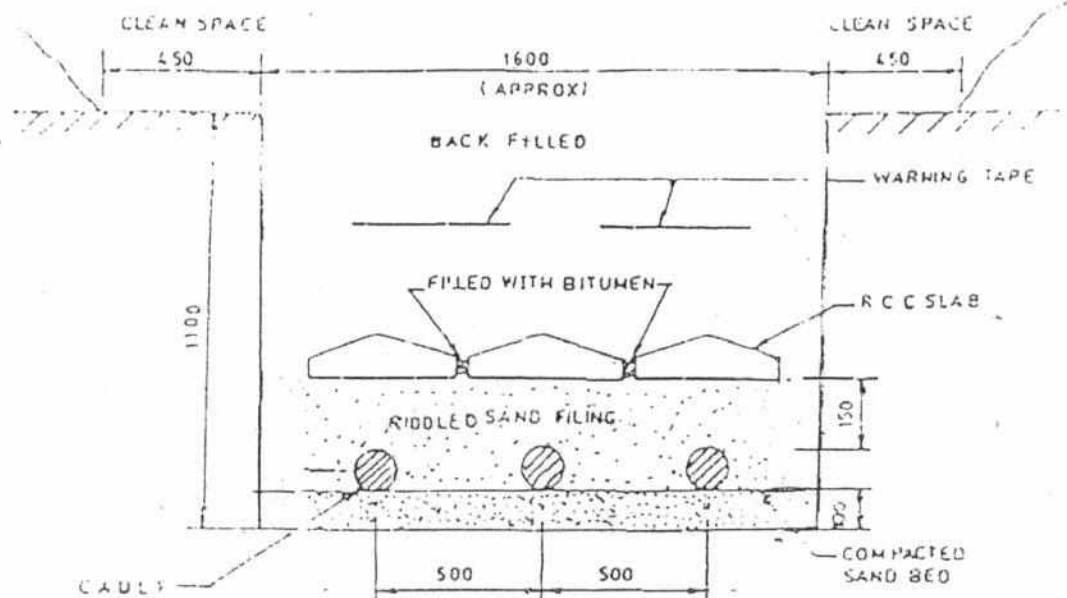
CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC																																					
5.01.00	Out Door Sealing Ends The termination shall be suitable for outdoor installation in heavily polluted atmosphere and shall be made completely weather proof through cable sealing ends. Accessories shall consist of stress relief system comprising of premoulded material. The termination for open connection shall be housed in porcelain insulator/composite insulator to give high creepage resistance. The minimum nominal specific creepage distance shall be 25mm/kv. Each outdoor type sealing ends shall be supplied complete with mounting plate insulators to insulate the sealing end from supporting structures. Each sealing end shall be provided with two terminals, diametrically opposite each, suitable for bolting of the copper screen and/or metallic sheath of cable.																																							
5.02.00	Link Boxes																																							
5.02.01	Link boxes shall be suitable for outdoor installation in heavily polluted atmosphere and shall be made completely weather proof. There shall be one link box for each phase. The cable screen/sheath connections shall be bolted type. The connecting bar and disconnecting link shall be of copper. The arrangement shall be installed in a water tight box of min. 2mm thick CRCA steel having degree of protection as IP 55.																																							
5.02.02	The cost of link boxes shall be deemed to be included in the supply price of 220KV cable.																																							
5.03.00	All accessories shall be suitable for the technical parameters as specified and shall be suitably derated to the site conditions.																																							
6.00.00	CABLE /ACCESSORIES PARAMETERS <table><tr><td>1</td><td>Type of Cables</td><td>Cross-linked polyethylene insulated</td></tr><tr><td>2</td><td>No. of Cores</td><td>Single.</td></tr><tr><td>3</td><td>Conductor size</td><td>400 sq. mm</td></tr><tr><td>4</td><td>Conductor material</td><td>Copper</td></tr><tr><td>5</td><td>Normal system voltage</td><td>220KV</td></tr><tr><td>6</td><td>Maximum system voltage</td><td>245kV</td></tr><tr><td>7</td><td>Fault current</td><td>Symmetrical short circuit 40kA r.m.s for 1 second</td></tr><tr><td>8</td><td>System frequency</td><td>50hz</td></tr><tr><td>9</td><td>Frequency variation</td><td>+/- 5%</td></tr><tr><td>10</td><td>Rated continuous Current</td><td>131 Amp.</td></tr><tr><td>11</td><td>Overload capacity</td><td>Nil</td></tr><tr><td>12</td><td>Maximum allowable temperature for cable and</td><td></td></tr></table>				1	Type of Cables	Cross-linked polyethylene insulated	2	No. of Cores	Single.	3	Conductor size	400 sq. mm	4	Conductor material	Copper	5	Normal system voltage	220KV	6	Maximum system voltage	245kV	7	Fault current	Symmetrical short circuit 40kA r.m.s for 1 second	8	System frequency	50hz	9	Frequency variation	+/- 5%	10	Rated continuous Current	131 Amp.	11	Overload capacity	Nil	12	Maximum allowable temperature for cable and	
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EPC Package for PTPS expansion phase-I		Bid Doc. No.: CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION -VI	PART-B Sub-Section -28 220 KV POWER CABLES																																				
Page 5 of 9																																								

CLAUSE NO.	TECHNICAL REQUIREMENTS	एन टी पी सी NTPC
	accessories. a) At rated full load and at site conditions. 90 deg C b) The conductor temperature after a short circuit for 1 second shall not exceed (with conductor temp. at inception of short circuit as 90 deg. C) 250 deg C 13 Basic impulse insulation level (1.2/50 micro second wave) 1050 kV (peak) 14 Power frequency withstand voltage 318 KV for 30 minute 15 Laying conditions (a) Directly Buried in soil in flat formation with spacing between cables center. 500 mm centre to centre (typical) (refer enclosed drawing) (b) Earthing of screen Bonded to earth at both ends. (c) Ambient air temp. 50 deg. C (d) Type of atmosphere Heavily polluted (e) Ground temperature 40 deg C (f) Thermal resistivity of soil 150 degC.cm/watt (g) Depth of buried cable 1 metre	
7.00.00	INSTALLATION WORK AT SITE	
7.01.00	Cable installation shall be carried out generally as per applicable standard/ manufacturer guidelines. Cable shall be laid directly buried. Typical sectional drawing for 220 KV underground buried cable trench enclosed with this chapter shall be followed for preparing the detailed drawing by contractor.	
7.02.00	Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall the drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out from over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be kept sealed by heat shrinkable PVC caps to prevent damage and ingress of moisture.	
EPC Package for PTPS expansion phase-I	Bid Doc. No.: CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION -VI
PART-B Sub-Section -28 220 KV POWER CABLES	Page 6 of 9	

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC			
7.03.00	While laying cable, ground rollers shall be used at every 2 meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangement. Pulling tension shall not exceed the values recommended by cable Manufacturer. Cable ends shall be kept sealed by heat shrinkable PVC caps to prevent damage and ingress of moisture. Selection of cable drums for each run shall be so planned so as to avoid straight through joints. Cable splices will not be allowed except where called for by the drawings or is unavoidable and permitted by the Project Manager. Care should be taken while laying the cables so as to avoid damage to cables.				
7.04.00	Bending radii for cables shall be as per manufacturer's recommendations. Manufacturer's instructions shall be strictly adhere to and necessary conducting medium for checking healthiness of outersheath shall be applied.				
7.05.00	Where cables cross roads/rail tracks underground, the cables shall be laid in HDPE pipes embedded in PCC in ground with a minimum cover of 1 metre. HDPE pipe shall also be provided where cables cross existing HT/LT cable trenches. The HDPE pipes and accessories shall be supplied, laid and encased in PCC by the employer. Ends of HDPE pipes shall be sealed properly after laying of cable.				
7.06.00	In each cable run, extra length shall be kept at suitable point to enable two straight joints to be made, should the cable develop fault at a later stage.				
7.07.00	Construction of buried cable trench shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of concrete protective covers, back filling and compacting, supply and installation of route markers. Bidder shall furnish the details for burying the cable in ground.				
7.08.00	RCC cable route markers and RCC joint markers shall be provided as required for buried cable trench. The voltage grade of cables shall be engraved on the marker. Location of underground cable joint shall be indicated with cable marker with an additional inscription "Cable Joint". The marker shall project 150 mm above ground and shall be provided at every change in direction. Top of cable marker/ joint marker shall be sloped to avoid accumulation of water/dust on marker.				
7.09.00	Bidder shall ensure that the drawings, instructions and recommendations are correctly followed to avoid damage to the equipment.				
7.10.00	Bidder shall carry out the bonding of screen at the both ends of terminal using the insulated conductor of required size with earth mat.				
7.11.00	The bidder shall ensure that the cables and accessories supplied by him are installed in a neat workman-like manner such that it is levelled, properly aligned and well oriented. The tolerance shall be as established in the bidder's drawing and/or as stipulated by the Employer.				
7.12.00	The cable termination work shall be carried out by an experienced cable jointer who shall have adequate experience in jointing and termination of 220kV or higher grade				
EPC Package for PTPS expansion phase-I		Bid Doc. No.: CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION -VI	PART-B Sub-Section -28 220 KV POWER CABLES	Page 7 of 9

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	XLPE cables. The successful bidder shall submit, sufficiently in advance, the bio-data of the cable jointer giving the details of his qualification and experience for employer's approval.			
8.00.00	TESTS :			
8.01.00	TESTS FOR EHV CABLE :			
8.01.01	a. All equipment 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. b. 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. 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. *(Specification clauses shall indicate list of Type tests on various equipment/components for which reports are required to be submitted.)			
8.01.02	The bidder shall clearly specify compliance to conducting all tests at works and at site and shall make necessary arrangement for testing equipment, as required, for works & site testing.			
8.01.03	Type tests, Routine tests and Acceptance tests shall be conducted on cables as per IEC 62067, Technical specifications and other relevant standards.			
8.01.04	a) Additional acceptance tests (1 sample/offered lot) shall be carried out for Ovality & Eccentricity, Tensile Strength and Elongation on insulation and outer sheath before and after ageing & Thermal Stability on outer sheath. b) The following tests shall be carried out on one length of each size of offered lot. i) Surface finish and length measurement.			
EPC Package for PTPS expansion phase-I		Bid Doc. No.: CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION -VI	PART-B Sub-Section -28 220 KV POWER CABLES
Page 8 of 9				

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
8.02.00	TESTS FOR EHV CABLE ACCESSORIES:			
8.02.01	Type Test reports shall be furnished in accordance with standard IEC 62067/ IEC 61462 as applicable.			
8.02.02	The bidder shall clearly specify compliance to all tests at works and at site and shall make necessary arrangement of testing equipment requirement for works & site testing.			
8.03.03	Routine tests and Acceptance tests on the accessories shall be conducted in accordance with standard IEC 62067/ IEC 61462 as applicable.			
8.03.00	SITE TESTS :			
	Following site tests shall be carried out by the bidder and all the equipment required for the site tests shall be arranged by the bidder.			
	a) HV test as per clause 14.2 IEC 62067.			
	b) After completion of installation non metallic outer sheath shall be tested in accordance with clause- 5 IEC 60229.			
	c) The insulation resistance of the cable shall be checked before & after the HV test on cable.			
	d) The core resistance shall be measured and the value corrected in accordance with clause 5 of IEC 60228.			
8.04.00	For indicative list of tests / checks for quality assurance, refer table enclosed with this chapter.			
EPC Package for PTPS expansion phase-I		Bid Doc. No.: CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION -VI	PART-B Sub-Section -28 220 KV POWER CABLES
Page 9 of 9				



UNDER GROUND CABLE LAYING
(132 KV XLPE CABLE)

RA	FOR TENDER PURPOSE ONLY	[Signature]					
REV. NO.	DESCRIPTION	DESIGN	CHKD	BY	DATE	APPRO	DATE
		CLEARED BY					
		NTPC Limited (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION					
PROJECT		STANDARD					
TITLE		UNDER GROUND CABLE LAYING FOR 132 kV CABLE					
SIZE	SCALE	DRG. NO.	0000-211-POE-A-052				REV. NO.
A4	NTS						RA

CAD FILE NAME : STAND-211-015.DWG

SECTION - 4

GUARANTEED TECHNICAL PARTICULARS FOR 220 KV POWER CABLE & ACCESSORIES

- NTPC datasheet for 220 kV Cable & Accessories enclosed herein (8 pages)

SUB-SECTION

220KV CABLE & ACCESSORIES

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE -I (3X 800MW)

TECHNICAL SPECIFICATION
SECTION – VI, PART-G
BID DOC NO. : CS-9585-001-2

CLAUSE NO.	BIDDER'S NAME				
EHV CABLE					
1.00.00	Bidder shall give the details of his previous experience for the similar supplies made by him till this date.				
2.00.00	DRAWINGS AND LITERATURE The following information and drawings on the proposed equipment shall be submitted in six (6) copies by the Bidder along with his proposal as separate appendices to the proposal.				
2.01.00	Complete technical literature supported by catalogue giving the following particulars for cables: a) General information b) Principal Technical Data c) Description of insulation and sheathing. d) Installation Instructions.				
2.02.00	Type test certificate for the cables				
2.04.00	Complete technical literature supported by catalogues giving constructional features, type of material, installation practice and any other relevant general information.				
2.04.00	English version of the relevant standards applicable, other than the specified Indian standard, if any.				
3.00.00	220 KV CABLE				
3.01.00	Maker's name and country of manufacturer's				:
3.02.00	Manufacturer's type designation				:
3.03.00	Applicable standard				:
3.04.00	Rated Voltage				:
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		BID DOC. NO.: CS-9585-001-2	TECHNICAL DATA SHEETS SECTION – VI, PART-G	220kV CABLE & ACCESSORIES	Page 1 of 8

CLAUSE NO.	BIDDER'S NAME	
	a) Normal(KV) :	
	b) Highest(KV) :	
3.05.00	Suitable for earthed or unearthed system? :	
3.06.00	Permissible voltage and frequency variation for satisfactory operation	
	a) Voltage Volts :	
	b) Frequency Hz :	
3.07.00	Continuous current rating when laid buried in ground under the following conditions of laying. :	
	i) Reference ground temp. 30 deg. C	
	ii) Maximum conductor temp. 90 deg. C	
	iii) Depth of laying (to the highest point) 1000mm	
3.08.00	Continuous current ratings when laid in air at an ambient temp, of 50 deg. C and for maximum conductor temp, of 90 deg. C Amps :	
3.09.00	Rating factors applicable to the Current rating given in the clause 3 08.00 for the following variations/ conditions of installation	
	a) Variation in ambient air Temperature from 30 deg C to 55 deg C in steps of 5 deg C :	

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)	BID DOC. NO.: CS-9585-001-2	TECHNICAL DATA SHEETS SECTION – VI, PART-G	220kV CABLE & ACCESSORIES	Page 2 of 8
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CLAUSE NO.	BIDDER'S NAME	एनटीपीसी NTPC		
3 10.00	b) Group rating factors for different spacing of cables installed in flat formation (for 1 -core cables) in horizontal cable trays arranged in vertical tiers, under the following methods of laying : i) Cables laid in formed concrete trenches : ii) Cables laid in overhead Cable trays :			
	Rating factor applicable to the current rating given in clause 3 07.00 for the following variations/conditions in installation. : a) Variation in ground temp, from 25 deg C to 50 deg. C in steps of 5 deg C : b) Variation in thermal resistivity of The soil in the range 100/120/150/ 200/250/300 CC cm/w : c) Group rating factor for different Spacing of cables installed horizontally (in flat formation} :			
3.11.00	Short Circuit Capacity a) Short circuit current (mis) KA : b) Duration of Short Circuit Sec : c) Conductor temp, allowed for the Short Circuit duty with			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		BID DOC. NO.: CS-9585-001-2	TECHNICAL DATA SHEETS SECTION – VI, PART-G	220kV CABLE & ACCESSORIES Page 3 of 8

CLAUSE NO.	BIDDER'S NAME	एनटीपीसी NTPC		
	conductor temp, as 90 deg C before inception of short circuit °C	:		
	d) Formula relating short circuit Current (rms) & Duration (Sec.)	:		
3.12.00	Loss tangent at normal frequency and rated voltage.	:		
3.13.00	Conductor			
	a) Material	:		
	b) Grade	:		
	c) Nominal cross sectional Area Sq, mm			
	d) Number & diameter of wires No. /mm	:		
	e) Form	:		
	f) Overall diameter of conductor mm	:		
3.14.00	a) Maximum D.C resistance of conductor per 1000 meters at 20degC. Ohms	:		
3.15.00	Reactance at 50 Hz per 1000 meters ohms	:		
3.16.00	Capacitance at 50 Hz per 1000 Meters (Micro "Farads)	:		
3.17.00	Maximum charging current per 1000 Meters at rated voltage. Amps.	:		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		BID DOC. NO.: CS-9585-001-2	TECHNICAL DATA SHEETS SECTION – VI, PART-G	220kV CABLE & ACCESSORIES Page 4 of 8

CLAUSE NO.	BIDDER'S NAME			
3.18.00	Conductor screening :			
3.19.00	a) Material :			
	b) Extruded/ wrapped or both? :			
	c) Thickness mm Insulation :			
	Insulation			
	a) Composition of insulation :			
	b) Filled or unfilled :			
	c) Type of Curing :			
	d) Thickness of insulation mm :			
3.20.00	e) Tolerance on thickness :			
	f) Specified insulation resistance at 90 deg. C :			
	g) Designed maximum dielectric stress. :			
	h) Insulation resistance at 20 deg. C :			
3.21.00	Insulation screening			
	a) Material :			
	b) Extruded, wrapped or both? :			
	c) Thickness :			
	Water Blocking Swellable tape			
	a) Material :			
	b) Thickness & Size :			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		BID DOC. NO.: CS-9585-001-2	TECHNICAL DATA SHEETS SECTION – VI, PART-G	220kV CABLE & ACCESSORIES Page 5 of 8

CLAUSE NO.	BIDDER'S NAME				
3.22.00	Moisture Barrier Metallic Sheath a) Material : b) Composition of Material : c) Thickness : d) Nominal diameter over metallic sheath :				
3.23.00	Metallic Copper wire screen i) Bedding over moisture barrier metallic sheath a) Material : b) Approx. thickness : ii) Metallic copper wire/ tape over bedding a) Material & type of screen : b) Min. area of screen : c) Nom. thickness of screen : d) Nom. thickness of copper tapes : e) Nom. width of copper tape : f) Whether screen is to be earthed at both termination? Yes/No : g) Screen Voltage/KM corresponding to rated current of cable with one end of screen unearthed :				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)	BID DOC. NO.: CS-9585-001-2	TECHNICAL DATA SHEETS SECTION – VI, PART-G	220kV CABLE & ACCESSORIES	Page 6 of 8	

CLAUSE NO.	BIDDER'S NAME			
3.24.00	h) Screen current corresponding to rated current of cable with one end of screen unearthed Amps.	:		
	i) Screen Loss/KM corresponding to rated current of cable with both end of screen unearthed. Watt.	:		
	j) Whether current rating given in 3.07.00 S 3.08.00 are furnished with screen earthed at both ends Yes/No	:		
	k) Screen Voltage /KM corresponding to short circuit current run cable for three phase fault with one end of screen unearthed. Volts	:		
	l) Screen current corresponding to short circuit content in cable for three phase fault with both ends of armour earthed Amp	:		
	m) I^2t rating of screen under short Circuit duty $\text{Amp}^2 \text{ sec}$	:		
	Outer sheath			
	a) Material	:		
	b) Details of rodent & termite protection.	:		
	c) Thickness of sheath mm	:		
3.25.00	Overall diameter of cable, mm	:		
3.26.00	Weight per meter Kg/m	:		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		BID DOC. NO.: CS-9585-001-2	TECHNICAL DATA SHEETS SECTION – VI, PART-G	220kV CABLE & ACCESSORIES
Page 7 of 8				

CLAUSE NO.	BIDDER'S NAME									
3.27.00	Recommended minimum installation radius	:								
3.28.00	Safe pulling force v Jhen pulled by pulling eye. Kg	:								
3.29.00	Cable drums									
	a) Dimensions : Flange/Dia/Barrel dia/thickness mm	:								
	b) Weight of cable drum with cable Kg.	:								
	c) Maximum length per drum for each size of cable (single length} mm	:								
	d) Whether treated with anti termicide chemicals	:								
3.30.00	Full details of tests proposed to be carried out furnished with the tender Yes/No,	:								
<table border="1"> <tr> <td>EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)</td> <td>BID DOC. NO.: CS-9585-001-2</td> <td>TECHNICAL DATA SHEETS SECTION – VI, PART-G</td> <td>220kV CABLE & ACCESSORIES</td> <td>Page 8 of 8</td> </tr> </table>						EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)	BID DOC. NO.: CS-9585-001-2	TECHNICAL DATA SHEETS SECTION – VI, PART-G	220kV CABLE & ACCESSORIES	Page 8 of 8
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)	BID DOC. NO.: CS-9585-001-2	TECHNICAL DATA SHEETS SECTION – VI, PART-G	220kV CABLE & ACCESSORIES	Page 8 of 8						

SECTION 5

ENCLOSURES TO SPECIFICATIONS

ANNEXURE I

SCHEDULE OF DEVIATION

SCHEDULE OF DEVIATIONS

Certified that the following are only deviations from the specification (for the equipment and systems being offered)

S.No.	Page No.	Clause No.	Deviation	Reason / Justification
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Date :

Signature :

Name:

Designation :