


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	S.NO.	DESCRIPTION OF MANUALS	NO OF PRINTS	NO. OF CD-ROMs
		i) For review/comment	2	2 CD ROM
		ii) For final approval	2	2 CD ROM
	20.	Welding Manual, Heat Treatment Manuals, Storage & preservation manuals		
		i) 1 st submission	4 sets	2 CD ROM
		ii) Final	4 sets	4 CD ROM
	21.	QA Documentation Package for items / equipment manufactured and dispatched to site	2 sets	4CD ROMS
	22.	QA Documentation Package for field activities on equipment / systems at site	2 sets	4 CD ROMS



GENERAL TECHNICAL REQUIREMENTS

ANNEXURE - II

PRODUCT	AREAS OF TRAINING REQUIREMENT				Operation & Maintenance of Plant
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work		
Steam Generator Thermal design and hydraulic circulation balance Combustion and Air & gas weight calculation Pressure part calculation Pressure parts and strength calculation Tube metal temp. calculation and selection Performance Duct design Pressure parts arrangement Equipment and system sizing and selection of mills, fans, airpreheater, soot blowers, dampers, valves heater, soot blowers, dampers, valves, feeders, burners, startup system, fuel firing system, fuel firing system, draft plant. Flow scheme development of air & flue gas, fuel oil, auxiliary steam, main and reheat steam feed water.	Familiarization with various system and equipment Performance data collection analysis and review O&M feed back Operation history of various equipments and system Failure analysis	Manufacturing process and pressure parts, equipments Welding process Testing facilities Product development in process Future plan for technology induction R&D work in progress	Control philosophy operation, notices, logic & protection schemes, O&M manual familiarization O&M issues. Familiarization of special maintenance techniques Special tool and tackles familiarization		

VINDHYACHAL STPP-V (1X500 MW)
STEAM GENERATOR WITH
ELECTROSTATIC PRECIPITATOR PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-2260-101-2

PART-C
(GTR)
ANNEXURE - II



GENERAL TECHNICAL REQUIREMENTS

	<p>PRODUCTION DESIGN</p> <p>Layout of over all plant, steam generator area, pressure part arrangements, platforms, equipment, piping and duct, coal pipe, flue gas ducts, bunker arrangement, valves and damper, ESP area, cable & piping trestles etc.</p> <p>Erection strategies, erection procedures</p> <p>Performance and demonstration tests.</p>			
MANDAYS	120	20	20	20
<p>CONTROL & INSTRUMENTATION</p> <p>DDCMIS*-Human Machine Interface - Hardware & Operating System</p>	<p>Hardware & Software organization of the system</p> <p>Basis of selection of H/W memory Sizing</p> <p>Operating system features, interface with other system, openness & inter-operability</p> <p>Upgradability</p> <p>System testing features</p>	Operational feedback		
MANDAYS	16	6		
<p>VINDHYACHAL STPP-V (1X500 MW) STEAM GENERATOR WITH ELECTROSTATIC PRECIPITATOR PACKAGE</p>		<p>TECHNICAL SPECIFICATION SECTION-VI BID DOCUMENT NO.: CS-2260-101-2</p>	<p>PART-C (GTR) ANNEXURE - II</p>	<p>PAGE 2 OF 5</p>



GENERAL TECHNICAL REQUIREMENTS

DDCMIS*-Human Machine Interface System Engineering & Application Software	Specific system customization Various system modules & interface with OS Database organization & development Development of mimics Other application like calculations, logs historical storage functionalities & use	Operation feedback		
MANDAYS	40	6		
DDCMIS* - Control System Hardware	Basic design features for system & its Modules System capabilities & system design Techniques Communication with HMI & other System	Operation feedback	Manufacturing processes special attention to handling of the modules Maintenance facilities	
MANDAYS	20	5	10	
DDCMIS*-Control system Application Software	Database structure Organisation & interface between application program & database Application for implementation of Control functions Study of standard algorithms & development of new algorithm	Operational feedback	System integration & System capabilities testing	
MANDAYS	12	4	4	
VINDHYACHAL STPP-V (1X500 MW) STEAM GENERATOR WITH ELECTROSTATIC PRECIPITATOR PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOCUMENT NO.: CS-2260-101-2	PART-C (GTR) ANNEXURE - II	PAGE 3 OF 5



GENERAL TECHNICAL REQUIREMENTS

DDCMIS* - Control Loop Study	General description of closed loop controls of thermal power plant Critical analysis of few control loops e.g., boiler start up control etc.	Specific operational feedback	
MANDAYS	4	2	
DDCMIS*-Burner Management Study	Hardware logic, NFPAN/DE requirements & other safety standards Flame scanner location	Operational feedback	Manufacturing procedure & precautions for handling the system System testing facilities
MANDAYS	10	3	3
Boiler Flame Viewing system Misc. system for SG C&I	Theory & principle of operation Details of software & methods of modification/customisation	Operational feedback	
MANDAYS	6	3	
Electric Power Supply System	Theory & design features		Manufacturing/assembly process Testing Methodology
MANDAYS	5	2	
Wherever "DDCMIS" is indicated, it will mean SG C&I part of DDCMIS, which is in Contractor's Scope.			
MANDAYS	45	10	10

VINDHYACHAL STPP-V (1X500 MW) STEAM GENERATOR WITH ELECTROSTATIC PRECIPITATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOCUMENT NO.: CS-2260-101-2	PART-C (GTR) ANNEXURE - II	PAGE 4 OF 5
---	--	----------------------------------	-------------



GENERAL TECHNICAL REQUIREMENTS

<p>QUALITY ASSURANCE & INSPECTION</p> <p>QA SYSTEM & PROGRAMME</p>	<p>Integrated QA Management System for enhanced reliability of equipments.</p> <ul style="list-style-type: none"> ● QA system in design, procurement, manufacturing, installation and operation of the equipments/ systems. ● QA system for developing and establishing new processes and vendors. ● System of structured documentation of Engg. And test records 	<p>Operating feed backs:</p> <ul style="list-style-type: none"> ● Co-relation of reliability and performance of the equipment with implementation of QA system. ● Appreciation of use of structured Engg./QA documentation during Operational phase of plant and during RLA studies of plant 	<ul style="list-style-type: none"> ● Appreciation of implementation of QA Programmes in various manufacturing, assembly and testing activities. ● Appreciation of developmental activities for new processes and vendors. ● System of prequalification of special processes. 	
<p>MANDAYS</p>	<p>20</p>	<p>10</p>	<p>26</p>	
<p>CONTROLS & INSTRUMENTS</p>	<p>Familiarization with control system and instrumentation</p> <p>QA system for manufacture of reliable components</p>	<p>Feedback on performance of C&I System</p>	<p>Manufacturing activities for critical instruments/items</p> <p>Implementation of testing programme to ensure reliability.</p>	
<p>MANDAYS</p>	<p>6</p>	<p>4</p>	<p>4</p>	

<p>VINDHYACHAL STPP-V (1X500 MW) STEAM GENERATOR WITH ELECTROSTATIC PRECIPITATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI BID DOCUMENT NO.: CS-2260-101-2</p>	<p>PART-C (GTR) ANNEXURE - II</p>	<p>PAGE 5 OF 5</p>
--	---	---------------------------------------	--------------------



GENERAL TECHNICAL REQUIREMENTS

ANNEXURE-III

		Project Package Supplier Contractor No. :	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL					DOC. NO.:		
		Stage :	SUB-SYSTEM :					REV. NO.:		
S. No.	Item	QP/Insp. Cat.	QP No.	QP Sub. Sched ule	QP approval schedule	Proposed sub-supplier	Place	Sub-supplier approval status/category	Sub-supplier Details submission schedule	Remarks

LEGENDS

1. **SYSTEM SUPPLIER / SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC)**
 A - For these items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list alongwith the condition of approval, if any.
 DR - For these items "Detailed required" for NTPC review. To be identified with letter "DR" in the list.
 NOTED - For these items vendors are approved by Main Supplier and accepted by NTPC without specific vendor approval from NTPC. To be identified with "NOTED".

2. **QP/INSPN CATEGORY:**
 CAT-I : For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC.
 CAT-II : For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP.
 CAT-III : For these items Main Supplier approves the Quality Plans. The final acceptance by NTPC shall be on the basis certificate of conformance by the main supplier.

UNITS/WORKS : Place of manufacturing Place of Main Supplier of multi units/works. 1/1

FORMAT NO.: QS-01-QAI-P-1/F3-R0 Engg. Div. / QA&I



GENERAL TECHNICAL REQUIREMENTS

ANNEXURE-IV

S. N.	Item / Service	QP/ Insp. Cat.	QP Sub. Schedule Approval schedule	Date of sub-mission	Date of commt Appl.	Status Code C/III	Proposed Sub-suppliers	Place of manufacturing works	Approval Status	Sub-supplier detail submission schedule	Remarks	DOC. NO.:
												REV. NO.:
												DATE :
												PAGE : OF
												Engg. Div. / QA&I
Project : STATUS OF ITEM REQUIRING QP & SUB-SUPPLIER APPROVAL Package : Contractor : Contractor No.:												1/1
FORMAT NO.: QS-01-QAI-P-02/F1-R0												

VINDHYACHAL STPP-V (1X500 MW) STEAM GENERATOR WITH ELECTROSTATIC PRECIPITATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOCUMENT NO.: CS-2260-101-2	PART-C (GTR) ANNEXURE - IV	PAGE 1 OF 1
---	--	----------------------------------	-------------



GENERAL TECHNICAL REQUIREMENTS

ANNEXURE-V

	Project : Contractor : Contractor No. : System :	Stage :	FIELD WELDING SCHEDULE (To be raised by the contractor) Welding Code:	DOC. NO. : REV. NO. : DATE : PAGE : OF
--	---	---------	--	---

Sl. No.	DRG No. for Weld Location and Identification mark	Description of parts to welded	Mati. Spec	Dimensions	Process of welding	Type of Weld	Electrode filler spec.	WPS. No.	Min. pre-heat	Heat treatment		NDT method/Quantum	REF		Remarks	
										Temp	Holding time		Spec. No.	ACC Norm Ref.		

NOTES:

SIGNATURE

Format No.: QS-01-CQA-W-11/F1-R0

1/1

Engg. Div. / QA&I

VINDHYACHAL STPP-V (1X500 MW)
STEAM GENERATOR WITH
ELECTROSTATIC PRECIPITATOR PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-2260-101-2

PART-C
(GTR)
ANNEXURE-V

PAGE 1 OF 1

GENERAL TECHNICAL REQUIREMENTS



ANNEXURE-VI

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN				PROJECT				
	ITEM :	SUB-SYSTEM:	QP NO.:	REV.NO.:	DATE:	PAGE: OF	PACKAGE	CONTRACT NO. :	MAIN-SUPPLIER :		
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK M C / N	REFERENCE DOCUMENT	ACCEPTANCE Norms	Format of Record	AGENCY M C N	REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	9. D*	** 10.	11.	
<p>LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE. CHP: NTPC SHALL IDENTIFY IN COLUMN 'N' AS 'W'</p>											
MANUFACTURER/ SUB-SUPPLIER		SIGNATURE		MAIN-SUPPLIER		FOR NTPC USE		REVIEWED BY		APPROVED BY	
										APPROVAL SEAL	

Format No.: QS-01-QAI-P-09/F1-r1

1/1

Engg. Div./QA&I

VINDHYACHAL STPP-V (1X500 MW)
STEAM GENERATOR WITH
ELECTROSTATIC PRECIPITATOR PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-2260-101-2

PART-C
(GTR)
ANNEXURE - VI



GENERAL TECHNICAL REQUIREMENTS

ANNEXURE-VII

SUPPLIER'S LOGO		SUPPLIER'S NAME AND ADDRESS		FIELD QUALITY PLAN					PROJECT PACKAGE	
		ITEM :		QP NO.: REV. NO.: DATE: PAGE: OF					CONTRACT NO.	
				SUB-SYSTEM:		TYPE OF CHECK			REFERENCE DOCUMENT	
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	QUANTUM OF CHECK	REMARKS	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS	Doc. No.	Rev. ...
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.
		MAIN-SUPPLIER		LEGEND: * RECORDS, IDENTIFIED WITH 'TICK' (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER. (A & B CHECK SHALL BE NTPC CHP STAGE)						
		SIGNATURE		REVIEWED BY		APPROVED BY		APPR OVAL SEAL		

FORMAT NO.: QS-01-QAI-P-09/F2-R1

1/1

ENGG. DIV./QA&I

VINDHYACHAL STPP-V (1X500 MW)
STEAM GENERATOR WITH
ELECTROSTATIC PRECIPITATOR PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-2280-101-2

PART-C
(GTR)
ANNEXURE - VII

PAGE 1 OF 1

NTPC LIMITED

1X500 MW VINDHAYACHAL STPS, STAGE-V, UNIT NO.- 13

VOLUME IIB

**TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM**

**SPECIFICATION NO.: PE-TS-389-166-A001
(ELECTRICAL PORTION)**



BHARAT HEAVY ELECTRICALS LTD

**POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI,NOIDA-INDIA**



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
FUEL OIL UNLOADING AND STORAGE SYSTEM
1X500MW VINDHYACHAL STPP STAGE-V**

SPECIFICATION NO. PE-TS-
VOLUME NO. : II-B
SECTION : C
REV NO. : 00 DATE : 07.03.14
SHEET : 1 OF 1

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER :

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Erection and Commissioning spares.
- e) Erection & Maintenance tools & tackles.
- f) Electrical load requirement for Fuel Oil Unloading and Storage System.
- g) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- h) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer /BHEL approval without any commercial and delivery implications to BHEL
- i) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/quality assurance requirements stipulated. In line with this two signed and stamped copies of the following shall be furnished by the bidder as technical offer:

- a) A copy of this sheet ”Electrical equipment Specification for Fuel Oil Unloading and Storage System” and sheet “Electrical Scope between BHEL and Vendor” with bidder’s signature and company stamp.
- b) List of Erection and Commissioning spares.
- c) List of Erection & Maintenance tools & tackles.
- d) Electrical load requirement

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 List of enclosures :

- a) Specification AC Motors, LT power, LT Control & Instrumentation cable.
- b) Data sheet of AC Motors.
- c) Quality Plan.
- d) Load data format.

**ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR
PACKAGE : FUEL OIL UNLOADING AND STORAGE SYSTEM**

PROJECT: 1X500MW VINDHYACHAL STPP STAGE-V

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	415 V Switchgear	NTPC	NTPC	415 V AC/240 V AC supply shall be provided by NTPC based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. DC supply (battery bank, charger etc) and any other supply as required for PLC/control panel (as applicable) shall be provided by vendor.
2	Local Push Button Station (for motors)	NTPC	NTPC	Located near the motors.
3	Power cables, control cables and screened control cables a) both end equipment in vendor's scope b) one end equipment in vendor's scope & one end in NTPC's scope. c) one end equipment in Vendor's scope & one end in BHEL scope.	Vendor NTPC BHEL	Vendor NTPC vendor	Sizes and quantity of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL/NTPC). Finalisation of cable sizes shall be done by NTPC. Vendor shall provide lugs & glands accordingly.
4	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc	Vendor	Vendor	not applicable for FOPH package
5	Cable trays, accessories & cable trays supporting system a) for cables in main route b) for cables in branch route	NTPC vendor	NTPC vendor	
6	Cable glands and lugs for equipments supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power cables 3. solder less crimping type heavy duty copper lugs for control cables.
7	Conduit and conduit accessories for cabling between equipments supplied by vendor	Vendor	Vendor	Cabling shall be through conduits. However vendor can use the trunk route where available for laying of cables. Conduits shall be supplied by vendor and shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537. Makes of conduits shall be subject to NTPC/ BHEL approval at contract stage.
8	Lighting	NTPC	NTPC	
9	Equipment grounding	NTPC	NTPC	
10	Lightning protection	Vendor	Vendor	
11	Below grade grounding	NTPC	NTPC	


ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR
PACKAGE : FUEL OIL UNLOADING AND STORAGE SYSTEM

11	Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to NTPC/ BHEL approval at contract stage.
12	Mandatory spares	Vendor	-	Vendor to quote as per specification.
13	Recommended O & M spares, E & C spares, erection & maintenance tools & tackle	Vendor	-	
14	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
15	a) Input cable schedules (C & I) b) Cable interconnection detail for the above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for control cables for vendor supplied equipment (soft copies in the NTPC cable schedule format) shall be furnished during detail engineering by vendor.
16	Equipment layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipments requiring cabling, and shall incorporate cable routing details marked on the drawing as per PEM interface comments. Electrical equipment layout drawing shall be to NTPC approval.
17	Electrical equipment GA drawing	Vendor	-	

NOTES:

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL/NTPC after award of contract.
2. All QPs shall be subject to approval of BHEL/NTPC after award of contract without any commercial implication.

MOTORS

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	MOTORS		
1.00.00	GENERAL REQUIREMENTS		
1.01.00	For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.		
1.02.00	All equipments shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.		
1.03.00	Contractor shall provide fully compatible electrical system, equipments, accessories and services.		
1.04.00	All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.		
1.05.00	The auxiliary AC voltage supply arrangement shall have 11kV, 3.3 kV and 415V systems and DC voltage shall be 220 V. It shall be designed to limit voltage variations as given below under worst operating condition :		
	(a) 11kV, 3.3 kV	+/- 6%	
	(b) 415/240V	+/- 10%	
	(c) 220 V DC	-15% to +10%. However the nominal continuous DC power supply shall be 242V.	
1.06.00	The voltage level for motors shall be as follows :-		
	a) Upto 0.2KW	: Single phase 240V AC / 3 phase 415V AC	
	b) Above 0.2KW and upto 200KW	: 3 phase 415V AC(Except for motor of DMCW pump for TG auxiliaries which shall be fed from 3.3 KV Three phase)	
	c) Above 200KW and upto 1500 KW:	3.3 kV	
	d) Above 1500 KW	: 11 kV	
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-2 MOTORS	PAGE TOP 10


CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC															
1.07.00	Fault level shall be limited to 40kA RMS for 1 second for 11kV & 3.3 kV system and 45 kA RMS 1 second for 415V system. 415V system shall be solidly grounded and 220 VDC system shall be isolated type.																
1.08.00	Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.																
1.09.00	The responsibility of coordination with electrical agencies and obtaining all necessary clearances shall be of the contractor.																
1.10.00	<p>Degree of Protection</p> <p>Degree of protection for various enclosures as per IS:4691, IEC60034-05 shall be as follows :-</p> <table border="0"> <tr> <td>i) Indoor motors</td> <td>-</td> <td>IP 54</td> </tr> <tr> <td>ii) Outdoor motors</td> <td>-</td> <td>IP 55</td> </tr> <tr> <td>iii) Cable box-indoor area</td> <td>-</td> <td>IP 54</td> </tr> <tr> <td>iv) Cable box-Outdoor area</td> <td>-</td> <td>IP 55</td> </tr> </table>	i) Indoor motors	-	IP 54	ii) Outdoor motors	-	IP 55	iii) Cable box-indoor area	-	IP 54	iv) Cable box-Outdoor area	-	IP 55				
i) Indoor motors	-	IP 54															
ii) Outdoor motors	-	IP 55															
iii) Cable box-indoor area	-	IP 54															
iv) Cable box-Outdoor area	-	IP 55															
2.00.00	<p>CODES AND STANDARDS</p> <table border="0"> <tr> <td>1) Three phase induction motors</td> <td>:</td> <td>IS:325, IEC:60034</td> </tr> <tr> <td>2) Single phase AC motors</td> <td>-</td> <td>IS:996, IEC:60034</td> </tr> <tr> <td>3) Crane duty motors</td> <td>-</td> <td>IS:3177, IEC:60034</td> </tr> <tr> <td>4) DC motors/generators</td> <td>:</td> <td>IS:4722</td> </tr> <tr> <td>5) Energy Efficient motors</td> <td>-</td> <td>IS 12615, IEC:60034-30</td> </tr> </table>	1) Three phase induction motors	:	IS:325, IEC:60034	2) Single phase AC motors	-	IS:996, IEC:60034	3) Crane duty motors	-	IS:3177, IEC:60034	4) DC motors/generators	:	IS:4722	5) Energy Efficient motors	-	IS 12615, IEC:60034-30	
1) Three phase induction motors	:	IS:325, IEC:60034															
2) Single phase AC motors	-	IS:996, IEC:60034															
3) Crane duty motors	-	IS:3177, IEC:60034															
4) DC motors/generators	:	IS:4722															
5) Energy Efficient motors	-	IS 12615, IEC:60034-30															
3.00.00	TYPE																
3.01.00	<p>AC Motors:</p> <table border="0"> <tr> <td>a) Squirrel cage induction motor suitable for direct-on-line starting.</td> <td></td> </tr> <tr> <td>b) Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature), shall be Energy Efficient motors, Efficiency class-Eff 1, conforming to IS 12615 or High efficiency (IE2) as per IEC:60034-30.</td> <td></td> </tr> <tr> <td>c) Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.</td> <td></td> </tr> </table>	a) Squirrel cage induction motor suitable for direct-on-line starting.		b) Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature), shall be Energy Efficient motors, Efficiency class-Eff 1, conforming to IS 12615 or High efficiency (IE2) as per IEC:60034-30.		c) Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.											
a) Squirrel cage induction motor suitable for direct-on-line starting.																	
b) Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature), shall be Energy Efficient motors, Efficiency class-Eff 1, conforming to IS 12615 or High efficiency (IE2) as per IEC:60034-30.																	
c) Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.																	
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-2 MOTORS	PAGE 2 OF 10														

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
3.02.00	DC Motors Shunt wound.			
4.00.00	RATING (a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor. (b) Whenever the basis for motor ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations. (c) For BFP motors starting MVA shall be restricted to 58 MVA.			
5.00.00	TEMPERATURE RISE Air cooled motors 70 deg. C by resistance method for both thermal class 130(F) & 155(F) insulation. Water cooled 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation. 41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class Y wet wound Boiler circulation pump motor.			
6.00.00	OPERATIONAL REQUIREMENTS			
6.01.00	Starting Time			
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.			
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.			
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time			
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-2 MOTORS	PAGE 3 OF 10	

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.,	
6.02.00	Torque Requirements	
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.	
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.	
6.03.00	Starting voltage requirement (a) 85% below 110 KW (b) 80% from 110 KW to 200 KW (c) 85% above 200 KW to 1000 KW (d) 80% from 1001 KW to 4000 KW (e) 75% > 4000KW Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%.	
7.00.00	DESIGN AND CONSTRUCTIONAL FEATURES	
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.	
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACWA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). CW motors can be screen protected drip proof (SPDP) type. Motors located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below (a) Fuel oil area : Group - IIB (b) Hydrogen generation plant area : Group - IIC (or Group-I, Div-II as per NEC)	
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-2 MOTORS
PAGE 4 OF 10	397	Page 160 of 275

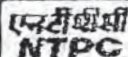
CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
7.03.00	<p>Winding and Insulation</p> <p>(a) Type : Non-hygroscopic, oil resistant, flame resistant</p> <p>(b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature. However the conveyor motor shall be suitable for 3 consecutive hot starts.</p> <p>(c) 11kV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin poor method. The lightning impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15</p> <p>(d) 240VAC, 415V AC & 220V DC motors : Thermal Class(B) or better</p>		
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.		
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.		
7.06.00	Noise level for all the motors shall be limited to 85dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.		
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.		
7.08.00	Motor body shall have two earthing points on opposite sides.		
7.09.00	HT motors can be offered with either elastimould termination or dust tight phase separated double walled (metallic as well as insulated barrier) cable boxes. In case elastimould terminations are offered, then protective cover and trifurcating sleeves shall also be provided. In case cable box is offered, then Employer shall provide		
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) — — STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-2 MOTORS	PAGE 5 OF 10

CLAUSE NO.	TECHNICAL REQUIREMENTS	एन.टी.पी.सी. NTPC
	<p>termination kit. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable boxes.</p>	
7.10.00	The spacing between gland plate & centre of terminal stud shall be as per Table-I.	
7.11.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.	
7.12.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.	
7.13.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.	
7.14.00	11kV and 3.3 kV motor Terminal Box shall be suitable for fault level of 750MVA for 0.12 sec and 250 MVA for 0.12 sec respectively. Elastimould termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.	
7.15.00	The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.	
8.00.00	<p>The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor.</p> <p>(a) Below 110KW : 10.0</p> <p>(b) From 110 KW & upto 200 KW : 9.0</p> <p>(c) Above 200 KW & upto 1000KW : 10.0</p> <p>(d) From 1001KW & upto 4000KW : 9.0</p> <p>(e) Above 4000KW : 6 to 6.5</p>	
10.00.00	TYPE TEST	
10.01.00	HT MOTORS	
10.01.01	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type	
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X506 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-2 MOTORS

CLAUSE NO.	TECHNICAL REQUIREMENTS	
	<p>tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.</p>	
10.01.02	<p>The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.</p>	
10.01.03	<p>In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the owner for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar 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. The owner reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.</p>	
10.01.04	<p>Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" 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.</p>	
10.01.05	<p>LIST OF TYPE TESTS TO BE CONDUCTED</p> <p>The following type tests shall be conducted on each type and rating of HT motor</p> <ul style="list-style-type: none"> (a) No load saturation and loss curves upto approximately 115% of rated voltage (b) Measurement of noise at no load. (c) Momentary excess torque test (subject to test bed constraint). (d) Full load test(subject to test bed constraint) 	
<p>VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION-VI PART-B</p>	<p>B-2 MOTORS</p> <p>PAGE 7 OF 10</p>

100

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	<p>(e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.</p> <p>(f) * Lightning Impulse withstand test on the sample coil shall be as per IEC-60034, part-15</p> <p>(g) Surge-withstand test on interturn insulation shall be as per clause no. 5.1.2 of IEC 60034, part-15</p>			
10.01.06	<p>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</p> <p>The following type test reports shall be submitted for each type and rating of HT motor</p> <p>(a) Degree of protection test for the enclosure followed by IR, HV and no load run test.</p> <p>(b) Terminal box-fault level withstand test for each type of terminal box of HT motors only.</p>			
10.02.00	LT Motors			
10.02.01	<p>LT Motors 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.</p>			
10.02.02	<p>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.</p>			
10.02.03	<p>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</p> <p>The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only</p>			
<p>VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION-VI PART-B</p>	<p>B-2 MOTORS</p>	<p>PAGE 8 OF 10</p>	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<ol style="list-style-type: none"> 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip . 5. Temperature rise test . 6. Momentary excess torque test. 7. High voltage test . 8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as per clause no 7.06.0C of this section) 10. Test for degree of protection and 11. Overspeed test. 			
10.03.00	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.			
10.04.00	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.			
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-2 MOTORS	PAGE 9 OF 10	

CLAUSE NO.

TECHNICAL REQUIREMENTS



TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm
UP to 3 KW	As per manufacturer's practice.
Above 3 KW - upto 7 KW	85
Above 7 KW - upto 13 KW	115
Above 13 KW - upto 24 KW	167
Above 24 KW - upto 37 KW	196
Above 37 KW - upto 55 KW	249
Above 55 KW - upto 90 KW	277
Above 90 KW - upto 125 KW	331
Above 125 KW-upto 200 KW	203

For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.

PHASE TO PHASE/ PHASE TO FARTH AIR CLEARANCE:

NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

Motor MCR in KW	Clearance
UP to 110 KW	10mm
Above 110 KW and upto 150 KW	12.5mm
Above 150 KW	19mm

SPECIFIC ELECTRICAL REQUIREMENT FOR FUEL OIL UNLOADING AND STORAGE SYSTEM

SL.NO.	PARAMETERS	UNIT	VINDHYACHAL STAGE-V		
	MOTOR				
1	DESIGN AMBIENT TEMP	DEG. C	50		
2	VOLTAGE SUPPLY AND VARIATION	VOLT	415V, ± 10%		
3	FREQUENCY WITH VARIATION	Hz	50, +3% & -5%		
4	COMBINED VOLTAGE & FREQUENCY VARIATION		10%		
5	MAX ACCEPTABLE RATING OF MOTOR AT 415 V	KW	Below 200 KW		
6	SYSTEM FAULT LEVEL AND ITS DURATION	KA	45 KA, 1 Sec		
7	SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION		50 KA, 0.2 sec		
8	CLASS OF INSULATION & TEMP RISE LIMITED TO		Class-F and temp rise limited to Class-B		
9	MIN. STARTING VOLTAGE		1) 85% for below 110 KW 2) 80% from 110 KW to 200 KW		
10	MOTOR RATING FOR SINGLE PHASE SUPPLY		0.2 kW & Below		
11	MAXIMUM LOCKED ROTOR CURRENT	% OF FLC	600% ± IS tolerance		
12	ACCEPTABLE NOISE LEVEL	DB	85dB at 1.5m		
13	TYPE OF STARTER PROVIDED IN MCC		DOL		
14	DOP OF ENCLOSURE		IP- 55		
15	SPACE HEATER REQUIREMENT	<30kW	30KW & ABOVE		
16	PAINT SHADE		RAL 5012 (Blue)		
17	SPECIAL REQUIREMENT		TYPE TEST REPORTS MORE THAN 5 YEARS OLD ARE NOT ACCEPTABLE		

Clause No.	MOTORS		
DE-1B (Bidder's Name)		
	<p>LT MOTORS</p> <p>A. GENERAL</p> <p>1. Manufacturer & Country of origin. (Shall be as per approved QA make)</p> <p>2. Equipment driven by motor</p> <p>3. Motor type</p> <p>4. Quantity</p> <p>B. DESIGN AND PERFORMANCE DATA</p> <p>1. Frame size</p> <p>2. Type of duty</p> <p>3. Type of enclosure /Method of cooling/Degree of protection</p> <p>4. Applicable standard to which motor generally conforms</p> <p>5. Efficiency class as per IS 12615</p> <p>6. (a) Whether motor is flame proof Yes/No</p> <p style="padding-left: 40px;">(b) If yes, the gas group to which it conforms as per IS:2148</p> <p>7. Type of mounting</p> <p>8. Direction of rotation as viewed from DE END</p> <p>9. Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)</p> <p>10. Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)</p>		
NAME OF THE PROJECT..... STEAMGENERATOR PACKAGE	TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL)	PAGE 10 OF 16

Clause No.	MOTORS		
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>11. Maximum continuous load demand of driven equipment in KW</p> <p>12. Rated Voltage (volts)</p> <p>13. Permissible variation of :</p> <p style="padding-left: 20px;">a. Voltage (Volts)</p> <p style="padding-left: 20px;">b. Frequency (Hz)</p> <p style="padding-left: 20px;">c. Combined voltage and frequency</p> <p>14. Rated speed at rated voltage and frequency(RPM)</p> <p>15. At rated Voltage and frequency:</p> <p style="padding-left: 20px;">a. Full load current</p> <p style="padding-left: 20px;">b. No load current</p> <p>16. Power Factor at</p> <p style="padding-left: 20px;">a. 100% load</p> <p style="padding-left: 20px;">b. NO load</p> <p style="padding-left: 20px;">c. Starting.</p> <p>17. Efficiency at rated voltage and frequency,</p> <p style="padding-left: 20px;">a. 100% load</p> <p style="padding-left: 20px;">b. 75% load</p> <p style="padding-left: 20px;">c. 50% load</p> <p>18. Starting current (amps) at</p> <p style="padding-left: 20px;">a. 100 % voltage</p> <p style="padding-left: 20px;">b. 85% voltage</p>		
NAME OF THE PROJECT..... STEAMGENERATOR PACKAGE	TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL)	PAGE 11 OF 16

Clause No.	MOTORS		
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>c. 80% voltage</p> <p>19. Minimum permissible starting Voltage (Volts)</p> <p>20. Starting time with minimum permissible voltage</p> <p>a. Without driven equipment coupled</p> <p>b. With driven equipment coupled</p> <p>21. Safe stall time with 100% and 110% of rated voltage</p> <p>a. From hot condition</p> <p>b. From cold condition</p> <p>22. Torques :</p> <p>a. Starting torque at min. permissible voltage(kg-mtr.)</p> <p>b. Pull up torque at rated voltage.</p> <p>c. Pull out torque</p> <p>d. Min accelerating torque (kg.m) available</p> <p>e. Rated torque (kg.m)</p> <p>23. Stator winding resistance per phase (ohms at 20 Deg.C.)</p> <p>24. GD^2 value of motors</p> <p>25. No of permissible successive starts when motor is in hot condition</p>		
NAME OF THE PROJECT..... STEAMGENERATOR PACKAGE	TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL)	PAGE 12 OF 16

Clause No.	MOTORS		
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>26. Locked Rotor KVA Input</p> <p>27. Locked Rotor KVA/KW</p> <p>28. Vibration limit :Velocity (mm/s)</p> <p>29. Noise level limit (dBA)</p> <p>C. CONSTRUCTIONAL FEATURES</p> <p>1. Stator winding insulation</p> <p style="margin-left: 20px;">a. Class & Type</p> <p style="margin-left: 20px;">b. Winding Insulation Process</p> <p style="margin-left: 20px;">c. Tropicalised (Yes/No)</p> <p style="margin-left: 20px;">d. Temperature rise over specified maximum ambient temperature of 50 deg C</p> <p style="margin-left: 20px;">e. Method of temperature measurement</p> <p style="margin-left: 20px;">f. Stator winding connection</p> <p>2. Main Terminal Box</p> <p style="margin-left: 20px;">a. Type</p> <p style="margin-left: 20px;">b. Location (viewed from NDE side)</p> <p style="margin-left: 20px;">c. Entry of cables(bottom/side)</p> <p style="margin-left: 20px;">d. Recommended cable size (To be matched with cable size envisaged by owner)</p> <p style="margin-left: 20px;">e. Fault level (MVA), Fault level duration (sec)</p> <p style="margin-left: 20px;">f. Cable glands & lugs details (shall be suitable for power cable)</p>		
NAME OF THE PROJECT..... STEAMGENERATOR PACKAGE	TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL)	PAGE 13 OF 16

Clause No.	MOTORS		
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>3. Type of DE/NDE Bearing</p> <p>4. Motor Paint shade</p> <p>5. Weight of</p> <p style="padding-left: 20px;">a. Motor stator (KG)</p> <p style="padding-left: 20px;">b. Motor Rotor (KG)</p> <p style="padding-left: 20px;">c. Total weight (KG)</p> <p>D. List of accessories.</p> <p>1. Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage)</p> <p>2. Terminal Box for Space Heater (Yes/No)</p> <p>3. Speed switch (Yes/No) No of contacts and contact ratings of speed switch</p> <p>4. Insulation of bearing (Yes/No)</p> <p>5. Noise reducer(Yes/No)</p> <p>6. Grounding pads</p> <p style="padding-left: 20px;">i) No and size on motor body</p> <p style="padding-left: 20px;">ii) Nos on terminal Box</p> <p>7. Vibration pads</p> <p style="padding-left: 20px;">i) Nos and size</p> <p style="padding-left: 20px;">ii) Location</p> <p>8. Any other fitments</p>		
NAME OF THE PROJECT..... STEAMGENERATOR PACKAGE	TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL)	PAGE 14 OF 16


Clause No.	MOTORS		
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>E. List of curves.</p> <ol style="list-style-type: none"> 1. Torque speed characteristic of the motor 2. Thermal withstand characteristic 3. Starting. current Vs. Time 4. Starting. current Vs speed 5. P.F. and Effi. Vs Load <p>F. Additional Data to be filled for each rating of DC Motor</p> <ol style="list-style-type: none"> 1. Rated armature voltage (Volt) 2. Rated field excitation (Amp) 3. Permissible % variation in voltage 4. Minimum Permissible Starting voltage (volt) 5. At rated voltage <ol style="list-style-type: none"> i) Full load Armature current.(Amp) ii) Full load Field current (Amp) iii) No load Armature current (Amp) 6. Full load Field current (Amp) 7. No load Aramature current (Amp) 8. Minimum permissible field current(Amp) to avoid overspeeding at <ol style="list-style-type: none"> i) Maximum permissible voltage 		
NAME OF THE PROJECT..... STEAMGENERATOR PACKAGE	TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL)	PAGE 15 OF 16


Clause No.	MOTORS		
	<p style="text-align: right;">..... (Bidder's Name)</p> <p>ii) Rated voltage</p> <p>iii) Minimum Permissible Voltage</p> <p>9. Resistance (indicative Values) in ohm</p> <p>i) Armature winding (Arm + IP + Series) at 25 deg.C</p> <p>ii) Field Winding at 25 deg. C</p> <p>10. Inductance (indicative values)</p> <p>i) Armature winding</p> <p>ii) Field winding</p> <p>11. Value of trimmer resistance (ohm) to be connected in series with the shunt field to obtain rated speed at</p> <p>i) 220 V DC</p> <p>ii) 250 V DC</p> <p>iii) 187 V DC</p> <p>12. Value of the external resistance (ohm) required to be connected in series with armature during starting only</p> <p>13. Technical data sheet for external resistance box</p> <p>14. GA drawing of motor</p> <p>15. Starting time calculation</p> <p>16. Starter resistance design calculation</p> <p>17. Electrical connection diagram of motor</p>		
NAME OF THE PROJECT..... STEAMGENERATOR PACKAGE	TECHNICAL DATA SHEET SECTION-VI BID DOC NO.: CS-9575/ 9571/ 0370/ 0360/ 9586-102-2	PART-F CHAPTER-I SUB-SECTION:DE1 (ELECTRICAL)	PAGE 16 OF 16


L.T. POWER CABLES


VINDHYACHAL SUPER THERMAL POWER PROJECT
STAGE-V (1X500 MW)
STEAM TURBINE GENERATOR PACKAGE


TECHNICAL SPECIFICATIONS
SECTION-VI
PART-B


CLAUSE NO.	TECHNICAL REQUIREMENTS			
LT POWER CABLES				
1.00.00	CODES & STANDARDS			
1.01.00	<p>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:</p> <p>IS :1554 - I PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.</p> <p>IS : 3961 Recommended current ratings for cables</p> <p>IS : 3975 Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.</p> <p>IS : 5831 PVC insulation and sheath of electrical cables.</p> <p>IS:7098 (Part -I) Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.</p> <p>IS : 8130 Conductors for insulated electrical cables and flexible cords.</p> <p>IS : 10418 Specification for drums for electric cables.</p> <p>IS : 10810 Methods of tests for cables.</p> <p>ASTM-D -2843 Standard test method for density of smoke from the burning or decomposition of plastics.</p> <p>IEC-754 (Part-I) Tests on gases evolved during combustion of electric cables.</p> <p>IEC-332 Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).</p>			
2.00.00	TECHNICAL REQUIREMENTS			
2.01.00	<p>The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.</p>			
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-3 L.T. POWER CABLES	PAGE 1 OF 8	


CLAUSE NO.	TECHNICAL REQUIREMENTS																
2.02.00	Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.																
2.03.00	Aluminium conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be stranded.																
2.04.00	XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C. 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.																
2.06.00	<p>For single core armoured cables, armouring shall be of aluminium wires/ formed wires. For multicore armoured cables, armouring shall be of galvanised steel as follows :</p> <table border="1" data-bbox="422 1010 1428 1489"> <thead> <tr> <th data-bbox="422 1010 758 1077">Calculated nominal dia. of cable under armour</th> <th data-bbox="927 1010 1246 1043">Size and Type of armour</th> </tr> </thead> <tbody> <tr> <td data-bbox="422 1111 576 1144">Upto 13 mm</td> <td data-bbox="775 1111 1002 1144">1.4mm dia GS wire</td> </tr> <tr> <td data-bbox="422 1178 711 1211">Above 13 & upto 25mm</td> <td data-bbox="775 1178 1382 1211">0.8 mm thick GS formed wire / 1.6 mm dia GS wire</td> </tr> <tr> <td data-bbox="422 1245 719 1279">Above 25 & upto 40 mm</td> <td data-bbox="775 1245 1366 1279">0.8mm thick GS formed wire / 2.0mm dia GS wire</td> </tr> <tr> <td data-bbox="422 1312 711 1346">Above 40 & upto 55mm</td> <td data-bbox="775 1312 1366 1346">1.4 mm thick GS formed wire /2.5mm dia GS wire</td> </tr> <tr> <td data-bbox="422 1379 719 1413">Above 55 & upto 70 mm</td> <td data-bbox="775 1379 1382 1413">1.4mm thick GS formed wire / 3.15mm dia GS wire</td> </tr> <tr> <td data-bbox="422 1447 584 1480">Above 70mm</td> <td data-bbox="775 1447 1382 1480">1.4 mm thick GS formed wire / 4.0 mm dia GS wire</td> </tr> </tbody> </table>			Calculated nominal dia. of cable under armour	Size and Type of armour	Upto 13 mm	1.4mm dia GS wire	Above 13 & upto 25mm	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 25mm	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																
2.06.01	The aluminium used for armouring shall be of H4 grade as per IS: 8130 with maximum resistivity of 0.028264 ohm mm ² per meter at 20 deg C. The sizes of aluminium armouring shall be same as indicated above for galvanized steel.																
2.06.02	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 /																
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-3 L.T. POWER CABLES	PAGE 2 OF 8														


CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<p>formed wire. Zinc rich paint shall be applied on armour joint surface of G.S.wire/ formed wire.</p>		
2.07.00	<p>Outer sheath shall be of PVC as per IS: 5831 & black 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.</p> <p>(a.) Oxygen index of min. 29 (as per IS 10810 Part-58).</p> <p>(b.) Acid gas emission of max 20% (as per IEC-754-1).</p> <p>(c.) Smoke density rating shall not be more than 60 % (as per ASTM D-2843).</p>		
2.08.00	<p>Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted:</p> <p>1 core - Red, Black, Yellow or Blue</p> <p>2 core - Red & Black</p> <p>3 core - Red, Yellow & Blue</p> <p>4 core - Red, Yellow, Blue and Black</p>		
2.09.00	<p>For reduced neutral conductors, the core shall be black.</p>		
2.10.00	<p>In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath.</p> <p>(a.) Cable size and voltage grade - To be embossed</p> <p>(b.) Word 'FRLS' at every 5 metre - To be embossed</p> <p>(c.) Sequential marking of length of the cable in metres at every one metre -To be embossed / printed</p> <p>The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.</p>		
2.11.00	<p>All cables shall meet the fire resistance requirement as per Category-B of IEC 332 Part-3.</p>		
2.12.00	<p>Allowable tolerances on the overall diameter of the cables shall be ± 2 mm maximum, over the declared value in the technical data sheets.</p>		
<p>VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION-VI PART-B</p>	<p>B-3 L.T. POWER CABLES</p>	<p>PAGE 3 OF 8</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.		
3.00.00	CABLE SELECTION & SIZING		
3.01.00	<p>LT Power cables shall be sized based on the following considerations:</p> <ul style="list-style-type: none"> (a) Rated current of the equipment (b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage (c) Short circuit withstand capability <p>This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the let out energy of the fuse. For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time.</p> <ul style="list-style-type: none"> (d) The minimum conductor size shall be 6 sqmm for aluminium conductor cables and 2.5 sqmm for copper conductor cables. The constructional details of copper conductor cables shall be same as indicated for copper control cable. 		
302.00	<p>Derating Factors</p> <p>Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes:</p> <ul style="list-style-type: none"> a) Variation in ambient temperature for cables laid in air b) Grouping of cables c) Variation in ground temperature and soil resistivity for buried cables. 		
3.03.00	Cable lengths shall be considered in such a way that straight through cable joints are avoided.		
3.04.00	Cables shall be armoured type if laid in switchyard area or directly buried.		
3.05.00	All LT power cables of sizes more than 120 sq.mm. shall be XLPE insulated and preferable sizes are 1Cx150, 1Cx300, 1Cx630, 3Cx150 & 3Cx240 sq.mm.		
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-3 L.T. POWER CABLES	PAGE 4 OF 8

CLAUSE NO.	TECHNICAL REQUIREMENTS			
4.00.00	<p>CONSTRUCTIONAL FEATURES</p> <p>(a.) 1.1 KV grade XLPE power cables shall have compacted aluminium conductor, XLPE insulated, PVC inner sheathed (as applicable), armoured/ unarmoured, FRLS PVC outer sheathed conforming to IS:7098. (Part-I).</p> <p>(b.) 1.1KV grade PVC power cables shall have aluminium conductor (compacted type for sizes above 10 sq.mm), PVC Insulated, PVC inner sheathed, armoured/ unarmoured, FRLS PVC outer sheathed conforming to IS:1554 (Part-I).</p>			
5.00.00	<p>CABLE DRUMS</p> <p>(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.</p> <p>(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 stencilled on both 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.</p> <p>(c) The standard drum length for power cables shall not be less than 500 meters. 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 drum with shorter lengths. For each size, the variance of total quantity, adding all the supplied drum lengths, from the ordered quantity, shall not exceed +/- 2%.</p>			
5.00.00	<p>TYPE TESTS</p>			
5.01.00	<p>General</p> <p>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</p>			
<p>VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION-VI PART-B</p>	<p>B-3 L.T. POWER CABLES</p>	<p>PAGE 5 OF 8</p>	

CLAUSE NO.	TECHNICAL REQUIREMENTS																														
<p>5.02.00</p> <p>5.02.01</p>	<p>test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>Type Tests</p> <p>The reports for the following type tests shall be submitted for one size each of LT XLPE and LT PVC Power cables. Size shall be decided by the employer during detailed engineering :</p> <table border="1" data-bbox="416 1144 1294 1877"> <thead> <tr> <th>S.No.</th> <th>Type test</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td colspan="3" style="text-align: center;">For Conductor</td> </tr> <tr> <td>1.</td> <td>Resistance test</td> <td></td> </tr> <tr> <td>2.</td> <td>Tensile test</td> <td>For circular non-compacted conductors only</td> </tr> <tr> <td>3.</td> <td>Wrapping test</td> <td>For circular non-compacted only</td> </tr> <tr> <td colspan="3" style="text-align: center;">For Armour Wires/ Formed Wires</td> </tr> <tr> <td>4.</td> <td>Measurement of Dimensions</td> <td></td> </tr> <tr> <td>5.</td> <td>Tensile Test</td> <td></td> </tr> <tr> <td>6.</td> <td>Elongation test</td> <td></td> </tr> </tbody> </table>			S.No.	Type test	Remarks	For Conductor			1.	Resistance test		2.	Tensile test	For circular non-compacted conductors only	3.	Wrapping test	For circular non-compacted only	For Armour Wires/ Formed Wires			4.	Measurement of Dimensions		5.	Tensile Test		6.	Elongation test		
S.No.	Type test	Remarks																													
For Conductor																															
1.	Resistance test																														
2.	Tensile test	For circular non-compacted conductors only																													
3.	Wrapping test	For circular non-compacted only																													
For Armour Wires/ Formed Wires																															
4.	Measurement of Dimensions																														
5.	Tensile Test																														
6.	Elongation test																														
<p>VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION-VI PART-B</p>	<p>B-3 L.T. POWER CABLES</p>	<p>PAGE 6 OF 8</p>																												


CLAUSE NO.	TECHNICAL REQUIREMENTS		
7.	Torsion test	For round wires only	
8.	Wrapping test	For aluminium wires / formed wires only.	
9.	Resistance test		
10(a)	Mass of zinc coating test	For GS Formed wires/wires only	
10(b)	Uniformity of zinc coating	For GS Formed wires /wires only	
11.	Adhesion test	For GS Formed wires/wires only	
For PVC/XLPE insulation & PVC Sheath			
12.	Test for thickness		
13.	Tensile strength & elongation tests	before ageing and after ageing tests	
14.	Ageing in air oven		
15.	Loss of mass test	For PVC insulation and sheath only	
16.	Hot deformation test	For PVC insulation and sheath only	
17.	Heat shock test	For PVC insulation and sheath only	
18.	Shrinkage test		
19.	Thermal stability test	For PVC insulation and sheath only	
20.	Hot set test	For XLPE insulation only	
21.	Water absorption test	For XLPE insulation only	
22.	Oxygen index test	For outer sheath only	
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-3 L.T. POWER CABLES	PAGE 7 OF 8


CLAUSE NO.	TECHNICAL REQUIREMENTS			
5.02.02	23.	Smoke density test	For outer sheath only	
	24.	Acid gas generation test	For outer sheath only	
	For completed cables			
	25.	Insulation resistance test (Volume resistivity method)		
	26.	High voltage test		
	27.	Flammability test as per IEC-332 Part-3 (Category-B)		
	5.02.02	Acceptance Tests (as per QA table)		
5.02.03	Routine Tests (as per QA table)			
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-3 L.T. POWER CABLES	PAGE 8 OF 8


L.T. CONTROL CABLES


VINDHYACHAL SUPER THERMAL POWER PROJECT
STAGE-V (1X500 MW)
STEAM TURBINE GENERATOR PACKAGE


TECHNICAL SPECIFICATIONS
SECTION-VI
PART-B


CLAUSE NO.	TECHNICAL REQUIREMENTS																									
LT CONTROL CABLES																										
1.00.00	CODES & STANDARDS																									
1.01.00	<p>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 :</p> <table border="0" data-bbox="400 636 1437 1592"> <tr> <td style="vertical-align: top;">IS :1554 - I</td> <td style="vertical-align: top;">PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.</td> </tr> <tr> <td style="vertical-align: top;">IS : 3961</td> <td style="vertical-align: top;">Recommended current ratings for cables</td> </tr> <tr> <td style="vertical-align: top;">IS : 3975</td> <td style="vertical-align: top;">Low carbon galvanised steel wires, formed wire and tapes for armouring of cables.</td> </tr> <tr> <td style="vertical-align: top;">IS : 4905</td> <td style="vertical-align: top;">Methods for random sampling.</td> </tr> <tr> <td style="vertical-align: top;">IS : 5831</td> <td style="vertical-align: top;">PVC insulation and sheath of electrical cables.</td> </tr> <tr> <td style="vertical-align: top;">IS : 8130</td> <td style="vertical-align: top;">Conductors for insulated electrical cables and flexible cords.</td> </tr> <tr> <td style="vertical-align: top;">IS : 10418</td> <td style="vertical-align: top;">Specification for drums for electric cables.</td> </tr> <tr> <td style="vertical-align: top;">IS : 10810</td> <td style="vertical-align: top;">Methods of tests for cables.</td> </tr> <tr> <td style="vertical-align: top;">ASTM-D -2843</td> <td style="vertical-align: top;">Standard test method for density of smoke from the burning or decomposition of plastics.</td> </tr> <tr> <td style="vertical-align: top;">IEC-754 (Part-I)</td> <td style="vertical-align: top;">Test on gases evolved during combustion of electric cables.</td> </tr> <tr> <td style="vertical-align: top;">IEC -332</td> <td style="vertical-align: top;">Tests on Electric cables under fire conditions Part-3 : Tests on bunched wires or cables (category - B)</td> </tr> </table>				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 wire and tapes for armouring of cables.	IS : 4905	Methods for random sampling.	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)	Test 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)
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 wire and tapes for armouring of cables.																									
IS : 4905	Methods for random sampling.																									
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)	Test 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 burried installation with chances of flooding by water.																									
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-4 L.T. CONTROL CABLES	PAGE 1 OF 7																							


CLAUSE NO.	TECHNICAL REQUIREMENTS																
2.02.00	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 multi 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.																
2.06.00	<p>For multicore armoured cables, the armouring shall be of galvanised steel as follows :-</p> <table border="1" data-bbox="416 875 1278 1525"> <thead> <tr> <th data-bbox="416 875 879 943">Calculated nominal dia of cable under armour</th> <th data-bbox="879 875 1278 943">Size and Type of armour</th> </tr> </thead> <tbody> <tr> <td data-bbox="416 976 879 1021">1) Upto 13 mm</td> <td data-bbox="879 976 1278 1021">1.4mm dia GS wire</td> </tr> <tr> <td data-bbox="416 1043 879 1111">2) Above 13 upto 25 mm</td> <td data-bbox="879 1043 1278 1111">0.8 mm thick GS formed wire / 1.6 mm dia GS wire</td> </tr> <tr> <td data-bbox="416 1144 879 1211">3) Above 25 upto 40 mm</td> <td data-bbox="879 1144 1278 1211">0.8mm thick GS formed wire / 2.0mm dia GS wire</td> </tr> <tr> <td data-bbox="416 1245 879 1312">4) Above 40 upto 55mm</td> <td data-bbox="879 1245 1278 1312">1.4 mm thick GS formed wire/ 2.5mm dia GS wire</td> </tr> <tr> <td data-bbox="416 1346 879 1413">5) Above 55 upto 70 mm</td> <td data-bbox="879 1346 1278 1413">1.4mm thick GS formed wire / 3.15mm dia GS wire</td> </tr> <tr> <td data-bbox="416 1447 879 1514">6) Above 70mm</td> <td data-bbox="879 1447 1278 1514">1.4 mm thick GS formed wire / 4.0 mm dia GS wire</td> </tr> </tbody> </table> <p data-bbox="416 1559 1437 1727">The gap between armour wire / formed wire 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.</p>			Calculated nominal dia of cable under armour	Size and Type of armour	1) Upto 13 mm	1.4mm dia GS wire	2) Above 13 upto 25 mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire	3) Above 25 upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire	4) Above 40 upto 55mm	1.4 mm thick GS formed wire/ 2.5mm dia GS wire	5) Above 55 upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire	6) 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																
1) Upto 13 mm	1.4mm dia GS wire																
2) Above 13 upto 25 mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire																
3) Above 25 upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire																
4) Above 40 upto 55mm	1.4 mm thick GS formed wire/ 2.5mm dia GS wire																
5) Above 55 upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire																
6) Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire																
2.07.00	Outer sheath shall be of PVC(grade as applicable) 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.																
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-4 L.T. CONTROL CABLES	PAGE 2 OF 7														


CLAUSE NO.	TECHNICAL REQUIREMENTS			
<p>2.08.00</p> <p>2.09.00</p> <p>2.10.00</p>	<p>(a) Oxygen index of min. 29 (As per IS:10810 (part-58))</p> <p>(b) Acid gas emission of max. 20% (As per IEC-754-I).</p> <p>(c) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTM-D-2843.</p> <p>Cores of the cables of upto 5 cores shall be identified by colouring of insulation. Following colour scheme shall be adopted.</p> <p>1 core - Red, Black, Yellow or Blue</p> <p>2 core - Red & Black</p> <p>3 core - Red, Yellow & Blue</p> <p>4 core - Red, Yellow, Blue and Black</p> <p>5 core - Red, Yellow, Blue, Black and Grey</p> <p>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 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.</p> <p>In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath :</p> <p>(a) Cable size and voltage grade - To be embossed</p> <p>(b) Word 'FRLS' at every 5 metre - To be embossed</p> <p>(c) Sequential marking of length of the cable in metres at every one metre. - To be embossed / printed.</p> <p>The embossing / printing shall be progressive, automatic, in line and marking shall be legible and indelible.</p>			
<p>VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION-VI PART-B</p>	<p>B-4 L.T. CONTROL CABLES</p>	<p>PAGE 3 OF 7</p>	


CLAUSE NO.	TECHNICAL REQUIREMENTS			
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			
2.14.01	<p>LT Control cables shall be sized based on the following considerations:</p> <p>(a) Rated current of the equipment</p> <p>(b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage</p> <p>(c) Short circuit withstand capability</p> <p>This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the let out energy of the fuse. For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time.</p> <p>(d) The minimum size of conductor shall be 1.5 sqmm</p>			
2.14.02	<p>Derating Factors</p> <p>Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes:</p> <p>a) Variation in ambient temperature for cables laid in air</p> <p>b) Grouping of cables</p> <p>c) Variation in ground temperature and soil resistivity for buried cables.</p>			
2.14.03	Cable lengths shall be considered in such a way that straight through cable joints are avoided.			
2.14.04	Cables shall be armoured type if laid in switchyard area or directly buried.			
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-4 L.T. CONTROL CABLES	PAGE 4 OF 7


CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.00.00	CONSTRUCTIONAL FEATURES			
3.01.00	1.1 KV Grade Control Cables Control Cables shall have stranded copper conductor multicore PVC insulated, PVC inner-sheathed, armoured / unarmoured, PVC outer-sheathed conforming to IS:1554. (Part-I).			
3.02.00	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 layer. 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 stencilled 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. For each size, the variance of total quantity, adding all the supplied drum lengths, from the ordered quantity, shall not exceed +/- 2%.			
4.00.00	TESTS			
4.01.00	GENERAL 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)			
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-4 L.T. CONTROL CABLES	PAGE 5 OF 7	


CLAUSE NO.	TECHNICAL REQUIREMENTS																													
4.02.00 4.02.01	<p>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.</p> <p>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.</p> <p>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.</p> <p>TYPE TESTS:</p> <p>The Type tests reports for the following shall be submitted for one size of LT control cable :</p> <table border="1" data-bbox="400 891 1289 1877"> <thead> <tr> <th data-bbox="400 891 938 936">S. No. Type Test</th> <th data-bbox="938 891 1289 936">Remarks</th> </tr> </thead> <tbody> <tr> <td data-bbox="400 936 938 981">a) For Conductor</td> <td data-bbox="938 936 1289 981"></td> </tr> <tr> <td data-bbox="400 981 938 1025">1. Resistance test</td> <td data-bbox="938 981 1289 1025"></td> </tr> <tr> <td data-bbox="400 1025 938 1070">b) For Armour Wires / Formed wires</td> <td data-bbox="938 1025 1289 1070"></td> </tr> <tr> <td data-bbox="400 1070 938 1115">2. Measurement of Dimensions</td> <td data-bbox="938 1070 1289 1115"></td> </tr> <tr> <td data-bbox="400 1115 938 1160">3. Tensile Test</td> <td data-bbox="938 1115 1289 1160"></td> </tr> <tr> <td data-bbox="400 1160 938 1205">4. Elongation test</td> <td data-bbox="938 1160 1289 1205"></td> </tr> <tr> <td data-bbox="400 1205 938 1249">5. Torsion test</td> <td data-bbox="938 1205 1289 1249">For round wire only</td> </tr> <tr> <td data-bbox="400 1249 938 1294">6. Winding test</td> <td data-bbox="938 1249 1289 1294">For Formed wires</td> </tr> <tr> <td data-bbox="400 1294 938 1339">7. Resistance test</td> <td data-bbox="938 1294 1289 1339"></td> </tr> <tr> <td data-bbox="400 1339 938 1384">8. Zinc Coating test</td> <td data-bbox="938 1339 1289 1384">For G.S. conductors only.</td> </tr> <tr> <td data-bbox="400 1384 938 1429">c) For PVC insulation & PVC Sheath</td> <td data-bbox="938 1384 1289 1429"></td> </tr> <tr> <td data-bbox="400 1429 938 1473">9. Test for thickness</td> <td data-bbox="938 1429 1289 1473"></td> </tr> </tbody> </table>			S. No. Type Test	Remarks	a) For Conductor		1. Resistance test		b) For Armour Wires / Formed wires		2. Measurement of Dimensions		3. Tensile Test		4. Elongation test		5. Torsion test	For round wire only	6. Winding test	For Formed wires	7. Resistance test		8. Zinc Coating test	For G.S. conductors only.	c) For PVC insulation & PVC Sheath		9. Test for thickness		
S. No. Type Test	Remarks																													
a) For Conductor																														
1. Resistance test																														
b) For Armour Wires / Formed wires																														
2. Measurement of Dimensions																														
3. Tensile Test																														
4. Elongation test																														
5. Torsion test	For round wire only																													
6. Winding test	For Formed wires																													
7. Resistance test																														
8. Zinc Coating test	For G.S. conductors only.																													
c) For PVC insulation & PVC Sheath																														
9. Test for thickness																														
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-4 L.T. CONTROL CABLES	PAGE 6 OF 7																											


CLAUSE NO.	TECHNICAL REQUIREMENTS			
4.02.02 4.03.00	10. Tensile strength and elongation test before ageing and after ageing			
	11. Ageing in air oven			
	12. Loss of mass test	For PVC insulation and sheath only		
	13. Hot deformation test	For PVC insulation and sheath only		
	14. Heat shock test	For PVC insulation and sheath only		
	15. Shrinkage test			
	16. Thermal stability test	For PVC insulation and sheath only		
	17. Oxygen index test	For outer sheath only		
	18. Smoke density test	For outer sheath only		
	19. Acid gas generation test	For outer sheath only		
	d) For completed cables			
	20. Insulation resistance test (Volume resistivity method)			
	21. High voltage test			
	22. Flammability test as per IEC - 332 Part-3 (Category-B)			
	4.02.02 Acceptance Tests (as per QA table)			
	4.03.00 Routine Tests (as per QA table)			
	VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	B-4 L.T. CONTROL CABLES	PAGE 7 OF 7


CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<h1>INSTRUMENTATION AND POWER SUPPLY CABLES</h1>			
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE	PAGE 1 OF 19	


CLAUSE NO.	TECHNICAL REQUIREMENTS												
<p>1.00.00</p> <p>1.01.00</p> <p>1.01.01</p> <p>1.01.01</p> <p>1.01.02</p> <p>1.01.03</p> <p>1.01.04</p> <p>1.01.05</p> <p>2.00.00</p> <p>2.01.00</p>	<p style="text-align: center;">INSTRUMENTATION AND POWER SUPPLY CABLE</p> <p>INSTRUMENTATION CABLE, POWER SUPPLY CABLE, INTERNAL WIRING AND ELECTRICAL FIELD CONSTRUCTION MATERIAL</p> <p>General Requirements</p> <p>All cables including special cables, internal wiring and electrical field construction material shall conform to this specification, Employer approved detail engineering drawings & documents and the latest edition of the relevant standards & guidelines. The Bidder shall furnish all material and services required for the completeness of the work identified in his scope as per this specification.</p> <p>The Contractor shall supply, erect, terminate and test all instrumentation cables for control and instrumentation equipment/devices/systems included under Contractor's scope as illustrated in the enclosed Drg. No. 0000-110-POI-A-021 and ensuring completeness of the control system.</p> <p>Any other application where it is felt that instrumentation cables are required due to system/operating condition requirements, are also to be provided by Contractor.</p> <p>Other type of cables like fiber optic/co-axial cables for system bus, cables for connection of peripherals etc. (under Contractor's scope) are also to be furnished by the Contractor.</p> <p>Contractor shall supply all cable erection and laying hardware from the main trunk routes like branch cable trays/sub-trays, supports, flexible conduits, cable glands, lugs, pull boxes etc. on as required basis for all the systems covered under this specification.</p> <p>Wherever the quantity has been defined as on as required basis, the same are to be furnished by contractor on as required basis within his quoted lump sump price without any further cost implication to the Employer.</p> <p>Specification of Instrumentation cable</p> <p>Common Requirements</p> <table border="1" data-bbox="419 1518 1436 1839"> <thead> <tr> <th>S. No.</th> <th>Property</th> <th>Requirement</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Voltage grade</td> <td>225 V (peak value)</td> </tr> <tr> <td>2.</td> <td>Codes and standard</td> <td>All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IS-8784, IS-</td> </tr> </tbody> </table>			S. No.	Property	Requirement	1	Voltage grade	225 V (peak value)	2.	Codes and standard	All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IS-8784, IS-	
S. No.	Property	Requirement											
1	Voltage grade	225 V (peak value)											
2.	Codes and standard	All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IS-8784, IS-											
<p>VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION-VI PART-B</p>	<p>SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE</p>	<p>PAGE 2 OF 19</p>										


CLAUSE NO.	TECHNICAL REQUIREMENTS																												
	<table border="1"> <thead> <tr> <th data-bbox="400 286 491 383">S. No.</th> <th data-bbox="491 286 938 383">Property</th> <th data-bbox="938 286 1444 383">Requirement</th> </tr> </thead> <tbody> <tr> <td data-bbox="400 383 491 501"></td> <td data-bbox="491 383 938 501"></td> <td data-bbox="938 383 1444 501">10810 (latest editions) and their amendments read along with this specification.</td> </tr> <tr> <td data-bbox="400 501 491 598">3.</td> <td data-bbox="491 501 938 598">Continuous operation suitability</td> <td data-bbox="938 501 1444 598">At 70 deg. C for all types of cables, while 205 Deg C for Type-C cables.</td> </tr> <tr> <td data-bbox="400 598 491 716">4.</td> <td data-bbox="491 598 938 716">Progressive automatic on-line sequential marking of length in meters</td> <td data-bbox="938 598 1444 716">To be provided at every one meter on outer sheath.</td> </tr> <tr> <td data-bbox="400 716 491 813">5.</td> <td data-bbox="491 716 938 813">Marking to read 'FRLS'</td> <td data-bbox="938 716 1444 813">To be provided at every 5 meters on outer sheath except for Type-C cable.</td> </tr> <tr> <td data-bbox="400 813 491 909">6.</td> <td data-bbox="491 813 938 909">Allowable Tolerance on overall diameter</td> <td data-bbox="938 813 1444 909">+/- 2 mm (maximum) over the declared value in data sheet</td> </tr> <tr> <td data-bbox="400 909 491 1005">7.</td> <td data-bbox="491 909 938 1005">Variation in diameter</td> <td data-bbox="938 909 1444 1005">Not more than 1.0 mm throughout the length of cable.</td> </tr> <tr> <td data-bbox="400 1005 491 1102">8</td> <td data-bbox="491 1005 938 1102">Ovality at any cross-section</td> <td data-bbox="938 1005 1444 1102">Not more than 1.0 mm</td> </tr> <tr> <td data-bbox="400 1102 491 1624">9</td> <td data-bbox="491 1102 938 1624">Others</td> <td data-bbox="938 1102 1444 1624"> a) Durable marking at intervals not exceeding 625 mm shall include manufacturer's name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacturer to be provided. b) Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground-buried installation c) Repaired cables shall not be acceptable. </td> </tr> </tbody> </table>	S. No.	Property	Requirement			10810 (latest editions) and their amendments read along with this specification.	3.	Continuous operation suitability	At 70 deg. C for all types of cables, while 205 Deg C for Type-C cables.	4.	Progressive automatic on-line sequential marking of length in meters	To be provided at every one meter on outer sheath.	5.	Marking to read 'FRLS'	To be provided at every 5 meters on outer sheath except for Type-C cable.	6.	Allowable Tolerance on overall diameter	+/- 2 mm (maximum) over the declared value in data sheet	7.	Variation in diameter	Not more than 1.0 mm throughout the length of cable.	8	Ovality at any cross-section	Not more than 1.0 mm	9	Others	a) Durable marking at intervals not exceeding 625 mm shall include manufacturer's name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacturer to be provided. b) Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground-buried installation c) Repaired cables shall not be acceptable.	
S. No.	Property	Requirement																											
		10810 (latest editions) and their amendments read along with this specification.																											
3.	Continuous operation suitability	At 70 deg. C for all types of cables, while 205 Deg C for Type-C cables.																											
4.	Progressive automatic on-line sequential marking of length in meters	To be provided at every one meter on outer sheath.																											
5.	Marking to read 'FRLS'	To be provided at every 5 meters on outer sheath except for Type-C cable.																											
6.	Allowable Tolerance on overall diameter	+/- 2 mm (maximum) over the declared value in data sheet																											
7.	Variation in diameter	Not more than 1.0 mm throughout the length of cable.																											
8	Ovality at any cross-section	Not more than 1.0 mm																											
9	Others	a) Durable marking at intervals not exceeding 625 mm shall include manufacturer's name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacturer to be provided. b) Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground-buried installation c) Repaired cables shall not be acceptable.																											
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE	PAGE 3 OF 19																										


CLAUSE NO.	TECHNICAL REQUIREMENTS				
2.02.00	Specific Requirements				
	Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable
	A. Conductors				
	Cross section area	0.5 sq. mm			
	Conductor material	ANSI type KX	ANSI type SX	High conductivity Annealed bare copper	ANSI type KX
	Colour code	Yellow-Red	Black-Red	As per VDE-815	Yellow-Red
	Conductor Grade	As per ANSI MC 96.1		Electrolytic	As per ANSI MC 96.1
	No & dia of strands	7x0.3 mm (nom)			
	No. of Pairs	2	2	4,8,12,16,24,48	2
	Max. conductor resistance per Km (in ohm) at 20 deg. C	As per ANSI MC 96.1		73.4 (loop)	As per ANSI MC 96.1
	Reference Standard	As per ANSI MC 96.1		VDE 0815	As per ANSI MC 96.1
	B. Insulation				
	Material	PVC type YI 3			Teflon (i.e. extruded FEP)
	Thickness in mm (Min/Nom/Max)	0.25/0.3/0.35			0.4/0.50
Volume Resistivity (Min) in ohm-cm	1 x 10 ¹⁴ at 20 deg. C & 1x10 ¹¹ at 70 deg. C.			---	
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B		SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE	PAGE 4 OF 19	


CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Voltage Rating	225 V peak operating voltage		
	Reference Standard	VDE 0207 Part 4	VDE 0207 Part 6 & ASTM D 2116.	
	Core diameter above insulation	Suitable for cage clamp connector		
	C. Pairing & Twisting			
	Max. lay of pairs (mm)	50		
	Single layer of Polyester tape on each pair provided	Numbered tape	Yes	N.A.
	Unit formation of four pairs with printing of no. of Unit provided	N.A.	Yes	N.A.
	Conductor /pair identification as per VDE0815	N.A.	To be provided (color coding attached).	N.A.
	D. Shielding			
	Type of shielding	Al-Mylar tape		
	Individual pair shielding	No	To be provided for F-type cable	No
	Minimum thickness of Individual pair shielding	No	28 micron	No
	Overall cable assembly shielding	To be provided		
	Minimum thickness of	55 micron		
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE	PAGE 5 OF 19	


CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Overall cable assembly shielding			
	Shielding coverage	100% with at least 20% overlap		
	Drain wire provided for individual shield	N.A.	Yes (for F-type) 7-strand 20 AWG (0.51 mm ²) annealed Tin coated copper	N.A.
	Drain wire provided for overall shield	Yes. 7-strand 20 AWG (0.51 mm ²) annealed Tin coated copper		
	E. FILLERS			
	Non-hygroscopic, flame retardant	To be provided		
	F. Outer Sheath			
	Material	Extruded PVC compound YM1 with FRLS properties		Teflon (i.e. extruded FRP)
	Minimum Thickness at any point	1.8 mm		0.4 mm
	Nominal Thickness at any point	>1.8 mm		0.5 mm
	Color	Blue		
	Resistant to water, fungus, termite & rodent attack	Required		
	Oxygen index as per ASTM D-2863	not less than 29%		N.A.
	VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE	PAGE 6 OF 19


CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Temperature index as per ASTMD-2863	not less than 250 deg.C		N.A.
	acid gas generation by weight as per IEC-60754-1	Maximum 20%		N.A.
	Smoke Density Rating as per ASTMD-2843	Maximum 60% (defined as the average area under the curve when the results of smoke density test plotted on a curve indicating light absorption vs. time as per ASTMD-2843)		N.A.
	Reference standard	VDE207 Part 5		VDE207 Part 6 & ASTM D2116
	G. Electrical Parameters			
	MUTUAL CAPACITANCE BETWEEN CONDUCTORS AT 0.8 KHZ (MAX.)	200 nF/km	120 nF/km for F type 100 nF/km for G-type	200 nF/km
	INSULATION RESISTANCE (MIN)	100 M Ohm/Km		
	CROSS TALK FIGURE (MIN.) AT 0.8 KHZ	60 Db	60 dB	N.A.
	CHARACTERISTIC IMPEDANCE (MAX) AT 1 KHZ	N.A.	320 ohm for F-type 340 ohm for G-type	N.A.
	ATTENUATION	N.A.	1.2 db/km	N.A.
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE	PAGE 7 OF 19	


CLAUSE NO.	TECHNICAL REQUIREMENTS				
3.00.00 3.01.00	FIGURE AT 1 KHZ (MAX)				
	H. Complete Cable				
	Complete Cable assembly	Shall pass Swedish Chimney test as per SEN-SS 4241475 class F3.			N.A.
	Flammability	Shall pass flammability as per IEEE-383 read in conjunction to this specification			N.A.
	I. Accessories				
	Cable accessories of flame retardant quality.	Yes. (Accessories such as harnessing components, markers, bedding, cable jointer, binding tape etc.)			
	J. Tests				
	Routine & Acceptance tests	Refer sub-section III E			
	Type tests	Refer sub-section-CNI TYPE TEST			
	K Cable Drum				
	Type	Non-returnable wooden drum (wooden drum to be constructed from seasoned wood free from defects with wood preservative applied to the entire drum) or steel drum.			
	Outermost layer covered with waterproof paper	Yes			
	Painting	Entire surface to be painted			
	Length	1000 m \pm 5% for up to & including 12 pairs 500 m \pm 5% for above 12 pairs			
3.00.00 3.01.00	<p align="center">SPECIFICATION OF OPTICAL FIBER CABLES (OFC)</p> <p>Optic Fiber cable shall be 4/8/12 core, galvanised corrugated steel taped armoured, fully water blocked with dielectric central member for outdoor/indoor application so as to prevent any physical damage. The cable shall have multiple single-mode or</p>				
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	SUB-SECTION-III C-07 INSTRUMENTATION AND POWER SUPPLY CABLE	PAGE 8 OF 19		


CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<p>multi mode fibers on as required basis so as to avoid the usage of any repeaters. The core and cladding diameter shall be 9 +/- 1 micrometer and 125 +/- 1 micrometer respectively. The outer sheath shall have Flame Retardant, UV resistant properties and are to be identified with the manufacturer's name, year of manufacturer, progressive automatic sequential on-line marking of length in meters at every meter on outer sheath.</p>			
3.02.00	<p>The cable core shall have suitable characteristics and strengthening for prevention of damage during pulling viz. Steel central member, Loose buffer tube design, 4 fibers per buffer tube (minimum), Interstices and buffer tubes duly filled with Thixotropic jelly etc. The cable shall be suitable for a maximum tensile force of 2000 N during installation, and once installed, a tensile force of 1000 N minimum. The compressive strength of cable shall be 3000 N minimum & crush resistance 4000 N minimum. The operating temperature shall be -20 deg. C to 70 deg. C</p>			
3.03.00	<p>All testing of the fiber optic cable being supplied shall be as per the relevant IEC, EIA and other international standards.</p>			
3.04.00	<p>Bidder to ensure that minimum 100% cores are kept as spares in all types of optical fibre cables.</p>			
3.05.00	<p>Cables shall be suitable for laying in conduits, ducts, trenches, racks and under ground buried installation.</p>			
3.06.00	<p>Spliced / Repaired cables are not acceptable.</p>			
3.07.00	<p>Penetration of water resistance and impact resistance shall be as per IEC standard.</p>			
4.00.00	<p>SPCIFICATION OF POWER SUPPLY CABLES</p>			
	<p>Refer relevant subsections of this specification.</p>			
5.00.00	<p>INSTRUMENTATION CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY</p> <p>The cable interconnection philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field mounted Group Junction Boxes (JBs) at strategic locations (where large concentration of signals are available, e.g. valves limit & torque switches, switchgear) is done and consequently cable with higher number of pairs are extensively used. The details of termination to be followed are mentioned in the given Table A.</p>			
<p>VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION-VI PART-B</p>	<p>SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE</p>	<p>PAGE 9 OF 19</p>	


CLAUSE NO.	TECHNICAL REQUIREMENTS				
	TABLE A: CABLE TERMINATION TO BE FOLLOWED				
	Application		Type Of Termination		Type Of Cable
	FROM (A)	TO (B)	END A	END B	
	Valves/dampers drives (Integral Junction box)	Marshalling cubicle/ Marshalling cum termination Cubicle/local group JB	Plug in connector	Posts mount cage clamp type.	G
	Transmitters, Process Actuated switches mounted in LIE/LIR	Integral Junction box of LIE/LIR	Plug in connector	Cage clamp (Rail mount) type.	F,G
	RTD heads	Local junction box	Plug in connector	Cage clamp (Rail mount) type.	F
	Thermocouple	CJC Bcx (if applicable)	Plug in connector	Cage clamp (Rail mount) type.	A,B,C*
	Other Field Mounted Instrument	Local JB/Group JB	Plug in connector	Screwed, Cage clamp (Rail mount) type	F,G
	RTD	Temperature transmitter	Plug in connector	Screwed, Cage clamp type	F
	Thermocouple	Temperature transmitter	Plug in connector	Screwed, Cage clamp type	A,B,C*
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B		SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE	PAGE 10 OF 19	


CLAUSE NO.	TECHNICAL REQUIREMENTS				
	Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/Group JB/ MCC/SWGR	Group JB	Cage clamp (Rail mount) type.	Cage clamp (Rail mount) type.	F,G
	Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/Group JB/ MCC/SWGR	Marshalling Cubicle/ Marshalling cum Termination Cabinet	Cage clamp (Rail mount) type.	Posts mount cage clamp type.	F,G
	Marshalling cubicle/ Termination Cabinet	Electronic system cabinet	Cage clamp Post mounted type.	Plug in connector/Other System as per manufacturer's Standard	Internal wiring
	Marshalling/ Termination System Cabinets	UCD mounted equipments	Post mount cage clamp type.	Plug in connector/Cage clamp type (rail mounted).	F,G (with plug-in connector at one end)
	DDCMIS/PLC cabinets	PC, Printers etc.	Plug in connector	Plug in connector	Mfr.'s Standard
	<p>Notes</p> <ol style="list-style-type: none"> Normally 10% spare cores shall be provided when the numbers of pairs of cables are more than four pairs except for pre-fabricated cables which shall be as per manufacturer's standard. For analog signals, individual pair shielding & overall shielding & for Binary signals, only overall shielding of instrumentation cables shall be provided. Also refer Drg. 0000-110-POI-A-021. *For high temperature applications only. Instrument Cabling for instruments/equipments covered under subsection MAIN EQP INST SYS shall be as per manufacturer's standard . 				
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE		PAGE 11 OF 19	


CLAUSE NO.	TECHNICAL REQUIREMENTS			
6.00.00 6.01.00 6.02.00 6.03.00 6.04.00 6.05.00 6.06.00 6.07.00	TERMINAL BLOCKS All terminal blocks shall be rail mounted/post mounted, cage clamp type with high quality non-flammable insulating material of melamine suitable for working temperature of 105 deg. C. The terminal blocks in field mounted junction boxes, temperature transmitters, instrument enclosures/racks, etc., shall be suitable for cage clamp connections. The terminal blocks in Control Equipment Room logic/termination/marshalling cubicles shall be suitable for post mounted cage clamp connection at the field input end. The terminal blocks for DDCMIS input/output connections from/to SWGR/MCC, Actuators with Integral Starter (for coupling relays and check back signals of 11 kV and 3.3 kV auxiliaries, LT drives/valves & dampers/solenoids, CT & VT, etc.) shall be provided with built in test and disconnect facilities complete with plug, slide clamp, test socket etc. The exact type of terminal blocks to be provided by the Bidder and the technical details of the same including width etc. shall be subject to Employer's approval. All the terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, partitions, small partitions, test plug bolts and test plug (as specified above for SWGR connections) transparent covers, support brackets, distance sleeves, warning label, marking, etc. The marking on terminal strips shall correspond to the terminal numbering on wiring diagrams. At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc. All terminal blocks shall be numbered for identification and grouped according to the function. Engraved labels shall be provided on the terminal blocks. For terminating each process actuated switches, drive actuators, control valves, Thermocouple, RTD, etc. in Local Junction Boxes, etc, refer Drg no. 0000-999-POI-A-065. The terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks and between terminal blocks and junction box walls. For ensuring proper connections, Bidder shall provide suitable accessories, along with insulation sleeves. The exact connecting accessory shall be finalised as per application during detail engineering stage subject to Employer's approval without any cost repercussions. Internal wiring in factory pre-wired electronic equipment cabinets may be installed according to the Bidder's standard as to wire size and method of termination or internal equipment. Terminal blocks for connection of external circuits into factory prewired electronic equipment cabinets shall meet all the requirements as specified above.			
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE	PAGE 12 OF 19	


CLAUSE NO.	TECHNICAL REQUIREMENTS								
<p>7.00.00</p> <p>7.01.00</p> <p>7.02.00</p> <p>7.03.00</p> <p>7.04.00</p> <p>7.05.00</p> <p>7.06.00</p> <p>7.07.00</p>	<p>INTERNAL PANELS/ SYSTEM CABINETS WIRING</p> <p>Internal panel/cabinet wiring shall be of multi-stranded copper conductor with FRLS PVC insulation without shield and outer sheath meeting the requirements of VDE 0815.</p> <p>Wiring to door mounted devices shall be done by 19 strand copper wire provided with adequate loop lengths of hinge wire so that multiple door opening shall not cause fatigue breaking of the conductor.</p> <p>All internal wires shall be provided with tag and identification nos. etched on tightly fitted ferules at both ends in Employer's approved format. All wires directly connected to trip devices shall be distinguished by one additional red colour ferrule.</p> <p>All external connection shall be made with one wire per termination point. Wires shall not be tapped or spliced between terminal points.</p> <p>All floor slots of desk/panels/cabinets used for cable entrance shall be provided with removable gasketed gland plates and sealing material. Split type grommets shall be used for prefabricated cables.</p> <p>All the special tools as may be required for solder less connections shall be provided by Bidder.</p> <p>Wire sizes to be utilised for internal wiring.</p> <table border="0" data-bbox="443 1137 1340 1435"> <tr> <td style="padding-left: 20px;">(i)</td> <td>Current (4-20 mA), low voltage signals (48V); Ammeter/Voltmeter circuit, control switches etc. for electrical system.</td> <td style="padding-left: 20px;">0.5 Sq.mm.</td> </tr> <tr> <td style="padding-left: 20px;">(ii)</td> <td>Power supply and internal illumination.</td> <td style="padding-left: 20px;">2.5Sq.mm. minimum (shall be as per load requirement.)</td> </tr> </table>	(i)	Current (4-20 mA), low voltage signals (48V); Ammeter/Voltmeter circuit, control switches etc. for electrical system.	0.5 Sq.mm.	(ii)	Power supply and internal illumination.	2.5Sq.mm. minimum (shall be as per load requirement.)		
(i)	Current (4-20 mA), low voltage signals (48V); Ammeter/Voltmeter circuit, control switches etc. for electrical system.	0.5 Sq.mm.							
(ii)	Power supply and internal illumination.	2.5Sq.mm. minimum (shall be as per load requirement.)							
<p>8.00.00</p> <p>8.01.00</p> <p>8.02.00</p>	<p>INSTRUMENTATION CABLE INSTALLATION AND ROUTING</p> <p>All cables assigned to a particular duct/conduit shall be grouped and pulled in simultaneously using cable grips and suitable lubricants. Cables removed from one duct/conduit shall not be reused without approval of Employer.</p> <p>Cables shall be segregated as per IEEE Std.-422. In vertically stacked trays, the higher voltage cable shall be in higher position and instrumentation cable shall be in bottom tier of the tray stack. The distance between instrumentation cables and those of other system shall be as follows:</p>								
<p>VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION-VI PART-B</p>	<p>SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE</p>	<p>PAGE 13 OF 19</p>						

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<p>From 11 kV/6.6 kV/3.3 kV tray system - 914 mm</p> <p>From 415V tray system - 610 mm</p> <p>From control cable tray system - 305 mm</p>		
8.03.00	<p>Cables shall terminate in the enclosure through cable glands. All cable glands shall be properly gasketed. Fire proof sealing (to prevent ingress of dust entry and propagation of fire) shall be provided for all floor slots used for cable entrance. Compression cable glands (double for armoured and single for other cables) shall be provided.</p>		
8.04.00	<p>All cables shall be identified by tag. Nos. provided in Employer's approved format at both the ends as well as at an interval of 5 meters.</p>		
8.05.00	<p>Line voltage drop due to high resistance splices, terminal contacts, insulation resistance at terminal block, very long transmission line etc. shall be reduced as far as practicable.</p>		
8.06.00	<p>The cables emanating from redundant equipment/devices shall be routed through different paths. The above segregation of cables & wiring for redundant equipments/devices shall be in accordance with IEEE-Std-422.</p>		
9.00.00	<p>CABLE LAYING AND ACCESSORIES</p>		
9.01.00	<p>CABLE LAYING</p> <ol style="list-style-type: none"> 1 CABLES SHALL BE LAID STRICTLY IN LINE WITH CABLE SCHEDULE. 2 IDENTIFICATION TAGS FOR CABLES. INDELIBLE TAGS TO BE PROVIDED AT ALL TERMINATIONS, ON BOTH SIDES OF WALL OR FLOOR CROSSING, ON EACH CONDUIT/DUCT/PIPE ENTRY/EXIT, AND AT EVERY 20 M IN CABLE TRENCH/TRAY. 3 CABLE TRAY NUMBERING AND MARKING. TO BE PROVIDED AT EVERY 10M AND AT EACH END OF CABLE WAY & BRANCH CONNECTION. 4 JOINTS FOR LESS THAN 250 METERS RUN OF CABLE SHALL NOT BE PERMITTED. 5 BURIED CABLE PROTECTION WITH CONCRETE SLABS; ROUTE MARKERS AT EVERY 20 METERS 		
<p>VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION-VI PART-B</p>	<p>SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE</p>	<p>PAGE 14 OF 19</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<p>ALONG THE ROUTE & AT EVERY BEND.</p> <p>6 ROAD CROSSINGS</p> <p>CABLES TO PASS THROUGH BURIED HIGH DENSITY PE PIPES ENCASED IN PCC. AT LEAST 300 MM CLEARANCE SHALL BE PROVIDED BETWEEN</p> <ul style="list-style-type: none"> - HT POWER & LT POWER CABLES, - LT POWER & LT CONTROL CABLES - LT CONTROL & INSTRUMENTATION CABLES, <p>SPACING BETWEEN CABLES OF SAME VOLTAGE GRADE SHALL BE IN ACCORDANCE WITH THE DERATING CRITERIA ADOPTED FOR CABLE SIZING.</p> <p>7 SEGREGATION (PHYSICAL ISOLATION TO PREVENT FIRE JUMPING)</p> <p>A ALL CABLE ASSOCIATED WITH THE UNIT SHALL BE SEGREGATED FROM CABLES OF OTHER UNITS.</p> <p>B INTERPLANT CABLES OF STATION AUXILIARIES AND UNIT CRITICAL DRIVES SHALL BE SEGREGATED IN SUCH A WAY THAT NOT MORE THAN HALF OF THE DRIVES ARE LOST IN CASE OF SINGLE INCIDENT OF FIRE.</p> <p>8 CABLE CLAMPING</p> <p>ALL CABLES LAID ON TRAYS SHALL BE NEATLY DRESSED UP & SUITABLY CLAMPED/TIED TO THE TRAY. FOR CABLES IN TREFOIL FORMATION, TREFOIL CLAMPS SHALL BE PROVIDED.</p> <p>9 Optical fiber cables inside conduit shall be laid on cable trays wherever available and feasible. In areas where the same are required to be buried, the same shall be buried in separate trench approx.1.6 meter depth, to be laid in 2" GI/rodent proof HDPE conduits covered with sand, brick and soil along the pipe line route;</p> <p>While crossing roads - to be laid in GI/rodent proof HDPE conduits with sand filling at bottom and sand, soil filling at top with cement concrete;</p> <p>While crossing canals/river- to be laid in GI/rodent proof HDPE conduits within hume pipe.</p>			
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE	PAGE 15 OF 19	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
9.02.00	Bidder shall supply and install all cable accessories and fittings like Light Interface Units, Surge suppressors, Opto isolators, Interface Converters, Fibre Optic Card Cage, Fibre Optic Line Driver, Repeater / Modem (for Optical Fibre Cables), cable glands, grommets, lugs, termination kits etc. on as required basis.			
9.03.00	Bidder shall furnish two completely new sets of cable termination kits like Crimping tools, etc., which are required for maintenance of the system as per the type of termination used.			
9.04.00	Cables, which terminate in cabinets of draw out sections shall have sufficient cable coiled in the bottom of the cabinet to permit full withdrawal of draw out sections without disconnecting the cables. When prefabricated cables with factory connectors on both ends are longer than required, the excess cable shall be coiled in the bottom of one or both termination cabinets.			
9.05.00	No splices shall be made in conductors for instrument and control circuits except where required at connections to devices equipped with factory installed pigtailed. Such splices shall be made only in approved splicing boxes of fitting with removable cover. The splices shall be made with sufficient slack left in the wires to permit withdrawal of the splice from the splicing box for ease of future disconnection of the splices. All exposed conductor or connector surfaces shall be covered with a minimum of three half-lapped layers of all weather vinyl plastic electrical tape. Taping shall extend a minimum of two cable diameters over the cable jacket and a similar distance over the other insulation or connections requiring insulation.			
9.06.00	The Bidder shall be responsible for proper grounding of all equipment under C&I package. Further, proper termination of cable shields shall be verified and the grounding of the same shall be coordinated so as to achieve grounding of all instrumentation cable shields at same potential. This shall be completed prior to system tests. All the cables etc. required for grounding of all equipments supplied under this package are to be supplied by the Bidder.			
9.07.00	The Contractor shall take full care while laying / installing cables as recommended by cable manufacturers regarding pulling tensions and cable bends. Cables damaged in any way during installation shall be replaced at the expense of the Contractor.			
10.00.00	<p>FIELD MOUNTED LOCAL JUNCTION BOXES</p> <p>(i) No. of ways 12/24/36/48/64/72/96/128 with 20% spares terminals.</p> <p>(ii) Material and Thickness 4mm thick Fiberglass Reinforced Polyester (FRP).</p> <p>(iii) Type Door gasket shall be of synthetic rubber.</p>			
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE	PAGE 16 OF 19	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	(iv) Mounting clamps and accessories (v) Type of terminal blocks (vi) Protection Class (vii) Grounding (viii) Color	Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands and lugs required for erection shall be of brass, included in Bidders scope of supply. Raceways shall be provided inside JB's for proper termination of cables. Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm ² . A M6 earthing stud shall be provided. IP: 55 minimum for indoor & IP-65 minimum for outdoor applications. To be provided. To be decided during detailed engineering & subject to Employer's approval.		
11.00.00	CONDUITS			
11.01.00	Conduits shall be generally used for interconnecting cables from field instruments to Local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS: 9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant lead coated steel, water leak, fire and rust proof. The temperature rating of flexible conduit shall be suitable for the following areas. (i) Mills (ii) Drum (iii) Main steam, RH steam (iv) Air heater (v) Furnace, BFP DT's And for remaining applications, water leak, fire & rust proof flexible G.I conduits shall be provided.			
11.02.00	The Bidder shall install conduits according to the general routing as approved by Employer and shall coordinate conduit locations with other works.			
11.03.00	All grounding bushings within all enclosures shall be wired together and connected internally to the enclosure grounding lug or grounding bus with 8 AWG bare copper conductor. Conduit runs to individually mounted equipment shall be grounded to the Employer's cable tray grounding conductor with 12 AEG bare copper conductor. All			
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE	PAGE 17 OF 19	

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	grounding bushings, clamps and connectors shall be subject to approval of the Employer.		
11.04.00	All rigid conduit fittings shall conform to the requirements of IS: 2667, 1976. Galvanized steel fitting shall be used with steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fittings shall be compatible with the flexible conduit supplied.		
11.05.00	All individually mounted equipment and devices shall be connected to the supply conduit, using not more than one meter of flexible conduit adjacent to the equipment or device. Flexible conduit shall be installed in all conduit runs, which are supported by both building steel and structures subject to vibration or thermal expansion. This shall include locations where conduit supported by building steel enters or becomes supported by the turbine generator foundation and where conduit supported by building steel or foundation becomes supported by steam generator framing.		
11.06.00	Special areas, such as control rooms in which external noise is to be minimized, shall have flexible conduit in conduit runs where the runs cross from the main building framing to the control room framing.		
11.07.00	<p>Conduit supports shall be furnished and installed in accordance with these specifications. Support material shall comply with the following requirements.</p> <p>i) Hanger rods shall be 12 mm diameter galvanized threaded steel rods.</p> <p>ii) Single conduit supports shall be one-hole cast metal straps and clamp backs unless other types are acceptable to the Employer. Multiple conduit bank supports shall be constructed of special galvanized support channels with associated conduit clips.</p>		
11.08.00	Conduit sealing, explosion proof, dust proof and other types of special fittings shall be provided as required by these specifications and shall be consistent with the area and equipment with which they are installed. Fittings installed outdoors and in damp locations shall be sealed and gasketed. Hazardous area fittings and conduits sealing shall conform to NEC requirements for the area classification.		
11.09.00	Contractor shall provide double locknuts on all conduit terminations not provided with threaded hubs and couplings. Water tight conduit unions and rain tight conduit hubs shall be utilised for all the application which shall be exposed to weather. Moisture pockets shall be eliminated from conduits.		
11.10.00	Conduits shall be securely fastened to all boxes and cabinets.		
12.00.00	CABLE SUB-TRAY & SUPPORT		
12.01.00	The cable sub-trays and the supporting system, to be generally used between Local/Group JB's and the main cable trays and the same shall be furnished and		
VINDHYACHAL SUPER THERMAL POWER PROJECT STAGE-V (1X500 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI PART-B	SUB-SECTION-IIIC-07 INSTRUMENTATION AND POWER SUPPLY CABLE	PAGE 18 OF 19