NEYVELI LIGNITE CORPORATION LIMITED
(NLC LTD)

NEYVELI NEW THERMAL POWER PROJECT
2x500 MW LIGNITE FIRED UNITS AT NEYVELI
(STEAM GENERATOR PACKAGE)

PROJECT SPECIFIC
TECHNICAL SPECIFICATION FOR
ELECTRIC HOIST

SPECIFICATION NO.: PE-TS-400-563-A002

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERIING MANAGEMENT
NOIDA
INDIA

	Title	Specification no.: PE-TS-400-563-A002
	TECHNICAL SPECIFICATION FOR WIRE ROPE ELECTRICAL HOIST 2X500 MW NNTPS (SG)	Rev. 00
		Date: DEC 2014
		Sheet 1 of 1

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BHEL	**TECHNICAL SPECIFICATION FOR ELECTRIC HOIST 2X500 MW NNTPS (SG)**	SPECIFICATION NO. PE-TS-400-563-A002	
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VOLUME - IIB

SECTION – A

SCOPE OF ENQUIRY

SCOPE OF ENQUIRY

1.1 The specification is intended to cover design, engineering, manufacturing, inspection and testing, painting, supply/ delivery duly packed at FOR site including erection & commissioning spares, maintenance tools & tackles, mandatory spares, all accessories (isolating switch and power cable from isolating switch to DSL rails) including freight in line with drawings/ documents/ test procedures approved by BHEL/ Customer for ELECTRIC HOIST.

1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. **Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the contractor of the responsibility of providing such facilities to complete the supply of ELECTRIC HOIST.**

1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.

1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.

1.5 The general term and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.

1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification **within 10 days of receipt of tender documents.** In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.

1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed deviation schedule along with cost of withdrawal; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.

1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder /vendor and Customer/ Purchaser/Employer will mean BHEL and /or customer including their consultant as interpreted by BHEL in the relevant context.

VOLUME - IIB

SECTION – B

PROJECT INFORMATION
(PROJECT SPECIFIC)

SECTION - 2

2 GENERAL PROJECT INFORMATION

2.1 Introduction

The project site at Neyveli has distinct location advantages, being at pit-head distance from the source of lignite supply from Mines, making it convenient for transportation of lignite by belt conveyor. Water source is readily available from the nearby mines lake. Besides, other infrastructure such as access road, railway connection etc, already exist.

2.2 Power Plant Site

The power plant site is located at Neyveli, opposite to the now defunct Fertilizer and Briquetting & Carbonization Plant, near TPS-1 Expansion and TPS-II.

2.3 Project & Site Information

(i).	Owner/Purchaser	:	Neyveli Lignite Corporation Limited (NLC Ltd), Neyveli, Cuddalore District, Tamil Nadu State, India
(ii).	Consultant	:	Lahmeyer International (India) Pvt. Ltd (LII), Gurgaon, NCR, India.
(iii).	Project Title	:	2x500 MW Neyveli New Thermal Power Station (NNTPS)
(iv).	Location	:	200 kms south of Chennai and 50 kms south-west of Cuddalore
(v).	Latitude	:	11° 34′ 00″ N to 11° 35′ 00″ N
(vi).	Longitude	:	79° 26′ 00″ E to 79° 27′ 00″ E
(vii).	Elevation above MSL	:	+67 m
(viii).	Nearest Railway Station	:	Neyveli,
(ix).	Nearest Sea Port	:	Chennai, at a distance of 200 km
(x).	Nearest Airport	:	Chennai, at a distance of 200 km
(xi).	Road Access/Approach to Site	:	Connected by Chennai-Thanjavur NH 45C road and state highway connecting Cuddalore – Virudhachalam via Neyveli. Both NH and state high way roads are well connected to NLC township roads.The approach road is approximately 15 kms from Chennai–Thanjavur NH – 45C road
(xii).	**Site Meteorological Data**		
	• Max ambient temperature	:	42.8° C

	• Min Ambient Temperature	:	26.9° C
	• Wet bulb temp	:	29° C
	• Max. Relative Humidity	:	92 % in the month of September
	• Min. Relative Humidity	:	23 % in the month of May
	• Rainfall	:	About 1265.7 mm annually (average)
	• Wind direction	:	South West to North East direction
	• Wind Speed	:	97.2 km/hr (maximum recorded) 4.3 km/hr (average wind speed)
	• Seismicity	:	As per IS: 1893 (part 4) (Zone-II) Importance factor: 1.75.
(xiii).	Languages spoken in the region	:	English, Tamil

* * * * *

VOLUME - IIB

SECTION – C

SCOPE OF WORK

1.0.0 **SCOPE OF WORK**

1.1.0 **SUPPLIES**

1.1.1 Equipment and services to be furnished by the bidder for the **WIRE ROPE ELECTRIC HOIST** with accessories as per the details given in Annexure A, Commissioning spares as per Annexure B, mandatory spares as per Annexure II, Vol- IIB sec C. Any equipment / accessories not specified in the specification but required to make the hoist units complete and efficient shall also be under the bidder's scope of work.

Each hoist shall include all necessary items but shall not be limited to the following: -

1. Travelling Trolley
2. Hoisting mechanism (motor and gear box, wire rope, load hook and hook block)
3. Electrical equipment (control panel, motor, limit switches)
4. Flexible trailing cable for motor, brake, limit switches, etc.
5. Painting of hoist.
6. Power supply thru' DSL including current collector, brackets etc.
7. O & M Manual, drawings and documents.
8. Testing of hoist.
9. Main isolating switch and power cable from 1.5M above ground / operating floor.
10. Any equipment / accessories not specified here but required to make the equipment complete and efficient shall be under bidder's scope of work.
11. Commissioning spares
12. Isolating switch
13. Mandatory spares

1.1.2 Maintenance Tools and Tackles

One (1) complete unused new set of special purpose tools, tackles and accessories along with detailed instructions and maintenance manual shall be supplied. **Tools shall be of suitable sizes for maintenance of electric hoist of each type and capacity.** Each tool and wrench shall be stamped so as to be identified easy for its use. The tools shall be supplied in steel toolbox and with a copy of instruction manual. The items supplied shall be of the best quality, specially protected against rusting. The following shall be provided as minimum requirement:

S-No.	Description	Qty.
1	Complete set of ring spanners (Indicate the sizes offered)	1 Set**
2	Complete set of screwdrivers (Indicate the sizes)	1 Set**
3.	Adjustable Spanner	1 No.
4.	Insulated plier	1 No.
5.	Grease gun	1 No.
6.	Oil gun	1 No.
7.	Line tester	1 No.

(**) – Set shall comprise of complete range of spanners suiting requirement for various capacities of electric hoists.

Note: - The tools shall be supplied in one tool box .Bidder shall ensure that the tools & tackles mentioned in above list are sufficient to handle all sizes/capacities of hoists & in case any other /additional tool is required for handling/maintenance any size/capacity of hoist the same shall be included in this list.

1.1.3 Erection and commissioning spares.

The Bidder shall also supply erection & commissioning spares along with his main equipment as per Annexure A of Vol IIB, sec C. This shall form part of the main equipment supply.

Note:

Any Erection and Commissioning spares, if required over and above quoted items, the same shall be supplied by the vendor without any commercial implication to the purchaser

1.1.4 Mandatory Spares -

A complete unused and new set of Mandatory Spare parts shall be supplied. The items supplied shall be of the best quality and specially protected against rusting in tropical climate. The minimum requirement of mandatory spare parts is listed in Annexure –II section-C, volume II-B of this specification.

1.2.0 **Services to be provided by the bidder**

1.2.1. Packing and forwarding and transportation to site.

1.2.2. Erection and commissioning procedure shall be submitted by successful bidder for carrying out the erection and commissioning at site by customer.

1.3.0. Inspection and Testing

As per enclosed BHEL standard quality plan, NTPC inspection quality check requirement and as per IS 3938 (latest revision). Prime inspection agency shall be BHEL/End Customer. Equipment supplied shall be strictly in accordance with nomenclature & technical specification. Any additional testing requirement/ CHP(Customer Hold Point) at any stage of inspection deemed necessary by Customer/BHEL during detailed engineering shall be carried out without any commercial or technical implication.

1.4.0. **Drawing / design document for submission**

Drawing/design documents for submission and number of prints / copies required for various drawing and documents are listed in Annexure –V, section-C, volume II-B of this specification.

2.0.0. Works Excluded

2.1.0 Supply of ISMB monorail.

2.2.0 Purchaser shall provide single point 415V, 3 phase, and 50Hz power feeder at any point of the bay or in the middle of the bay. Vendor shall provide main isolating switch at 1.5 M above the ground / operating floor level and cable required from isolating switch to DSL.

Any other supply required by the bidder shall be arranged by the bidder himself, using suitable transformer as per the specification.

3.0.0. **Deviations**

If the offer submitted has got any deviation from the technical stipulations in the tender document, bidder shall tabulate the same in the appropriate “Schedule of Deviations” furnishing full particular of such deviations. Deviations are to be furnished [illegible] to specific clause number. Reasons / expla[illegible]

for such deviations shall be furnished. If there are no deviations from the tender document, bidder shall furnish NO DEVIATION CERTIFICATE regarding the same in the schedule of deviation attached with unpriced bid (also attached in Volume-III).

4.0.0. **Demonstration Guarantee**

Hoist along with its drives, controls and other accessories shall be demonstrated for the rated capacity against the rated speed of motions and for the service conditions specified as specified in QAP and as per IS 3938.

The bidder shall have the full responsibility for the safe and efficient operation of the hoist with associated accessories as a single unit.

If the shop performance tests indicate the failure of any of the components to achieve the guaranteed performance, the deficiency shall be made good at bidder's cost.

Demonstration tests shall be carried out each time after the rectification /modification is carried out.

5.0.0. **Make of Sub - Vendor items**

The make of bought out items shall be considered as per Annexure-I, section C, Volume II-B of the specification.

6.0.0 **Packing**

In general packing shall be wooden box packing.

7.0.0 **Painting**

Refer attachment – "Painting Requirements" in Volume-IIB, Section-C.

8.0.0 **OTHER REQUIREMENTS**

Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.

	2X500 MW NNTPS (SG)		Rev 00			
	SCOPE OF ELECTRIC HOIST				Annexure A	
A	Electric wire rope hoist					
S. No.	**Equipment to be Handled/Area**	Capacity (T)	Height of lift (m)	Travel (m)	Qty (FOR 2 UNITS)	Type of path
1	AHU (for SG area)	3	6	10	2 (1 per AHU room)	Straight
2	DMCW pump/Motor (SG Aux.)	5	9	8.5	2	Straight
3	Boiler MCC room	3	9	5	2	Straight
4	ESP control room at 3.7 m level	10	9	5	2	Straight
5	AC PLANT ROOM 2	3	8	20	1	Curved
List of Commissioning Spares – Annexure-B						
Sl.no	Description	Total quantity required	Unit			
A	for 3T capacity electric hoist.	3	Sets			
I)	Overload Relay					
ii)	Limit Switch					
iii)	Fuse Link					
B	for 5T capacity electric hoist.	1	Sets			
i)	Overload Relay					
ii)	Limit Switch					
iii)	Fuse Link					
C	for 10T capacity electric hoist.	1	Sets			
I)	Overload Relay					
ii)	Limit Switch					
iii)	Fuse Link					

ANNEXURE-I
MAKES OF SUB VENDORS ITEMS

S.N.	ITEM	MAKES
1.0	STEEL	SAIL/TISCO/ JINDAL
2.0	HOOKS	KARACHIWALA/ SMRITI FORGING / Steel Forging & Engg. Co., Kolkata
3.0	GEAR COUPLINGS	ALLIANCE / HICLIFF / OEM
4.0	WIRE ROPE	USHA MARTIN/ Bharat wire rope/FORT WILLIAMS
5.0	BEARINGS	SKF/ FAG/ TATA/ NBC
6.0	MOTORS	SIEMENS/NGEF/CROMPTON-Ahmednagar /KIRLOSKAR-Hubli, Bangalore / BHARAT BIJLI-Mumbai / ALSTHOM / ABB-Faridabad
7.0	BRAKES	ELECTROMAG /SPEED-O- CONTROL / EMCO LENZE/PETHE/BCH
8.0	CONTACTOR	SIEMENS / L&T /TELE MECHANIQUE / BCH
9.0	OVER LOAD RELAYS	SIEMENS / L&T / TELE MACHANIQUE / ABB
10.0	HRC FUSES	SIEMENS / L&T/ GEII/ L&T
11.0	ISOLATING SWITCH	SIEMENS/ L&T / CONTROL & SWITCH GEAR
12.0	SWITCH FUSE UNITS	SIEMENS/ L&T/ CONTROL/ & SWITCH GEAR
13.0	TIME DELAY RELAYS	SIEMENS/ L&T/ ABB/ BCH/ TELEMECHANIQUE
14.0	TRANSFORMERS	INDCOIL / LOGICSTAT / PRAGATI / PRAYOG KAPPA / SOTHERN ELECTRIC / AUTOMATIC ELECTRIC / PRECISE ELECTRICALS / SILKAAN
15.0	BULB & FLOURESCENT TUBES/FITTINGS	PHILIPS/ BAJAJ/ CROMPTON (Except electric ballast)
16.0	CABLE LUGS (HEAVY DUTY)	DOWELLS / UML ENGINEERING
18.0	LIGHTING SWITCHES	ANCHOR / ELLORA
19.0	CABLES	
a)	POWER CABLES	NICCO / UNIVERSAL / INCAB / FORT GLOSTER TORRENT / CCI / ICL / RADIANT/POLYCAB/KEI
b)	CONTROL CABLES	NICCO / UNIVERSAL / INCAB / FORT GLOSTER TORRENT / CCI / ICL / RADIANT/POLYCAB/KEI
c)	FLEXIBLE TRAILING CABLES	NICCO / UNIVERSAL / POLYCAB / KEI
20.0	Cable gland	COMMET / SUNIL&CO. / ARUP ENGINEERING
21.0	PUSH BUTTONS	SIEMENS / L&T / BCH
22.0	LIMIT SWITCHES	SPEED-O-CONTROL / ELECTROMAG
24	SAFETY SWITCHES	ALSTHOM / L&T / SIEMENS
25	PENDENT PUSH BUTTON STATION	OEM
26	INDICATING LAMPS	TECKNIC / BCH / SIEMENS / STANDARD
27	MCB	MDS / INDO COPP / STANDARD
28	PANELS	OEM
31	INSULATORS & COPPER CONDUCTORS	BHEL APPROVED MAKE
32	CASTINGS	KOLHAPUR STEEL / GNAT FOUNDRY / KIRTI ALLOYS
34	SHROUDED DSL	SUSHEEL / STROMAG

NOTE :- Bidder to note that the list of sub-vendor shall be adhered to, any addition/ deletion of sub-vendor by Customer during detail engineering will not call for any Commercial implication.

ANNEXURE II

LIST OF MANDATARY SPARES TO BE SUPPLIED

	Electric Hoist (for each capacity Hoists)	
1	**Mechanical**	
i)	1st input pinion assly.	1no.each type for all drives
ii)	Brake shoe liner	6 pair each type
iii)	CT wheel assly. Complete (driving)	1 no. each type
iv)	CT wheel assly. Complete (idle)	1 no. each type
v)	Oil seal	4 nos. each type
vi)	Rope guide	2 nos. each type
vii)	Rope sheave assly. With brgs	1 no. each type
2	Electrical	
i)	Star-delta contactors	Min. 1 no. of each type
ii)	Overload relay	2 nos of each type
iii)	Fuses	30% of each rating
iv)	Relay/Timers	3 nos. of each type
v)	Push buttons	30% of each rating
vi)	Diode bridge	20% of each rating
vii)	Switch fuse unit	2 nos. of each rating
viii)	Brake coil	30% of each rating
	MOTORS (To be repeated for each type & rating)	
i	Bearing (driving end)	1 No. of each type
ii	Bearing (Non-driving end)	1 No. of each type
iii	End shield (DE and NDE)	1 set of each type
iv	Cooling fan of motors	1 No. of each type
v	Fan cover	1 No. of each type
vi	Lubrication oil pump motor	1 No. of each type and rating
vii	Bearing puller	1 Nos. of each type
viii	Grease gun	2 Nos.
ix	Special spanners/tools	1 Set

Note:
1. “One (1) no.” and “One (1) set of each type & size” is defined as 100% requirement for one electric hoist for the entire electric hoist of similar size & capacity.

	MANUFACTURERS NAME & ADDRESS		STANDARD QUALITY PLAN				PROJECT					
	AS PER APPROVED VENDOR LIST		ITEM:	ELECTRIC WIRE ROPE	QP NO		PACKAGE			WIRE ROPE ELECTRIC HOIST		
					REV	0	CONTRACT No					
					DATE	Dec-14	CONTRACTOR			BHEL		
					PAGE	1 of 4						

Sl.No	COMPONENT & OPERATIONS	CHARACTERISTICS	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*	AGENCY M	AGENCY C	AGENCY N	REMARKS
1	2	3	4	5	6	7	8	9		**	10		11
1.0	**RAW-MATERIALS**												
1.1	a) STRUCTURAL MATERIAL b) RAW MATERIAL FOR HOIST AND GEAR BOX HOUSEING, TROLLEY PLATE (AS APPLICABLE)	MECH. , CHEM. PROPS	MA	CHEMICAL COMPOSITION AND TENSILE STRENGTH	1 / lot	APPD. DRG./ DATA SHEET	APPD. DRG./ DATA SHEET	Mill.s TC	√	V	V	V	Test shall be carried out in absence of mill TC
1.2	GEARS, SHAFT/AXLES, WHEELS	MECH , CHEM. PROPS	MA	CHEMICAL COMPOSITION, HARDNESS (DURING IN-PROCESS)	I / LOT	APPD. DRG./ DATA SHEET	APPD. DRG./ DATA SHEET / IS:3938	LAB. REPORT / MANUFACTURER'S TEST CERTIFICATE	√	P	V	V	In case the items are not manufactured in-house, the manufacturer's test certificate shall be submitted for chemical
		U.T FOR DIA/THK > 50mm	CR	NDT	100%	ASTM A 388	NOTE 4	INSPN. REPORT	√	P	**V**	V	
1.3	WIRE ROPE	Dimensional CHECK	MI	Dia.	100%	APPD. DRG./ DATA SHEET	APPD. DRG./ DATA SHEET	MFRS' TEST CERT.	√	P	V	V	
		BREAKING LOAD CAPACITY	CR	BREAKING LOAD	100%	APPROVED DRG/DATA SHEET / IS:3938 / IS: 2266	APPROVED DRG/DATA SHEET AND / IS:3938 / IS:2266	MFRS' TEST CERT.	√	P	V	V	
1.4	HOOKS	PHYS./ MECH. , CHEM. PROPS.	MA	CHEMICAL COMPOSITION, HARDNESS	I / LOT	APPROVED DRG/DATA SHEET / IS:3938 / IS:15560	APPROVED DRG/DATA SHEET / IS:3938 / IS:15560	MFRS' TEST CERT.	√	P	V	V	
		U.T IF SHANK DIA > 50mm	CR	NDT	100%	ASTM A 388	NOTE 1	INSPN. REPORT	√	P	W	V	**SHANK PORTION ONLY**
		PROOF LOAD CAPACITY	CR	PROOF LOAD TEST	100%	APPROVED DRG/DATA SHEET / IS:3938 / IS:15560	APPROVED DRG/DATA SHEET ≠ IS:3938 / IS:15560	INSPN. REPORT	√	P	W	V	
		DP AFTER PROOF LOAD	CR	NDT	100%	ASTM E-165	NO CRACKS	INSPN. REPORT	√	P	V/W	V	
2.0	**IN-PROCESS**												
2.1*	WELDING PROCEDURE SPECIFICATION	CORRECTNESS	MA	SCRUTINY	100%	IS:7307 / ASME SEC IX	IS:7307 / ASME SEC IX	FORMAT OF IS / ASME SEC IX		P	V	V	
2.2*	PROCEDURE & WELDER QUALIFICATION	WEDLING PARAMETRES	MA	PHYS. TESTS/RT	100%	IS:7310 / ASME SEC IX	IS:7310 / ASME SEC IX	AS PER ASME SEC IX	√	P	W	W	IN CASE OF LLOYDS / EIL / TPL QUALIFIED WELDERS AVAILABLE, REQUALIFICATION OF WELDER IS NOT REQUIRED

LEGNDS

* RECORDS INDENTIFIED WITH 'TICK'(√) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION

** M: MANUFACTURER/SUBCONTRACTOR

C: CONTRACTOR NOMINATED INSPECTION AGENCY(BHEL) N: CUSTOMER

INDICATE 'P' PERFORM"W" WITNESS AND "V" VERIFICATION AS APPROPRIATE " CHP" CUSTOMER SHALL IDENTIFY IN COLUMN"N"

MANUFACTURER/ SUB CONTRACTOR	CONTRACTOR	REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY &SEAL
SIGNATURE			

	MANUFACTURERS NAME & ADDRESS	STANDARD QUALITY PLAN				PROJECT		2X500 MW NNTPS (SG)			
	AS PER APPROVED VENDOR LIST	ITEM:	ELECTRIC WIRE ROPE	QP NO		PACKAGE		WIRE ROPE ELECTRIC HOIST			
				REV	0	CONTRACT No					
				DATE	Dec-14	CONTRACTOR		BHEL			
				PAGE	1 of 4						

Sl.No	COMPONENT & OPERATIONS	CHARACTERISTICS	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*	AGENCY M	AGENCY C	AGENCY N	REMARKS
1	2	3	4	5	6	7	8	9		** 10			11
2.3*	WELD SET UPS	DIMENSIONS	MA	MEAS. , VISUAL	100%	WPS, APPD. DRG.	WPS, APPD. DRG.	INSPN. REPORT		P	V		
2.4*	WELDMENTS –FINAL RUN	SURFACE DEFECTS	MA	PT	100%	IS:3658 / ASTME:165	ASME SEC. VIII DIV. I	INSPN. REPORT	√	P	**V**	V	
2.5	**TRUNION / TROLLEY WHEELS**, GEARS PINION	SURFACE & INTERNAL FLAWS (**FOR DIA. / THICKNESS >50MM)**	MA	PT / **UT**	100%	ASTME:165	NO LINEAR DEFECTS / **NOTE-4**	INSPN. REPORT	√	P	W	V	
2.6	NDT OF LOAD BEARING BUTT WELDS (**IF ANY)**	WELD QUALITY OF a)Butt weld on tension 100% RT and 100% DPT b)Butt weld oncompression 10% RT and 100% DPT c)Butt weld on rope drum 100% RT and 100% DPT d) Fillet weld - Random 10% DPT	CR	PT & RT	100%	ASME SEC. VIII DIV. I	ASME SEC. VIII DIV. 4 . CLUW-51 FOR RT APPENDIX -8 FOR PT	INSPN. REPORT ND FILM	√	P	V	V	FILMS TO BE REVIEWED BY BHEL & Customer. DPT SHALL BE CHP FOR Customer & BHEL
2.7	**GEAR BOXES**												
	COMPLETE ASSEMBLY	OVERALL DIMENSIONS	MA	MEAS.	100%	MFG. DRG.	MFG. DRG.	INSPN. REPORT	√	P	V		
	Gear shall be checked for reduction ratio, backlash & contact pattern.	CHECK FOR OIL LEAKAGE, VIBRATION, NOISE TEMP. RISE	MA	NO LOAD RUNNING FOR TWO HOURS	100%	MFG. DRG.	MFG. STD.	- DO -	√	P	V	V	
2.8	**ELECTRICALS**												
1	MOTORS	TYPE TESTS (INCLUDING DEGREE OF PROTECTION)	MA	TYPE TESTS	1 / TYPE, 100%	IS:3938	IS:3938	MFRS' TEST CERT., INSPN REPORT	√	P	V	V	
		ROUTINE TESTS		ROUTINE TESTS	100%	IS 325	IS 325	DO	√	P	V	V	
2	RESISTANCES (IF APPLICABLE)	TEMPERATURE RISE	MA	VERTIFICATION OF MNFRS' TEST CERT.	100%	IS:3938, RELV. ISS	IS:3938, RELV. ISS	MFRS' TEST CERT.	√	P	V	V	
3	CONTROLLER, LIMIT SWITCHES (IF APPLICABLE)	ROUTINE TESTS	MA	ROUTINE TEST	100%	IS:6975/TECH. SPEC.,	IS:6875/TECH. SPEC.,	MFRS' TEST CERT.	√	P	V	V	Rating and make to be verified.
4	BRAKES	ROUTINE TESTS	MA	ROUTINE TEST	100%	TECH. SPEC. / IS:15560	IS:3938/TECH. SPEC.	MFRS' TEST CERT.	√	P	V	V	
5	BRAKE DRUM (IF APPLICABLE)	VERIFICATION OF HT CHARTS, HARDNESS (IF APPLICABLE)	MA	VISUAL, HARDNESS TEST	100%	APPD. DRGS./TECH. SPC.	APPD. DRGS./TECH. SPEC.	HT. CHART /INSPN. REPORT	√	P	V	V	
6	CONTACTOR	ROUTINE TESTS	MA	ROUTINE TEST	100%	IS:2959 AND TECH. SPEC., IS:6547 / IS:3938	IS:2959 AND TECH. SPEC., IS:6547 / IS:3933	INSPN. REPORT	√	P	V	V	Rating and make to be verified.
7	CONTROL PANEL, PENDANT SWITCH	* FIXING OF COMPONENTS WIRING MARKING CONTINUITY * FUNCTIONAL TEST * IR & H.V. TEST * IP - PROTECTION TEST * PAINT SHADE, THICKNESS, SHEET THICHKNESS	MA	VISUAL	100%	APPD.DRG. WIRING DIAGRAM,	APPD. DRG. WIRING DIAGRAM,	INSPN. REPORT	√	P	V	V	BOUGHT OUT ITEMS AS PER BHEL / CUSTOMER APPROVAL LIST

LEGNDS

* RECORDS INDENTIFIED WITH 'TICK'(√) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION

** M: MANUFACTURER/SUBCONTRACTOR

C: CONTRACTOR NOMINATED INSPECTION AGENCY(BHEL) N: CUSTOMER

INDICATE 'P' PERFORM"W" WITNESS AND "V" VERIFICATION AS APPROPRIATE " CHP" CUSTOMER SHALL IDENTIFY IN COLUMN"N"

MANUFACTURER/ SUB CONTRACTOR	CONTRACTOR	REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY &SEAL
SIGNATURE			

	MANUFACTURERS NAME & ADDRESS		STANDARD QUALITY PLAN				PROJECT	2X500 MW NNTPS (SG)
	AS PER APPROVED VENDOR LIST		ITEM:	ELECTRIC WIRE ROPE	QP NO		PACKAGE	WIRE ROPE ELECTRIC HOIST
					REV	0	CONTRACT No	
					DATE	Dec-14	CONTRACTOR	BHEL
					PAGE	1 of 4		

Sl.No	COMPONENT & OPERATIONS	CHARACTERISTICS	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*	AGENCY M	AGENCY C	AGENCY N	REMARKS
1	2	3	4	5	6	7	8	9		** 10			11
8	CABLES	TYPE AND ROUTINE TESTS	MA	TYPE & ROUTINE TESTS	100%	AS PER TECH. SPEC. IS:1554/IS:9968- PART - I / IS:694 / RELEVANT IS FOR FRLS CABLES	AS PER TECH. SPEC. IS:1554/IS:9968-PART - I / IS:694	MNFRS' TEST CERT.	Ó	P	V	V	
3.0	FINAL INSPECTION												
3.1	COMPLETELY ASSEMBLED HOIST	1. COMPLETENESS, CORRECTNESS, OVERALL DIMENSIONS	MA	VISUAL, MEAS	100%	APPD. DRG.	APPD. DRG.	MNFRS' TEST CERT.	√	P	W	V	
3.2	ASSEMBLED HOIST PERFORMANCE	1. LOAD TEST	CR	LOAD TEST at SWL	100%	IS:6547 / IS:3938	IS:6547 / IS:3938	MNFRS' TEST CERT.	√	P	W	V	
		2. HOISTING & LOWERING SPEED, PERFORMANCE OF CONTROLLERS SWITCHES CONTRACTORS, RELAYS AND OTHER CONTROL DEVICES CORRELATIONS OF CIRCUITS AND INTERLOCKS AND SEQUENCES OF OPERATION	CR	MEAS & VISUAL	100%	IS:6547 / IS:3938, TECH SPEC.	TECH SPEC.	MNFRS' TEST CERT.	√	P	W	V	
		3. OPERATION OF ALL PROTECTIVE DEVICES	CR	VISUAL	100%	TECH SPEC	TECH SPEC.	MNFRS' TEST CERT.	√	P	W	V	
3.3	OVER LOAD TEST	1. OVER LOAD	CR	TEST AT 125 % OF-SWL	100%	IS:6547/IS:3938	IS:6547/IS:3938	INSPN. REPORT	√	P	W	V	
4	PAINTING												
1	PRIMER & FINISHING AND SHADE	1. TO RELEVANT IS	MI	CORRECTNESS OF MFG. TEST CERT.	EACH CONSIGN MENT	DRG. & DATA SHEET & RELV. IS SPEC.	DRG. & DATA SHEET & RELV. IS SPEC.	MNFRS' TEST CERT.		P	V		
	NOTE:												
	*** 1.0 Clause from 2.1 to 2.4 shall be applicable for load bearing welded joints.**												
	2.0 Back Wall Echo shall be adjusted to 100% of Full Screen Height in sound (Defect Free) Area. Defect Echo Height more than 20% of Screen Height shall be treated as unacceptable. Back Wall Echo shall not be less than 80% of Screen Height in any case.												

			LEGNDS		
			* RECORDS INDENTIFIED WITH 'TICK'(√) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION		
			** M: MANUFACTURER/SUBCONTRACTOR		
MANUFACTURER/ SUB CONTRACTOR		CONTRACTOR	C: CONTRACTOR NOMINATED INSPECTION AGENCY(BHEL) N: CUSTOMER		
			INDICATE 'P' PERFORM"W" WITNESS AND "V" VERIFICATION AS APPROPRIATE " CHP" CUSTOMER SHALL IDENTIFY IN COLUMN"N"		
SIGNATURE				REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY &SEAL

ANNEXURE IV

PAINTING

TABLE OF CONTENTS

11.1 General

1. The term "Painting" referred herein covers rust preventive, preventive and decorative coating along with surface of the following areas.
   a) All Mechanical equipment, Technological structures, chutes, piping, ducts etc.
   b) Various types of static and rotary equipment inclusive of electric motors etc.
   c) Steel tanks and vessels
   d) Pipe work including trestles, supports, hangers, etc.
   e) Metallic duct work such as ventilation ducts, gas ducts including supports, hangers, etc.
2. Surfaces made of aluminium, brass, bronze, stainless steel, cast iron and other corrosion resistant alloys are not required to be painted unless specified except for identification bands or for aesthetic purposes.
3. All machined mating surfaces (e.g. flanges) will be properly cleaned, greased and protected before despatch.
4. The complete paint system for any item includes the following basic activities:
   a) Proper surface preparation
   b) Application of primer coats
   c) Application of intermediate coats
   d) Application of finished coats

All the above coats will be of quality paint products and the scope of work will also include supply of all paint materials as per specification.

11.2 Painting for mechanical & electrical equipment, mechanical structures, piping, ducts etc.

1. This section covers the painting requirements for the equipments, structures, piping, duct etc. and any other surface required to be painted for all the equipments in the section-1 of this specification.
2. Codes and Standards

   Painting of equipment will be carried out as per the specifications indicated below and will conform to the relevant IS specification for the material and workmanship.

   The following Indian Standards may be referred to for carrying out the painting job:

Table 11.1
Codes and Standards for Painting

S.No	Code	Description
1.	IS:5	Colours for ready mixed paints and enamels
2.	IS 1303	Glossary of terms relating to paints

S.No	Code	Description
3.	IS 2379	Colour code for identification of pipelines
4.	IS 1477	Code of practice for painting of ferrous metals in buildings (Parts I & II)
5.	IS 2524	Code of practice for painting of non-ferrous metals in buildings (Part I & II)
6.	IS 2395	Code of practice for painting of concrete, masonry and plaster surfaces (Part I & II)
7.	IS 2338	Code of practice for finishing of wood based materials (Parts I & II)
8.	IS 6278	Code of practice for white washing and colour washing
9.	IS 3140	Code of practice for painting asbestos cement building products
10.	IS 158	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting
11.	IS 2074	Ready mixed paint, air drying, red oxide, Zinc Chrome, priming
12.	IS 104	Ready mixed paint, brushing, Zinc Chrome, priming
13.	IS 2932	Enamel, synthetic, exterior (a) undercoating (b) finishing specification.

3. **Preparation Of Surfaces**

a) Surface preparation being a pre requisite for any paint application, will be such as to clean the surface thoroughly of any materials which will be conducive to premature failure of the paint substrates and the surface preparation will be as per the painting scheme elaborated subsequently.

b) Solvent cleaning (SP 1)

The surface will be cleaned by wiping, immersion, spraying or vapour contacting of a suitable solvent or washing with an emulsion or alkaline solution to remove oil, grease, dirt, old paint, etc. Solvent cleaning will not remove rust, scales, mill scales or weld flux. Therefore, before application of paint, solvent cleaning will be followed by other cleaning procedures as stated below.

c) Hand tool cleaning(SP2)

The surface will be cleaned by vigorous wire brushing done manually to St-2 quality. This method effectively removes loosely adherent materials, but would not affect residues of rust or mill scales that are intact and firmly adherent.

d) Power tool cleaning(SP3)

The surface will be cleaned by electric or pneumatic tools to St-3 quality. The tools will be used carefully to prevent excessive roughing of surface and formation of ridges and burns. This method will remove

loosely adherent materials but would not affect residues of rust or mill scales that are firmly adherent.

e) Blast cleaning (SP4)

The surface will be cleaned by impingement of abrasive materials, at high velocity created by clean and dry compressed air blast. This method will remove loosely adherent materials as well as adherent scales and mill scales. Prior to application of blast, heavy deposit of oil and grease are removed by solvent cleaning and excessive surface scales are removed by hand tools or power tool cleaning. The surface will be cleaned to Sa-2 1/2 quality (SP 4) which means that to 95% of surface area is free from all rust, mill scales and visible residues, foreign materials, etc. The blast cleaning is not recommended for sheet metal work.

f) Blast cleaning (SP5): In this process the surface will be cleaned to 35 to 50 Microns.

4. **Primer Paints (P)**

After the surface is prepared in a manner acceptable to Owner/ consultant, two (2) coats of Primer paints will be applied only on dry and clean surfaces. Second coat of red oxide primer will be applied only after first coat has dried up completely. Coating of primer will in general conform to IS:2074-92 and will be applied by brushing to ensure a continuous film without "holidays".

a) Primer paint P1: (Epoxy based)

A two pack air drying epoxy polyamide resin based red oxide –zinc phosphate (primer):

Epoxy content (% wt)	15 to 18
Air drying time	About 30 minutes (touch dry) Over night (hard dry)
Dry film thickness (DFT/coat)	30 microns (min)
Temperature resistance	Upto 120°C dry heat

b) Primer paint P2 (Epoxy based)

A two pack air drying epoxy polyamide with zinc dust of at least 92% zinc dust on the dry film.

Epoxy content (% wt)	8 to 10
Air drying time	About 10 minutes (touch dry) 2 hours (hard dry)
Dry film thickness (DFT/coat)	40 microns (min)
Temperature resistance	Upto 300°C dry heat

c) Primer paint P3 (Ethyl zinc silicate, EZS, based)

A two pack heavy duty zinc dust rich silicate primer:

Total solids (% wt)	84 + 2

Air drying time	16 hours
Density	3.07 + 0.005
Dry film thickness (DFT/coat)	60 microns (min)
Temperature resistance	Upto 450°C dry heat

d) Primer paint P4 : Double boiled linseed oil as per IS – 77 : specification for linseed oil, boiled for paints

e) Primer paint P5: In organic Zinc silicate with suitable air drying time. 40 microns per coat

f) Primer paint P6 : Red oxide Zinc phosphate as per IS 12744 with DFT 30 microns per coat

g) Primer paint P7 : Red oxide Zinc chrome primer(alkyd based) as per IS 2074 with DFT 40 microns per coat

5. **Intermediate paints (I)**

These paints will be applied over primer coats as an intermediate layer to provide weather proof seal of primer coats.

a) Intermediate paint (I1)

A two pack air drying high build epoxy resin based paint with MIO.

Air drying time	6 to 8 hours (touch dry) 7 days (full cure)
Dry film thickness (DFT/coat)	100 microns
Temperature resistance	Upto 180 deg.C dry heat
Compatible with	Primer P1 and P2

Intermediate Paint I2: Synthetic Enamel (long oil alkyd) to IS 2932, 1 coat = 20 Microns per coat.

6. **Finish Paint (F)**

Finish paint coats will be applied over primer coats and intermediate coats after proper cleaning and touch up of primed coats. Synthetic enamel paint comprising of IS: 2932-95 will be used for finish coats.

a) Finish paint (F1)

A two pack air drying epoxy polyamide enamel suitably pigmented.

Air drying time	2 to 3 hours (touch dry) 7 days (full cure)
Dry film thickness (DFT/coat)	40 microns
Temperature resistance	Upto 130°C dry heat
Compatible with	Primers Intermediate
Color	Generally all shades

b) Finish paint (F2)

A single pack synthetic rubber based enamel paint.

Air drying time	2 hours (touch dry)

	24 hours (hand dry)
Dry film thickness (DFT/coat)	25 microns
Temperature resistance	Upto 200°C dry heat
Compatible with	No primers
Color	Generally all shades

c) Finish Paint F3

A single pack heat resistant silicon resin based paint with leafing aluminium.

Air drying time	3 to 4 hours (touch dry) 24 hours (hard dry)
Dry film thickness (DFT/coat)	20 microns (min)
Temperature resistance	upto 400°C dry heat
Compatible with	no primer paint except P3
Colour	smooth aluminium

d) Finish Paint F4: Heat resistant Alumina Paint IS 13183 Gr II, DFT 20 microns per coat.

e) Finish Paint F5: Heat resistant Silicone Aluminium Paint with suitable air drying time as per IS 13183 Gr I, 25 microns per coat.

f) Finish Paint F6: Aliphatic acrylic polyurethane paint, DFT = 30 microns per coat.

g) After cleaning the dust on the dried up primer/ intermediate paint, first coat of synthetic enamel will be applied. After this first coat dries up hard, the surface is wet scrubbed cutting down to a smooth finish and ensuring that at no place the first coat is completely removed. After allowing the water to get evaporated completely, the second finish coat of synthetic enamel paint will be applied only after gently removing the gloss of first coat from entire surface and it is dusted off the surfaced. The requirement of workmanship will be as per IS: 1477-71.

h) Equipment No. and the name of the equipment will be painted on the surface of the equipment on visible locations. Service of the Pipe/Line designation with arrow identification for the direction of flow will be painted on all pipes at visible locations at an interval of 20 metres. Wherever pipelines are insulated, the service of the piping and arrow mark will be painted over the clad surface.

i) The color code to be followed during painting of piping will be in line with IS 9404:2002 (Identification of pipelines used in Thermal Power Plants – Color Code).

j) For painting of structure, equipment, tanks & vessels etc. suggested color code is given in Table 11.3.

k) For insulated pipeline the finish paint will be applied at that place where color band is to be painted on the aluminium sheeting. The finished paint (color band) will be of 2m length at that place.

l) Color band for piping will be applied at these following locations-
- At start and end point.
- At every 50m intervals.
- At every T joints and cross connection of piping.
- At every battery limit of pipeline.
- Near valves located at terminal points.

m) Width of band

Table 11.2

Width of band

S.No.	Size of pipe including insulated pipe line outside diameter	Width of band
1	80mm and below	25 mm
2	Above 80 mm upto 150 mm	50 mm
3	Above 200 mm upto 300 mm	75 mm
4	Above 350 mm	100 mm

n) Direction of flow will be indicated by black or white arrow in contrast to the base color on the pipeline. Length of the arrow will be minimum 125 mm and width will be minimum 65 mm. These will be put at an interval of 10 m.

7. **Suggested Colour Codes for Painting of Structures, equipments, tanks & vessels etc.**

Table 11.3

Colour of Specific Items

S.No.	Item / Service	Colour	IS-5	Colour Band	IS-5
1.	Structures, platforms, galleries, ladders and handrails	Dark admiralty grey	632	-	-
2.	Boiler casing, ESP and ducting	Nut Brown	413	-	-
3.	Fans, pumps, motors, compressors, Mills.	Light grey	631	-	-
a)	Outdoor ,Stand pipes, vent pipes	Aluminium	-	-	-
b)	Indoor Tanks	Aluminium	-	-	-
4.	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
5.	Switchgear	Light grey	631	-	-

S.No.	Item / Service	Colour	IS-5	Colour Band	IS-5
6.	MCC/PDB, Local control panels, Bus Ducts	Light grey	631/7078 of IS:1650	-	-
7.	Transformers	Dark admiralty grey	632	-	-
8.	Machinery guards	Signal red	537	-	-
9.	Water System				
a)	Boiler feed	Sea green	217	-	-
b)	Condensate	Sea green	217	Light brown	410
c)	D M Water	Sea Green	217	Light orange	557
d)	Soft water	Sea green	217	French blue	166
e)	Bearing cooling water	Sea green	217	French blue	166
f)	Potable & filtered water	Sea green	217	French blue	166
g)	Service & clarified water	Sea green	217	French blue	166
h)	Raw water(if applicable)	Sea green	217	White	-
i)	Cooling water	Sea green	217	French blue	166
10.	Compressed Air System				
a)	Service air	Sky Blue	101	-	-
b)	Instrument air	blue	101	White	-
11.	Oil system				
a)	Fuel oil	Light brown	410	French	166
b)	Light oil	Dark Brown	412	Brilliant green	221
c)	Lubricating oil	Light brown	410	Light grey	631
d)	Control oil	Light brown	410	Light orange	557
e)	Transformer oil	Light brown	410	Light orange	557
12.	Fire services	Fire red	536	-	-
a)	Ash slurry pipes	Black	-	-	-
b)	Vacuum pipes	Sky blue	101	Black	-
c)	Fuel pipes (Lignite)	Light brown	410	-	-
d)	Drainage	Black	-	-	-
e)	Stand pipes and all Vent pipes	Aluminum	-	-	-
f)	Bottom Ash system	Light Grey	631	-	-

8. **Paint Application**

a) Paint will be applied in accordance with manufacturer's recommendations. The work will generally follow IS 1477 (Part II) for jobs carried out in India and SSPC-PA-I or DIN 55928 or equivalent for jobs carried out outside India. Touch up paint to be applied to cover scratches after erection and assembly of equipment at site.

b) Paint will not be applied when the ambient temperature is 5°C and below. Also paint will not be applied in rain, wind, fog or at relative humidity of 80% and above.

c) Each coat of paint will be continuous, free of pores and of even film thickness without thin spots. The first coat of finish paint at site will be applied preferably within three months of the shop paint.

d) Each coat of paint will be dry sufficiently before application of next coat.

e) Surface which cannot be painted but require protection will be given a coat of rust inhibitive grease according to IS:958-75 or solvent deposited compound according to IS:1153-75 or IS:1674-60.

f) Surfaces which will be inaccessible after assembly will receive minimum coats of specified primer. Surfaces to be in contact with wood, brick or other masonry will be given one shop coat of the specified primer.

g) Parts of steel structure to be embedded in concrete will be given a protective coat of Portland cement slurry immediately after fabrication and thoroughly cleaning the surfaces from grease, rust, mill scales etc. No paint will be applied on this part.

h) The Contractor will furnish paint manufacturer's test report or technical data sheet pertaining to the paint selected. The data sheet will indicate among other things the relevant standards, if any, composition in weight percent of pigments, vehicles, additives, drying time, viscosity, spreading rate, flash points, methods of application quality of surface preparation required, corrosion resistance properties and colour.

i) Rust preventive coating should be given to HSFG bolt and nut threads.

j) Machined surfaces/weld edges are to be applied with a coating of temporary rust preventive oil.

k) All threaded and other surfaces of foundation bolts ands its materials, insulation pins, anchor channels, sleeves will be coated with temporary rust preventive fluid and during execution of civil works; the dried film of coating will be removed using organic solvents.

l) No painting is required for stainless steel components.

m) The temporary rust preventive coating that already been applied on any components, tubes, pipes etc., will be removed by suitable solvents/ heating to 350-400°C for an hour before primer paint application-but, in case, it should be ensured that the minimum surface cleanliness required for primer paint application will be Sp2 (equivalent to hand tool cleaning).

n) In components, where ver plates/sheets of thickness less than or equal to 5mm, pipes, rods are used, power tool / hand tool cleaning to SP3/SP2 will be followed and the painting will be done as per the painting scheme adopted for components that are coming in the flue gas path.

o) All weld edge preparation for site welding will be applied with one coat of weldable primer.

p) For internal protection of pipes/tubes, VCI pellets will be used at both ends after sponge testing and ends capped. VCI pellets will not be used for SS components and composite assemblies.

q) Wherever inside surfaces of ducts need protection till erection, two coats of red oxide zinc phosphate primer (P1) paint to IS 12744 to a DFT of 60 microns will be applied after power tool cleaning.

9. **Painting scheme**

a) Type of paint products like P1, P2, P3,P4,P5,P6,P7, I1, I 2,F1, F2 and F3,F4,F5,F6 has been specified elsewhere in the specification.

b) For a complete painting scheme of any item being painted, all types of paints are to be procured from the same manufacturer as approved by the Owner.

10. **Legends**

Sa - 2 .5 – The quality of surface cleaning, i.e 95 % of the surface area is free from all rust, mill scales and visible residues, foreign materials etc.

SP1-Solvent Cleaning

SP2- Hand tool cleaning

SP3 – Power tool cleaning

SP 4: Blast cleaning (Sa 2.5)

SP 5: Blast cleaning (35 to 50 microns surface cleaning)

SP 6 – Phosphating

SP - surface preparation quality

2P1 - Two (2) coats of primer paint type P1

1I1 - One (1) coat of intermediate paint type I1

2F1 - Two (2) coats of finish paint type F1

DFT - Dry film thickness

CRT - Clean and retouch.

The painting scheme to be followed for various mechanical/ electrical equipment / structures is briefly given below for guidance to the Contractor.

Table 11.4

Painting Scheme and Total DFT in Microns

S.No.	Description	Painting scheme		Total DFT in Microns
		At shop	At site	
1.	Steel structures (for Boiler Proper, Lignite bunkers, Mills, mill maintenance building, Air heaters, aux. boiler, Fans, ESPs, etc)	SP-Sa 2 ½ 2P1 + 1I1	2 F1	240
2.	Separator and separator vessel	a) Surface preparation : Power tool cleaning to St-3 grade b) 2 coats of alkyd red oxide zinc phosphate primer to IS 12744 DFT 30 micron per coat c) 3 coats of long oil alkyd synthetic enamel finish paint (International Orange) to IS 2932 – DFT 20 microns / coat (min) d) Total DFT 120 microns (min)	-	120
3.	Separator internals	SP 1 or SP 3 Rust preventive fluid of DFT = 25 µ/coat		25
4.	Following insulated parts viz., Piping,fitting/components, Pipe clamps, vessels/tanks, Equipments and ducts etc	SP 3 2P1, Total DFT – 60 microns P1 = pack of air drying alkyd red oxide zinc phosphate primer to IS 12744 – 2 coats, 30 microns per coat. Total DFT 60 microns (minimum)	-	60
5.	Following un insulated parts viz., Piping, fitting/ components, Pipe clamps, vessels/tanks, Equipments and ducts etc	a) Surface preparation : Power tool cleaning to St-3 grade b) 1 coat of alkyd red oxide zinc phosphate primer to IS 12744 DFT 30 micron per coat	1F2	70

S.No.	Description	Painting scheme		Total DFT in Microns
		At shop	At site	
		c) 2 coats of long oil alkyd synthetic enamel finish paint to IS 2932 – DFT 20 microns / coat (min) d) Total DFT 70 micron (min)		
6.	Constant load hangers (CLH) & Variable Load hanger(VLH)	SP-Sa 2 ½ 1P2+1 F6	-	70
7.	Hangers mentioned other than (6) above	a)Surface preparation : Power tool cleaning to St-3 grade b) 1 coat of alkyd red oxide zinc phosphate primer to IS 12744 DFT 30 micron per coat c) 2 coats of long oil alkyd synthetic enamel finish paint to IS 2932 – DFT 20 microns / coat (min) d) Total DFT 70 micron (min)	-	70
8.	Valves			
9.	Cast carbon steel valves Cast alloy steel valves, API valves, QCNRV, SV and SRV, Silencers and soot blower components	SP3 2F4	-	40
10.	Forged valves	a)Surface preparation : Solvent cleaning to SSPC-SP1 Grade. b) Phosphating to 16.15 g/sq.m.		-
11.	Top covers of Soot blower	a)Surface preparation : Power tool cleaning to St-3 grade b) 1 coat of alkyd red oxide zinc phosphate primer to IS 12744 DFT 30 micron per		70

S.No.	Description	Painting scheme		Total DFT in Microns
		At shop	At site	
		coat c) 2 coats of long oil alkyd synthetic enamel finish paint to IS 2932 – DFT 20 microns / coat (min) d) Total DFT 70 micron (min)		
12.	Floor grills, hand rails and posts, ladders / rungs	Hot dip galvanizing to 610 gms/sq.m	-	-
13.	(a)Components coming in the flue gas path like water walls	a)Power tool cleaning to St- 2 / 3 b) One coat of dip – coat paint – Red oxide zinc phosphate primer (dip / brush) DFT = 30 microns		30
	(b)Components coming in the flue gas path, Surfaces in the flue gas path of ESP, Fans and APH	a) Power tool cleaning to St- 2 / 3 b) Two coats of dip – coat paint – Red oxide zinc PO4 to IS 12744DFT = 30 microns per coat		60

Note! For components not covered above, Contractor's standard practice will be followed with Owner's / Consultant's approval.

*****

ANNEXURE-V

DRAWINGS/ DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT

The successful bidder shall submit the following drawings / documents during detail engineering for customer's approval /information:

Sl. No.	BHEL DRG.NO	DRAWING TITLE	REMARKS	SUBMISSION SCHEDULE - WEEK NUMBER FROM DATE OF LOI
1	PE-V0-400-563-A100	Manufacturing Quality Plan with Sub vendor list	APPROVAL	2
2	PE-V0-400-563-A101	GA Drawing for Electric Hoist, DSL arrangement and painting details	APPROVAL	3
3	PE-V0-400-563-A102	Schematic Circuit Diagram	APPROVAL	3
4	PE-V0-400-563-A103	Mechanism Sizing Calculation	APPROVAL	3
5	PE-V0-400-563-A104	Detailed BOM/BOQ for crane	INFORMATION	4
6	PE-V0-400-563-A105	O & M Manual	INFORMATION	6
7	PE-V0-400-563-A106	Mandatory spares list	APPROVAL	6
8	PE-V0-400-563-A107	Erection procedure	INFORMATION	6

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order..

2. Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.

3. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:-

   a) All drawings and documents shall indicate the list of all reference drawings including general arrangement.

   b) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.

   c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.

   d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.

   e) Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C… etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3 ….etc.

DOCUMENT MANAGEMENT SYSTEM

1.0 Bidder to note that BHEL reserves the right for drawing/document submission through web based Document Management System. Bidder would be provided access to the DMS for drawing/document [illegible]val and adequate training for the same. Detailed methodology would be finalized during the kick-off [illegible]ng. Bidder to ensure following at their e[illegible]

- **Internet explorer version – Minimum Internet Explorer 7.**
- **Internet speed – 2 mbps (Minimum preferred).**
- **Pop ups from our external DMS IP (124.124.36.198) should not be blocked.**
- **Vendor's Internal proxy setting should not block DMS application's link (http://124.124.36.198/wrenchwebaccess/login.aspx).**

DRAWING/DOCUMENT DISTRIBUTION LIST

All documents & drawings shall be in English and in metric units

SI		LII	NLC (HQ)	NLC-SITE	BHEL SITE	PMG BHEL	PEM/ UNITS/ PSSR	REMARKS
1	Master list of drawings / document (duly indicating schedule of submission)	Soft copy	Soft copy	Soft copy		Soft copy	Soft copy (S)	
2	Drawings / document for Approval/Information (First Submission)	Soft copy + 2 prints	Soft copy + 3 prints	Soft copy + 1 print		Soft copy	Soft copy (S)	
3	Return with comments/approval	Soft copy (S)	Soft copy	Soft copy		Soft copy	Soft copy	
4	Drawings / Documents for approval (second & subsequent submissions till approval)	Soft copy	Soft copy	Soft copy		Soft copy	Soft copy (S)	
5	Drawings / documents for distribution (Approved by NLC, in cat. 1 or Received for Information)	Soft copy + 2 print (HQ+ Site)	Soft copy + 3 prints	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
6	Erection Drawings / documents	-	Soft copy + 1 print	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
7	As built Drawings / documents	Soft copy + 1 print	Soft copy + 1 print	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
8	Operation & Maintenance Manual	-	Soft copy + 1 print	Soft copy + 10 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
9	Type Test Certificate	Soft copy	Soft copy + 1 print	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	

NOTES:

1. The above schedule of submission does not include Docs/Drgs. of quality assurance/inspection and delivery/dispatches. QAP documents to be submitted as per distribution schedule.
2. Date of submitting soft copy is to be taken as date of submission.
3. S – Source for generation of document.

NLC technical requirement

13.8 Electric Hoist

13.8.1 Scope Of Work

Scope of work of the Contractor will consist of design, manufacture, inspection, assembly, and painting at manufacturer's shop as well as at site after erection, supply and transportation to site, unloading and re-conservation at site, erection testing & commissioning of Electric hoist/ Manual hoists of suitable capacity for maintenance of the equipment in the following buildings as given below:

1. Fuel oil Unloading and pressurizing pump house
2. Boiler Area
   a) I.D Fans & motors
   b) F.D Fans& motors
   c) Seal air Fans & Motors
   d) Mills & Gearboxes
   e) Air heater areas (Steam coil air pre heaters and rotary air pre heaters)
   f) Boiler water circulation pumps

ESP Transformer rectifier sets

4. Air conditioning and Ventilation system.

5. Any other equipments requiring handling facilities.

Manual Hoist will be provided for weight more than 400 kg to 1000 kg. Electric hoist will be provided for weight more than 1000 kgs. For lift more than 6 meters with weight more than 400 kg Electric hoist will be provided. Hoists will be provided with all accessories like driving motor, driving gear, limit switches, cables, supporting fixtures etc.

(1).Technical Specification

a) The hoist will be designed in accordance with IS: 3938-1983.

b) For outdoor hoists, motors, brakes & other equipment will be covered to suit to outdoor operations.

c) All Electric hoists will be pendent operated.

d) Power supply will be through flexible trailing cables, which will be clamped with PVC or non-metallic clamps.

e) Power isolator will be provided at operating height.

f) Defects in the materials like fractures, cracks, blowholes, or laminations are not allowed.

g) No cast iron parts will be used except for electrical equipments and no wood or combustible material will be used unless specifically mentioned otherwise.

h) All working parts requiring replacements or inspection or lubrication will be easily accessible without the need for dismantling of other equipment or structure.

i) All bolts except those with nyloc nuts will be provided with grip lock nuts or spring washer.

j) All parts of the hoist will be thoroughly cleaned of all loose mill scales, rust or foreign matter & then painted as specified. All parts inaccessible after assembly will be painted before assembly & assembled while paint is still wet.

k) All hoists will be provided with maintenance / repair platforms with handrails and staircase at one end. Requirement of maintenance platforms in places where there are layout constraint will be decided on case to case basis.

l) All parts except motors, resistors, gears, thrustors, solenoids, etc. will be de-rusted manually & suitably painted taking into consideration corrosive atmosphere.

(2).Mechanical details

a) Wheel & drive

The electric hoist will run on two pairs of wheels, a pair of which will be driven by motor through reduction gear. The wheels will be of cast steel/forged steel, single flanged with taper / parallel treads to suit to monorail. The wheels will be mounted on anti-friction bearings & will be easily removable for repair & replacement. The wheel diameter will be selected such that skidding does not take place even under unloaded condition.

b) Hoist mechanism

The hoist mechanism will consist of a bottom block fitted with a standard forged swivel hook of the specified capacity, supported on 2 or 4 falls of wire rope. However, non-spinning type of wire rope will be used for 2 falls rope arrangement. The wire rope will be wound on a grooved drum which will be sufficiently long to accommodate in one layer the length of rope requisite for the specified equipment, in addition not less than two turns at each anchored end and one spare groove at the opposite end. The hoist drum will be motor driven through gears enclosed in oil filled reduction gearbox.

c) Gearing

Straight & helical spur gearing will be used for all motions. Worm & bevel gears will not be used with specific permission from purchaser. Preferably all first reduction gears will have single helical teeth. All gears will be hardened & tempered alloy or carbon steel with machine out teeth. Surface hardening of teeth is not acceptable. All gears will be enclosed in oil filled gear box except when not possible.

d) Couplings

Each motor will be connected to its gear drive by a flexible coupling.

e) Lubrication

All gears & bearings will be lubricated either by splash lubrication or by grease. If possible, all the lubricating points will be grouped together in easily accessible positions.

f) Bearings

Ball & roller antifriction bearings of reputed make will only be used, with minimum bearing life as per IS: 3938.

g) Brakes

D.C. Electromagnetic brake will be provided for each motion, however in case of conical rotor motors manufacturer's standard brake can be used.

h) The Electric hoists will be inspected as per IS: 3938 - 1983 and as specified in GCC.

(3). Electrical Details

i) **Scope of supply**

Contractor's scope of supply will include the following:

- DSL/Festooned cable arrangement for power supply to the hoist.
- Power cable junction box (fixed)
- Flexible festoon cable system with supporting rollers and guide rail for power cable and for control cable/DSL power supply system with bend tracks.
- Electrical panel housing main power disconnecting switch with fuses, main line contactor, control transformer with cutouts on primary and secondary sides, individual mechanism motor control units & set of power & control terminals. DC supply for DC brakes & speed control system (if employed), corresponding AC/DC converter & speed control devices are also to be included in the panel.
- Drive motors
- Brakes
- Limit switches
- Power & Control cables for fixed wiring & hoist unit.
- Pendant control station with suspension control posts.
- Necessary erection and installation accessories required for wiring & start up
- Power Isolator at operating height

ii) **Power supply condition**

The power supply will be 415V ± 10%, 3 phase, 50 Hz +/-5%, AC 4 wire with solidly earth neutral. The following voltage will be used in the hoist:

- 415 volts, 3 phase, 50 Hz – for motors
- 110 volts, single phase, 50 Hz- for electrical circuit of pendant control /control posts.
- DC for DC electromagnetic brakes.
- The different voltages mentioned above, other than 415V, 3 phase, 50 Hz will be obtained through individual separate transformers & transformer rectifier units connected to 415 V.
- Each transformer will be provided with tapping at ± 5% & ± 10% on the secondary. One pole of the central supply will be earthed.
- Electrical system will be designed for a fault level of 50 KA for 1 second.

iii) **Power supply collection and distribution**

Power supply for the hoist will be collected form the DSL/festoon cable system. Necessary isolators, HRC fuses, magnetic contactors, DC sources, overload relays, reversing contactors, transformers, transformer rectifier sets, speed control mechanism / Variable frequency drive and any

other equipment required will be included in the scope. The control panel will be located in suitable approachable location.

All drive motors will be controlled with individual magnetic reversing type contactors. The reversing contactors for individual motors will be interlocked. The control scheme adopted will ensure smooth normal speed lowering/hoisting & travel as specified.

iv) Pendant Push Button Station

The Pendant Push Button Station will comprise of following push buttons & indicating lamps

- Start & Stop
- Trolley travel To & Fro
- Hoist & Lower
- Red lamp will indicate supply ON.

v) Limit switches

Hoist/travel motion will be provided with limit switches to limit the ultimate positions of the hook & hoist block. The limit switches will conform to the requirements specified in IS:3938/International standards.

vi) Motors

All motors will be totally enclosed fan cooled enclosure IP-55, squirrel cage induction type and suitable for hoist duty. Hoist motor and other drives will have minimum 60 starts/hour. For technical details regarding motors, Volume-IV (Electrics) may be referred.

vii) Brakes

Separate suitable electromagnetic brakes, operated through direct current will be provided for each motor-driven mechanism.

Brakes will be designed as per the latest edition of IS:3938/International standards.

viii) Wiring

Fixed wiring on the hoist block will comply with following requirement:

All cables will be installed with adequate protection against mechanical damage and damage from weather. Alternatively, multi-core armoured power & control cables, suitably clamped, may be used. Suitable clamps should be provided at both ends of each multi-core cable.

All power& control cables will be tagged at both ends(as per approved drawings) for quick identification.

ix) Enclosure class

All electrical equipments like motors, junction boxes, electrical panel, limit switches, brakes, etc. will be provided with enclosure class IP-55 and will have features for individual item as applicable and indicated in EOT cranes.

x) Cables

The cables for power connection on the hoist block up to electrical panel will comprise multi-strand FRLS PVC insulated & sheathed, copper conductor ,1.1 KV grade cables and will have a minimum cross sectional area of 4 sq. mm of copper.

Conductor for control cables from electric hoist to electrical panel will be made of copper with standard construction & with a sectional area not less than 2.5 sq. mm. Flexible cables will be of finely stranded copper conductor having a min. conductor section of 4 sq. mm copper for power circuits & 2.5 sq. mm for control circuits. Cable will generally conform to the specification as detailed in Electrical Volume (Volume-IV of TA1-SG portion of the Contract).

(4).Documentation

1. **Drawings and documents to be submitted by the Contractor during detailed engineering:**

   The Contractor will submit adequate sets of following technical drawings & technical data/ information during detailed engineering for cranes.

   a) General arrangement drawings of the Hoist with all technical parameters & details.

   b) Duly filled in questionnaire.

2. **List of Drawing/ Documents to be furnished by the Contractor for approval / reference**

   a) General arrangement drawing of equipment showing full details in plan and sections.

   b) Quality assurance plan for inspection.

   c) Specification of oils and lubricants and other consumables and their quantity and frequency of change (reference)

   d) Detailed layout plan and sections for power supply system.

3. **List of Drawings/ Documents to be furnished along with equipment by the Contractor**

   a) GA drawings, complete assembly and sub assembly drawings of the equipment.

   b) Engineering and design calculations.

   c) Motor data sheets/ characteristic curves

   d) Electrical schematic diagrams.

   e) Test and warranty certificate for each item of equipment.

   f) Test reports and inspection reports.

g) Instruction manuals for testing and commissioning.

h) Operation, maintenance and safety manuals.

i) Requirement of tools and tackles, if any, for subsequent maintenance.

j) All other drawings and documents as stipulated in General Conditions of Contract.

VOLUME- IV
SECTION-2,
MOTOR

TABLE OF CONTENTS

1 GENERAL

This specification is intended to cover the design, Engineering, manufacture, assembly, testing at manufacturer's works, supply in properly packed condition for transport to site and delivery of Electric Motor complete with all accessories for efficient and trouble-free operation of 2 x 500 MW New Thermal Power Plant at Neyveli, Tamilnadu for Neyveli Lignite Corporation Limited.

2 CODES & STANDARDS

All equipment and materials will be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) / IEC as given below except where modified and/or supplemented by this specification.

Code		Name of standard
IEC: 60034-1	:	Rotating electrical machines.
NEMA. MG-1	:	Motors and Generators
ISO : 1940-1	:	Mechanical vibration – Determination of permissible residual unbalance
IS : 325	:	Specification for three phase induction motor.
IS : 900	:	Code of Practice for installation and maintenance of induction motors
IS : 996	:	Single phase AC motors
IS : 1231	:	Dimensions of three-phase foot-mounted induction motors
IS : 1271	:	Thermal evaluation and classification of electrical insulation.
IS : 2223	:	Dimensions of flange mounted ac induction motors.
IS : 2254	:	Dimensions of vertical shaft motors for pumps
IS : 3043	:	Code of practice for earthing.
IS : 3177	:	Crane duty motors

Code		Name of standard
IS : 4029	:	Guide for testing three phase induction motors.
IS : 4691	:	Degree of protection for enclosures of rotating electrical machinery.
IS : 4722	:	Specification for rotating electrical machinery.
IS : 4728	:	Terminal marking and direction of rotation for rotating electrical machinery.
IS : 4889	:	Methods of determination of efficiency of rotating electrical machines.
IS : 5571	:	Guide for selection of electrical equipment for hazardous areas.
IS : 6362	:	Designation of Method of Cooling of Rotating electrical machines.
IS : 8223	:	Dimensions and output ratings for foot mounted rotating electrical machines with frame numbers 355 to 1000.
IS : 8789	:	Values of performance characteristics for three phase induction motors.
IS : 12065	:	Noise level of motors.
IS : 12075	:	Measurement and evaluation of vibration of rotating electrical machines.
IS : 12615	:	Induction motors - Energy efficient, three-phase, squirrel cage - Specification
IS : 12802	:	Temperature rise measurement of rotating electrical machines
IS : 12824	:	Type of duty and classes of rating assigned.

Code		Name of standard
IS : 14222	:	Requirements and method of Impulse withstand test
DIN/IEC/IS	:	RTD
BS 5308 part II	:	RTD triad Cable

Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted will be furnished during detail engineering.

The electrical installation will meet the requirements of Indian Electricity Rules as amended up to date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work will be followed.

3 DESIGN CRITERIA

All motors shall be suitable for an ambient temperature of 50 degree C and relative humidity of 85%. The motors shall be suitable for operation in a highly polluted environment.

AC Motors shall be of constant speed, squirrel cage, three/ single phase, induction type. Motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity.

DC motors provided for emergency service shall be shunt / compound wound type. Motor shall be sized for operation with fixed resistance starter for maximum reliability.

Power supply for AC motors shall be as follows:

•	Description		Supply
•	Below 0.22 kW	:	240V, 1 Phase, 50Hz
•	From 0.22 kW up to & including 160 kW	:	415V, 3 Phase, 50Hz
•	Above 160 kW up to & including 750 kW	:	3.3kV, 3 Phase, 50Hz
•	Above 750 kW	:	11KV, 3 Phase, 50Hz

All AC motors shall be suitable for following voltage & frequency variations as follows:

•	Description		Supply variation
•	Voltage Variation	:	(±) 10%
•	Frequency Variation	:	(+) 3% to (-)5%
•	Combined Variation of Voltage & Frequency	:	10% (absolute sum)

The motor characteristics will match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.

Moreover, motors will 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.

For 11kV motors, locked rotor current not to exceed 600% of full load including positive tolerance, except for ID fan motor without VFD.

For ID fan motor without VFD, the starting current shall not be more than 450% of FLC.

For 3.3 kV and 415 V motors Locked rotor current not to exceed 600% of full load with IS tolerance.

Maximum continuous motor ratings shall be at least 15% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.

Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.

The motors will be suitable for bus transfer schemes provided on the 11KV, 3.3kV and 415V systems without any injurious effect on its life. If motors are connected to an automatic bus transfer system, they may be subjected to 150% of the nominal voltage during changeover of buses due to the phase difference between the incoming voltage and motor residual voltage. In such cases, Motors will be capable of restarting under full load after momentary loss of voltage.

Motors shall be of energy efficient of type Eff-2 as per IS: 12615/equivalent IEC/ International Standards.

Motor will be designed to keep torsional and rotational natural frequencies of

Vibration of the motor and driven equipment at least 25% above the motor operating speed range.

System Grounding

(a)	11 kV , 3.3 kV	:	Low Resistance Grounded to limit the earth fault current to 300 Amps
(b)	415 V	:	Solidly Grounded
(c)	220V DC	:	Ungrounded

Fault Level

(a)	11 kV , 3.3 kV	:	40 kA for 1 second
(b)	415 V	:	50 kA for 1 second
(c)	220V DC	:	15 kA for 1 second

Degree of Protection

(a)	Indoor Motors	:	IP 54
(b)	Outdoor Motors	:	IP 55
(c)	Cable Box located in Indoor Area	:	IP 54
(d)	Cable Box located in Outdoor Area	:	IP 55

Winding Insulation

(a)	For 11 kV/3.3 kV AC Motors	:	Class - F
(b)	For 415V AC Motors	:	Class - F
(c)	For 220V DC Motors	:	Class - F

Winding Conductor Material

(a)	For 11 kV/3.3 kV AC Motors	:	Copper
(b)	For 415V AC Motors	:	Copper
(c)	For 220V DC Motors	:	Copper

Bearing

(a)	For Drive End	:	Roller
(b)	For Non Drive End	:	Roller / Ball

Temperature Rise

(a)	For Air Cooled Motors	:	70 °C over ambient temperature
(b)	For Water Cooled Motors	:	80 °C over inlet cooling water temperature

Motor Earthing

(a)	Motors above 90 kW	:	50 x 6 mm GI Flat
(b)	Motors above 30 kW and up to 90 kW	:	25 x 6 mm GI Flat
(c)	Motors above 5 kW and up to 30 kW	:	25 x 3 mm GI Flat
(d)	Motors up to 5 kW	:	8 SWG GI Wire
(e)	Terminal Box	:	8 SWG GI Wire

Space Heater

(a)	For Motors 30 kW rating and above	:	Space heater suitable for 1Phase, 240V AC, 50 Hz supply
(b)	For Motors below 30 kW	:	No Space heater required

rating.

Painting

(a)	Paint Type	:	Epoxy based with approved class
(b)	Paint Thickness	:	Within 100 to 150 micron.

4 SPECIFIC REQUIREMENTS

4.1 Locked Rotor Withstand Time

HT Motor

- The locked rotor withstand time for HT motors under hot conditions at 110% rated voltage will be more than the starting time at minimum permissible voltage by at least three seconds or 15% of the accelerating time whichever is greater.
- Provision of speed switches will be avoided to the extent possible. In case speed switch is required to mount on the motor shaft, the same will remain closed for speeds lower than 20% and open for speeds above 20% of the rated speed. The speed switch will be capable of withstanding 120% over speed in either direction of rotation.

LT Motor

- The starting time of the motor will be at the minimum permissible voltage.
- For motors with starting time up to 20 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit will be at least 2.5 second more than starting time.
- For motors with starting time more than 20 second and up to 45 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit will be at least 5 second more than starting time.
- For motors with starting time more than 45 seconds at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit will be more than starting time by at least 10% of the starting time.
- Speed switches mounted on the motor shaft will be provided in cases where above requirements are not met.

4.2 Starting Voltage Requirement

(a)	85% up to 1500 kW
(b)	80% for above 1500 kW up to 4000 kW

(c) 75% > 4000 kW

Motor will be designed for direct on line starting at full voltage.

The motor will be capable of withstanding the stresses imposed if started at 110% rated voltage.

H.T Motor will start with rated load and accelerate to full speed with 80% rated voltage at motor terminals except for mill motors for which 90% RV will be the minimum starting voltage. L.T Motor will start with rated load and accelerate to full speed with 85% rated voltage at motor terminals.

Pump motor subject to reverse rotation will be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% rated speed in reverse direction.

The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.

The motor will be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.

4.3 Winding and Insulation

(a)	Type	:	Non-hygroscopic, oil resistant, flame resistant
(b)	11 kV and 3.3 kV AC motors	:	Winding material shall be of copper. Insulation shall be of Class F with winding temperature rise limited to Class B. They shall withstand 1.2/50 microsecond switching surges of "4U+5 KV" (U=Line voltage in KV). The coil inter-turn insulation shall be suitable for 0.3/3 micro second surge of 32 / 12 KV followed by 1 min power frequency high voltage test of appropriate voltage on inter turn insulation.
(c)	415V AC & 220V DC	:	Winding material shall be of copper. Insulation shall be of Class F with temperature rise limited

	motors	to Class B.
(d)	Conveyor motors	Short circuit rings of conveyor motors shall be either joint less or welded type. Brazed joint is not acceptable.

4.4 **Motor Control**

(a) **For HT Motors**

- Motors of rating above 160 kW and up to 750 KW shall be suitable for 3.3 KV voltage
- Motors above 750 KW shall be suitable for 11 KV voltage.
- Frequent starting motors of rating above 160 kW to 750 kW shall be suitable to be controlled by vacuum contactors

(b) **For LT Motors**

Motors of rating 90 KW and up to 160 KW shall be operated by Air circuit breakers from PCC/ PMCCs and shall be provided with comprehensive numerical motor protection relays

Motors of rating less than 90 kW shall be operated by Contactor from respective intelligent MCCs as below:.

- Motors of rating up to 18.5 KW shall be provided with MPCBs, Electronic overload relays etc.
- Motors rated above 18.5 KW and below 45 KW shall be provided with MCCBs Electronic overload relays etc
- Motors of rating 45 KW and above but less than 90 KW shall be provided with MCCBs, CT operated Electronic over load relays etc

4.5 Starting duty

Motors will be suitable for 3 nos. consecutive Cold starts up and 2 nos. consecutive Hot starts up. Motors will be suitable for three equally spread starts per hour when the motor is under normal service condition. However in case of multiple start motors like conveyor motors three starts will be allowable from hot condition with maximum 20 starts per day and minimum 20,000 starts during life time of motor.

4.6 Bearings

- Anti-friction type radial and thrust bearings (ball, roller) and sleeve bearing will be rated for minimum standard life of 40,000 hours taking bearing and driven equipment loads (in case the drive is not having separate thrust bearing) into account. If bearings are lubricated, loss of grease will be scarce and it will not creep along shaft into motor housing. Facility of removal of excess grease will also be provided for grease lubricated bearings.
- Vertical shaft motors will be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. However, if Anti-friction bearings can take vertical thrust, thrust & guide bearings are not required.
- Bearing will be effectively sealed against dust ingress and will be pressure grease gun lubricated. The bearing and housing will be so designed that greasing will be possible while the motor is running, without removal of covers.
- Where bearing supports are attached to the motor casing, adequate bracing will be provided on these supports to reduce vibrations and ensure life of bearings.
- If the bearings are oil lubricated, a drain plug will be provided for draining residual oil and oil level gauge will be provided to show precisely oil level required under standstill and running conditions.
- Unless otherwise approved, bearing lubricating system will be such that no external forced oil or water is necessary to maintain required oil supply to keep bearing temperature within design limits.
- Lubricants will be selected for prolonged storage and normal use of motors in tropical climate and will contain corrosion and oxidation inhibitors. Greases will have suitable bleeding characteristics to minimize setting. The selected lubricants will be indigenously available.
- Motors rated above 1000 kW will have insulated bearings to prevent flow of shaft currents.

4.7 Temperature Rise

- For Air Cooled Motors, temperature rise of insulation should be limited to 70 Deg C over ambient temperature by resistance method.
- For Water Cooled Motors, temperature rise of insulation should be limited to 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method.

4.8 Cooling

All motors will be either Totally Enclosed Fan Cooled (TEFC) or Totally Enclosed Tube Ventilated (TETV) or Closed Air Circuit Air Cooled (CACA) type. However, motors rated 3000 kW or above can be Closed Air Circuit Water Cooled (CACW).

4.9 Enclosure

- All motor enclosures will conform to the degree of protection of IP54 for indoor and IP-55 for outdoor installation unless other wise specified. Motor for outdoor or semi outdoor service will be of weather proof construction. Motors of large output rating located indoor could have screen protected drip proof (SPDP) enclosure conforming to IP-23.
- For motors located in outdoor & corrosive locations, FRP canopy will be provided. In case steel canopy is provided, the same will be epoxy painted to meet the surrounding atmosphere. Motors located in hazardous areas will have flame proof enclosures conforming to IS: 2148 as detailed below:

- Fuel oil area : Group – IIB

4.10 Noise Level and Vibration

- Noise level will be limited to 85 dB (A) at 1.5 meters from the motor. However the same will be as per IS: 12065 unless otherwise specified. The peak amplitude of vibration will be within the specified limits laid down in IS: 12075. Motors will withstand vibrations produced by driven equipment. HT motor bearing housings will have flats in both X and Y directions suitable for mounting 80mmX80mm vibration pads. Vibration pads with screwed holes for mounting vibration probes will be provided at both DE and NDE.

4.11 Temperature Monitoring

In HT motors, at least four numbers simplex/ two numbers duplex platinum resistance type temperature detectors will be provided for each phase of stator winding. Each bearing will be provided with dial type thermometer with adjustable alarm contact and two numbers duplex Platinum resistance type temperature detector (3 wire 100ohm at zero deg C). In case of CACA and CACW motors dial type temperature indicator will be provided (one each for hot and cold air temperature monitoring for CACA and CACW and one each for inlet and outlet water temperature monitoring for CACW). If alarm and trip are required for cooling air temperature, temperature switch will be provided. The contact rating will be minimum 0.5A at 220V DC and 5A at 240V AC. Flow switches will be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing. The contact rating will be minimum 0.5A at 220V DC and 5A at 240V AC.

4.12 Earthing

Motor body will have two earthing points on opposite sides. Motor terminal boxes will also have separate grounding terminals.

4.13 Termination

- HT motors can be offered with either Elastimold termination or dust tight phase segregated double walled (metallic as well as with insulated barrier) cable boxes. In case Elastimold terminations are offered, then protective cover and trifurcating sleeves will also be provided. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) will be provided in case of cable boxes. The main cable box / terminal box shall withstand a fault current up to 40 kA for 0.25 seconds for MV motors and 50 kA for 0.25 seconds for LV motors. Separate terminal boxes will be provided for space heaters and RTDs.
- All the terminal boxes except phase segregated terminal of main terminal box will be capable of being turned through 360 degrees in steps of 90 degrees.
- For HT motors the distance between gland plate and the terminal studs will not be less than 500 mm.
- Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

Table 4.1

Minimum inter-phase & Phase earth air Clearances

S.No	Motor MCR in kW	Clearance, in mm
1	Up to 110kW	10
2	Above 110 and Up to 150kW	12.5
3	Above 150kW	19

4.14 Differential Protection

- For motors rated 11kV, 1000 KW & above, neutral current transformers of PS class will be provided on each phase in a separate neutral terminal box for differential protection.

4.15 Tropical Protection

- All motors will have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

- All fittings and hardware will be corrosion resistant.
- Space Heater
- Suitable single phase space heaters operated at 240V, 50Hz, 1Phase AC supply will be provided on motors rated for 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs will be provided.
- The space heater will be sized to maintain the motor internal temperature above dew point when the motor is in idle condition.

4.16 Rating Plate

Motor will have Stainless steel nameplate(s) showing diagram of connections, all particulars as per IS: 325 / NEMA-MG-1 and following additional information:

a) Type of bearing and recommended lubricants along with location of insulated bearing.
b) Temperature rise under normal/abnormal conditions.
c) In addition to above, an arrow block will be screwed on to the body of motor on the non-driving end to indicate normal direction of rotation of motor.
d) Year of Manufacture

4.17 Drain Plug

Motor will have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.

4.18 Dowel Pins

Motor will be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.

4.19 Painting

The complete motor assembly including fan will be painted with corrosion proof paints of approved class.

4.20 Lifting provision

Motor weighing 25 Kg or more will be provided with eyebolt or other adequate provision of lifting.

5 TESTS

5.1 HT Motors

5.1.1 Routine Test

All equipment will be completely assembled, wired, adjusted and routine tested as per relevant IS / IEC Standards at manufacturer's works in the presence of consultant /purchaser or his representative.

5.1.2 Type Test

For each type & rating of HT motors the Contractor will submit for Owner's approval the reports of all the type tests as per relevant standards.. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been conducted at an independent laboratory.

In case the Contractor is not able to submit report of the type test(s) conducted,, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor will conduct all such tests under this contract free of cost to the Owner and submit the reports for approval.

5.2 LT Motors

5.2.1 Routine Test

All equipment will be completely assembled, wired, adjusted and routine tested as per relevant IS/IEC Standards at manufacturer's works in the presence of consultant /purchaser or his representative.

Type Test

LT motors shall be of type tested quality. For each type & rating of LT motors rated above 50 KW, the Contractor shall submit for Owner's approval the reports of all the type tests as per relevant standards These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been conducted at an independent laboratory.

In case the Contractor is not able to submit report of the type test(s) conducted,, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests free of cost in the presence of the Owner and submit the reports for approval.

5.3 Test Witness

The tests shall be carried out in presence of the Owner's representative, for which a minimum 7 days notice shall be given by the Contractor. The Contractor shall obtain the Owner's approval for the type test procedure before conducting the type test. The test procedure will 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.

5.4 Test Certificates

- Certified copies of all tests carried out at works and at site shall be furnished in requisite no. of copies for approval of the Owner.
- The equipment shall be dispatched from works only after receipt of Owner's written approval of shop test reports.

6 DRAWINGS, DATA & MANUALS

Drawings, data & manuals for the motors will be submitted as indicated below:

Dimensional General Arrangement drawing

- Motor sizing calculation
- Foundation Plan & Loading
- Cable end box details
- Space requirement for rotor removal
- Thermal withstand curves hot & cold
- Starting and speed torque characteristics at 80% & 100% voltage
- Complete motor data
- Erection & Maintenance Manual
- Test reports
- QAP

VOLUME- IV
SECTION-09
LV POWER & CONTROL CABLE

TABLE OF CONTENTS

1 GENERAL

This specification is intended to cover the design, engineering, manufacture, assembly, testing at manufacturer's works, supply & delivery, properly packed for transport to site of LT Power & Control Cable complete with all accessories for efficient and trouble-free operation for 2 x 500 MW New Thermal Power Plant at Neyveli, Tamilnadu for Neyveli Lignite Corporation Limited.

2 CODES AND STANDARDS

All equipment and materials will be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) / IEC as given below or any international standard acceptable to purchaser.

CODE	:	NAME OF STANDARD
IS:1554(Part I)	:	PVC insulated(heavy duty) electric cables for working voltage up to and including 1100V
IS:1554(Part II)	:	PVC insulated(heavy duty) electric cables for working voltage from 3.3kv up to and including 11Kv
IS: 3961	:	Recommended current ratings for cables.
IS: 8130	:	Conductors for insulated electric cables and flexible cords
IS:5831	:	PVC insulation and sheath of electric cables
IS: 2982	:	Copper conductor in insulated cables and cords.
IS: 3975	:	Mild steel wires, strips and tapes for armouring cables
IS: 5609	:	Specification for low frequency wirers and cables with PVC insulation and PVC sheath
IS: 6380	:	Specification of elastomeric insulation of sheath of electric cables.
IS: 434(I and II)	:	Specification for rubber insulation cables.

IEC: 540	:	The methods for insulations and sheath of electric cables and cords(elastomeric and thermoplastic compounds)
IEC: 230	:	Impulse tests on cables and their accessories
IEC: 60	:	High voltage test techniques
IEC: 287	:	Calculation of the continuous current rating of the cables (100% load factor).
IEC: 288	:	Nominal cross sectional area and composition of conductor of insulated cables.
IEC: 502	:	Extruded solid dielectric insulated power cables for rated voltages from 1kV upto 30kV.
NEMA-WC-5	:	Thermoplastic insulated wires and cables for transmission and distribution of electrical energy.
IEEE: 383	:	Standard for type test for class IE electric cables, filled splices and connection for nuclear power generation station.
IEC: 332-1	:	Test on electric cables under fire conditions.
ASTM-D-2843	:	Standard test method for density of smoke from burning/decomposition of plastics.
ASTM-D-2863	:	Test for determination of oxygen index.
IEC-754-I	:	Test method for acid gas generation
IEC-331	:	Fire resisting characteristics of electric cables
		SVENSK Standard SS-4241475 Class F3

- BICC Hand Book For cables in fire regarding temperature index-chapter-6

- Indian Electricity Rule.

Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted subject to approval of the Owner. In such case, copies of the English version of the standards adopted will have to be submitted during detail engineering.

The electrical installation will meet the requirements of Indian Electricity Rules as amended up to date and relevant IS Codes of Practice. In addition, other rules and regulations applicable to the work will be followed.

3 DESIGN CRITERIA

The cable will be used for connection of power and control circuits of the auxiliary electrical systems.

The cable will be suitable for installation in the required site conditions.

Cables will be sized suitably with proper de-rating factors as per the installation conditions of the cable.

For continuous operation at specified rating as well as during short circuit condition the maximum conductor temperature will be limited to the permissible value as per relevant standard.

The insulation and sheath materials will be resistant to oil, acid and alkali and will be tough enough to withstand mechanical stresses during handling.

Armouring, wherever provided, will be single round/ flat wire of galvanised steel for multi-core cables and aluminium for single core cable. Cables in buried formation will be armored. Cables laid in duct banks/conduits will be unarmoured.

The outer sheath as well as the inner sheath will have flame retardant low smoke (FRLS) characteristics and will meet the requirements of additional tests specified for this purpose.

Core identification for multi-core cable will be provided by colour coding.

Power cables will be chosen taking into account the following factors:

a) System Fault level.

b) Maximum time for fault clearance (i.e, operating time of the back up protection relays plus the time of operation of the circuit breakers).

c) Full load current of the circuit.

d) Short circuit current and duration (for breaker protected cables)

e) Installation conditions.

f) Voltage drop under normal running and starting condition

g) Voltage drop at motor terminals will be within permissible limit during starting & normal running.

h) The cable should withstand the maximum fault current corresponding to the particular voltage level for the minimum time before the fault is cleared.

i) Consideration will also be given to limit the cable to the nearest standard sizes instead of using too many types.

j) The standard cable sizes, ampacities, de-rating factors, etc. will be as given in IS or relevant standard.

k) The minimum size of power cables to be used will be as follow :

Aluminium conductor	:	6 Sq. mm.
Copper conductor	:	2.5 Sq. mm.

4 SPECIFIC REQUIREMENTS

4.1 Type of Cable

LV power cables shall be stranded aluminium conductor, cross linked polyethylene (XLPE) insulated, extruded black FRLS PVC inner sheathed, armoured and overall FRLS extruded black PVC sheathed cables conforming to IS: 7098.

Control Cables shall be 1100 V grade with annealed high conductivity stranded copper conductor, PVC insulated, FRLS PVC inner sheathed, armoured and FRLS extruded black PVC outer sheathed cables conforming to IS : 1554.

4.2 Conductor

The cable conductor shall be made from standard Aluminum for LT Power cables and Copper for control cables to form compact conductor having a resistance within the limits specified. All the cables of size 25mm^2 and above shall have sector shaped conductors.

4.3 Insulation

The insulation of the LV power cable shall be XLPE type & for control the insulation shall be PVC type. It will be designed and manufactured for the specified system voltage. The manufacturing process will ensure that insulation will be free from voids. The insulation will withstand mechanical and thermal stresses under steady state and transient operating conditions. The extrusion method should give a very smooth interface between semi conducting screen and insulation. The insulation of the cables will be of high standard quality.

4.4 Inner Sheath

The sheath will be suitable to withstand the site conditions and the desired temperature. It will be of adequate thickness and applied by a continuous

process to produce a sheath of consistent quality free from all defects. PVC sheath will be extruded.

4.5 Armour

Hard drawn aluminum wire armouring/ galvanized steel tape/ wire armouring will be used for single core and multi-core cable respectively. Cables should be un-armoured wherever indicated. The hard drawn aluminium wire for armour will be of H4 grade, as per IS-8130 (having tensile strength above 150 N/mm2). The diameter of the aluminium wire will be as per the table for the dimensions of the galvanized steel wire armour given in the relevant standard.

4.6 Outer sheath

FRLS extruded black PVC serving as per IS: 1554 otherwise will be applied over the armouring with suitable additives to prevent rodent and termites. All serving must be given anti-termite treatment.

4.7 Packing

- Cables will be supplied in non-returnable drums. Drum lengths will be such so that cable joints are totally avoided. The drums will be of heavy construction. All wooden parts will be manufactured from seasoned wood. All ferrous parts used will be treated with suitable rust preventive finish or coating to avoid rusting during transit or storage. Wooden cable drum will be treated by immersing in copper-nitrate solution.
- The ends of each cable length will be sealed before shipment. Heat shrinkable cable cap will be used for this purpose.
- A label will be securely attached to each end of the reel indicating the Purchaser's order number, Owner's identification mark i.e. "NNTPP ", length, type, voltage grade, conductor size and number of cores of the cable. A tag containing the same information will be attached to the leading end of the cable inside. An arrow and necessary instructions will be marked on the drum indicating the direction in which it should be rolled. Drum numbers are to be indicated on the cable drums.

4.8 Spare Core

Multi-core control cables will have 20% spare core, minimum one spare.

Separate cables for each type of following services / functions as applicable will be used for each feeder. Same multi-core cable using different services will not be acceptable.

a) Power.
b) Control, interlock and indication.
c) Metering and measuring.
d) Alarm and annunciation.
e) C.T. Cables.

f) V.T. Cables.

4.9 Constructional Requirements

a) Cable will have suitable fillers laid up with the conductors to provide a substantially circular cross section before the sheath is applied. Fillers will be suitable for the operating temperature of the cable and compatible with the insulating material. All materials will be new, unused and of finest quality.

b) Workmanship will be neat, clean and of the highest grade.

c) LT Power cables will be 1.1kV grade, heavy duty, stranded aluminium conductor, XLPE Insulated galvanized steel wire/strip armoured, flame retardant low smoke (FRLS) extruded PVC type outer sheathed.

d) Control cables will be 1.1kV grade, heavy duty, stranded copper conductor, PVC Type-A insulated, galvanized steel wire armoured, flame retardent low smoke (FRLS) extruded PVC of Type - ST1 outer sheathed.

e) Special Properties:
All the above cables will be conforming to the relevant Indian/IEC standard in general, with the following special properties:

- Oxygen Index of the outer sheath will not be less than 29, when tested as per ASTM-D-2863.
- Temperature Index of the outer sheath will not be less than 250°C, when tested as per ASTM-D-2863.
- Halogen acid contents in outer sheath will not be more than 20%, when tested as per IEC-60754.
- The maximum smoke density in percent light absorption should not exceed 60% in case of PVC compound and 20% in case of fire survival cables, when tested as per ASTM-D-2843.
- Swedish chimney test as per SS-4241475 class F3 and ladder test for flammability as per IEEE-383.

4.10 Joints and Terminations

Materials of construction for a joint/termination will perfectly match with the dielectric chemical and physical characteristics of the associated cables. The material and design concepts will incorporate a high degree of operating compatibility between the cable and joints. The protective outer covering (jacket) used on the joints/terminations will have the same qualities as that of the cable outer sheath in terms of ambient/operating temperature withstand capability and resistance to hazardous environments and corrosive elements. No joints will be allowed unless the cable drawn length is exceeded.

4.11 Cable Identification

Cable identification will be provided by embossing the following on the outer sheath:

a) Manufacturer's name or trade mark

b) Voltage grade
c) Year of manufacture
d) Type of insulation.
e) Type of outer sheath e.g. "FRLS" etc.
f) ISI marks
g) Nominal cross sectional area of the conductor & no of cores
h) Sequential marking
i) Owner's identification mark "NNTPS"

5 TESTS

5.1 Type Test

Cables will be type tested quality. For each type and rating of cables reports on all type tests carried out as per relevant standards will be submitted.

These reports will be for the tests conducted on the similar type of cables proposed to be supplied under this contract. These tests should have been conducted at an independent laboratory. In case the contractor is not able to submit report of the type test(s) conducted or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor will conduct all such tests in the presence of the Purchaser without cost implication and submit the reports for approval.

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5.2 Shop Tests

The Cables shall be tested in accordance with relevant IS/IEC standards at manufacturers' works as given below:

- Routine tests on each drum of cables.
- Acceptance tests on drums chosen at random for acceptance of the lot shall be conducted in the presence of Consultant / purchaser or his representative.

5.3 Additional Tests

Following additional acceptance tests shall also be performed on each type of cables having outer sheath with improved fire performance (Category C1, Type FR/ Category C2, Type FRLS). All the additional tests shall be conducted in the presence of the purchaser.

a) Oxygen index test (for both C1 & C2) – The oxygen index test shall be carried out as per ASTM D2863. The Oxygen index shall not be less than 29.
b) Temperature Index Test (for both C1 & C2) - The measured value of temperature index shall be 21 at a temperature of 250°C.
c) Flame retardance test on single cable and on bunched cables (for both C1 & C2) - After the test, there should be no visible damages on the test specimen within 300mm from its upper end. After burning has ceased, the cables should be wiped clean and the charred or affected portion should not have reached a height exceeding 2.5 meter above the

bottom edge of the burner, measured at the front and rear of the cable assembly.

d) Halogen acid gas evolution test (for category C2) – This test shall be as per IEC-754-1.The level of HCL evolved shall not exceed 20 per cent by weight.

e) Smoke density test (for category C2) – Smoke generation by outer sheath under fire as per ASTM D 2843. The cables shall meet the requirements of light transmission of minimum 40% after the test.

f) Test for rodent & termite repulsion property.

6 FIRE PROOF SEALING SYSTEM

Fire proof sealing system will consist of Fire-stops/fire-seals for sealing of cable/cable tray and conduit/pipe penetrations, both horizontal and vertical, through brick or RCC walls/floors, to prevent the spread of fire from one area, which is separated from others by fire-resistant barriers. The rating of the fire proof sealing system shall be minimum two hours.

'Fire-breaks' provided on long runs of cable racks/trays to prevent the propagation of fire along the cable rack, within a single fire-area or fire- zone.

The FPS system will also include all the necessary accessories and equipment required for supporting, holding in position, fixing and installation of the fire-stop/fire-break.

The FPS system will comply in all respects with the requirements of the codes and standards listed below

IEEE-634, ASTM-E-814, ANSI-IEEE-383, IEC-331, IEC-332.

Wherever the cables pass through walls/ floors, fire proof cable penetration seals rated for two hours will be provided.

Fire stop/ seal

The FPS system adopted for cables or cable trays penetrating through walls and floor constitute a openings, or cables passing through embedded conduits / pipes / pipe- sleeves, fire stop / seal', which is meant to prevent spreading of fire between areas separated by fire-resistant barriers.

Fire Break

The fire proofing system, other than fire-stops, adopted to retard flame propagation long runs of horizontal or vertical cable trays in the same fire zone or area, in an event of a fire, will constitute a `fire-break' and will be provided by applying a suitable fire -resistance coating on cables and cable trays for the required length, with or without a fire resistant panel, at the point of the fire break to obtain the fire-rating specified.

Application of fire proof sealing system

Fire stops will be provided for cable penetration openings listed below

The passage of cables/cable trays pipe sleeves/embedded conduits through walls / floors.

Vertical raceways, which carry cables between successive floors, through openings provided in the RCC floor slab, will be sealed by fire stops at each floor level.

Cable entry through openings in floor slabs below HT/LT switchgear, MCCs, various Control and relay panels and other bottom entry panels, will be effectively sealed by fire stop

Location of fire breaks

Firebreaks will be provided on both cable rack and trenches at all cable tray Intersections and tee-offs.

On linear runs of cable trays between fire stops or fire breaks, fire breaks will be provided at intervals of 15 metres on horizontal cable runs and 5 m on vertical cable runs.

Fire breaks in linear runs of cable trenches between intersections and tee-offs will be provided at intervals of 30 metres.

Contractor will furnish the test certificates for the fire stops and fire breaks after award of contract for Owner/Owner's Representative review. If the certificates are not satisfactory all the tests will be conducted free of cost. The offered system i.e. fire stops and fire breaks will be identical (or better) with the system which is successfully type tested for the specified rating i.e. the composition density of the material, thickness of coating in case of fire breaks and any other properties of the material / system offered will be identical or better than the tested system and will be subject to Owner / Owner's Representative.

Test on fire stops

The fire stops shall be subjected to the following type tests:

- Fire Rating Test
- Hose Stream Test

Type tests shall be conducted on different fire stop test specimens described above as per IEEE-634. The sizes of the fire stop test specimens shall be similar to the largest of the sizes being used in the plant.

Preconditioning of fire stop test specimens before conducting the fire rating and hose stream tests, each test specimen shall be preconditioned for thermal ageing, water immersion and vibration.

Test on Fire Stops

During the fire rating test, the transmission of heat through the cable penetration fire stop shall not raise the temperature on its unexposed surface above the self ignition temperature of the outer cable covering, the cable penetration fire stop material, or material in contact with the cable penetration fire stop, with a maximum temperature limit on the unexposed surface of 200°C.

Tests on fire breaks

- Firebreaks shall undergo the following tests as per ANSI-IEEE-383:
- Ampacity test
- Flame test

7 DRAWINGS, DATA AND MANUALS TO BE FURNISHED FOR APPROVAL

- Cable datasheets
- Cable sizing
- QAPs & Test Reports
- Relevant catalogues

8 RATINGS AND REQUIREMENTS

8.1 L.V. Power cables 1100 V grade

1100 V grade, power cable conforming to following requirement and in line with IS-1554, IS-5831, IS-8130 & IS-3975.			
S.NO.	**DESCRIPTION**	:	**SPECIFICATION**
	Conductor	:	Stranded and compacted plain aluminium of grade H2 and class 2/stranded, high conductivity annealed plain copper as per Annexure, generally conforming to IS:8130
	Insulation	:	Extruded Cross linked Polyethylene (XLPE).
	Inner Sheath	:	Extruded FRLS PVC compound conforming to type ST2 of IS: 5831 for multicore cable.
	Armour	:	Galvanised single round/ strip steel wire armour for twin and multicore cables. Non-magnetic hard drawn aluminium single round wire conforming to H4 grade for single core cables.
	Overall Sheath	:	Extruded FRLS PVC compound conforming to type

			ST2 of IS: 5831.

8.2 Control Cables 1100 V Grade

1100 V grade, 700 C rating, PVC Control cable conforming to following requirement and in line with IS-1554, IS-8130, IS-5831 & IS-3975.

S.NO.	DESCRIPTION	:	SPECIFICATION
	Conductor	:	Stranded, non-compacted & circular, high conductivity annealed plain copper, generally conforming to IS: 8130.
	Insulation	:	Extruded PVC compound conforming to type A of IS: 5831.
	Inner sheath	:	Extruded FRLS PVC compound conforming to type ST1 of IS: 5831 for multicore cables. Single core cables shall have no inner sheath
	Armour	:	Galvanised single round steel wire for twin and multicore cables.
	Overall sheath	:	Extruded FRLS PVC compound conforming to type ST1 of IS:5831

8.3 Trailing Cables (Power & Control)

Trailing cable, 1.1kV grade with highly flexible stranded tinned copper conductor, insulation of EPR (Ethylene-propylene Rubber) each individual core protected and covered and overall outer cover of poly-chloroprene rubber cable will conform to IS 9968 part-1.

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General

List of tests/check given under this section are indicative and for reference. Quality plan based on manufacturer's standard practices and procedure shall be submitted for approval of purchaser/consultant during detail engineering. Contractor shall conduct the tests as per relevant standard and also as per the detail given in the respective equipment chapter of technical specification.

MOTOR

Attributes / Characteristics / Item /Components	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/ Chem. Properties	NDT /DP/MPI/UT		Electrical Characteristics	Welding, Brazing (WPS/PQR)	Heat Treatment
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y				Y
Shaft	Y	Y	Y	Y	Y				Y
Magnetic Material	Y	Y	Y	Y	Y		Y		Y
Rotor Copper/Aluminium	Y	Y	Y	Y	Y		Y		Y
Stator copper	Y	Y	Y	Y	Y		Y		Y
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y
Insulating Material	Y	Y	Y	Y	Y				Y
Tubes, for Cooler	Y	Y	Y	Y	Y				Y
Sleeve Bearing	Y	Y	Y	Y	Y		Y		Y
Stator/Rotor, Exciter Coils	Y	Y	Y	Y	Y		Y	Y	
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y	
Fabrication & machining of stator, rotor, terminal box	Y	Y						Y	Y
Wound stator	Y	Y			Y			Y	
Wound Exciter	Y	Y						Y	
Rotor complete	Y	Y							
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y							
Accessories, RTD, BTD,CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y						
Complete Motor	Y	Y	Y						

TESTS/CHECKS / ITEMS/COMPONENTS	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS- 9283/ IS2148/ IEC60034/IEC 60079-I	Vibration		Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.										
Shaft										
Magnetic Material	Y		Y							
Rotor Copper/Aluminium										
Stator copper			Y							
SC Ring										
Insulating Material			Y							
Tubes for Cooler		Y								
Sleeve Bearing		Y								
Stator/Rotor, Exciter Coils										
Castings, stator frame, terminal box and bearing housing etc.										
Fabrication & machining of stator, rotor, terminal box										
Wound stator										
Wound Exciter										
Rotor complete				Y	Y					
Exciter, Stator, Rotor, Terminal Box assembly										
Accessories, RTD, BTD,CT, Space heater, antifriction bearing, gaskets etc.										
Complete Motor						Y	Y		Y	Y

L.T POWER CABLES

Attributes 1.1.1.1. / Item /Components Sub System	Make, Rating, Type & TC	Dimension/surface finish	Mechanical Properties	Chemical Composition	Electrical Properties	Spark Test	Hot set test (XLPE)	Lay length / Sequence	Armour coverage, Cross over, looseness, Gap between two armour wire/strip	Sequential marking/surface finish /cable length	Tensile strength, elongation before & after ageing of insulation & outer sheath	Thermal Stability of insulation and outer sheath*	Anti termite treatment on wooden drums	Constructional / requirement as per OWNER Spec.	Routine and acceptance test as per Relevant Standard and OWNER specification	FRLS Test
Aluminum (IS-8130)	Y	Y	Y	Y	Y											
PVC Compound (IS-5831)	Y	Y	Y		Y						Y					
XLPE Compound (IS-7098 Part-I)	Y	Y	Y		Y		Y				Y					
FRLS PVC Compound (IS-5831) ASTM-D-2843/ IS 10810 (Part-58) IEC-60754 Part-I	Y										Y					
Armour wire/strip (IS-3975)		Y	Y													
Insulated Core		Y				Y	Y					Y				
Laid up core		Y						Y								
PVC Inner sheath		Y														
Armouring		Y							Y							
Outer sheath		Y								Y	Y	Y				Y

Finish cable (IS-1554 & 7098 – Part-1) ASTM-D-2843/ IS 10810 (Part- - 58) IEC-60754 Part-I Swedish Chimney SS 4241475 for (F3 category) Flammability test IEC-60332 Part –3 Cat-B	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y
Wooden drum (IS-10418) / Steel drum		Y											Y			

Note:
1. This is an indicative list of test/checks. The manufacturer is to furnish a detailed quality plan indicating the practice and procedure along with relevant supporting documents.
2. Not applicable for XLPE insulation

(1.1 KV PVC & XLPE CABLES)

ROUTINE TESTS

Routine tests will be carried out on each drum of finished cables for all types & sizes. Following will constitute routine tests:

1) Conductor Resistance test
2) High voltage test at room temperature

ACCEPTANCE TESTS

Following Acceptance tests will be carried out for each type and size of the cables on the cable drums selected at random as per sampling plan mentioned in IS: 1554 Part 1 & IS 7098 Part-I

A) For Conductor

1) Annealing test for copper conductor only
2) Tensile test for aluminium conductor only
3) Wrapping test For aluminium conductor only
4) Resistance test

B) For Armour Wires / Formed Wires (If applicable)

1) Measurement of Dimensions
2) Tensile Tests
3) Elongation Test
4) Torsion Test — For Round wires only
5) Wrapping Test
6) Resistance Test
7) Mass of Zinc coating test — For G S wires / Formed wiresonly
8) Uniformity of Zinc coating — For G S wires / Formed wires only
9) Adhesion test — For G S wires / Formed wires only
10) Freedom from defects

C) For PVC / XLPE insulation & FRLS PVC Sheath

1) Test for thickness
2) Hot set test For XLPE insulation only

3) Tensile strength & Elongation before ageing

D) For completed cables

1) Insulation resistance test (Volume resistivity method)
2) High voltage test **at room temperature**

E) Following tests will be carried out and only one sample will be take from each offered lot of all sizes for these tests:-

1) Thermal stability test on PVC insulation and outer sheath
2) Oxygen index test on outer sheath
3) Smoke density rating test on outer sheath as per ASTM –D 2843
4) Acid gas generation test on outer sheath as per IEC –60 754 (Part 1)

F) Ageing test on PVC / XLPE insulation and FRLS PVC outer sheath as per following:

Samples as per relevant IS from every size per type of cable in the offered lot will be tested for tensile strength & elongation (before ageing). The values will be compared with corresponding values mentioned in the type test report accepted by OWNER. In case values of tensile strength & elongation (before ageing) are within + /- 15% of the type test reports then 1 sample per type of cable of offered lot will be put on accelerated ageing test. The accelerated ageing test procedure: sample to be put in air oven at temperature of 130°C +/- 2°C for 5 hours, tensile strength & elongation acceptance norms as per relevant IS. However in case the tensile strength and elongation values are not within +/- 15% of type test values then ageing test will be carried out on that particular size of cable of offered lot as per relevant IS.

G) Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cable as per following sampling plan.

The test will be carried out on every size & type of power cable offered for inspection as an acceptance test. This test will be carried out using composite sampling i.e. irrespective of sizes of cables of a particular type, may be tested together as per calculations in line with the IEC (all sizes will be covered)

H) Following tests will be carried on one length of each size of offered lot:

Surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires.

I) Additional tests as per the relevant part of the specification.

LT CONTROL CABLES

Attributes 1.1.1.1 / Item / Components Sub System	Make, Rating, Type & TC	Dimension/surface finish	Mechanical Properties	Chemical Composition	Electrical Properties	Spark Test	Hot set test (XLPE)	Lay length / Sequence	Armour coverage, Cross over, looseness, Gap between two armour wire/strip	Sequential marking/surface finish /cable length	Tensile strength, elongation before & after ageing of insulation & outer sheath	Thermal Stability of insulation and outer sheath *	Anti termite treatment on wooden drums	Constructional / requirement as per OWNER Spec.	Routine and acceptance test as per Relevant Standard and OWNER specification	FRLS Test
Aluminum (IS-8130)	Y	Y	Y	Y	Y											
PVC Compound (IS-5831)	Y	Y	Y		Y						Y					
XLPE Compound(IS-7098 Part-I)	Y	Y	Y		Y		Y				Y					
FRLS PVC Compound(IS-5831) ASTM-D-2843/ IS 10810 (Part-58) IEC-60754 Part-I	Y															
Armour wire/strip (IS-3975)		Y	Y													
Insulated Core		Y				Y	Y				Y					
Laid up core		Y						Y								
PVC Inner sheath		Y														
Armouring		Y							Y							
Outer sheath		Y								Y	Y	Y				Y

Finish cable (IS-1554 & 7098 – Part-1) ASTM-D-2843/ IS 10810 (Part- - 58) IEC-60754 Part-I Swedish Chimney SS 4241475 for (F3 category) Flammability test IEC-60332 Part –3 Cat-B	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y
Wooden drum (IS-10418)/Steel drum		Y											Y			

ROUTINE TESTS

Routine tests will be carried out on each drum of finished cables for all types & sizes. Following will constitute routine tests:

1) Conductor Resistance test
2) High voltage test at room temperature

ACCEPTANCE TESTS

Following Acceptance tests will be carried out for each type and size of the cables on the cable drums selected at random as per sampling plan mentioned in IS: 1554 Part 1

A) For Conductor

1) Annealing test — For copper conductor only
2) Resistance test

B) For Armour Wires / Formed Wires (If applicable)

1) Measurement of Dimensions
2) Tensile Tests
3) Elongation Test
4) Torsion Test — For Round wires only
5) Wrapping Test
6) Resistance Test
7) Mass of Zinc coating test — For G S wires / Formed wires only
8) Uniformity of Zinc coating — For G S wires / Formed wires only
9) Adhesion test — For G S wires / Formed wires Only
10) Freedom from defects

C) For PVC / XLPE insulation & FRLS PVC Sheath

1) Test for thickness
2) Tensile strength & Elongation before ageing

D) For completed cables

1) Insulation resistance test (Volume resistivity method)
2) High voltage test at room temperature

E) Following tests will be carried out and only one sample will be taken from each offered lot of all sizes for these tests:-

1) Thermal stability test on PVC insulation and outer sheath
2) Oxygen index test on outer sheath
3) Smoke density rating test on outer sheath as per ASTM –D 2843

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4) Acid gas generation test on outer sheath as per IEC –60 754 (Part 1)

F) **Ageing test on PVC insulation and FRLS PVC outer sheath as per following:**

Samples as per relevant IS from every size per type of cable in the offered lot will be tested for tensile strength & elongation (before ageing). The values will be compared with corresponding values mentioned in the type test report accepted by OWNER. In case values of tensile strength & elongation (before ageing) are within + /- 15% of the type test reports then 1 sample per type of cable of offered lot will be put on accelerated ageing test. The accelerated ageing test procedure: sample to be put in air oven at temperature of 130°C +/- 2°C for 5 hours, tensile strength & elongation acceptance norms as per relevant IS. However in case the tensile strength and elongation values are not within +/- 15% of type test values then ageing test will be carried out on that particular size of cable of offered lot as per relevant IS.

G) **Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cable as per following sampling plan.**
The test will be carried out on every size & type of control cable offered for inspection as an acceptance test. This test will be carried out using composite sampling i.e. irrespective of sizes of cables of a particular type, may be tested together as per calculations in line with the IEC (all sizes will be covered)

H) **Following tests will be carried on one length of each size of offered lot:**
Surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wire.

I) **Additional tests as per the relevant part of the specification.**

CABLING, EARTHING & LIGHTNING PROTECTION

ATTRIBUTES/ CHARACTERISTICS / ITEM/ COMPONENTS/SUB SYSTEM	Dimension	Paint shade, paint thickness, adhesion	Pre-treatment of sheet	IP protection	Proof load*	Surface finish	Deflection test*	HV & IR	Galvanize Test (If Applicable)	Functional	Bought out items/Bill of material	Routine tests as per relevant standard & specification	Acceptance tests as per relevant standard & specification	Constructional feature as per OWNER
Wall Mounted-Lighting Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y
Switch box/junction box/ Receptacles Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y
Cable glands (BS-6121)	Y											Y		
Cable lug (IS-8309)	Y											Y		

Lighting wire (IS-694)	Y										Y		
Conduits(Galvanize & Epoxy) IS-9537 & IS-2629,2633 ,6745	Y	Y	Y								Y		Y
RCC Hume Pipe (IS-458)											Y		Y
Cable termination & straight through joint (VDE-0278)	Y		Y								Y		
Cable Trays, Flexible supports system & accessories IS-513, 2629,2633,6745	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y		Y
Trefoil clamp	Y										Y		Y
GI flats for earthing & lighting protection (IS 2062, 2629, 6745, 2633)	Y	Y									Y		Y
GI wire (IS-280)	Y										Y		Y
Fire Sealing System (BS –476)	Y										Y		Y

NOTE:

1. This is an indicative list of tests /checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. *Deflection Test on cable trays and Proof Load test on cable trays support system will be as per details given in the OWNER technical specification & approved MQP. The above acceptance tests shall be done only on one sample from each size of offered lot.
3. Make of all items will be subject to OWNER approval.

A.0.0 **TECHNICAL DATA SHEET OF ELECTRIC HOIST**

Sl.no	DESCRIPTION	TECHNICAL PARTICULARS
1.0	Type	Steel wire electric hoist with electrically operated trolley
2.0	Scope (Qty., Capacity, Lift, Travel Length)	As per specification and layout requirement
3.0	Type of service	Indoor
4.0	Overload test	125% of SWL
5.0	Design Ambient temperature	50° C
6.0	General Design	As per IS: 3938 / 1983 or latest
6.1	Design standards	IS: 3938, IS: 2266,IS: 4029, IS: 900,IS: 4237, IS: 694, IS: 3043, IS: 1822, IS: 2147. IS: 1554, IS: 325, IS: 15660, IS 9968 Part I etc as per latest revision
6.2	Duty class	Class II duty
7.0	Operating speed	
7.1	Hoisting speed	3 MPM.
7.2	Trolley speed	10 MPM
8.0	Type of transmission	Through Electric motor and gear box.
9.0	Wire Rope	
9.1	Construction / core	6 X 36 Steel core , Galvanised
9.2	Code	IS:2266
9.3	Number of falls	Min. 4
9.4	Factor of safety	5
10.0	Load Hook and block	NORMALISED HOOK ONLY
10.1	Type of load hook	Plain shank trapezoidal section with safety latch.
10.2	Load hook Code	IS: 15560
10.3	Load hook Material	As per IS:15560
10.4	Hook suspension	Thrust bearing
10.5	Material of block suspension	Fabricated from steel plate, Material: IS: 2062
11.0	Gearing	
11.1	Type	Spur / Helical
11.2	Gear/ pinion material	as per IS 3938
11.3	Lubrication	Oil splash/ grease lubricated
11.4	Bearing type	Antifriction Ball / Roller
12.0	Trolley drive	
	Wheel	aper thread

12.2	Wheel conform to (Std. / code)	IS: 3938	
12.3	Wheel material	C55Mn75/ En-8/ En-9/ As per IS 3938. (Max hardness 200 BHN)	
12.4	Bearing type	Antifriction Ball / Roller	
12.5	Trolley type	Rolled structural steel with side plates extended beyond wheel flanges to protect wheels.	
12.6	Hardness	Max hardness 200 BHN	
13.0	SHEAVE		
13.1	Material	Fabricated from steel plate. IS: 2062 Gr. A or Gr. B / as per IS: 3938	
13.2	Bearing type	Antifriction Ball / Roller.	
14.0	BRAKE (HOIST and TROLLEY)		
14.1	Type	DC EM brakes disc type (fail to safety).	
14.2	Capacity	150 % of FLT for hoisting, 125% of FLT for travel	
14.3	Number	One number for each motor.	
15.0	ROPE DRUM		
15.1	Material	Cast iron, cast steel or mild steel.	
15.2	Flange / Flangeless	Flanged	
15.3	Type of groove	Right hand groove or Right hand and left hand groove. (Shall be decided during detail engineering)	
17.0	TYPE OF DSL		
17.1	CT travel	PVC Shrouded bus bar conductor type DSL	
18.0	MOTORS		
18.1	Type	Sq. Cage induction, TEFC, S4 duty, 40% CDF.	
18.2	Number of start	150 starts / hr	
18.3	Voltage , Phase and Frequency	415V ±10%, 3 phase, 4 wire, 50 Hz	
18.4	Class of insulation	Class “F” and temperature rise limited to class B.	
18.5	Type of enclosure	TEFC	
18.6	Degree of protection provided for enclosure	IP-55 (indoor/outdoor)	
18.7	Margin	15% over maximum continuous load demand	
19.0	LIMIT SWITCHES	Hoisting	Trolley
19.1	Type	Snap action, self actuating type	Lever type
20.0	Control panel	* Fabricated from Cold rolled sheet steel not less than ont & rear & 2mm for side, top & bottom	

		portion with gland plate of 3mm thick. * Degree of protection shall be IP 54. * Power on indicating lamps shall be provided * Panel illumination lamps operated by door switch. * 2 nos earthing terminals on panel. * 20 % spares terminals (clip on type) shall be provided. * Power and control terminals (clip on type) shall be on separate channels. * Gland plate shall be double brass compression type.
20.1	Qty	1 No.
21.0	Pendent Push buttons	Up /down / forward / Reverse push buttons. Indicative marking for easy operation shall be provided.
22.0	Power cables	Stranded aluminium conductor, cross linked polyethylene (XLPE) insulated, extruded black FRLS PVC inner sheathed, armoured and overall FRLS extruded black PVC sheathed cables conforming to IS 7098
23.0	Control cable	1100 V grade with annealed high conductivity stranded copper conductor, PVC insulated, FRLS PVC inner sheathed, armoured and FRLS extruded black PVC outer sheathed cables conforming to IS : 1554
24.0	Flexible trailing cable	1.1 kV grade with highly flexible stranded tinned copper conductor, insulation of EPR (Ethylene-propylene Rubber) each individual core protected and covered and overall outer cover of poly-chloroprene rubber cable conforming IS: 9968 (Part-I)-1988.
25.0	Control Voltage	110 V

PACKAGE : ELECTRIC HOIST REV : 0 DATE : 22.12.14

S. NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V Local Starter Panel	Vendor	BHEL	BHEL will provide one number 415 V supply feeders up to DSL for electric hoist
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.	Vendor	BHEL	
3	Cabling material (cable trays, accessories, cable tray supporting system, conduits etc).	Vendor	BHEL	
4	Equipment Earthing	Vendor	BHEL	All equipments metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL / customer.
5	Motors	Vendor	BHEL	
6	Cable glands and lugs for equipment supplied by vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type tinned copper heavy duty lugs for power cables. 3 solderless crimping type heavy duty copper lugs for control cables.
7	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for C & I systems for vendor supplied equipment shall be furnished during detail engineering by vendor in soft copies in the BHEL cable schedule format.
8	Equipment layout drawings	Vendor	-	
9	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

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) Erection and Commissioning spares.
d) Erection & Maintenance tools & tackles.
e) Electrical load requirement for electric hoist
f) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
g) 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
h) 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 " 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/DC Motors
b) Data sheet of AC/DC Motors.
c) Load data format.

STANDARD TECHNICAL REQUIREMENT (MECHANICAL)

1.0.0 **INTENT OF SPECIFICATION**

This specification covers the design, engineering, manufacture, inspection and testing at manufacturer's works, properly packed and delivery to site for the steel wire rope electric hoist as specified in the Data Sheet A enclosed. The equipment specified shall include all accessories required for trouble free operation.

2.0.0 **Design Particulars**

The steel wire rope electric hoist covered in this specification shall be suitable for the lift as specified in Annexure- A. Equipment offered shall be conforming to specification requirements as per **IS: 3938 (latest edition)** and other specified Indian Standards.

3.0.0 **Technical Particulars**

3.1.0 Quantity:

The quantity of various steel wire electric hoist shall be as mentioned in Annexure A.

3.2.0 Type - Electrically operated with trolley.

3.3.0 Capacity / Lift: **As indicated in Annexure - A**

3.4.0 Applicable IS	DESCRIPTION
i) IS: 2266	Specification for steel wire ropes for general engineering purposes.
ii) IS: 4029	Guide testing induction motor.
iii) IS: 900	Code of practice for installation and maintenance of induction motor.
iv) IS: 4237	General requirement of switchgear and control gear for voltage motor exceeding 1000 Volts.
v) IS: 694	Copper conductors PVC insulated cables for voltage up to 1000 Volts
vi) IS: 3043	Code of practice for Earthing.
vii) 1S: 1822	Motor starters for Voltages up to 650V.
viii) IS: 2147	Degree of protection provided by enclosures for low voltage switch— gear and control gear.
ix) IS: 1554	PVC insulated (Heavy-duty) electric cables for working voltages and including 1100 volts.
x) IS: 325	Three phase induction motors.
xi) IS: 15660	Point hook with shank.
xii) IS 9968 Part I	Flexible trailing cables

3.5.0 **Material of Construction**

i)	Frame	—	M.S.Plate-IS: 2062.
ii)	Wheels	—	Single flanged conform to IS: 3938
iii)	Gearbox	—	MS fabricated IS: 2062
iv)	Hook	--	As per IS: 15560

4.0.0 Quality Plan & Inspection

To ensure that the equipment and services are in accordance with the specification, the vendor shall follow/adopt BHEL's STANDARD QUALITY PLAN (enclosed herewith)/Customer approved QAP to control critical activities at all essential points. The enclosed standard quality plan should be duly signed and stamped as a token of acceptance and submitted by the bidder along with the offer.

Inspection shall be carried out by BHEL/customer representative as the case may be in line with the approved drawing / document. Any necessary requirement at any stage of inspection deemed necessary by Customer/BHEL shall be carried out without any commercial or technical implication.

5.0.0 **Name Plate**

All the electric hoists shall be provided with individual nameplate indicating minimum the following data's:

Name of manufacturer

Capacity (in tons)

Lift (in meters)

Serial No.

6.0.0 Painting Procedure

6.1.0 All surfaces to be painted shall be thoroughly cleaned of all grease, oil, loose mill scale, dust, rust and any other foreign matter. Mechanical cleaning by power tool and scrapping with steel wire brushes shall be adopted to clear the surfaces.

6.2.0 Machined and bearing surface shall be protected with varnish or thick coat of grease. Also refer "Painting Requirements" in Volume IIB, Section C.

7.0.0 DESPATCH

All the Electric hoists shall be packed to avoid any damage during transits and storage at site.

8.0.0 **POST CONTRACT DRAWINGS AND DOCUMENTS**

The drawings / documents shall be submitted after placement of order as per Clause 3.00 of Section C.

9.0.0 INFORMATION TO BE FURNISHED WITH THE OFFER

As per Annexure VI, vol III.

10.0.0 COLOUR SCHEME

Color scheme shall be intimated by the purchaser to vendor during the contract execution stage and the same shall be strictly followed.

11.0.0 GENERAL DESIGN FEATURE

Parts requiring replacement or lubrication shall be easily accessible & without dismounting type.

Equipment shall include the devices as required and comply with applicable standards/specification requirements.

Defects in material not acceptable/allowed. Rectification of any flaw is permissible only with the approval of Purchaser.

Hoist shall be rigid in construction and all movements shall be smooth and non-jerky.

Design shall provide for easy maintena , particularly the wheel bearings.

Design shall conform to IS: 3938 and other standards as specified.

Both hoists and trolleys are driven electrically. Wheels shall be single flanged type and to suit different monorail beam sizes and the same shall be intimated to purchaser during of manufacturing stage.

Hook shall be swiveling type and fitted with a safety latch.

Hoists shall be designed for minimum headroom above the highest position of hook and for closest hook approaches.

Hoist shall be designed with the following electrical features:

11.1.0 ELECTRICAL MOTOR DESIGN

Motor shall be squirrel cage induction type, and suitable for AC supply of 415V, 3 phase, 50 HZ, 40% CDF with IP—55 degree of protection. Motors shall be class 'F' insulated with temperature rise limited 70^0 C & suitable for 150 starts/hr. Motors shall conform to IS-325 and tested in line with enclosed Quality Plan.

11.2.0 ELECTRICAL POWER

Hoist mounted heavy duty, electrical panel, direct on reversing type Air brake contactors, electrically interlocked for safety with necessary control gears such as control transformer, MCB (Control and Power), limit switches, thermostat, space heater, neutral **link,** ON/OFF 3 Phase door interlock switch, wrong connection preventor, overload relays with SPP features, indicating lamps, cable glands, lugs, terminals, cables etc. housed in totally enclosed IP— 55 degree of panel. Control voltage shall be 110V.

11.3.0 LIMIT SWITCH

Limit switches to prevent over hoisting, over lowering & over travelling shall be provided.

11.4.0 Brake

The hoist and cross traverse motors are fitted with an DC electro-magnetic disc type brake designed and built to arrest, and hold safely the full load capacity of load. The brakes shall be fail-safe type wherein failure of current immediately applies the brake.

11.5.0 PUSH BUTTON STATION

Pendent push button station shall be provided with minimum 5 nos. of glow type push buttons such as hoisting/lowering, cross traverse forward/reverse and emergency stop (mushroom head type). The contactors are operated by pendent push button station suspended from the hoist for easy operation and suspension is made on steel link chain. Necessary cable glands, lugs, terminals along with connecting cable of 12C—1.5 copper flexible cable shall be provided. Emergency stop push button shall be mushroom head (lockable) type. Pendent push button shall return to off position when released.

11.6.0 EARTHING

All electrical equipment (motor,panel,pendent) shall be provided with proper elements like bolts, washers ,nuts etc. for proper earthing at site.

11.7.0 POWER SUPPLY TO HOIST:

i) Shrouded Bus Bar Conductor Type DSL complete with brackets and other fixing arrangements.

ii) Isolator and cable from isolator at 1.5 m operating floor to DSL shall be supplied by the manufacturer.

LV-MOTOR DATA SHEET -A

SPECIFIC ELECTRICAL REQUIREMENT

SL.NO.	PARAMETERS	UNIT	NLC
	MOTOR		
1	DESIGN AMBIENT TEMP	DEG. C	50
2	VOLTAGE SUPPLY AND VARIATION	VOLT	415V, ± 10%
3	FREQUENCY WITH VARIATION	Hz	50 (+) 5% to (-) 3%
4	COMBINED VOLTAGE & FREQUENCY VARIATION		10%
5	MAX ACCEPTABLE RATING OF MOTOR AT 415 V	KW	160 KW & below
6	SYSTEM FAULT LEVEL AND ITS DUARTION	KA	50kA, 1sec
7	SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION		50 KA, 0.25 sec
8	CLASS OF INSULATION & TEMP RISE LIMITED TO		Class-F or better and temp rise limited to Class-B
9	MIN. STARTING VOLTAGE		85%
10	MOTOR RATING FOR SINGLE PHASE SUPPLY		0.22 kW & Below
11	MAXIMUM LOCKED ROTOR CURRENT	% OF FLC	As per IS 12615
12	ACCEPTABLE NOISE LEVEL	DB	Noise level for all motors shall be limited to 85dB(A) at 1.5 m (in line with IS 12065)
13	TYPE OF STARTER PROVIDED IN MCC		DOL
14	DOP OF ENCLOSURE		IP-54 for indoor duty
15	SPACE HEATER REQUIREMENT	<30kW	30KW & ABOVE
16	PAINT SHADE		DURING DETAIL ENGINEERING.
17	CRANE DUTY MOTOR AS PER IS3177		S4- Duty with 40% cyclic duration factorshall be considered. Motor operating through VFD shall be suitable for inverteer duty.

	TITLE	SPECIFICATION NO.
BHEL	MOTOR DATA SHEET - C	VOLUME II B SECTION D REV NO. 00 DATE 29/08/2005 SHEET 1 OF 2

S. No.	Description	Data to be filled by successful bidder
A.	**General**	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
B.	**Design and Performance Data**	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a Voltage	
6	b Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	

NAME OF VENDOR				REV.	
NAME	SIGNATURE	E	SEAL		

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	**Constructional Features**	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	**Characteristic curves/ drawings** (To be enclosed for motors of rating ≥ 55KW)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

VOLUME III

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
																		ANNEXURE-II
AHU (for SG area) (3T)		3 kW	S	2	0	D	S	N	I									
DMCW pump/Motor (SG Aux.) 5T		5 kW	U	1	0	D	S	N	I									
Boiler MCC room 3T		3 kW	U	1	0	D	S	N	I									
ESP control room at 3.7 m level 10T		9 kW	U	1	0	D	S	N	I									
AC PLANT ROOM 2 (3T)		3 kW	S	1	0	D	S	N	I									

NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (dc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

LOAD DATA (ELECTRICAL)	JOB NO.	400	ORIGINATING AGENCY		PEM (ELECTRICAL)	
	PROJECT TITLE	2 X 500MW NNTPS TPP (SG)	NAME		DATA FILLED UP ON	
	SYSTEM	ELECTRIC HOIST	SIGN.		DATA ENTERED ON	
	DEPTT. / SECTION	ELECTRICAL	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE	

Annexure-VI

VENDOR HAS TO SUBMIT ONLY FOLLOWING DOCUMENTS ALONG WITH THE OFFER, FOR TECHNICAL EVALUATION OF THE BID:-

1) SCHEDULE OF TECHNICAL DEVIATION (IF ANY)
   OR

   'NO DEVIATION CERTIFICATE' – Clearly mentioning that bidder has considered 'No - Deviation' from the technical specification provided by BHEL.

2) SIGNED AND STAMPED COPY OF COMPLIANCE CUM CONFIRMATION CERTIFICATE.
3) Unpriced format, duly mentioned 'Quoted' against each Sl.no. below each column.
4) A copy of the sheet "Electrical Equipment Specification for Electrical Hoists' and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
5) Electrical load requirement in the load data format.

Note1:- Any other standard document/ details furnished by the bidder i.e. Data sheet / GA Drawing/ QAP etc. shall not be taken in to consideration for evaluation.

Note 2:- Bidder to note that if the bidder does not submit the documents mentioned in Sl. No. 1, 2, and 3 along with their offer then their offer is liable to be rejected.

PRE-BID CLARIFICATION SCHEDULE

S. No.	Section/Clause /Page No.	Statement of the referred clause	Clarification Required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE: _____

NAME: _____

DESIGNATION: _____

COMPANY: _____

DATE: _____

COMPANY SEAL

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate (every sheet) and furnish same with the offer.

a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under "exclusion" in section C and those resolved as per 'Schedule of Deviations', if applicable, with regard to same.

b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.

c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This shall be within the contracted price with no extra implications to BHEL after award of the contract.

d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.

e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre - bid discussions, otherwise BHEL/ Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

   For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.

g) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.

h) The EQUIPMENT'S functional guarantees shall stand valid till at least eighteen (18) months from PERFORMANCE GUARANTEE test of equipment as per technical specification or commercial terms and conditions, whichever is later.

i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities. This clause will apply in case during site commissioning additional requirements emerges due to customer and/ or consultant's comments. No extra claims shall be put on this account.

j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

k) As built drawings shall be submitted as and when required during the project execution.

l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

Project: 2X500 MW NNTPS, (SG)								
Enquiry No.:								
Package: ELECTRIC WIRE ROPE HOISTS								
Price Format								
S.N.	**Description of equipment / item**	**Total Qty requird**	**Unit ex-works price (duly packed) (Rs.)**	**Total ex-works price (duly packed) (Rs.)**	**Excise duty**	**Central sales tax against form C / VAT (Rs.)**	**Freight charges including service tax @ % (Rs.) if any**	**Total FOR site price Rs.**
1	2	3	4	5	6	7	8	9
1.0	Total lumpsum firm price for design, engineering, manufacturing, inspection and testing at vendor's works, painting, supply/delivery duly packed at FOR Site including freight, for the following Electric Hoists along with Maintenance tools & tackles, commissioning spares, mandatory spares, initial fill of lubricants and all other accessories in line with drawings / documents / test procedures approved by BHEL/Customer for the total scope defined as per technical specification PE-TS-400-563-A002 taking into account all clarifications, confirmations and agreements till date.	9 no.s						
	Break-up of 1.0 (1.1 to 1.12)							
1.1	Total lumpsum price of 2 No. Electric Hoist of 3T cap, 6 m lift, 10 m runway length (straight path) for AHU (SG area) with all accessories including isolating switch, dsl, etc.	2 no.s						
1.2	Total lumpsum price of 2 No. Electric Hoist of 5 T cap, 9 m lift, 8.5 m runway length (straight path) for DMCW PUMPS MOTOR HANDLING (SG) (AB BAY, EL+0.0M) with all accessories including isolating switch, dsl, etc.	2 no.s						
1.3	Total lumpsum price of 2 No. Electric Hoist of 3 T cap, 9 m lift, 5m runway length (straight path) for BOILER MCC ROOM with all accessories including isolating switch, dsl etc.	2 no.s						
1.4	Total lumpsum price of 2 No. Electric Hoist of 10 T cap,19 m lift, 5m runway length (straight path) below 8.4 M level at ESP BUILDING with all accessories including isolating switch, dsl etc.	2 no.s						
1.5	Total lumpsum price of 1 No. Electric Hoist of 3 T cap, 8 m lift, 20m runway length (curved path) for AC plant room 2 with all accessories including isolating switch, dsl etc.	1 no.s						
1.6	Total lumpsum price of mandatory spares as per Ann C for 3T cap EH	Lot						
1.7	Total lumpsum price of mandatory spares as per Ann D for 5T cap EH	Lot						
1.8	Total lumpsum price of mandatory spares as per Ann E for 10T cap EH	Lot						
1.9	Total price of ten (10) sets of Commissioning Spares for 3 T, 5T & 10T capacity Electric Hoists (Break up at ANNEXURE A)	10 sets						
1.10	Total price of one (1) set of Maintenance tools and tackles for 3T, 5T & 10T capacity Electric Hoists (Break up at ANNEXURE B)	1 set						
	Total from sl no. 1.1 to 1.10 (Should match with the price mentioned at 1.0)							
2.0	**Break up prices**							
2.1	**Break up prices of sl no 1.1**							
a)	Total lumpsum price of 2 No. Electric Hoist of 3T cap, 6 m lift (straight path) for AHU (SG area) with all accessories	2 no.s						
b)	Total price of isolating switch (located at 1.5m at floor level) and power cable from isolating switch to DSL.	2 lot						
c)	Total price of PVC shrouded type DSL suitable for 10 m travel length in straight path.	2 lot (each of 10 m baylength)						
d)	Total from 2.1 a) to c)							
2.2	**ces of sl no 1.2**							
a)	price of 2 No. Electric Hoist of 5 T cap, 9 m lift (str W PUMPS MOTOR HANDLING (SG) (AB BAY, all accessories							

Project: 2X500 MW NNTPS, (SG)								
Enquiry No.:								
Package: ELECTRIC WIRE ROPE HOISTS								
Price Format								
S.N.	**Description of equipment / item**	**Total Qty requird**	**Unit ex-works price (duly packed) (Rs.)**	**Total ex-works price (duly packed) (Rs.)**	**Excise duty**	**Central sales tax against form C / VAT (Rs.)**	**Freight charges including service tax @ % (Rs.) if any**	**Total FOR site price Rs.**
1	2	3	4	5	6	7	8	9
b)	Total price of isolating switch (located at 1.5m at floor level) and power cable from isolating switch to DSL.	2 lot						
c)	Total price of PVC shrouded type DSL suitable for 8.5 m travel length in straight path.	2 lot (each of 8.5 m baylength)						
d)	Total from 2.2 a) to c)							
2.3	**Break up prices of sl no 1.3**							
a)	Total lumpsum price of 2 No. Electric Hoist of 3 T cap, 9 m lift (straight path) for BOILER MCC ROOM with all accessories	2 no.s						
b)	Total price of isolating switch (located at 1.5m at floor level) and power cable from isolating switch to DSL.	2 lot						
c)	Total price of PVC shrouded type DSL suitable for 5 m travel length in straight path.	2 lot (each of 5 m baylength)						
d)	Total from 2.3 a) to c)							
2.4	**Break up prices of sl no 1.4**							
a)	Total lumpsum price of 2 No. Electric Hoist of 10 T cap,19 m lift (straight path) below 8.4 M level at ESP BUILDING with all accessories	2 no.s						
b)	Total price of isolating switch (located at 1.5m at floor level) and power cable from isolating switch to DSL.	2 lot						
c)	Total price of PVC shrouded type DSL suitable for 5 m travel length in straight path.	2 lot (each of 5 m baylength)						
d)	Total from 2.4 a) to c)							
2.5	**Break up prices of sl no 1.5**							
a)	Total lumpsum price of 1 No. Electric Hoist of 3 T cap, 8 m lift (curved path) for AC plant room 2 with all accessories	1 no.s						
b)	Total price of isolating switch (located at 1.5m at floor level) and power cable from isolating switch to DSL.	1 lot						
c)	Total price of PVC shrouded type DSL suitable for 20 m travel length in straight path.	1 lot (each of 20 m baylength)						
d)	Total from 2.5 a) to c)							
NOTE								
1	Bidder to note that total price indicated above at 1.00 shall be considered for evaluation and hence should be complete in all respect for the full scope defined and considering all terms and conditions agreed.							
2	Any item not included in the price quoted above and shown separately will not be taken cognizance of and the offer shall be liable for rejection.							
3	Prices mentioned against clause no. 2.1 c), 2.2 c), 2.3 c), 2.4 c), 2.5 c), above will be taken for price adjustment due to change in bay length, if any, at actual site condition than mentioned here.							
4	Bidder to note that in their un-price bid, you must indicate as "QUOTED" against unit price & total price column. Price should be indicated in Price Bid only.							
					Signature of bidder with seal			

2X500 MW NNTPS, (SG)									
No.:								**ANNEXURE-A**	
Package: ELECTRIC WIRE ROPE HOISTS									
Price Format									

List of Commisioning spares

Sl.no	Description	Total quantity required	Unit	Unit ex-works price (duly packed) (Rs.)	Total ex-works price (duly packed) (Rs.)	Excise duty	Central sales tax against form C / VAT (Rs.)	Freight charges including service tax @ % (Rs.) if any	Total FOR site price Rs.
1	2	3	4	5	6	7	8	9	10
A	**for 3T capacity electric hoist.**	3	Sets						
I)	Overload Relay								
ii)	Limit Switch								
	Fuse Link								
	for 5T capacity electric hoist.	1	Sets						
	Overload Relay								
ii)	Limit Switch								
iii)	Fuse Link								
C	**for 10T capacity electric hoist.**	1	Sets						
I)	Overload Relay								
ii)	Limit Switch								
iii)	Fuse Link								
	Total for site price for Comm. Spares								
	Date: _____								
	Bidder's / bidder's representative signature					Company Seal			

: 2X500 MW NNTPS, (SG)

y No.: ANNEXURE-B

Package: ELECTRIC WIRE ROPE HOISTS

Price Format

List of Maintenance Tools & Tackles

Sl.no	Description	Total quantity required	Unit	Unit ex-works price (duly packed) (Rs.)	Total ex-works price (duly packed) (Rs.)	Excise duty	Central sales tax against form C / VAT (Rs.)	Freight charges including service tax @ % (Rs.) if any	Total FOR site price Rs.
A.	**COMMON FOR ALL ELECTRIC HOISTS**								
1	Complete set of 6 nos. ring spanners(Indicate sizes)	1	Sets						
2	Complete set of screwdrivers (Min 6 nos , indicate size)	1	Sets						
3	Adjustable Spanner	1	no.						
4	Insulated plier	1	no.						
5	Grease gun	1	no.						
6	Oil gun	1	no.						
7	Line tester	1	no.						
	Total FOR site Price of A.								

Note: - 1) The tools shall be supplied in one tool box .

2) Any additional tools and tackles required for maintenance shall be supplied.

Date: _____

Bidder's / bidder's representative signature

Company Seal

2X500 MW NNTPS (SG) Annexure C

PRICE SCHEDULE FOR MANDATORY SPARES FOR 3T CAP ELECTRIC HOIST

S. No	DESCRIPTION OF EQUIPMENT / ITEM	Qty	Unit Ex-works price (Rs.)	Total Ex-works price (Rs.)	ED including cess	VAT/CST as applicable (Rs.)	Freight	TOTAL F.O.R. Site Price (Rs.)
1	2	3	4	5	6	7	8	9
1	**MECHANICAL**							
i)	1st input pinion assly.	1no.each type for all drives						
ii)	Brake shoe liner	6 pair each type						
iii)	CT wheel assly. Complete (driving)	1 no. each type						
iv)	CT wheel assly. Complete (idle)	1 no. each type						
v)	Oil seal	4 nos. each type						
vi)	Rope guide	2 nos. each type						
vii)	Rope sheave assly. With brgs	1 no. each type						
2	**Electrical**							
i)	Star-delta contactors	Min. 1 no. of each type						
ii)	Overload relay	2 nos of each type						
iii)	Fuses	30% of each rating						
iv)	Relay/Timers	3 nos. of each type						
v)	Push buttons	30% of each rating						
vi)	Diode bridge	20% of each rating						
vii)	Switch fuse unit	2 nos. of each rating						
viii)	Brake coil	30% of each rating						
3	**MOTORS (To be repeated for each type & rating)**							
i)	Bearing (driving end)	1 No. of each type						
ii)	Bearing (Non-driving end)	1 No. of each type						
iii)	End shield (DE and NDE)	1 set of each type						
iv)	Cooling fan of motors	1 No. of each type						
v)	Fan cover	1 No. of each type						
vi)	Lubrication oil pump motor	1 No. of each type and rating						
vii)	Bearing puller	1 Nos. of each type						
viii)	Grease gun	2 Nos.						
ix)	Special spanners/tools	1 Set						
	Total (1 (i) to 3 (ix))							

Note :

1	It is not the intent to specify completely herein, all the details of spares required for good maintenance of the equipment. However, all the spares required for three years normal operation of the equipment/systems shall be supplied(whether indicated in the specifications or not) and the spares shall conform in all respects to high standards of engineering, design & workmanship and be capable of performing in continuous commercial operation.
2	The lists of spares indicated are for the type equipment generally used in thermal power plants. If the design or type of equipment proposed by the bidder is different, then the bidder shall suit the spares list according to the type of equipment. However, the numers or quantity of spares, indicated shall not be reduced.
3	All essential spares shall be supplied as per the requirement of the specifications. In case any spare indicated in the specification is not applicable for particular equipment then suitable applicable alternate spare have been offered / shall be supplied without any financial implication.
4	Any change or variation in equipment or systems during detailed engineering stage which would cause changes / variations in the essential spares quantity, shall be supplied by Vendor without any commercial implications
5	For quantities indicated in percentage, fractions are to be rounded-off to next higher integer.
6	Any item which is “not applicable” in the above list and is found to be “applicable” at a later date shall be supplied by theVendor without any extra cost.
7	If any of the items of spares/tools & tackles ordered is found to be not applicable during detailed engineering stage/execution stage, the contractor will have to supply alternative items of spares/tools & tackles. The alternative items of spares/tools & tackles are to be mutually agreed between the PURCHASER and VENDOR

2X500 MW NNTPS (SG) Annexure D

PRICE SCHEDULE FOR MANDATORY SPARES FOR 5T CAP ELECTRIC HOIST

S. No	DESCRIPTION OF EQUIPMENT / ITEM	Qty	Unit Ex-works price (Rs.)	Total Ex-works price (Rs.)	ED including cess	VAT/CST as applicable (Rs.)	Freight	TOTAL F.O.R. Site Price (Rs.)
1	2	3	4	5	6	7	8	9
1	**MECHANICAL**							
i)	1st input pinion assly.	1no.each type for all drives						
ii)	Brake shoe liner	6 pair each type						
iii)	CT wheel assly. Complete (driving)	1 no. each type						
iv)	CT wheel assly. Complete (idle)	1 no. each type						
v)	Oil seal	4 nos. each type						
vi)	Rope guide	2 nos. each type						
vii)	Rope sheave assly. With brgs	1 no. each type						
2	**Electrical**							
i)	Star-delta contactors	Min. 1 no. of each type						
ii)	Overload relay	2 nos of each type						
iii)	Fuses	30% of each rating						
iv)	Relay/Timers	3 nos. of each type						
v)	Push buttons	30% of each rating						
vi)	Diode bridge	20% of each rating						
vii)	Switch fuse unit	2 nos. of each rating						
viii)	Brake coil	30% of each rating						
3	**MOTORS (To be repeated for each type & rating)**							
i)	Bearing (driving end)	1 No. of each type						
ii)	Bearing (Non-driving end)	1 No. of each type						
iii)	End shield (DE and NDE)	1 set of each type						
iv)	Cooling fan of motors	1 No. of each type						
v)	Fan cover	1 No. of each type						
vi)	Lubrication oil pump motor	1 No. of each type and rating						
vii)	Bearing puller	1 Nos. of each type						
viii)	Grease gun	2 Nos.						
ix)	Special spanners/tools	1 Set						
	Total (1 (i) to 3 (ix))							

Note :

1	It is not the intent to specify completely herein, all the details of spares required for good maintenance of the equipment. However, all the spares required for three years normal operation of the equipment/systems shall be supplied(whether indicated in the specifications or not) and the spares shall conform in all respects to high standards of engineering, design & workmanship and be capable of performing in continuous commercial operation.
2	The lists of spares indicated are for the type equipment generally used in thermal power plants. If the design or type of equipment proposed by the bidder is different, then the bidder shall suit the spares list according to the type of equipment. However, the numers or quantity of spares, indicated shall not be reduced.
3	All essential spares shall be supplied as per the requirement of the specifications. In case any spare indicated in the specification is not applicable for particular equipment then suitable applicable alternate spare have been offered / shall be supplied without any financial implication.
4	Any change or variation in equipment or systems during detailed engineering stage which would cause changes / variations in the essential spares quantity, shall be supplied by Vendor without any commercial implications
5	For quantities indicated in percentage, fractions are to be rounded-off to next higher integer.
6	Any item which is “not applicable” in the above list and is found to be “applicable” at a later date shall be supplied by theVendor without any extra cost.
7	If any of the items of spares/tools & tackles ordered is found to be not applicable during detailed engineering stage/execution stage, the contractor will have to supply alternative items of spares/tools & tackles. The alternative items of spares/tools & tackles are to be mutually agreed between the PURCHASER and VENDOR

2X500 MW NNTPS (SG) Annexure E

PRICE SCHEDULE FOR MANDATORY SPARES FOR 10T CAP ELECTRIC HOIST

S. No	DESCRIPTION OF EQUIPMENT / ITEM	Qty	Unit Ex-works price (Rs.)	Total Ex-works price (Rs.)	ED including cess	VAT/CST as applicable (Rs.)	Freight	TOTAL F.O.R. Site Price (Rs.)
1	2	3	4	5	6	7	8	9
1	**MECHANICAL**							
i)	1st input pinion assly.	1no.each type for all drives						
ii)	Brake shoe liner	6 pair each type						
iii)	CT wheel assly. Complete (driving)	1 no. each type						
iv)	CT wheel assly. Complete (idle)	1 no. each type						
v)	Oil seal	4 nos. each type						
vi)	Rope guide	2 nos. each type						
vii)	Rope sheave assly. With brgs	1 no. each type						
2	**Electrical**							
i)	Star-delta contactors	Min. 1 no. of each type						
ii)	Overload relay	2 nos of each type						
iii)	Fuses	30% of each rating						
iv)	Relay/Timers	3 nos. of each type						
v)	Push buttons	30% of each rating						
vi)	Diode bridge	20% of each rating						
vii)	Switch fuse unit	2 nos. of each rating						
viii)	Brake coil	30% of each rating						
3	**MOTORS (To be repeated for each type & rating)**							
i)	Bearing (driving end)	1 No. of each type						
ii)	Bearing (Non-driving end)	1 No. of each type						
iii)	End shield (DE and NDE)	1 set of each type						
iv)	Cooling fan of motors	1 No. of each type						
v)	Fan cover	1 No. of each type						
vi)	Lubrication oil pump motor	1 No. of each type and rating						
vii)	Bearing puller	1 Nos. of each type						
viii)	Grease gun	2 Nos.						
ix)	Special spanners/tools	1 Set						
	Total (1 (i) to 3 (ix))							

Note :

1	It is not the intent to specify completely herein, all the details of spares required for good maintenance of the equipment. However, all the spares required for three years normal operation of the equipment/systems shall be supplied(whether indicated in the specifications or not) and the spares shall conform in all respects to high standards of engineering, design & workmanship and be capable of performing in continuous commercial operation.
2	The lists of spares indicated are for the type equipment generally used in thermal power plants. If the design or type of equipment proposed by the bidder is different, then the bidder shall suit the spares list according to the type of equipment. However, the numers or quantity of spares, indicated shall not be reduced.
3	All essential spares shall be supplied as per the requirement of the specifications. In case any spare indicated in the specification is not applicable for particular equipment then suitable applicable alternate spare have been offered / shall be supplied without any financial implication.
4	Any change or variation in equipment or systems during detailed engineering stage which would cause changes / variations in the essential spares quantity, shall be supplied by Vendor without any commercial implications
5	For quantities indicated in percentage, fractions are to be rounded-off to next higher integer.
6	Any item which is “not applicable” in the above list and is found to be “applicable” at a later date shall be supplied by theVendor without any extra cost.
7	If any of the items of spares/tools & tackles ordered is found to be not applicable during detailed engineering stage/execution stage, the contractor will have to supply alternative items of spares/tools & tackles. The alternative items of spares/tools & tackles are to be mutually agreed between the PURCHASER and VENDOR

DEVIATION SHEET (COST OF WITHDRAWL)

PROJECT:- 2X500 MW NNTPS (SG)

PACKAGE:- ELECTRIC HOIST

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATIO N/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	**DESIGNATIONS**	**SIGN & DATE**	

NOTES:

1. For self manufactured items of bidder, cost of withdrawl of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawl of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawl of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawl of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of withdrawl is to be given seperately for each deviation. In no event bidder should club cost of withdrawl of more than one deviation else cost of withdrawl of such deviations which have been clubbed together shall be considered as NIL.
13. In case nature of cost of withdrawl (positive/negative) is not specified it shall be assumed as positive.
14. In case of descrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.