3 x 800 MW PVUNL PATRATU TPP PHASE-I - SINGLE GIRDER EOT / HOT MISC. CRANE

BOQ CUM UNPRICE SCHEDULE

TECHNICAL SPECIFICATION - PE-TS-434-524-A001

Item Number	Item Title	Item Description	Item Quantity	Unit of Measure	To be filled by bidder (Quoted/Not Quoted)
1	MAIN SUPPLY & COMMISSIONING SPARES	For: Compressor House (INDOOR) Type: Single Girder Overhead Crane Capacity: 8T Span: 13.3 m Lift: 5.5 m Baylength: 30 m	1	No.	
2		PVC Shrouded bus bar type DSL complete with all accessories for complete baylength	1	Lot	
3		VVVF Drives	1	Set	
4		COMMISSIONING SPARES	1	Set	
5		For: CEP HANDLING (OUTDOOR) Type: Single Girder UNDERSLUNG Crane Capacity: 15T Span: 6 m Lift: 13 m Baylength: 15 m	3	Nos.	
6		PVC Shrouded bus bar type DSL complete with all accessories for complete baylength	3	Lot	
7		VVVF Drives	3	Set	
8		COMMISSIONING SPARES	1	Set	
9		Maintenance tools and tackles	1	set	
10	MANDATORY SPARES FOR COMPRESSOR HOUSE CRANE	All Bearings	2 sets of each type/ rating		
11		Brake assembly and its liners	2 sets of each type/ rating		
12		Wire rope	Two complete length for each type/ rating		
13	Supervision of Erection & Commisioning	Charges per visit	4	Nos.	
14		Charges per man-day	8	Nos.	

Note:

Compressor house crane is common for all three units of Patratu project however CEP crane (15T) is provided for each unit.

1) Prices mentioned against Item no 2 & 6 above will be taken for price adjustment due to change in baylength, if any, during detailed engineering.
2) Bidder to note that there shall be no implication for change in lift and/or span upto (+/-)500 mm for CEP handling Crane .
3) The requirement for visit &/or supervision at site as indicated at S no 13 & 14 shall vary as per requirement of site. Any variation shall be adjusted as per Unit rate mentioned against these clauses.
4) Mandatory spares listed above is bare minimum requirement. In case any additional mandatory spares requirement is covered elsewhere in the tender specification apart from specified above, same shall be deemed to have been covered in bidders scope of supply.
5) 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.
6) 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.
7) 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.
8) For quantities indicated in percentage, fractions are to be rounded-off to next higher integer.
9) 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.
10) 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.

Risk & Cost Purchase clause- Annexure-II

BHEL reserves the right to terminate the contract or withdraw portion of work and get it done through other agency, at the risk and cost of the contractor after due notice of a period of 14 days' by BHEL in any of the following cases:

i) If the Seller/Contractor fails to deliver the goods or materials or any instalment thereof within the period(s) fixed for such delivery or the Seller's poor progress of the supply/ services vis-à-vis delivery/execution timeline as stipulated in the Contract, backlog attributable to seller including unexecuted portion of supply does not appear to be executable within balance available period;

ii) Delivers goods or materials not of the contracted quality and failing to adhere to the contract specifications;

iii) Withdrawal from or repudiation/ abandonment of the supply/ services by Seller before completion as per contract or if the Seller refuses or is unable to supply goods or materials covered by the Order/Contract either in whole or in part or otherwise fails to perform the Order/Contract;

iv) Non-supply by the Seller within scheduled completion/delivery period as per Contract or as extended from time to time, for the reasons attributable to the Seller;

v) Termination of Contract on account of any other reason (s) attributable to Seller.

vi) Assignment, transfer, subletting of Contract without BHEL's written permission resulting in termination of Contract or part thereof by BHEL.

vii) If the Seller be an individual or a sole proprietorship Firm, in the event of the death or insanity of the Seller;

viii) If the Seller/Contractor being an individual or if a firm on a partnership thereof, shall at any time, be adjudged insolvent or shall have a receiving order for administration of his estate made against him or shall take any proceeding for composition under any Insolvency Act for the time being in force or make any assignment of the Order/Contract or enter into any arrangement or composition with his creditors or suspend payment or if the firm dissolved under the Partnership Act;

ix) If the Seller/Contractor being a company is wound up voluntarily or by order of a Court or a Receiver, Liquidator or Manager on behalf of the debenture holders and creditors is appointed or circumstances shall have arisen which entitles the Court of debenture holder and creditors to appoint a receiver, liquidator or manager;

x) Non-compliance to any contractual condition or any other default attributable to Seller.

Such defaulting vendor/Seller shall not be eligible to participate in re-tendering conducted on account

of risk purchase made due to fault of such vendor/Seller.

3.1 Risk & Cost Amount against Balance Work:

Risk & Cost amount against balance work shall be calculated as follows:

Risk & Cost Amount= [(A-B) + (A x H/100)]

Where,

A= Value of Balance scope of Work (*) as per rates of new contract

Risk & Cost Purchase clause- Annexure-II

B= Value of Balance scope of Work (*) as per rates of old contract being paid to the contractor at the time

of termination of contract i.e. inclusive of PVC & ORC, if any.

H = Overhead Factor to be taken as 5

In case (A-B) is less than 0 (zero), value of (A-B) shall be taken as 0 (zero).

3.2 * Balance scope of work (in case of termination of contract):

Difference of Contract Quantities and Executed Quantities as on the date of issue of Letter for 'Termination of Contract', shall be taken as balance scope of Work for calculating risk & cost amount.

Contract quantities are the quantities as per original contract. If, Contract has been amended, quantities as per amended Contract shall be considered as Contract Quantities.

Items for which total quantities to be executed have exceeded the Contract Quantities based on drawings issued to contractor from time to time till issue of Termination letter, then for these items total Quantities as per issued drawings would be deemed to be contract quantities.

Substitute/ extra items whose rates have already been approved would form part of contract quantities for this purpose.

Substitute/ extra items which have been executed but rates have not been approved, would also form part of contract quantities for this purpose and rates of such items shall be determined in line with contractual provisions.

However, increase in quantities on account of additional scope in new tender shall not be considered for this purpose.

NOTE: In case portion of work is being withdrawn at risk & cost of contractor instead of termination of contract, contract

quantities pertaining to portion of work withdrawn shall be considered as 'Balance scope of work' for calculating Risk &

Cost amount.

3.3 LD against delay in executed work in case of Termination of Contract:

LD against delay in executed work shall be calculated in line with LD clause no. 16 of GCC, for the delay attributable to

contractor. For limiting the maximum value of LD, contract value shall be taken as Executed Value of work till termination

of contract.

Method for calculation of LD against delay in executed work in case of termination of contract" is given below.

i. Let the time period from scheduled date of start of work till termination of contract excluding the period of

Hold (if any) not attributable to contractor = T1

ii. Let the value of executed work till the time of termination of contract = X

iii. Let the Total Executable Value of work for which inputs/fronts were made available to contractor and were

planned for execution till termination of contract = Y

iv. Delay in executed work attributable to contractor i.e. T2 = [1-(X/Y)] x T1

v. LD shall be calculated in line with LD clause (clause 16) of the Contract for the delay attributable to

contractor taking “X” as Contract Value and “T2” as period of delay attributable to contractor.

3.4. Recoveries arising out of Risk & Cost and LD or any other recoveries due from Contractor

Without prejudice to the other means of recovery of such dues from the Seller recoveries from the Seller on whom risk & cost has been invoked shall be made from the following:

a) Dues available in the form of Bills payable to seller, SD, BGs against the same contract.

b) Dues payable to seller against other contracts in the same Region/Unit/ Division of BHEL.

c) Dues payable to seller against other contracts in the different Region/Unit/ division of BHEL.

In-case recoveries are not possible with any of the above available options, Legal action shall be initiated for recovery against contractor.

530912/2021/PS-PEM-MAX

	PRE-QUALIFICATION REQUIREMENT- SINGLE GIRDER EOT/HOT CRANE WITH MINIMUM 5T CAPACITY	PE-PQ-999-524A-A001	
		DATE	
		REV NO	00

1.0	Bidder should have capabilities for design, manufacturing and testing of Single Girder EOT/HOT crane with minimum 5T capacity.
2.0	The Bidder has to submit following supporting documents meeting above mentioned pre-qualifying requirement a. Copy of minimum one (1) performance certificate (in English) from end user along with copy of related Purchase Order (PO) or Letter of intent (LOI) or Letter of Award (LOA) or Work Order (WO) specifying that the product/equipment is running successfully for one (1) year from date of commissioning meeting the minimum pre-qualifying requirement. OR b. Minimum two PO/ LOI/ LOA/ WO placed with a minimum gap of six (6) months from same purchaser meeting the minimum pre-qualifying requirement. OR c. Minimum one PO/ LOI/ LOA/ WO after commissioning of first order from same purchaser meeting the minimum pre-qualifying requirement. OR d. Minimum three customer's/ third party's inspection reports/ test certificates meeting the minimum pre-qualifying requirement.
3.0	Credentials for Double Girder EOT crane shall also be considered for qualification for Single Girder EOT/HOT crane for which documents listed at S.No. 2.0 are to be furnished.
4.0	Bidder shall submit design documents to substantiate technical parameters specified in PQR, if the same is not mentioned in performance certificate/purchase order.
5.0	Minimum one (1) no. Purchase order shall be submitted which should not be more than seven (7) years old as on date of bid submission, for establishing continuity in business. This is over and above the requirement of PO mentioned of PQR clause at S. No. 2.0 above.
6.0	Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.
7.0	Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.
8.0	Consideration of offer shall be subject to customer's approval of bidders, if applicable.
9.0	After satisfactory fulfilment of all the above criteria/ requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.

NTPC LTD

3 X 800 MW PVUNL PATRATU SUPER THERMAL POWER PROJECT, STAGE I

TECHNICAL SPECIFICATION FOR SINGLE GIRDER EOT CRANE

SPECIFICATION NO.: PE-TS-434-524-A001

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERIING MANAGEMENT
NOIDA
INDIA

	3X800 MW PATRATU STPP	SPECIFICATION No: PE-TS-434-524-A001
		SECTION
	SINGLE GIRDER EOT CRANE	
		REV. 00
	CONTENTS	DATE: OCTOBER 2021

CONTENTS

PROJECT INFORMATION:

CLAUSE NO.	PROJECT INFORMATION

PATRATU STPS EXPANSION PHASE-I (3X800 MW)

1.00.00 BACKGROUND

A Memorandum of Agreement (MOA) has been entered on 29.07.2015 amongst Govt. of Jharkhand (GoJ), Jharkhand Urja Vikash Nigam Limited (JUVNL), Jharkhand UrjaUtpadan Nigam Limited (JUUNL), Jharkhand BijliVitaran Nigam Limited (JBVNL) and NTPC Limited to form a Joint Venture Company of NTPC Limted& JBVNL for transfer of Patratu Thermal Power Station (PTPS) located in Ramgarh District of Jharkhand State to the proposed JV Company for Performance Improvement of existing capacity & 4000 MW Capacity expansion of PTPS.

Further to signing of JV agreement on 29.07.2015, a Joint Venture Company namely Patratu Vidyut Utpadan Nigam Limited (PVUNL) has been incorporated amongst GoJ, JUVNL, JBVNL and NTPC Ltd. on 15.10.2015. The Performance Improvement of existing capacity and 4000 MW Capacity expansion of Patratu STPS will be implemented by the JV Company (JVC). The configuration of expansion of 4000 MW shall consist of 5 units of 800 MW to be implemented in two phases; Phase-I: 3x800 MW and Phase-II: 2x800 MW.

The present proposal is for Patratu STPS Phase-I (3x800 MW). The project is envisaged to be commissioned during XIII Plan period.

2.00.00 CAPACITY

Patratu STPS Phase-I: 3x800 MW - Present proposal

3.00.00 MODE OF OPERATION

Base Load

4.00.00 LOCATION AND APPROACH

4.01.00 Patratu Thermal Power station (PTPS) is located just outside the coal belt of South Karanpura in Ramgarh District of Jharkhand State. The nearest Railway Station is Patratu which is at a distance of about 4 km on Barkakhana-Barwadih Railway line.

4.02.00 **The latitudes and longitudes of the site are as follows:**

Corner name	Latitude	Longitude
Top Corner	23° 38 ‘ 60 ‘’ N	85° 17’ 51.5” E
Bottom Corner	23° 38 ‘12.5 ‘’ N	85° 17’ 27” E
Left Corner	23° 38 ‘ 22.5 ‘’ N	85° 17’ 10.6 ‘’ E
Right Corner	23° 38 ‘ 40 ‘’ N	85° 17’ 57 ‘’ E

4.03.00 **Airport**

The nearest commercial airport is Ranchi at about 45 km by road.

CLAUSE NO.	PROJECT INFORMATION
	A copy of Vicinity plan of the project site is placed at **Annexure - I**.
5.00.00	**LAND**
	The total land to be transferred to JV Company is 1859 acres. Out of 1859 acre, about 1234 acres of land has been envisaged for Plant, Ash pond and Land on railway track of the for Phase-I (3x800 MW). The balance 625 acre of land shall be transferred during commencement of Phase-II (2x800 MW).
6.00.00	**WATER**
	The make-up water for PSTPS is to be met from Patratu Dam on Nalkari River (capacity 99 MCM i.e. 110 Cusecs). About 52.34 Cusecs of water will be available at 90% dependable monsoon flow after considering evaporation loss.
	GoJ/JUVNL owns and controls water of Patratu Dam. GoJ/JUUNL supplies water to PTPS and to the other entities in the vicinity from this water reservoir. JUVNL had entered into agreements with these other entities for supply of water from water reservoir. JUVNL shall revisit these agreements to meet the requirement of water for expansion projects, if required.
	Make up water requirement of PSTPS, Phase-I (3x800 MW) would be about 27 Cusecs with “Air Cooled Condenser” based power plant. GoJ shall provide the required water from the existing reservoir to the JV Company.
	The JVC shall be responsible for the water supply arrangement starting at the downstream of intake chamber from where water supply commences for the Station. Ownership of the entire water supply system and related plant and equipment, including the water treatment plant, shall be that of the JVC and after the asset transfer, the JVC shall maintain, take care and use the same. The additional facility including addition of plant, equipment etc. for enhanced requirement (if any) and drawl of water shall be the responsibility of JVC and to be arranged by the JVC at their own cost.

CLAUSE NO.	PROJECT INFORMATION
7.00.00	**COAL**
7.01.00	**Coal Requirement, Availability and Linkage** About 12 MTPA of coal will be required to meet coal requirement of the Phase-I (3x800 MW) of the project. The Banhardih captive coal block at a distance of about 155 km from plant is allocated to JUVNL for end use of Patratu expansion. The coal from Banhardih captive coal block shall be transferred to the JVC for the usage of PSTPS with the approval of Ministry of Coal, GOI. MOC (11.09.15) has accorded in-principle approval of the Central Govt. to assign Banhardih Coal Block allocated to JUVNL to the JV Company.
7.02.00	**Coal Transportation** The envisaged mode of coal transportation from the coal mines to the power plant is by Indian Railways through BOBR / BOX- N wagons.
7.03.00	**Coal Quality** The primary fuel for the main steam generator shall be coal. The domestic coal quality parameters are indicated in **Annexure-IV-2** and imported coal parameters are indicated in **Annexure-IV-4** are to be considered for steam generator design.
7.04.00	**Fuel Oil** The fuel oils to be used for start-up, coal flame stabilization and low load operation of the steam generator shall be Heavy Fuel Oils having the characteristics given at **Annexure-IV-3**and Light Diesel Oil having the characteristics given at **Annexure-IV-1.**
8.00.00	**NOT USED**
9.00.00	**STEAM GENERATOR TECHNOLOGY** The steam generators shall be super critical once through type, water tube, direct pulverized coal fired, top supported, balanced draft furnace, single reheat, radiant, dry bottom type, suitable for outdoor installation. The gas path arrangement shall be single pass (Tower type) or two pass type.
10.00.00	**FLUE GAS DESULPHURIZATION SYSTEM (FGD) &SCR:** The project is envisaged with Flue Gas Desulfurization (FGD) system and SCR meeting Ministry of Environment, Forest & Climate Change notification dated 07.12.2015. Limestone to be used for design of FGD system shall be as per the characteristic given at Annexure-IV-5.
11.00.00	**POWER EVACUATION SYSTEM** 85% of power from the project is envisaged to be allocated to Jharkhand State subject to approval of Ministry of Power, while balance 15% would be as unallocated portion and Project is envisaged as regional project. Since major power (85%) is proposed to be absorbed by Jharkhand, the issue of Associated Transmission

CLAUSE NO.	PROJECT INFORMATION
	System for the project would be taken up with them for planning and execution of transmission system modalities as Inter-State System or ISTS System. Considering overall capacity of the project as 4000 MW, 765 kV step-up system has been envisaged. Two D/C 765 KV line, one each to New Ranchi (Bero) and Gaya has been envisaged. This would also form part of 765 kV transmission corridor connecting Ranchi to Gaya. These lines can be used to evacuate power to the Eastern Region ISTS as well as to Jharkhand State. In view of above, provision of four nos. of 765 kV outgoing Line bays has been kept in the new 765 kV generation switchyard. The issue of power evacuation of the proposed project shall be taken up with appropriate Transmission Utility (STU or CTU) as per regulatory provision, based on allocation of power.
12.00.00	**METEOROLOGICAL DATA** The meteorological data from nearest observatory is placed at **Annexure-II.**
13.00.00	**PLANT WATER SCHEME** The Plant water scheme is described below.
13.01.00	**Equipment Cooling Water (ECW) System (Unit Auxiliaries)** The plant auxiliaries of Steam Generator and Turbine Generator shall be cooled by Demineralized (DM) water in a closed circuit. The primary circuit DM water shall be cooled through plate type heat exchangers by Circulating Water tapped from ACW system in a secondary circuit. The station auxiliaries such as Air compressors, Compressors of ash handling plant, compressor of mill reject system etc. shall also be cooled by Demineralized (DM) water in a closed circuit .The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system. It is proposed to provide independent primary cooling water circuit for Steam Generator & auxiliaries and TG & its auxiliaries.
13.02.00	**Not used**
13.03.00	**Other Miscellaneous Water Systems** (a)The drinking water requirement of the plant shall be provided from water treatment plant. (b) Steam Cycle make-up water, makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water shall be provided from demineralizing plant. (c) The quality of Raw Water & DM Water is enclosed with this sub-section as **Annexure-III**. (d) Effluent from various areas in TG & SG system shall be collected in respective pits in their areas and pumped to a common terminal point as shown in plant water scheme.

CLAUSE NO.	PROJECT INFORMATION

14.00.00 CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

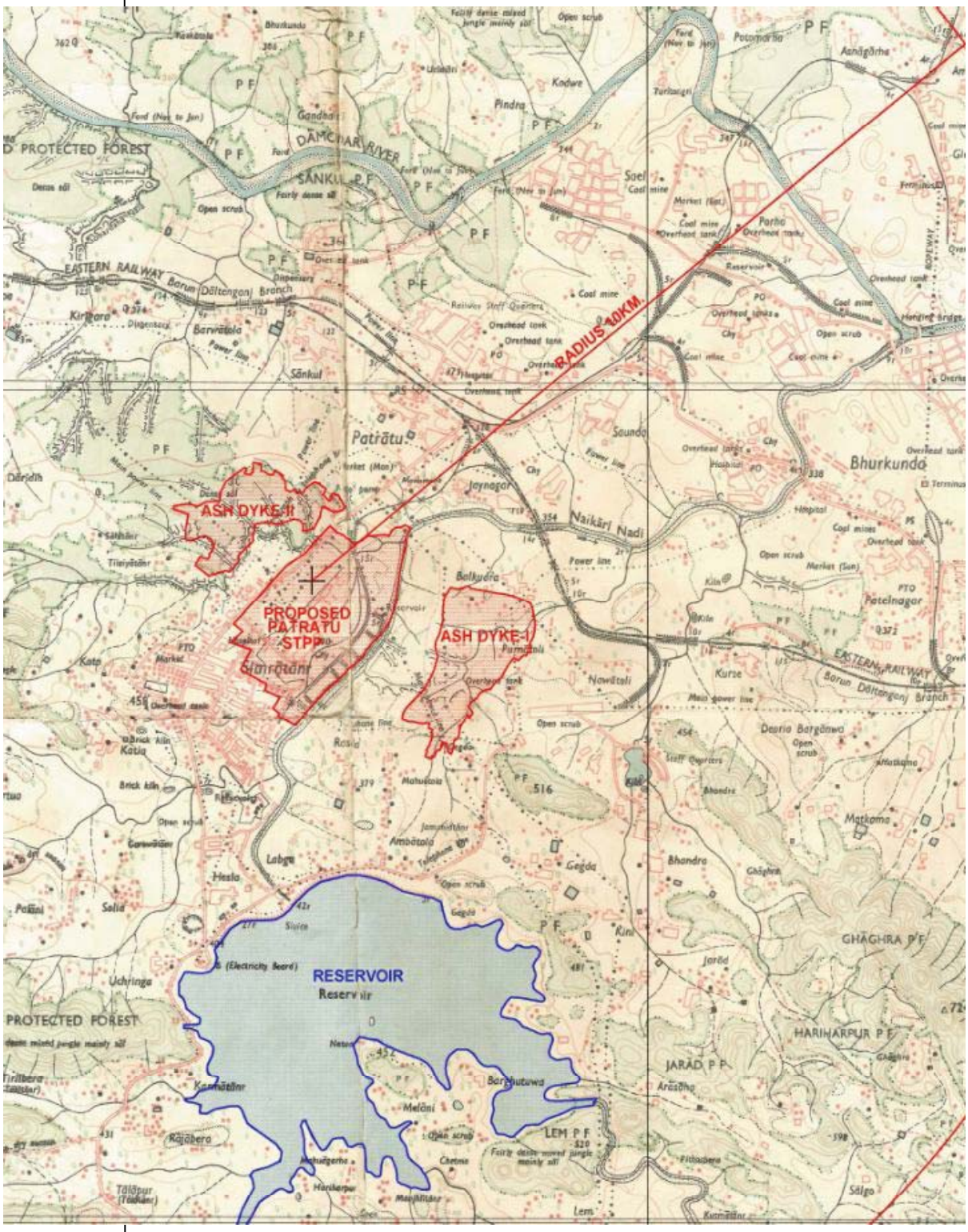
All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in Part-B of this section.

15.00.00 CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given as given in Part-B of this section.

CLAUSE NO.	PROJECT INFORMATION	एनटीपीसी NTPC

ANNEXURE-I



CLAUSE NO.	PROJECT INFORMATION	एनटीपीसी NTPC

ANNEXURE-II

C

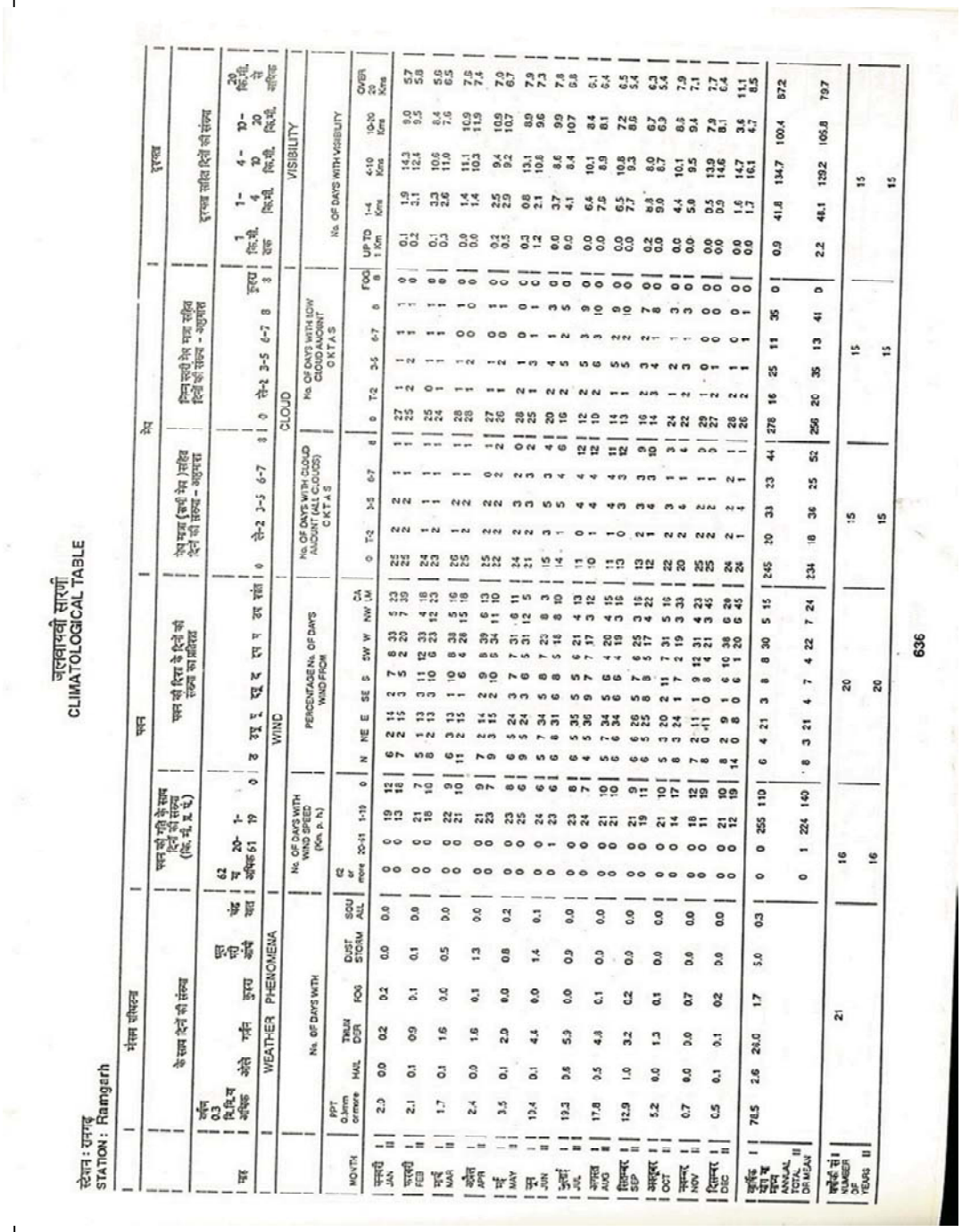
जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्टेशन : रामगढ़ STATION : Ramgarh — अक्षांश LAT 23°38' N — देशांतर LONG 85°30' E — समुद्री तल मध्य से ऊँचाई HEIGHT ABOVE M. S. L. 335 मीटर METRES

1953 से 1980 तक के प्रेक्षणों पर आधारित BASED ON OBSERVATIONS FROM 1953 TO 1980

MONTH (माह)		STATION LEVEL PRESSURE (स्टेशन का तल दाब)	AIR TEMPERATURE (वायु तापमान) – MEAN – DRY BULB (शुष्क बल्ब)	MEAN – WET BULB (नम बल्ब)	MEAN – DAILY MAX (दैनिक अधिक तम)	MEAN – DAILY MIN (दैनिक न्यून तम)	MEAN – HIGHEST IN THE MONTH (माह में उच्चतम)	MEAN – LOWEST IN THE MONTH (माह में निम्नतम)	EXTREMES (चरम) – HIGHEST (उच्चतम)	DATE AND YEAR (दिनांक और वर्ष)	LOWEST (निम्नतम)	DATE AND YEAR (दिनांक और वर्ष)	HUMIDITY (आर्द्रता) – RELATIVE HUMIDITY (सापेक्ष आर्द्रता)	VAPOUR PRESSURE (वाष्प दाब)	CLOUD AMOUNT (मेघ की मात्रा) – ALL CLOUDS (समस्त मेघ)	LOW CLOUDS (निम्न मेघ)	RAINFALL (वर्षा) – MONTHLY TOTAL (मासिक योग)	NO. OF RAINY DAYS (वर्षा के दिनों की संख्या)	TOTAL IN WETTEST MONTH WITH YEAR (वर्षसहित सबसे नम महीने का योग)	TOTAL IN DRIEST MONTH WITH YEAR (वर्षसहित शुष्कतम महीने का योग)	HEAVIEST FALL IN 24 HOURS (24 घंटों की सबसे भारी वर्षा)	DATE AND YEAR (दिनांक और वर्ष)	MEAN WIND SPEED (माध्य पवन गति)
		एच. पी. ए. hPa	डि.से. °C	डि.से. °C	डि.से. °C	डि.से. °C	डि.से. °C	डि.से. °C	डि.से. °C		डि.से. °C		प्रतिशत %	एच.पी.ए. hPa	आकाश के अष्टमांश Oktas of sky		मि.मि. mm		मि.मि. mm	मि.मि. mm	मि.मि. mm		कि.मी. प्र. घं. Kmph
जनवरी JAN	I		14.6	11.9	24.5	8.2	28.5	3.7	33.4	31 1967	1.2	05 1978	68	11.8	1.2	0.6	16.7	1.7	62.3 1953	0.0	42.0	04 1966	2.0
	II		20.2	15.2									55	13.3	1.3	0.7							
फरवरी FEB	I		17.1	13.3	27.6	10.5	32.7	5.5	37.8	24 1967	3.0	10 1978	62	12.4	1.0	0.5	19.3	1.3	94.0 1961	0.0	54.0	08 1961	2.8
	II		23.5	16.6									48	13.4	1.1	0.6							
मार्च MAR	I		23.5	17.2	33.0	15.1	37.3	10.4	41.4	29 1966	7.0	11 @ 1979	50	14.6	1.1	0.4	11.4	1.2	36.4 1956	0.0	23.2	06 1962	3.3
	II		29.3	18.7									35	14.3	1.5	0.6							
अप्रैल APR	I		30.2	21.3	38.4	21.0	42.3	15.6	45.2	16 1973	13.5	07 1967	42	18.5	1.2	0.4	16.0	1.4	52.7 1952	0.0	41.0	01 1959	4.3
	II		34.5	22.1									34	16.7	1.8	0.8							
मई MAY	I		32.6	24.1	40.8	24.5	44.8	20.0	48.0	11 1973	17.0	06 @ 1979	47	23.2	1.6	0.0	28.7	2.3	136.6 1959	0.0	76.4	28 1958	4.5
	II		36.3	24.3									38	20.7	2.4	1.2							
जून JUN	I		30.9	25.5	37.5	25.5	43.2	21.7	47.6	12 1965	19.5	01 1979	62	28.3	3.5	1.9	129.4	7.4	332.4 1961	13.4 1973	140.0	07 1961	4.9
	II		32.0	25.6									62	27.3	4.4	2.7							
जुलाई JUL	I		28.1	25.4	32.3	24.3	37.3	22.1	46.5	1961	20.0	09 @ 1974	77	30.3	5.5	4.0	289.9	16.5	565.3 1950	131.9 1966	205.2	18 1950	4.2
	II		28.9	25.7									77	30.6	5.8	4.1							
अगस्त AUG	I		27.6	25.3	31.7	24.1	35.3	22.1	38.0	06 1973	18.2	20 1960	79	30.5	5.3	3.5	288.7	15.8	616.0 1953	50.0 1974	169.9	24 1953	3.5
	II		28.3	25.8									81	31.1	5.6	3.7							
सितम्बर SEP	I		27.2	24.8	31.6	23.0	35.0	21.1	38.0	05 1974	18.9	30 1957	79	29.5	4.5	3.0	253.8	11.4	770.8 1957	92.7 1955	198.1	01 1957	3.1
	II		27.8	25.3									81	30.2	5.0	3.4							
अक्तूबर OCT	I		24.9	22.1	31.4	19.1	34.4	14.4	38.0	02 1970	10.6	27 1966	74	24.4	2.4	1.4	91.7	4.2	265.7 1963	2.6 1979	134.4	12 1973	2.0
	II		26.7	23.2									74	25.7	2.8	1.6							
नवम्बर NOV	I		19.6	16.3	28.3	12.4	31.5	8.2	35.1	01 1973	5.4	23 1960	66	15.9	0.9	0.2	3.9	0.5	77.5 1948	0.0	34.3	07 1948	1.6
	II		22.8	18.4									63	17.9	1.1	0.5							
दिसम्बर DEC	I		14.7	12.1	24.5	8.3	28.6	4.0	32.0	01 1971	0.6	24 1961	68	12.0	0.9	0.4	2.7	0.3	56.4 1950	0.0	56.4	28 1950	1.7
	II		19.6	15.3									60	13.9	1.2	0.6							
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I		24.3	19.9	31.8	18.0	44.9	3.0	48.0		0.6		65	21.0	2.4	1.4	1208.2	64.0	1840.1	798.7	205.2		3.2
	II		27.5	21.4									59	21.3	2.8	1.7			1961	1955			
वर्षों की सं NUMBER OF YEARS	I		23	23	21	21	21	21	22		22		24	23	22	17	26	26	27	27	27		16
	II		24	24									24	24	23	17							

635



जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्टेशन : रामगढ़
STATION : Ramgarh

636

ANNEXURE-III

RAW WATER ANALYSIS

S.No	Constituent	As	mg/l
1	Calcium	$CaCO_3$	105
2	Magnesium	$CaCO_3$	81
3	Sodium	$CaCO_3$	70
4	Potassium	$CaCO_3$	7
	Total cations	$CaCO_3$	263
5	HCO3	$CaCO_3$	180
6	P- Alkalinity	$CaCO_3$	0
7	Chloride	$CaCO_3$	60
8	Sulphate	$CaCO_3$	23
	Total Anions	$CaCO_3$	263
9	Silica, Reactive	Si	3
10	Iron (Total)	Fe	0.6
11	pH	-	7.0-7.8
12	Turbidity	NTU	100
13	Total dissolved solids		230-300
14	Temperature	Deg C	20-35
15.	Organics ($KMnO_4$)		2

	3X800 MW PVUNL PATRATU STPP	SPECIFICATION No: PE-TS-434-524-A001	
		VOLUME: II B	
	SINGLE GIRDER EOT CRANE	SECTION-I	
		SUB-SECTION-IA	
	SPECIFIC TECHNICAL REQUIREMENT	REV 00	DATE OCTOBER,2021

SUB SECTION-IA

SPECIFIC TECHNICAL REQUIREMENT (MECHANICAL)

INTENT OF SPECIFICATION

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

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, erection & commissioning and load testing of the cranes and its accessories**.

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 Section-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. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.

1.9 In the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, more stringent requirement as per the interpretation of the owner shall apply.

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

1.11 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. For details refer the relevant clause in GCC.

Scope of Single girder cranes:

Sl No.	Area/Equipment Description	Type	Quantity (Nos.)	Capacity (T)	Span (m)	Lift (m)	Travel (m)
1	CEP Pump House	Under slung	3	15	6	13	15
2	Compressor House	EOT	1	8	13.3	5.5	30

1.0.0 **SCOPE OF WORK**

1.1.0 **SUPPLIES**

1.1.1 Equipment and services to be furnished by the bidder for the Single Girder EOT crane with accessories as per the details given in data sheet. Any equipment / accessories not specified in the specification but required to make the crane units complete and efficient shall also be under the bidder's scope of work.

Each EOT crane shall include all necessary items but shall not be limited to the following (as applicable): -

1. Crane girder.
2. End carriages complete with wheels
3. Electric Hoist for EOT crane
4. CT / L T drive arrangement
5. VVVF Drives for all 3 motions
6. Electrical equipments (Control Panel, Limit Switch, pendent, power & control cable etc.)
7. PVC Shrouded Conductor (GI) Bus Bar Type DSL with accessories for entire bay length (with current collector & mounting brackets). Flexible cable with Taut wire / Festoon cable arrangement for CT motion for all cranes.
8. Earthing arrangement.
9. Painting of crane.
10. First fill of lubricants
11. Main isolating switch and power cable from 1.5M above ground / operating floor to down shop lead.
12. Power cable with cable tray, clits & other accessories.
13. Control transformer with standby arrangement.
14. End stoppers (4 nos. for each crane)
15. All fasteners (nuts, bolts, washer required for complete assembly of cranes.
16. Platforms (as applicable)
17. All components of the crane should be provided with protective cover (canopy for CEP crane).
18. The crane shall be provided with suitable manual arrangement (for anchoring to prevent any motion due to storm)

1.1.2 Maintenance Tools and Tackles

A complete unused new set of tools & tackles and accessories along with detailed instructions and maintenance manual for the crane shall be supplied. Each tool and wrench shall be stamped, so as it can be easily identified for 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 and specially protected against rusting in tropical climate and minimum the following shall be provided.

S. No.	Description	Qty.
1	Complete set of ring spanners (Indicate the sizes offered)	1 Set
2	Complete set of screwdrivers (Min. 6 nos. Indicate the sizes)	1 Set
3.	Adjustable Spanner	1 No.
4.	Insulated pliers	1 No.
5	Wrench spanner	1 No.
6.	Grease Gun	1 No.
7.	Oil Gun	1 No.
8.	Hand Lamp	1 No.
9	Line tester	1 No.

Note: All maintenance tools & tackles are to be supplied in a tool box.

1.1.3 Erection and commissioning spares

The Bidder shall also supply erection & commissioning spares along with his main equipment as per Table 1 given below, for replacement of damaged or unserviceable parts during the execution of the project at site, to avoid delay in the project schedule. This shall form part of the main equipment supply. The Purchaser shall retain the unutilized commissioning spares.

TABLE 1

S. No.	Description of equipment/item	Quantity
1	Overload Relay	1 set for each crane
2	Limit Switch	1 set for each crane
3	Fuse Link	1 set for each crane

1.1.4 Mandatory Spares -

A complete unused and new set of Mandatory Spare parts shall be supplied. Each part shall be stamped so as to be identified, easy for it use. 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 IA of this specification.

1.2.0 Services to be provided by the bidder

1.2.1. Packing, 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 BHEL.

1.2.3. Scope of Supervision for Erection & commissioning: Tentatively following visits shall be planned by site team which shall be as follows:-

a) One visit per crane for supervision for erection & commissioning (total 4 Visits).

b) Two man days per crane for supervision for erection & commissioning (total 8 Man-days).

c) Any additional visit as per requirement of BHEL site office.

Note: Bidder shall be informed at least 10 days in advance for the requirement of visit at site. Visiting team shall consist of one or two expert of bidder as deemed necessary by them

1.3.0. Inspection and Testing

1.3.1. Inspection and testing at Manufacturer's works

A. **Shop inspection and tests will include but not limited to the following - (In-process)**

i. Identification, co-relation and verification of material test certificates for the important components like girders, major load carrying components, hooks, gears, shafts, wheels, wire rope drum, wire rope, gear box etc. For other components supporting test certificates or random check tests shall be conducted / furnished.

ii. Qualification of welder and welding procedure as per ASME section IX .

iii. 100% radiography of tension zone & 25% radiography of compression zone on butt welds of load bearing members shall be carried out with acceptance norms as per ASME Sec VIII Div.1 UW 51. DP test of all butt welds shall be carried out as per ASTM E 165/ ASTM E 109 with acceptance norms as per ASME Sec VIII Div.1

iv. For fillet welds visual inspection on all welds. Die- penetration test (DPT) for fillet welds in the load bearing members as per ASME-165/ASTME 109 and acceptance norm as per ASME section VIII Div. 1.

v. Ultrasonic test on forgings and casting of critical components like hook, shafts, axles, gears, wheels, pulleys, etc. Ultrasonic test for casting as per ASME Section III NB 2572 & for forging as per ASTM A388.

Unacceptable defects in forgings are as given below: -

1. Cracks, flaws, seams and laps.
2. Defects giving indication larger than 4mm diameter equivalent flaw.
3. Groups of defects with maximum indication less than that from a 4mm dia, equivalent flaw, which cannot be separated at testing sensitivity if the back echo is reduced by 50%.
4. Defects giving indication of 2 to 4 mm diameter equivalent flaw separated by a distance less than 4 the size of the larger of the adjacent flaws.

vi. PT/MT on component with surface hardening as per ASTME -165 and ASTME 138 respectively with no surface defects.

vii. Gearbox trial run test as per IS / AGMA standards.

viii. Acceptance and routine tests (HV and insulation) for all electrical and electromechanical components and system as per governing specification

ix. Functional and simulated operation test, sequencing, interlocks, safety, protection and alarm system. Test on CRANE / CRAB motors and other mechanical, electrical, electro-mechanical as per BHEL technical specification and or as per applicable code

x. Cranes shall be completely assembled at manufacturers' works to check the misalignment of gears, shafts and other items. Gear box shall have the idle run for minimum two (2) hours.

B. Testing At Works (Final)

i. Deflection test of bridge girder at rated load.

ii. No load (both hoisting & CT), load (SWL)(both hoisting & CT), Over load test (Hoisting at 125% of rated load.)

iii. Electrical tests for brakes, panel, electrical equipment etc as per IS - 3177

iv. Measurement of speed of CT & Hoisting (lowering & raising) at rated load.

v. All Other tests as per IS-3177.

Note: Refer Annexure-IV, Section-IA, Volume II-B for "Shop test Procedure for Load/Overload testing of EOT cranes at Manufacturer's Works.

1.3.2 Testing at site

The following tests shall be carried out at site by **BHEL** as a part of Erection and Commissioning:

a) All the tests as mentioned against S.N. 1.3.1 (B) above, with actual hook and wire rope.

b) No load, load test (SWL) for LT

c) Speed test at rated load for hoisting, CT and LT mechanism.

d) Brake test and working of electric hoist.

e) Any other test as per IS-3177

The successful bidder shall furnish their recommended procedure for carrying out the Erection, Commissioning & testing at site as mentioned above.

1.4.0 Surface Preparation, Painting & Colour Scheme

Refer Annexure III, Section IA, Volume IIB. .

1.5.0. Drawing / design document for submission after award of contract

Drawing/ design documents to be submitted as per list & submission schedule attached as Annexure-V Section IA, Volume IIB.

Any other design document/ drawing as required by customer/ BHEL shall be submitted by bidder during detail engineering without any implication.

2.0.0. **Works Excluded**

2.1.0 Supply of steel gantry girders/ ISMB for crane travel

2.2.0 For EOT crane:

The purchaser shall provide single point 415V, 3 phase, 4 wire and 50Hz power feeder at any point of the bay or in the middle of the bay as specified in the Data sheet A. 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 by using suitable transformer as per the specification.

3.0.0. **Deviations**

If the proposal submitted has got any deviation from the technical stipulations in the tender document, bidder shall tabulate the same in the appropriate “Schedule of Deviations- with cost of withdrawal” furnishing full particular of such deviations. Deviations are to be furnished with mention to specific clause number. Reasons / explanations for such deviations shall be furnished. Notes / comments etc. is not acceptable. If there are no deviations from the tender document, bidder shall indicate ‘NO DEVIATION’ in the deviation schedule.

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

Make of bought out items will be as per Annexure-I, section IA, volume II-B of the specification. No other make will be acceptable, until and unless specifically got approved by BHEL/Customer during detail engineering. Acceptance/non acceptance of same shall not have any impact on manufacturing & delivery schedule and on cost of crane.

5.0.0 **INFORMATION TO BE FURNISHED BY BIDDER ALONG WITH THE OFFER**

As detailed in “List of documents to be submitted with bid”, Section III

6.0.0 **OTHER REQUIREMENTS**

Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract along with supply of concerned equipment / component.

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.

QUALITY ASSURANCE PLAN

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN	PROJECT:3X800 MW PATRATU STPP
	ITEM: EOT CRANES - SINGLE GIRDER CAPACITY: -	REV Rev 00 DATE PAGE Page 1 of 4	PACKAGE: SG crane P.O.NO – BHEL NO: CONTRACTOR: BHEL

S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record	Agency				Remark
									D	M	C	N	
1	2	3	4	5	6	7	8	9		10			11
`	***FOR EOT CRANE***												
1.0	**RECEVING INSPECTION**												
1.1	Structural-Plates/RSJ for Main Girders, End Carriages Trolley, Pulley, Gearbox housing , rope drum (if fabricated) etc.	Physical & Chemical	Major	Lab Analysis	100%	IS:2062 Gr. A or B / As per approved G.A.		MTC / Lab Report	_/	P/V	V	V	
1.2	Rope Drum (Seamless Pipe)	Chemical Mechanical	Major	Lab Analysis	1/pipe	Approved drg/DS ASTM A106 Gr A or B		Lab Report	_/	P	V	V	
		Flattening & Acid etching Test Surface defect	Major	Mech test Visual	1/pipe 100%	no cracks, pitting, rusting, damage ,etc		I.R.	_/	P	V	V	
1.3	Gears, pinions, shafts, axles & wheels (#)	Chemical& Mechanical,	Major Major	Lab Analysis UT	1/lot 100%	IS:2004 (45C8/55C8) (Relevant IS/appd drg) ASTM A388/NOTE 1		MTC I.R	_/ _/	P P	V V	V V	# If wheel, gears, pinions, shafts & axle diameter / thickness is equal to or more than 50 mm UT shall be carried out, ref & acceptance norm at S.no.1.4(UT of hook) to be followed
1.4	Hook	Chemical & Mechanical	Major	Lab Analysis	100%	IS: 15560 Related Std. As per appd. Drg./data sheet		MTC	_/	V	V	V	
		UT (above 50 mm dia)	Major	UT on shank portion only	100%	ASTM A388 / ASME Sec VIII Divn 2 – NOTE:1		MTC/ ALC/QCR /UT report	_/	P	V	V	
1.5	Wire Rope	Examination of report of breaking load Dimension &	Major	Review of TC Measurement	100% 100%	IS: 2266 Appd G A drg	IS: 2266 Appd G A drg	Mfr's TC QCR	_/	P P	V V	V V	

		LEGEND: CLASS **A: Critical, B: Major, C: Minor**		DOC. NO.:
		** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB N: Customer R: Test / Dim Report, IR-Inspection Report INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert. "V" VERIFICATION, ALC: Approved Laboratory Certificate, QCR: Quality Control Report		
MANUFACTURER	CONTRACTOR			
NAME & SIGNATURE				NAME & SIGN OF APPROVING AUTHORITY & SEAL

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT:3X800 MW PATRATU STPP
	ITEM: EOT CRANES - SINGLE GIRDER	REV Rev 00	PACKAGE: SG crane
		DATE	P.O.NO –
	CAPACITY: -	PAGE Page 2 of 4	BHEL NO:
			CONTRACTOR: BHEL

S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record	Agency				Remark
									D	M	C	N	
1	2	3	4	5	6	7	8	9		10			11
		Type, construction											
1.6	Motors & cables. Brakes	Make/Type/Rating/ Routine test Make/ type / rating/ HV/IR functional test	Major	Visual / Measurement	100%	Appd drg/DS/Tech spec/Rel IS	I.R	STC	_/	P	V	V	For motor, ref. Note 2
1.7	Sheaves	Mech		Tensile & Hardness	1/lot	Approved Drg / Mfg drg		MTC	_/	P	V	V	
1.8	Limit switch, SFU, Relays, MCB, Fuses, Push buttons Etc Control transformer	Make/Type/Rating Functional /continuity Make , type, rating, input/output	Major	Review of TC	100%	Appd drg./DS/Scheme/NLC Spec./Manu.Std		QCR Routine TC/COC of mfgr	_/	V	V	V	
1.9	DSL	Make , type, rating, Dimension.	Major	Review of TC	100%	Appd drg./DS/Scheme /NLC Spec./ Manu.Std		QCR Routine TC/COC of mfgr.	_/	V	V	V	
2	**INPROCESS- INSPECTION**												
2.1	WPS,PQR & WPQ	Verification of approval	Major	Performance	100%	WPS,PQR & WPQ / Qualified by NTPC/ LLOYDS / EIL / TPL			_/	P	V	V	IN CASE OF NTPC/ LLOYDS / EIL / TPL QUALIFIED WELDERS AVAILABLE, REQUALIFICATION OF WELDER IS NOT REQUIRED
2.2	Assembled gear box	No load run test backlash & contact pattern, noise, vibration & oil temp rise (for oil lubrictd)				Apprvd drg/DS/Mfg std Noise 85dbA max, vibration 75 microns max, oil temp rise – 30 °C above ambient max			_/	P	V	V	

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MANUFACTURER	CONTRACTOR			
NAME & SIGNATURE				

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT:3X800 MW PATRATU STPP
	ITEM: EOT CRANES - SINGLE GIRDER	REV Rev 00	PACKAGE: SG crane
		DATE	P.O.NO –
	CAPACITY: -	PAGE Page 3 of 4	BHEL NO:
			CONTRACTOR: BHEL

S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record	Agency				Remark
									D	M	C	N	
1	2	3	4	5	6	7	8	9		10			11
2.3	Welding of end carriage, Main Girder, Trolley , rope drum (if fabricated) etc.,	DPT of Welds(all)	Major	LPI	100% on butt&10% on fillet	ASTM E165 or Eq. / No crack or linear indication		I.R.	_/	P	V	V	
		RT of Butt weld	Major	RT	100%/10%	ASME Sec.VIII,Div.1, UW 51/52		RT film & report	_/	P	V	V	@RT-100%, for Butt weld in tension & 25% in compression. 100% RT on butt weld for fabricated rope drum
2.4	Hook	Dimension	Major	Measurement	100%	Mfr's drg / Related Std. As per appd. Drg./data sheet/ IS: 15560 IS: 15560		QCR	_/	P	V	V	
		Proof Load	Major	Load Test				QCR	_/	P	V	V	
		NDT after proof load	Major	LPI	100%	ASTME 165 or Eq. / No crack or linear indication		I.R.		P	V	V	
2.5	Gears, pinions, shafts, axles & wheels (#)	Hardness Surface Defect (after machining)	Major	DPT	100%	Approved Drg/ Data sheet ASTM E-165 No linear indication		MTC	_/	P	V	V	
3	**FINAL INSPECTION**												
3.1	Overall dimensions	Dimensions (span) level, alignment	Critical	Measurement	100%	Appd GA drg & IS: 3177/IS:3938		I.R.	_/	P	W	W	FUNCTIONAL CHECK OF PENDENT &
3.2a	Assembled Crane along with individual control panel & pendant station	Current & speed for Cross Travel & Hoisting, interlocking sequencing, inching operation, Limit switch operation	Critical	Measure /Verify	100%	Appd GA drg & IS: 3177/Appd data sheet		I.R.	_/	P	W	W	PANEL FOR SPECIFIC CRANE
		Deflection at SWL		Measurement					_/	P	W	W	
3.2b	Overload test at 125% of SWL	Holding capacity of brakes		Lifting from mid Air	100%	Appd GA drg & IS: 3177/ IS:3938/ Appd data sheet		I.R.	_/	P	W	W	

		LEGEND: CLASS A: Critical, B: Major, C: Minor		DOC. NO.:
		** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB N: Customer R: Test / Dim Report, IR-Inspection Report INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert. "V" VERIFICATION, ALC: Approved Laboratory Certificate, QCR: Quality Control Report 24 of 137		NAME & SIGN OF APPROVING AUTHORITY & SEAL
MANUFACTURER	CONTRACTOR			
NAME & SIGNATURE				

MANUFACTURER'S NAME & ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT:3X800 MW PATRATU STPP
	ITEM: EOT CRANES - SINGLE GIRDER	REV Rev 00	PACKAGE: SG crane
		DATE	P.O.NO –
	CAPACITY: -	PAGE Page 4 of 4	BHEL NO:
			CONTRACTOR: BHEL

S.NO.	Component & Operation	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Format of Record	Agency				Remark
									D	M	C	N	
1	2	3	4	5	6	7	8	9		10			11
3.3	Control Panel & Pendant station	1. Make/type/rating of Bois. 2.IR-HV functional &interlocks 3.DOP by paper insertion for panel	Major Major do	Visual, Operational & Functional Measurement do	100% 100% 100%	Approved drawing / Data sheet / is: 3177 Paper should not go easily.		I.R.		P P	W W	W W	HV of power circuit at 2kV and control circuit at 1kV. IR of power & control circuit with 500V Meggar with acceptance norm of 0.5 Mega Ohm.
3.4	Painting	Examination – shade	Minor	Visual & measurement	100%	Customer's / Approved Painting Procedure				P	V	-	
		Dry Film Thickness	Major	Measurement	Sample					P	V	-	

NOTE1:'**' When back wall echo is set to 100% in sound area then,
a) defect echo shall not exceed 20%
b) Back echo shall be minimum 80% in any area

Note 2:- Less than 30 KW. Acceptance of motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows: It is hereby confirmed that the above mentioned motor/motors was/were manufactured taking care of specification requirement regarding ambient temp, voltage & frequency variation, hot start, pull out torque, starting KVA/KW, temp rise, distance between center of stud and gland plate and tested in accordance with approved drawing/data sheet.

		LEGEND: CLASS **A: Critical, B: Major, C: Minor**		DOC. NO.:
		** M: MANUFACTURER / SUB-CONTRACTOR D: Records for Data Fold C: CONTRACTOR /NOMINATED INSPECTION AGENCY, ND: NDT LAB N: Customer R: Test / Dim Report, IR-Inspection Report INDICATE "P" PERFORMS, "W" WITNESS, MTC: Mfr's Test Cert. "V" VERIFICATION, ALC: Approved Laboratory Certificate, QCR: Quality Control Report 25 of 137		NAME & SIGN OF APPROVING AUTHORITY & SEAL
MANUFACTURER	CONTRACTOR			
NAME & SIGNATURE				

ANNEXURES

ANNEXURE-I

MAKES OF SUB VENDORS ITEMS

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	STEEL	SAIL		
		TISCO		
		JINDAL		
		ESSAR		
2.	HOOKS	STEEL FORGING & ENGG. CO.,	KOLKATA	
		SIMRITI FORGING		
		KARACHIWALA		UP TO 25T CAPACITY
3.	GEAR COUPLINGS	ALLIANCE		
		FLEX-TRANS (formerly known as HICLIFF)		
		SAHARA		
		NUTECH		
		OEM		
4.	WIRE ROPE	USHA MARTIN		
		FORT WILLIAMS		
		BHARAT WIRE ROPES		
5.	BEARINGS	SKF		
		FAG		
		TATA		
		NBC		
6.	MOTORS	SIEMENS		
		NGEF (up to 15KW)		
		CROMPTON		
		KIRLOSKAR		
		BHARAT BIJLI		
		MARATHON		
		ABB		
		LHP		
7.	BRAKES	ELECTROMAG		
		SPEED-O- CONTROL		
		BCH		FOR DCEM BRAKES ONLY
		KAKKU		
		PETHE		
8.	CONTACTOR	SIEMENS		
		L&T		
		SCHNEIDER (Earlier TELE MECHANIQUE)		
		BCH		
9.	OVER LOAD RELAYS	SIEMENS		
		L&T		

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		ABB		
		SCHNEIDER (Earlier TELE MACHANIQUE)		
10.	HRC FUSES	SIEMENS		
		L&T		
		ENGLISH ELECTRIC		
		GE POWER		
		EATON (BUSSMANN)		
		ABB		
11.	ISOLATING SWITCH	SIEMENS		
		L&T		
		CONTROL & SWITCH GEAR		
		ABB		
12.	SWITCH FUSE UNITS	SIEMENS		
		L&T		
		CONTROL & SWITCH GEAR	-	
		ABB		
13.	TIME DELAY RELAYS	SIEMENS		
		L&T		
		ABB		
		BCH		
		SCHNEIDER (Earlier TELE MACHANIQUE)		
14.	TRANSFORMERS	INDCOIL		
		LOGICSTAT		
		KAPPA		
		AUTOMATIC ELECTRIC		
		PRECISE ELECTRICALS		
		SILKAAN ELECTRIC MFG. CO. LTD.		
		SOUTHERN ELECTRIC		
		NEC		
15.	CABLE LUGS (HEAVY DUTY)	DOWELLS		
		UML ENGINEERS	KOLKATA	
		JAINSON		
16.	PVC POWER CABLES	APAR INDUSTRIES LTD.	MUMBAI	
		CORDS CABLE INDUSTRIES LTD.	NEW DELHI	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GOYOLENE FIBRES (INDIA) PVT.LTD	MUMBAI	
		GOVIND CABLE INDUSTRIES	KOLKATA	
		GUPTA POWER	BHUBNESWAR	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		INFRASTRUCTURE LIMITED		
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD.	NEW DELHI	
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		MANSFIELD CABLES COMPANY LTD.	NOIDA	
		NICCO CORPORATION LTD.	KOLKATA	
		PARAMOUNT COMMUNICATIONS LTD.	NEW DELHI	
		POLYCAB WIRES PVT. LTD.	MUMBAI	
		RADIANT CORPORATION PRIVATE LIMITED	HYDERABAD	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD.	VADODARA	
		SRIRAM CABLES PVT. LTD.	NEW DELHI	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD.	SOLAN	
		SAM CABLES & CONDUCTORS (P) LTD	UDHAM SINGH NAGAR	
		THERMO CABLES LTD	HYDERABAD	
17.	**PVC CONTROL CABLES**	ADVANCE CABLE TECHNOLOGIES (P) LTD	BANGALORE	
		APAR INDUSTRIES LTD., CMI LTD	MUMBAI	
		CMI LIMITED	FARIDABAD	
		CORDS CABLE INDUSTRIES LTD	NEW DELHI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DELTON CABLES LTD	NEW DELHI	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		ELKAY TELELINKS LTD	NEW DELHI	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	
		GOVIND CABLE INDUSTRIES	KOLKATA	
		GUPTA POWER INFRASTRUCTURE LIMITED	BHUBNESWAR	
		HAVELLS INDIA LIMITED	NOIDA	
		INCOM CABLES (P) LTD	NEW DELHI	
		KEI INDUSTRIES LTD	NEW DELHI	
		KRISHNA ELECTRICAL	GWALIOR	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		INDUSTRIES LTD		
		KEC INTERNATIONAL LIMITED	MUMBAI	
		MANSFIELD CABLES COMPANY LTD	NOIDA	
		NICCO CORPORATION LTD	KOLKATA	
		PARAMOUNT COMMUNICATIONS LTD	NEW DELHI	
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	
		SPECIAL CABLES PVT. LTD	NEW DELHI	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD	SOLAN	
		SAM CABLES & CONDUCTORS (P) LTD	UDHAM SINGH NAGAR	
		SPM POWER & TELECOM PVT. LTD	HYDERABAD	
		TORRENT CABLES LTD	AHMEDABAD	
		THERMO CABLES LTD	HYDERABAD	
		TIRUPATI PLASTOMATICS PVT. LTD	JAIPUR	
		UNIVERSAL CABLES LTD	SATNA	
18.	TRAILING CABLES	NICCO	KOLKATA	
		UNIVERSAL	SATNA	
		INCAB		
		ICL	NEW DELHI	
		APAR INDUSTRIES LTD	MUMBAI	
		CMI LTD	FARIDABAD	
		KEI INDUSTRIES LTD	NEW DELHI	
		SUYOG ELECTRICALS LTD	VADODARA	
19.	XLPE POWER CABLES	APAR INDUSTRIES LTD	MUMBAI	
		CORDS CABLE INDUSTRIES LTD	NEW DELHI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	
		GOVIND CABLE INDUSTRIES	KOLKATA	
		GUPTA POWER INFRASTRUCTURE LIMITED	BHUBNESWAR	
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD	NEW DELHI	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		MANSFIELD CABLES COMPANY LTD	NOIDA	
		PARAMOUNT COMMUNICATIONS LTD	NEW DELHI	
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	
		SPECIAL CABLES PVT. LTD	NEW DELHI	
		SCOT INNOVATION WIRES AND CABLES PVT. LTD	SOLAN	
		SRIRAM CABLES PVT. LTD	NEW DELHI	
		TORRENT CABLES LTD	AHMEDABAD	
		THERMO CABLES LTD	HYDERABAD	
		TIRUPATI PLASTOMATICS PVT. LTD	JAIPUR	
20.	**XLPE CONTROL CABLES**	APAR INDUSTRIES LTD	MUMBAI	
		CABLE CORPORATION OF INDIA LTD	MUMBAI	
		CRYSTAL CABLE INDUSTRIES LTD	KOLKATA	
		DIAMOND POWER INFRASTRUCTURE LTD	VADODARA	
		GEMSCAB INDUSTRIES LTD	NEW DELHI	
		HAVELLS INDIA LIMITED	NOIDA	
		KEI INDUSTRIES LTD	NEW DELHI	
		KRISHNA ELECTRICAL INDUSTRIES LTD	GWALIOR	
		KEC INTERNATIONAL LIMITED	MUMBAI	
		PARAMOUNT COMMUNICATIONS LTD	NEW DELHI	
		POLYCAB WIRES PVT. LTD	MUMBAI	
		RADIANT CORPORATION PRIVATE LIMITED	HYDERABAD	
		RAVIN CABLES LIMITED	MUMBAI	
		SUYOG ELECTRICALS LTD	VADODARA	
		SRIRAM CABLES PVT. LTD	NEW DELHI	
		TORRENT CABLES LTD	AHMEDABAD	
		UNIVERSAL CABLES LTD	SATNA	
21.	**CABLE GLAND**	COMMET		
		SUNIL&CO		

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		ARUP ENGINEERING		
		JAINSON		
		DOWELL		
22.	PUSH BUTTONS	SIEMENS		
		L&T		
		BCH		
		SCHNEIDER		
23.	LIMIT SWITCHES	SPEED-O-CONTROL		
		ELECTROMAG		
24.	PENDENT PUSH BUTTON STATION	OEM		
25.	INDICATING LAMPS	TECKNIC		
		BCH		
		SIEMENS		
		STANDARD		
26.	MCB	MDS		
		INDO COPP		
		STANDARD		
		SIEMENS		
		L&T		
		ABB		
		SCHNEIDER		
27.	PANELS	OEM		
		RITTAL		
		PYROTECH		
28.	RESISTANCE BOXES	ENAPROS		
		OEM		
		SAFEX FIRE SERVICES LTD		
		UNITED FIRE EQUIPMENTS PVT. LTD		
		ZENITH FIRE SERVICES (INDIA) PVT LTD		
29.	VVVF	YASKAWA		
		ABB		
		SIEMENS		
		SCHNIEDER		
		FUJI ELECTRIC		
		MITSUBISHI ELECTRIC		
		CG POWER & INDUSTRIAL SOLUTIONS LTD		
30.	SHROUDED DSL	SUSHEEL		
		STROMAG		
31.	LOAD CELL	IPA		
		SARTORIUS		

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
32.	GEAR BOX	OEM		* = Applicable for Geared Motors only
		ELECON ENGINEERS		
		SHANTI GEARS		
		PBL*		
		NAW*		
		NORD*		
		SEW*		
		BONGFILIOLI*		
33.	RAIL	JSPL		
		SAIL		

NOTE:

1. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL.

2. THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER, THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ CUSTOMER.

ANNEXURE II

MANDATORY SPARES LIST FOR COMPRESSOR HOUSE CRANE

Sl. no	Description Quantity	Quantity
1	All bearings	2 set of each type/rating
2	Brake assembly and its liners	2 set of each type/rating
3	Wire rope	2 complete length for each type /rating.

Notes

a) One (1) set means 100% requirement for one crane.
b) In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed as per the list.
c) Any item which is quoted as “not applicable” in the above list and is found to be “applicable” at a later date shall be supplied by the Bidder without any commercial implications.
d) Any change or variation in equipment or systems during detailed engineering stage which would cause changes / variations in the essential spares, shall be supplied by Bidder without any commercial implications.
e) Mandatory spares shall not be dispatched before dispatch of corresponding main equipment.
f) The spares shall be treated and packed for a long storage under the climatic condition prevailing at site.
g) Each spare part shall be clearly marked and labelled on the outside of the packing with its description. When more than one spare part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers, and other packages must be suitably marked and numbered for the purpose of identification.
h) The Bidder shall note that if there in any change/ variation in equipment/ system during detail engineering which causes any change/ variation in the essential spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the purpose of evaluation.

ANNEXURE III

PAINTING SPECIFICATION

Crane, structure, equipments	**Primer**	All Steel surfaces shall be provided with self -curing Inorganic Zinc Silicate Primer Coat (Solid by Volume Minimum 60%) of Minimum 75 Micron Dry Film Thickness (DFT) applied over blast cleaned surface to near white metal conforming to Sa 2 ½ finish of Swedish standard SIS-05-5900. The Primer Coat shall be applied in Shop immediately after blast cleaning by Airless spray technique.
	Intermediate	Primer Coat shall be followed with the application of Intermediate Coat of Polyamide Cured pigmented Titanium Dioxide (Ti02) or Micaceous Iron Oxide (MIO) Epoxy Based Paint (Solid by Volume Minimum 60%) of Minimum 75 Micron DFT. This Coat Shall be applied in Shop after an interval of Minimum overnight (from the application Of Primer Coat) by Airless spray technique.
	Finish Paint	Intermediate Coat shall be followed with the application of Finish Coat of Polyamide Cured color pigmented Epoxy based Paint (Solid by Volume Minimum 60%) of Minimum 75 Micron DFT. This Coat shall be applied after an interval of Minimum overnight and maximum indefinite (from the application of Intermediate Coat) either before Erection by Airless spray technique or after Erection by brush and spray. Color and shade of the Coat shall be as approved by the Employer. The Finish Coat thickness of 75 Micron can be built up either in Single application at shop or in two applications one at Shop and the other at Site. Finish Coat shall be followed with the application of Final Finish Coat of Polyurethane based color pigmented Paint (Solid by Volume Minimum 40%) of Minimum 25 Micron DFT. This Coat shall be applied within Seven (7) days (from the completion of Finish Coat), after Erection by brush and spray.
Panel	**Seven Tank Process**	Primer-Zinc phosphate (alkyd medium) 2coats DFT 25-35 microns per coat Finish -Synthetic Enamel 3 coats (alkyd medium) as per IS 2932 per coat DFT 20-25 microns Total DFT 90-120 microns.

PAINTING PROCEDURE / COLOR SCHEME ANNEXURE IV

Color Shade:

1. For structure, platform, Galleries, ladders & Hand rails: Shade Golden Yellow RAL 1004.
2. for Motor: RAL 5012
3. Electrical control panel: RAL 9002 for front & rear and RAL 5012 for side covers.
4. Black zebra strips 100 mm wide on Hook, Black strip on Bottom block assembly & End carriage sweep to be applied.

ANNEXURE IV

Procedure for Load/Overload testing of Single Girder EOT/ Underslung crane at Manufacturer's Works

Objective: To demonstrate final No load, Load, Overload, Deflection & Functional tests of assembled Crane for the purpose of acceptance in line with IS 3177.

Basic Assumptions / Inputs for testing at Works:

- Actual job hook shall be used for load, overload tests for hoisting.
- Actual wire ropes shall be used for load, overload testing.
- Shop cables can be used for temporary power supply for the purpose of showing various functional tests at shop.
- Interlock and limit switch operation check will be shown for hoisting and CT motion.

Procedure for Load / Overload testing:

- The cranes shall be tested for no load and load /overload test at works generally in conformance with the IS – 3177 . Specifically with respect to the load / overload testing of crane, the following tests as per the outlined procedures shall be done at works.
- Deflection of the girder will be measured at SWL when the trolley with load is at the middle of the girder.
- No load and full load current of the motors will be measured to verify whether it is as per the approved data sheet of the motor. Resisters in the circuit will be checked for any overheating of the element.
- The load will be gradually raised to 125 percent of the rated capacity (SWL) with actual hook. The load will be lifted upward to about 1 meter height above its support and stop again. Check for any undue drift in the load. If load drifts, check the adjustment of brakes and repeat the above procedure. Then lower the load to rest on support/ground.
- For checking the cross travel, raise the load up to one (1) meter height above supports and then move the trolley with load about one (1) meter in either direction of the bridge. Then lower the load to rest on support/ground.
- Creep speed motions shall be checked over a distance of about 500 mm.

ANNEXURE – V

A.0 DRAWINGS/DESIGN DOCUMENTS FOR SUBMISSION (during detailed engineering)

Sl. No.	BHEL DRG.NO	DRAWING TITLE	REMARKS	SUBMISSION SCHEDULE - WEEK NUMBER FROM DATE OF P.O/LOI
1	PE-V0-434-524-A100	Manufacturing Quality Plan with sub vendor list for single girder EOT crane	APPROVAL	2
2	PE-V0-434-524-A101	Data sheet of Single Girder Crane with painting details	APPROVAL	2
3	PE-V0-434-524-A102	G A of Single Girder EOT CRANE along with CT festoon cable details	APPROVAL	2
4	PE-V0-434-524-A103	Mechanism Sizing Calculation	APPROVAL	2
5	PE-V0-434-524-A104	G.A. drg. of Hoist with trolley wheel assembly	INFORMATION	3
6	PE-V0-434-524-A105	Bottom Block assembly	INFORMATION	3
7	PE-V0-434-524-A106	General arrangement for LT cable trailing for Single Girder crane	INFORMATION	3
8	PE-V0-434-524-A107	Schematic Circuit Diagram for following a) Main Protective panel & BOM b) Main hoist panel & BOM c) Cross Traverse and Long Travel panel & BOM d) Pendent and earthing.	APPROVAL	3
9	PE-V0-434-524-A108	Long travel Machinery Assembly with LT wheel assembly	INFORMATION	4
10	PE-V0-434-524-A109	Detailed BOM/BOQ for crane	INFORMATION	6
11	PE-V0-434-524-A110	General arrangement of panel & pendent push button	INFORMATION	4
12	PE-V0-434-524-A111	Cable sizing calculation and schedule.	APPROVAL	3
13	PE-V0-434-524-A113	Mandatory spare parts list	APPROVAL	6
14	PE-V0-434-524-A112	O & M Manual	INFORMATION	8
15	PE-V0-434-524-A115	Erection procedure	INFORMATION	8

Notes:
BHEL/CUSTOMER SHALL COMMENT /APPROVE THE DRAWINGS WITHIN 15 DAYS OF RECIEPT OF DRAWINGS.
VENDOR SHALL RESUBMIT THE REVISED DRAWINGS WITHIN 7 DAYS OF RECIEPT OF COMMENTS.

INCOMPLETE DRAWINGS/DOCUMENTS SHALL NOT BE TREATED AS SUBMITTED. MANUFACTURING SHALL BE STARTED ON RECIEPT OF CAT II APPROVED DRAWINGS.

B.0 NO.OF DRAWINGS/DOCUMENTS FOR SUBMISSION

A.	Drawing for Approval	No. of prints/copies (hard prints)
i.	For approval	8
ii.	For final distribution (after the vendor obtains final approval from the customer).	12
B.	Certificate, reports etc. (Material test, inspection report and all other type of tests etc.)	6
C.	O&M Manual	
I.	Draft for approval	2
ii.	For final distribution	12

Note:
a) The number of prints/hard copies are indicative and may change on project to project basis.

b) Bidder to note that all the drawings and documents shall also be submitted on CD's (compact dics) in following software.

I. All the drawings shall be prepared in AutoCAD.
II. All the documents shall be prepared MS word / EXCEL.
III. PDF files for all drawings/documents shall also be submitted.

C.0 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 approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

- 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).

ANNEXURE -VI

Check List for Operation & Maintenance Manual

0Project name :
1Project number :
2Package Name :
3PO reference :
4Document number :
5Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	**Cover page**				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	**Index**				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	**Description of Plant/System**				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				
4.0	**Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)**				

4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	**Operation Guidelines for plant personal/user/operator**				
5. 1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5. 2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5. 3	Do's & Don't of the equipments.				
5. 4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5. 5	Parameters to be monitored with normal values and limiting values				
5. 6	Trouble shooting with causes and remedial measures				
5. 7	Routine operational checks, recommended logs & records				
5. 8	Changeover schedule if more than one auxiliary for the same purpose is given				
5. 9	Painting requirement and schedule				
5. 10	Inspection, repair , Testing and calibration procedures				
6.0	**Maintenance guidelines for plant personal**				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules				

	especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	**Statutory and other specific requirements considerations.**				
8.0	**List of reference documents**				
9.0	**Binding as per requirement**				

Checked by
Dealing Engineer

Key Resource Person

Section Head

ANNEXURE –VII

PACKING PROCEDURE

Packing and Marking

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

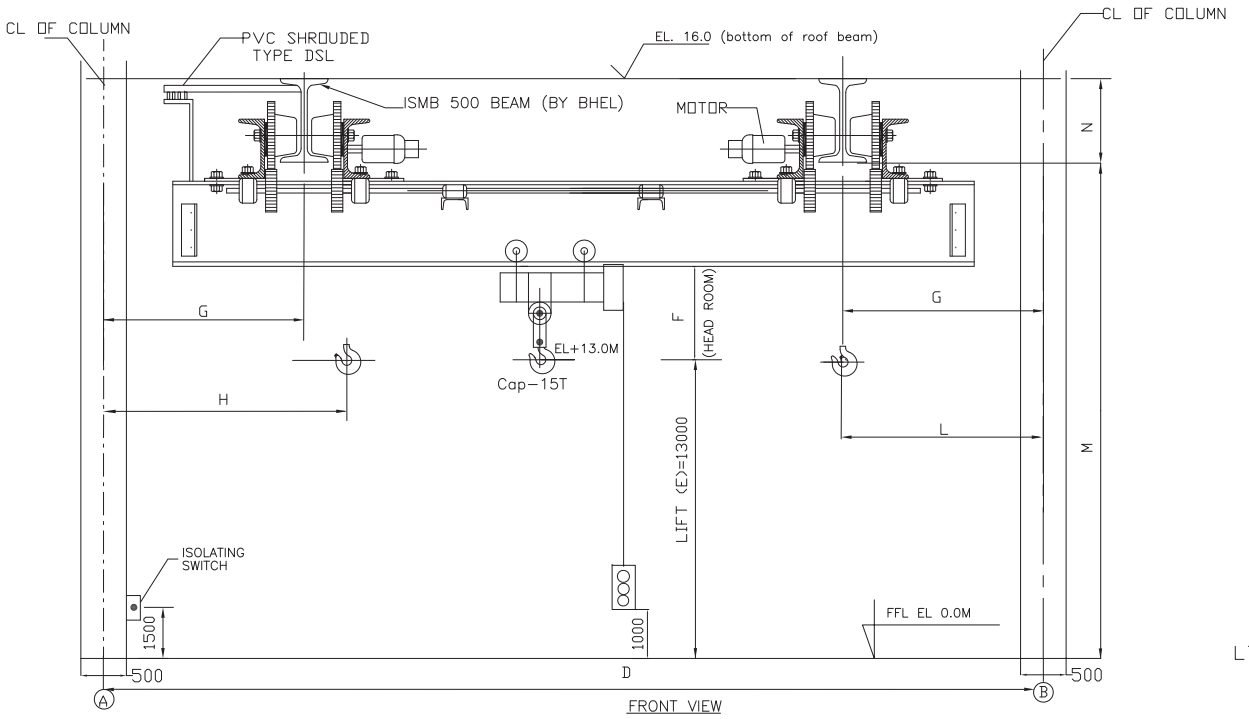
The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement.

Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material.

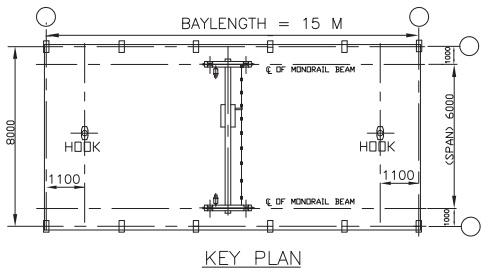
ANNEXURE –VIII

CRANE CLEARANCE DIAGRAMS

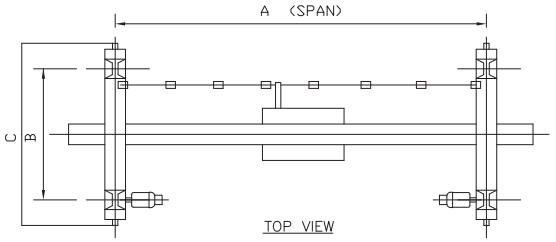
DESIGN PARAMETERS	
A	6000
B	*
C	*
D	8000
E	13000
F	*
G	1000
H	1200
L	1000
M	15500
N	500



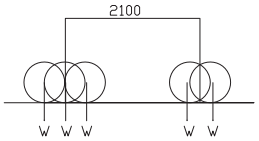
FRONT VIEW



KEY PLAN



TOP VIEW



LT WHEEL LOAD WITH OUT IMPACT (W=2.5T APPROX.)

NOTES:
1. ALL DIMENSIONS ARE IN MM.
2. ALL '*' DIMENSIONS ARE TENTATIVE & SHALL BE FINALISED DURING DETAILED ENGG.

NTPC DRG. No.	
CUSTOMER	NTPC LTD. PATRATU STPP (3 X 800 MW)

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
	DRN	DSR		16.06.20
	DESN	DSR		16.06.20
	CHD	PKK		16.06.20
	APPD	GB		16.06.20

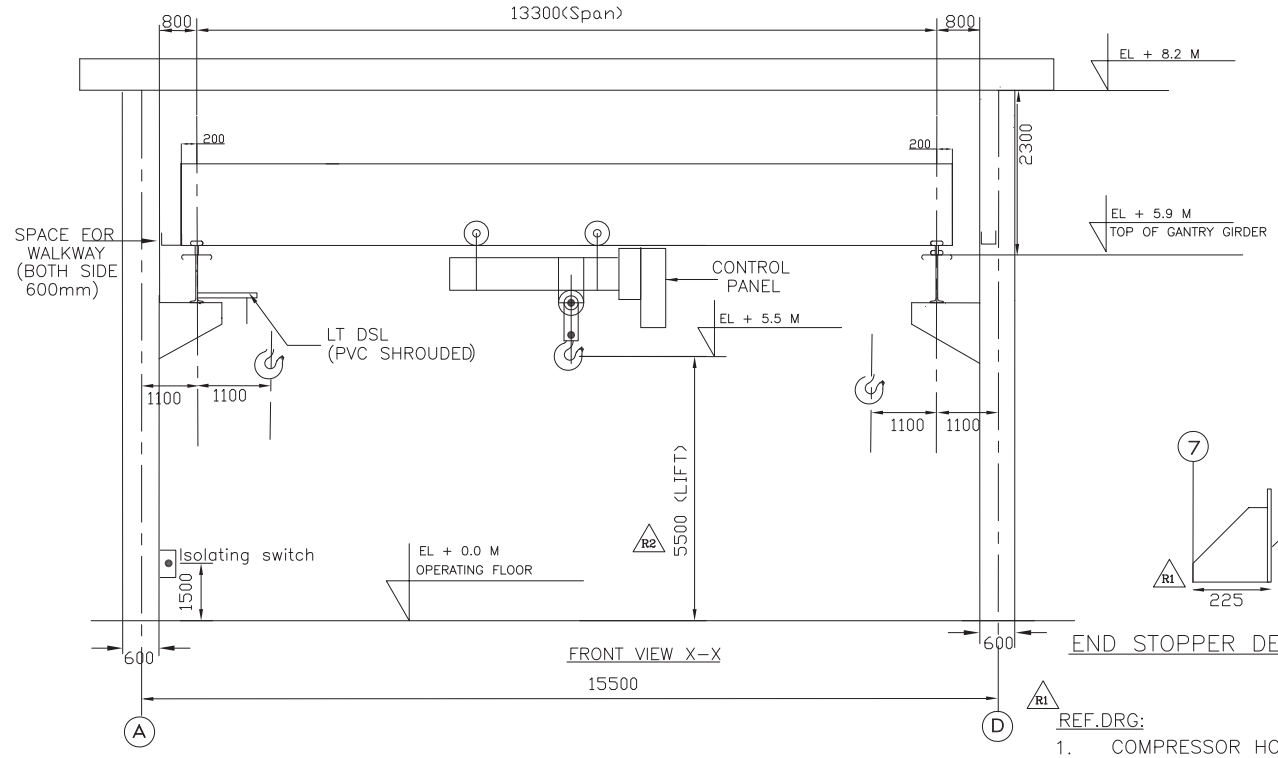
TITLE
CRANE CLEARANCE DIAGRAM OF
15 T UNDERSLUNG SINGLE GIRDER CRANE FOR CEP HANDLING

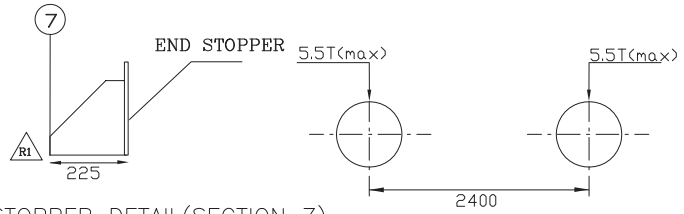
DEPT.	SCALE	DRAWING NO.
SIGN		PE-DG-434-524-A002
DATE		SHEET 1 OF 1 REV. 0

ALL DIMENSIONS ARE IN MM — FIRST ANGLE PROJECTION

DRAWING No PE-DG-403-524-A001

12.	CREEP SPEED SHALL BE ACHIEVED THRU' VVVF DRIVES	
11.	CLASS	M5
10.	DUTY	INDOOR DUTY
9.	QTY.	1 NO
8.	BAYLENGTH	30.0 MTRS
7.	LIFT	5.5 MTRS
6.	WHEEL LOAD (WITHOUT IMPACT) PER PAIR	5.5 T
5.	LT SPEED/CREEP SPEED	8/0.8 MPM
4.	CT SPEED/CREEP SPEED	4/0.4 MPM
3.	HOISTING/CREEP SPEED	1.6/0.16 MPM
2.	SPAN	13.3 MTRS
1.	SAFE WORKING LOAD	8 T
SL NO.	TECHNICAL SPECIFICATIONS PARAMETERS	



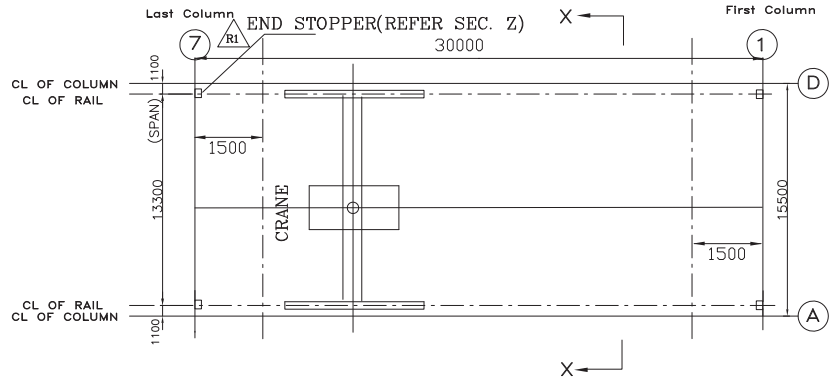


END STOPPER DETAIL(SECTION Z)

LT WHEEL LOAD (WITHOUT IMPACT)

REF.DRG:

1. COMPRESSOR HOUSE LAYOUT (DRG. NO. 9585-001-102-PVM-F-009
2. ARCHITECTURAL DRG OF COMPRESSOR HOUSE(9585-001-315-PVC-C-0272)
3. COMPRESSOR HOUSE: GANTRY GIRDER DETAIL(9585-001-315-PVC-C-0276C)



KEY PLAN

NOTES:

R3 1. HEAVIST WEIGHT -MOTOR=5T, CRANE CAPACITY SELECTED = 8 T

2. "*"MARKED DIMENSIONS ARE TENTATIVE & COLUMN SIZE SHALL BE DECIDED BY CIVIL

NTPC DRG. No.	9585-001-102-PVM-B-088
CUSTOMER	NTPC LTD.
	PATRATU STPS EXPANSION PHASE-I (3 X 800MW)

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
	DRN	DSR		20/02/19
	DESN	DSR		20/02/19
	CHD	PK		20/02/19
	APPD	SKB		20/02/19

TITLE: CRANE CLEARANCE DIAGRAM OF

8 T SINGLE GIRDER E.O.T. CRANE OF AIR COMPRESSOR HOUSE

DEPT.	SCALE	DRAWING NO.
SIGN		PE-DG-434-524-A001
DATE		SHEET 1 OF 1 — REV. 3

SUB SECTION-IB

SPECIFIC TECHNICAL REQUIREMENT (ELECTRICAL)

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

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

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

Refer "Electrical Scope between BHEL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

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

a) A copy of this sheet "Electrical equipment Specification for DG EOT CRANE 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) Electrical scope between BHEL & vendor.
b) Technical specification, datasheets & quality plans for 415V Electric motors.
c) Technical Specification, datasheets & quality plans for LT power & control cables.
d) Technical Specification, datasheets & quality plans for cabling, earthing & lightning protection.
e) Electrical Load data format.
f) Cable Listing Format

Note: The requirements mentioned in Customer Motor Spec for Motors shall prevail in case of conflict between the same and the corresponding requirements mentioned in the Section C/ Section D/ Datasheet A

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGE: DOUBLE GRIDER EOT CRANES

SCOPE OF VENDOR: SUPPLY , ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT :

S. NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	Isolating Switch	Vendor	Vendor	BHEL will provide one number 415 V(3ph, 4W) supply feeder only up to isolating switches for cranes. Any other voltage level (AC/DC) required will be derived by the vendor. Motor starter shall be part of crane control panel.
2	Power cables, control cables, screened control cables and any special cables (if required) between equipment supplied by vendor.	Vendor	Vendor	Cable from supply feeder to isolating switch shall be in BHEL scope.
3	Cabling material (cable trays, accessories, cable tray supporting system, conduits etc).	Vendor	Vendor	
4	Equipment Earthing	Vendor	Vendor	All equipment metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL.
5	Motors	Vendor	Vendor	
6	Cable glands and lugs for equipment supplied by vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power & 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 Control and Instrumentation Cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
8	Equipment layout drawings	Vendor	-	
9	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00

	TITLE : GENERAL TECHNICAL REQUIREMENTs FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : **II-B**
		SECTION :
		REV NO. : **00** DATE :
		SHEET : 1 OF 4

1.0 **INTENT OF SPECIFIATION**

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0 **CODES AND STANDARDS**

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement ofr rotating electrical machnines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechnical vibration of rotatinf electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0 **DESIGN REQUIREMENTS**

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3 **Starting Requirements**

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.

ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)

iii) Motors for coal conveyor and coal crusher application shall be suitable fro three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be sutable fro mimimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechnical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

4.0 **CONSTRUCTIONAL FEATURES**

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.

4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.

4.5 Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.

4.6 In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.

4.7 **Terminals and Terminal Boxes**

4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.

Unless otherwise statedin Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".

4.7.2 Unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.

4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or V W & V respectively.

4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.

4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.

4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.

4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.

4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.

4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.

4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

4.9 **General**

4.9.1 Motors provided for similar drives shall be interchangeable.

4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.

4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.

4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.

4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.

4.9.6 Name plate with all particulars as per IS: 325 shall be provided

4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

5.0 INSPECTION AND TESTING

5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.

5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.

5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.

5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

a) OGA drawing showing the position of terminal boxes, earthing connections etc.
b) Arrangement drawing of terminal boxes.
c) Characteristic curves:
(*To be given for motor above 55 kW unless otherwise specified in Data Sheet*).

i) Current vs. time at rated voltage and minimum starting voltage.
ii) Speed vs. time at rated voltage and minimum starting voltage.
iii) Torque vs. speed at rated voltage and minimum voltage.
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

SUB–SECTION – B-07

MOTORS

CLAUSE NO.	TECHNICAL REQUIREMENTS
	MOTORS
1.00.00	**GENERAL REQUIREMENTS**
1.01.00	For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.
1.02.00	All equipment shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.
1.03.00	Contractor shall provide fully compatible electrical system, equipment, accessories and services.
1.04.00	All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.
1.05.00	Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.
1.06.00	The responsibility of coordination with electrical agencies and obtaining all necessary clearances for contractors equipment and systems shall be under the contractor scope.
1.07.00	Degree of Protection Degree of protection for various enclosures as per IEC60034-05 shall be as follows:- i) Indoor motors - IP 54 ii) Outdoor motors - IP 55 iii) Cable box-indoor area - IP 54 iv) Cable box-Outdoor area - IP 55
2.00.00	**CODES AND STANDARDS** 1) Three phase induction motors : IS/IEC:60034 2) Single phase AC motors : IS/IEC:60034 3) Crane duty motors : IS:3177, IS/IEC:60034 4) DC motors/generators : IS/IEC:60034 5) Energy Efficient motors : IS 12615, IEC: 60034-30

CLAUSE NO.	TECHNICAL REQUIREMENTS
3.00.00	**TYPE**
3.01.00	**AC Motors:** a) Squirrel cage induction motor suitable for direct-on-line starting. b) Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30. c) Crane duty motors shall be squirrel cage Induction motor as per the requirement. d) Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.
3.02.00	DC Motors Shunt wound
4.00.00	**RATING** (a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor. (b) Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations. (c) For BFP motors, starting MVA shall be restricted to meet requirements indicated in B-0. (d) The starting current for the DC motors shall be restricted to 3 times of the full load current.
5.00.00	**TEMPERATURE RISE** **Air cooled motors** 70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation. **Water cooled** 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class 90 (Y) wet wound Boiler circulation pump motor.
6.00.00	**OPERATIONAL REQUIREMENTS**
6.01.00	**Starting Time**
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
6.02.00	**Torque Requirements**
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.
6.03.00	**Starting voltage requirement** (a) Up to 85% of rated voltage for ratings below 110 KW (b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW (c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW (d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW (e) Up to 75 % of rated voltage for ratings above 4000KW Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%.

CLAUSE NO.	TECHNICAL REQUIREMENTS
7.00.00	**DESIGN AND CONSTRUCTIONAL FEATURES**
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS: 2148 as detailed below (a) Fuel oil area : Group – IIB (b) Hydrogen generation : Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA / IEC60034)
7.03.00	Winding and Insulation (a) Type : Non-hygroscopic, oil resistant, flame resistant (b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature. (c) 11kV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e. resin poor method. The lightning Impulse & intertern insulation surge withstand level shall be as per IEC-60034 part-15. However winding insulation for wet wound Boiler circulation pump motor shall be thermal class 90 (Y) or better. (d) 240VAC, 415V AC & 220V DC motors : Thermal Class (B) or better
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.

CLAUSE NO.	TECHNICAL REQUIREMENTS
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.
7.06.00	Noise level for all the motors shall be limited to 85dB (A) except for BFP motor for which the maximum limit shall be 90 dB(A). Vibration shall be limited within the limits prescribed in IS/IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.
7.08.00	Motor body shall have two earthing points on opposite sides.
7.09.00	11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.
7.10.00	3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Suitable termination kit shall be provided for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material for single core cables) shall be provided.
7.11.00	The spacing between gland plate & center of terminal stud shall be as per Table-I.
7.12.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.
7.15.00	The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.

CLAUSE NO.	TECHNICAL REQUIREMENTS
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor. (a) Below 110KW : 11.0 (b) From 110 KW & upto 200 KW : 9.0 (c) Above 200 KW & upto 1000KW : 10.0 (d) From 1001KW & upto 4000KW : 9.0 (e) Above 4000KW : 6 to 6.5
9.00.00	CW motor shall be designed with minimum power factor of 0.8 at design duty point.
10.00.00	**TYPE TEST**
10.01.00	**HT MOTORS**
10.01.01	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII-(BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.
10.01.02	The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.
10.01.03	In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the employer for waival of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.
10.01.04	Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED "and carried out within last ten years from the date of bid opening. These reports should be for

CLAUSE NO.	TECHNICAL REQUIREMENTS
	the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.
10.01.05	**LIST OF TYPE TESTS TO BE CONDUCTED** **The following type tests shall be conducted on each type and rating of HT motor** (a) No load saturation and loss curves upto approximately 115% of rated voltage (b) Measurement of noise at no load. (c) Momentary excess torque test (subject to test bed constraint). (d) Full load test (subject to test bed constraint) (e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.
10.01.06	**LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED** **The following type test reports shall be submitted for each type and rating of HT motor** (a) Degree of protection test for the enclosure followed by IR, HV and no load run test. (b) Terminal box-fault level withstand test for each type of terminal box of HT motors only. (c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15 (d) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15

CLAUSE NO.	TECHNICAL REQUIREMENTS
10.02.00	**LT Motors**
10.02.01	LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for employer's approval the reports of all the type tests as listed in this specification and carried out within last *ten* years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
10.02.02	However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.
10.02.03	**LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED** **The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only** 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip. 5. Temperature rise test. 6. Momentary excess torque test. 7. High voltage test. 8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section) 10. Test for degree of protection and 11. Over speed test.

CLAUSE NO.	TECHNICAL REQUIREMENTS

12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1

10.03.00 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

10.04.00 The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet.

TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

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

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

PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:

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

CLAUSE NO.	TECHNICAL REQUIREMENTS

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

SUB–SECTION – B-20

LT POWER CABLES

CLAUSE NO.	TECHNICAL REQUIREMENTS
1.00.00	**CODES & STANDARDS**
1.01.00	All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:
	IS :1554 - I — PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
	IS : 3961 — Recommended current ratings for cables
	IS : 3975 — Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.
	IS : 5831 — PVC insulation and sheath of electrical cables.
	IS:7098 (Part -I) — Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.
	IS : 8130 — Conductors for insulated electrical cables and flexible cords.
	IS : 10418 — Specification for drums for electric cables.
	IS : 10810 — Methods of tests for cables.
	ASTM-D -2843 — Standard test method for density of smoke from the burning or decomposition of plastics.
	IEC-754 (Part-I) — Tests on gases evolved during combustion of electric cables.
	IEC-332 — Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).
2.00.00	**TECHNICAL REQUIREMENTS**
2.01.00	The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.

CLAUSE NO.	TECHNICAL REQUIREMENTS

2.02.00 All cables including EPR cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.

2.03.00 Aluminium conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be stranded.

2.04.00 XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C. PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.

2.05.00 The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS : 5831.

2.06.00 For single core armoured cables, armouring shall be of aluminium wires/ formed wires. For multicore armoured cables, armouring shall be of galvanised steel as follows :

Calculated nominal dia. of cable under armour	Size and Type of armour
Upto 13 mm	1.4mm dia GS wire
Above 13 & upto 25mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire
Above 25 & upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire
Above 40 & upto 55mm	1.4 mm thick GS formed wire /2.5mm dia GS wire
Above 55 & upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire
Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire

2.06.01 The aluminium used for armouring shall be of H4 grade as per IS: 8130 with maximum resistivity of 0.028264 ohm mm^2 per meter at 20 deg C. The sizes of aluminium armouring shall be same as indicated above for galvanized steel.

2.06.02 The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface of G.S.wire/ formed wire.

2.07.00 Outer sheath shall be of PVC as per IS: 5831 & black in colour. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties.

(a.) Oxygen index of min. 29 (as per IS 10810 Part-58).

(b.) Acid gas emission of max. 20% (as per IEC-754-I).

CLAUSE NO.	TECHNICAL REQUIREMENTS
	(c.) Smoke density rating shall not be more than 60 % (as per ASTMD-2843).
2.08.00	Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted: 1 core - Red, Black, Yellow or Blue 2 core - Red & Black 3 core - Red, Yellow & Blue 4 core - Red, Yellow, Blue and Black
2.09.00	For reduced neutral conductors, the core shall be black.
2.10.00	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath. (a.) Cable size and voltage grade - To be embossed (b.) Word 'FRLS' at every 5 metre - To be embossed (c.) Sequential marking of length of the cable in metres at every one metre -To be embossed / printed The embossing shall be progressive, automatic, in line and marking shall be legible and indelible. For EPR cables identification shall be printed on outer sheath.
2.11.00	All cables shall meet the fire resistance requirement as per Category-B of IEC 332 Part-3.
2.12.00	Allowable tolerances on the overall diameter of the cables shall be +\-2 mm maximum, over the declared value in the technical data sheets.
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.
2.14.00	Cable selection & sizing
2.14.01	Cables shall be sized based on the following considerations: (a) Rated current of the equipment (b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage (c) Short circuit withstand capability This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the letout energy of the fuse. For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time.

CLAUSE NO.	TECHNICAL REQUIREMENTS
2.14.02	Derating Factors Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes: a) Variation in ambient temperature for cables laid in air b) Grouping of cables c) Variation in ground temperature and soil resistivity for buried cables.
2.14.03	Cable lengths shall be considered in such a way that straight through cable joints are avoided.
2.14.04	Cables shall be armoured type if laid in switchyard area, CHP area or directly buried.
2.14.05	All LT power cables of sizes more than 120 sq.mm. shall be XLPE insulated and preferable sizes are 1Cx150, 1Cx300, 1Cx630, 3Cx150 & 3Cx240 sq.mm. However for cable sizes upto 120 sq.mm. both XLPE insulated & PVC insulated LT power cables are acceptable
3.00.00	**CONSTRUCTIONAL FEATURES**
3.01.00	1.1 KV Grade Power Cables (a) 1.1 KV grade XLPE power cables shall have compacted aluminium conductor, XLPE insulated, PVC inner-sheathed (as applicable), armoured/ unarmoured, PVC outer-sheathed conforming to IS:7098. (Part-I). (b) 1.1KV grade PVC power cables shall have aluminium conductor(compacted type for sizes above 10 sq.mm), PVC Insulated, PVC inner sheathed (as applicable) armoured/ unarmoured, PVC outer-sheathed conforming to IS:1554 (Part-I). (c) 1.1 KV grade Trailing cables shall have tinned copper(class 5)conductor, insulated with heat resistant elastomeric compound based on Ethylene Propyline Rubber(EPR) suitable for withstanding 90 deg.C continuous conductor temperature and 250deg C during short circuit, inner-sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer-sheathed with heat resistant, oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968.
4.00.00	**CABLE DRUMS** (a) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418. (b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stencilled on both sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled. (c.) The standard drum length for power cables shall not be 1000 metres; however for cable sizes of 1C X 630mm2, 3C X 150mm2 and 3C X 240mm2 (sizes if

applicable) standard drum length shall be 750 meters. The length per drum shall be subjected to a maximum tolerance of +/- 5% of the standard drum length. The Employer shall have the option of rejecting cable drums with shorter lengths.

5.00.00 TESTS

1.0 All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

2.0 However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval.

3.0 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

4.0 The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

5.01.00 **Type Tests**

5.01.01 The reports for the following type tests shall be submitted for one size each of LT XLPE and LT PVC Power cables. Size shall be decided by the employer during detailed engineering:

S.No.	Type test	Remarks
	For Conductor	
1.	Resistance test	
2.	Tensile test	For circular non-compacted conductors only
3.	Wrapping test	For circular non-compacted only
	For Armour Wires/ Formed Wires	
4.	Measurement of Dimensions	
5.	Tensile Test	
6.	Elongation test	
7.	Torsion test	For round wires only
8.	Wrapping test	For aluminium wires / formed wires only.

9.	Resistance test	
10(a)	Mass of zinc coating test	For GS Formed wires/wires only
10(b)	Uniformity of zinc coating	For GS Formed wires /wires only
11.	Adhesion test	For GS Formed wires/wires only
	For PVC/XLPE insulation & PVC Sheath	
12.	Test for thickness	
13.	Tensile strength & elongation tests	before ageing and after ageing
14.	Ageing in air oven	
15.	Loss of mass test	For PVC insulation and sheath only
16.	Hot deformation test	For PVC insulation and sheath only
17.	Heat shock test	For PVC insulation and sheath only
18.	Shrinkage test	
19.	Thermal stability test	For PVC insulation and sheath only
20.	Hot set test	For XLPE insulation only
21.	Water absorption test	For XLPE insulation only
22.	Oxygen index test	For outer sheath only
23.	Smoke density test	For outer sheath only
24.	Acid gas generation test	For outer sheath only
	For completed cables	
25.	Insulation resistance test (Volume resistivity method)	
26.	High voltage test	
27.	Flammability test as per IEC-332 Part-3 (Category-B)	

Indicative list of tests/checks, Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of LT power cables enclosed.

SUB–SECTION – B-21

LT CONTROL CABLES

CLAUSE NO.	TECHNICAL REQUIREMENTS

1.00.00 CODES & STANDARDS

1.01.00 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:

IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
IS : 3961	Recommended current ratings for cables
IS : 3975	Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.
IS : 5831	PVC insulation and sheath of electrical cables.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Specification for drums for electric cables.
IS : 10810	Methods of tests for cables.
ASTM-D –2843	Standard test method for density of smoke from the burning or decomposition of plastics.
IEC-754 (Part-I)	Tests on gases evolved during combustion of electric cables.
IEC-332	Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).

2.00.00 TECHNICAL REQUIREMENTS

2.01.00 The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.

2.02.00 All cables including EPR cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions as specified elsewhere in this specification.

2.03.00 Conductor of control cables shall be made of stranded, plain annealed copper.

2.04.00 PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.

2.05.00 The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831.

2.06.00 For multicore armoured cables, the armouring shall be of galvanised steel as follows:

Calculated nominal dia of cable under armour	Size and Type of armour
Upto 13 mm	1.4mm dia GS wire
Above 13 upto 25 mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire
Above 25 upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire
Above 40 upto 55mm	1.4 mm thick GS formed wire/2.5mm dia GS wire
Above 55 upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire
Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire

The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface.

2.07.00 Outer sheath shall be of PVC as per IS: 5831 and grey in colour. In addition to meeting all the requirements of Indian Standards referred to, outer sheath of all the cables shall have the following FRLS properties.

(a.) Oxygen index of min. 29. (As per IS 10810 Part-58)

(b.) Acid gas emission of max. 20% (As per IEC-754-I)

(c.) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTMD-2843.

2.08.00 Cores of the cables of upto 5 cores shall be identified by colouring of insulation. Following colour scheme shall be adopted.

1 core - Red, Black, Yellow or Blue

2 core - Red & Black

3 core - Red, Yellow & Blue

4 core - Red, Yellow, Blue and Black

5 core - Red, Yellow, Blue, Black and Grey

2.09.00 For cables having more than 5 cores, core identification shall be done by numbering the insulation of cores sequentially, starting by number 1 in the inner layer (e.g. say for 10 core cable, core numbering shall be from 1 to 10). The number shall be printed in Hindu-Arabic numerals on the outer surfaces of the cores. All the numbers shall be of the same colour, which shall contrast with the colour of insulation. The colour of insulation for all the cores shall be grey only. The numerals shall be legible and indelible. The numbers shall

CLAUSE NO.	TECHNICAL REQUIREMENTS
	be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is a single numeral, a dash shall be placed underneath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecutive numbers shall not exceed 50 mm.
2.10.00	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath: (a.) Cable size and voltage grade - To be embossed (b.) Word 'FRLS' at every 5 metre - To be embossed (c.) Sequential marking of length of the cable in metres at every one metre - To be embossed / printed. The embossing / printing shall be progressive, automatic, in line and marking shall be legible and indelible. For EPR cables identification shall be printed on outer sheath.
2.11.00	All cables shall meet the fire resistance requirement as per Category-B of IEC-332 Part-3.
2.12.00	Allowable tolerances on the overall diameter of the cables shall be +\-2 mm maximum over the declared value in the technical data sheets.
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.
2.14.00	Cable selection & sizing Control cables shall be sized based on the following considerations: (a) The minimum conductor cross-section shall be 1.5 sq.mm. (b) The minimum number of spare cores in control cables shall be as follows:

No. of cores in cable	Min. No. of spare cores
2C, 3C	NIL
5C	1
7C-12C	2
14C & above	3

2.14.01	Cable lengths shall be considered in such a way that straight through cable joints are avoided.
2.14.02	Cables shall be armoured type if laid in switchyard area, CHP area or directly buried.
3.00.00	**CONSTRUCTIONAL FEATURES**
3.01.00	1.1 KV Grade Control Cables shall have stranded copper conductor and shall be multicore PVC insulated, PVC inner sheathed, armoured / unarmoured, FRLS PVC outer sheathed conforming to IS: 1554. (Part-I).
3.02.00	1.1 KV grade Trailing cables shall have tinned copper(class 5)conductor, insulated with heat resistant elastomeric compound based on Ethylene Propyline Rubber(EPR) suitable for withstanding 90 deg.C continuous conductor temperature and 250deg C during short circuit,

inner-sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer-sheathed with heat resistant, oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968. Minimum conductor size shall be 2.5 sqmm.

4.00.00 CABLE DRUMS

(a.) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.

(b.) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stenciled on both the sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

(c.) The standard drum length for control cables shall not be less than 1000 metres. The length per drum shall be subjected to a maximum tolerance of +/- 5% of the standard drum length. The Employer shall have the option of rejecting cable drums with shorter lengths.

5.00.00 TESTS

All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval.

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price

The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

5.01.00 **TYPE TESTS**

5.01.01 The reports for the following type tests shall be submitted for one size of control cables. Size shall be decided by the employer during detailed engineering

S. No.	Type Test	Remarks
	For Conductor	
1.	Resistance test	
	For Armour Wires / Formed Wires (If applicable)	
2.	Measurement of Dimensions	
3.	Tensile Test	
4.	Elongation test	
5.	Torsion test	For round wire only
6.	Wrapping test	For aluminium wires / formed wires only.
7.	Resistance test	
8(a).	Mass of zinc Coating test	For GS wires/formed wires only
8(b).	Uniformity of zinc coating	For GS wires/formed wires only
9.	Adhesion test	For GS wires/formed wires only
	For PVC insulation & PVC Sheath	
10.	Test for thickness	
11.	Tensile strength and elongation test	before ageing and after ageing
12.	Ageing in air oven	
13.	Loss of mass test	For PVC insulation and sheath only
14.	Hot deformation test	For PVC insulation and sheath only
15.	Heat shock test	For PVC insulation and sheath only
16.	Shrinkage test	
17.	Thermal stability test	For PVC insulation and sheath only

CLAUSE NO.	TECHNICAL REQUIREMENTS

S. No.	Type Test	Remarks
18.	Oxygen index test	For outer sheath only
19.	Smoke density test	For outer sheath only
20.	Acid gas generation test	For outer sheath only
	For completed cables	
21.	Insulation resistance test(Volume resistivity method)	
22.	High voltage test	
23.	Flammability test as per IEC-332 Part-3 (Category-B)	

5.02.00 Indicative list of tests/checks, Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of Control Cables enclosed.

	3X800MW PATRATU STPP EPC PACKAGE TECHNICAL SPECIFICATION FOR CABLE TRAYS & ACCESSORIES	SPECIFICATION NO.PE-TS-434-507-E021 VOLUME II B SECTION REVISION 0 | DATE: MAY 18 SHEET 1 of 2

DATASHEET-A

1.0 APPLICABLE STANDARDS

a)	IS: 1079	For hot rolled carbon steel sheet and strip.
b)	IS: 1730	For dimensions for steel sheet and strip.
c)	IS: 1363	Hexagon head bolts, screws and nuts.
d)	IS: 2629	For hot dip galvanising of steel & surface pre treatment.
e)	IS: 2633	For testing of zinc coating.
f)	IS: 6745	For determining of mass of zinc coating.
g)	IS: 1367 (Part-XIII)	Galvanised Coating on threaded Fasteners.
h)	IS: 1852	For Rolling and Cutting Tolerances of hot rolled steel products.
i)	IS: 9595	For thickness of welding of carbon & carbon manganese steels

2.0 CABLE TRAYS & ACCESSORIES

2.1	Material	:	Hot Rolled Mild Steel
2.2	Type	:	Ladder Type Perforated Type Cable trough
2.3	Standard Length of Straight Length of Cable Trays	:	2.5 meters
2.4	Standard Width (mm)	:	Cable Trays : 600 300 150 Cable Trough: 75 50
2.5	Construction	:	Conforming to enclosed drawing [PE-DG-405-507-E005]
2.6	Bending Radius of Accessories(in mm)	:	600 mm
2.7	Tolerance in length/width / height	:	+ /- 2 mm

3.0 FITTINGS

End connections	:	Through Coupler plates (Side Coupler Plates shall be provided as part of cable tray & accessories supply with bolts, nuts, washers etc)

4.0 SHEET THICKNESS

a) For cable trays & Accessories	:	min 2.0 mm
b) For Coupler plate	:	min 3.0 mm
c) Tolerance in Thickness	:	(+ 0.2 mm) (NO NEGATIVE TOLERANCE IS PERMITTED)

6.0 SURFACE TREATMENT

a) Pre-treatment : IS 2629 before galvanisation

b) Type : Hot dip galvanisation

c) Applicable Standard : IS 2629

d) Minimum thickness : 75 microns (minimum)

e) Min. weight of Zinc deposit : 610 grams per square meter

f) Tests for galvanizing : (i) Weight of Zinc Coating as per IS 6745.
(ii) Thickness of Zinc Coating as per IS 4759.
(iii) Uniformity of Zinc Coating as per IS 2633.
(iv) Adhesion Test as per IS 2629.

7.0 NUMBER OF COUPLER PLATES, BOLTS, WASHERS & NUTS REQUIRED FOR EACH CABLE TRAY SECTION (2.5 MTRS)

Sl. No.	NAME OF ITEM	COUPLER PLATE (nos.)	NUTS (nos.)	WASHERS (nos.)	BOLTS (nos.)
1	Cable tray of standard length 2.5 meters	4	16	32	16

NOTE: - Based on above table, no. of coupler plates, bolts, washers & nuts shall be calculated for the offered lot. Over & above the calculated quantity, additional 5% coupler plates & 10% bolts, washers & nuts shall be supplied by the bidder.

DATASHEET A
(SPECIFIC TECHNICAL REQUIREMENTS)

1.0 APPLICABLE STANDARDS:

a) IS: 2062 For structural steel.
b) IS: 1079 For hot rolled carbon steel sheet and strip.
c) IS: 513 For cold rolled low carbon steel sheet & strips
d) IS: 1730 For dimensions for steel sheet and strip.
e) IS: 1363 Hexagon head bolts, screws and nuts.
f) IS: 5 For colours of paint.
g) IS: 2629 For hot dip galvanising of steel & surface pre-treatment.
h) IS: 2633 For testing of zinc coating.
i) IS: 6745 For determining of mass of zinc coating.
j) IS: 1852 For rolling and cutting tolerances of hot rolled steel products.

2.0 CABLE TRAY SUPPORT

a) Tray support type:	Boltable type
b)Material:	Hot/ Cold Rolled MS sheet steel for channel SC1/ DC1 and channel portion of cantilever arms
c)Thickness:	2.5 mm
d) Length:	Standard length of 6 meters
e) Fabrication :	At works
f) Construction:	Conforming to enclosed drawings [PE-DG-405-507-E013]

3.0 SURFACE TREATMENT:

Galvanizing:

a) Pre-treatment:	As per IS 2629 prior to galvanisation
b) Type	Hot dip galvanization
c) Applicable Standard:	IS 2629
d) Minimum thickness:	75 microns (minimum)
e) Min. weight of Zinc deposit:	610 gms. per square meter
f) Tests for galvanizing:	i) Weight of zinc coating as per IS : 6745 ii) Thickness of zinc coating as per IS : 4759 iii) Uniformity of zinc coating as per IS : 2633 iv) Adhesion as per IS: 2629

TITLE	SPECIFICATION NO.
LV MOTORS	VOLUME II B
	SECTION D
DATA SHEET-A	REV NO. 00 DATE 01/10/2012
	SHEET 1 OF 1

1.0	Design ambient temperature	:	50 ºC
2.0	Maximum acceptable kW rating of LV motor	:	≤200KW
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Degree Of Protection (Indoor/Outdoor)	:	IP54/IP55
5.0	Type of Cooling	:	TEFC/CACA/TETV
6.0	Details of supply system		
	a) Rated voltage (with variation)	:	415V ± 10%
	b) Rated frequency (with variation)	:	50 Hz (Variation: +3% TO –5%)
	c) Combined voltage & freq. variation	:	10%
	d) System fault level at rated voltage	:	50 kA for 1 sec
	e) Short time rating for terminal boxes		
	o 110kW & Above (Breaker controlled)	:	50 kA for 1 sec
	o Below 110kW (SFU+ Contactor controlled)	:	50 KA for 0.20 sec.
	f) LV System grounding	:	Solidly
7.0	Class of insulation	:	Class 'F', with temp rise limited to class B. (Refer clause 5.00.00 of Motors)
8.0	Minimum voltage for starting (As percentage of rated voltage)	:	As per Customer Motor Spec (enclosed)
9.0	Power cables data	:	Shall be given during Detailed engg.
10.0	Earth Conductor Size & Material	:	Shall be given during Detailed engg.
11.0	Space heater supply	:	240 V, 1Φ , 50 Hz
12.0	Rating up to which Single phase motor	:	Acceptable below 0.20 kW
13.0	Tests	:	As per Customer motor spec. (enclosed)
14.0	Energy efficient/ Flame proof motor	:	As per Customer spec. requirement

- **Also detail Customer spec. for Motors to be referred as enclosed with spec.**
- **The requirements mentioned in Customer Motor Spec for Motors shall prevail in case of conflict between the same and the corresponding requirements mentioned in the Section C/ Section D/ Datasheet A**

			CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
	QUALITY PLAN		BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 1 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVENT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
BHEL			**PARTICULARS**		**BIDDER/VENDOR**							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

	QUALITY PLAN	CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE
	SHEET 2 OF 9	SYSTEM	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION / VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE
	SHEET 3 OF 9	SYSTEM	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2	
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG. .	MANUFR'S DRG.	-DO-	3	-	2	FOR MV MOTOR INSULA-TION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
		2.ELECT. PROP, & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	RELEVANT IS/ BS OR OTHER STANDARDS	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2	

BHEL	PARTICULARS	BIDDER/VENDOR	
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	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE
	SHEET 4 OF 9	SYSTEM	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
1.10	BEARINGS	1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE
	SHEET 5 OF 9	SYSTEM	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVENT SPEC./ ASTM-E165	MANUFR'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE
	SHEET 6 OF 9	SYSTEM	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10	10	10	11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	FOR MV MOTOR
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	THREE DIPS TO BE GIVEN

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE
	SHEET 7 OF 9	SYSTEM	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.7	COMPLETE STATOR ASSEMBLY	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	VERIFICATION FOR MV MOTOR ONLY
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1	

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

BHEL	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 8 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1$	1	$ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1$	1	$ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1$	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY $ NOTE - 2

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :		
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE		
	SHEET 9 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11

NOTES:

1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.

2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.

3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.

4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION TITLE			
		SHEET 1 OF 2	SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3
BHEL			**PARTICULARS**		**BIDDER/VENDOR**							
			NAME									
			SIGNATURE									

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION : TITLE :			
		SHEET 2 OF 2	SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	

NOTES:

1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON

2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	**PARTICULARS**	**BIDDER/VENDOR**
	NAME	
	SIGNATURE	
	DATE	BIDDER'S/VENDORS COMPANY SEAL

QUALITY ASSURANCE & INSPECTION MODULE NO. SQE-16

CABLING, EARTHING, LIGHTNING PROTECTION

ATTRIBUTES / CHARACTERISTICS / ITEMS/COMPONENTS / SUB SYSTEMS	Dimension	Paint shade, paint thickness, adhesion	Pre-treatment of sheet	IP protection	Proof load*	Surface finish	Deflection test*	HV & IR	Galvanise 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 NTPC
Wall Mounted-Lighting Panel (IS-513, IS:5, IS:2629, 2633, 6745)	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	Y													Y
Lighting wire (IS-694)	Y											Y		
Flexible conduits	Y											Y		Y
Conduits (Galvanise & Epoxy) IS-9537 & IS-2629, 2633, 6745	Y		Y						Y			Y		Y
RCC Hume Pipe (IS-458)												Y		
Cable termination & straight through joint (IS 13573)	Y											Y		Y
Cable Trays, bends, tees, crosses, Flexible supports system & accessories IS-513, 2629,2633,6745	Y		Y		Y	Y	Y		Y			Y	Y	Y
Trefoil clamp	Y													Y
GI flats for earthing & lighting protection (IS 2062, 2629, 6745,2633)	Y		Y						Y			Y		Y
GI wire (IS-280)	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 NTPC technical specification & approved MQP. The above acceptance tests shall be done only on one sample from each size of offered lot. This test is not applicable on bends, tees & crosses.

3. Make of all items will be subject to NTPC approval.

MOTOR

TESTS/CHECKS / TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	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			Y
Magnetic Material	Y	Y	Y	Y			Y		
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y
Stator copper	Y	Y	Y	Y			Y		Y
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y
Insulating Material	Y		Y	Y			Y		
Tubes, for Cooler	Y	Y	Y	Y	Y				Y
Sleeve Bearing	Y	Y	Y	Y	Y				Y
Stator/Rotor, Exciter Coils	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	Y
Wound stator	Y	Y					Y	Y	
Wound Exciter	Y	Y					Y	Y	
Rotor complete	Y	Y					Y		
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y		
Accessories, RTD, BTD,CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y						
Complete Motor	Y	Y	Y						

Note:
1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.
2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard
3. Makes of major bought out items for HT motors will be subject to NTPC approval.

Y1 = for HT Motor / Machines only.

MOTOR

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/IS 2148/IEC60034\IEC 60079-I	Vibration	Over speed	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	Y1	Y

Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.

2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard

3. Makes of major bought out items for HT motors will be subject to NTPC approval.

Y1 = for HT Motor / Machines only.

LT Power Cables

Attributes / Characteristics / Item / Components / Sub System Assembly	Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test(as applicable)	Electrical properties	Hot Set Test/ Eccentricity & Ovality	Lay length & Sequence	Armour coverage, cross over, looseness, gap between two	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability	Anti termite coating on wooden	Constructional requirements feature as per NTPC specification	Routine & Acceptance Tests as per relevant standard & NTPC	FRLS Tests
Aluminum (IS-8130)	Y	Y	Y	Y		Y										
XLPE Compound (IS-7098)	Y		Y			Y	Y				Y					
PVC insulation Compound (IS: 5831)	Y		Y			Y					Y	Y				
FRLS PVC Compound (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1)	Y		Y								Y	Y				Y
Extrusion & curing /Manufacturing of Core (PVC / XLPE)		Y			Y		Y					Y				
Core Laying								Y								
Armour wire/strip	Y	Y	Y													
Inner sheath	Y	Y														
Armouring		Y							Y							
Outer Sheathing		Y								Y						
Power Cable (Finished) (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1, IEC 60332 part III cat B)								Y	Y	Y	Y	Y		Y	Y	Y
Wooden drum(IS-10418) /Steel Drum		Y											Y	Y		

Notes:
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. Make of all major Bought out items will be subject to NTPC approval.

ROUTINE TESTS	**Following routine tests shall be carried out on each drum of finished cables for all types (PVC / XLPE insulated) & sizes.**	
1)	Conductor Resistance test	
2)	High voltage test	
ACCEPTANCE TESTS	**Following Acceptance tests shall be carried out on each size of each type (PVC / XLPE insulated) of cables, in the offered lot.**	
A) For Conductor (as per sampling plan mentioned in IS: 1554 / 7098)		
	1)	Annealing test (Copper)
	2)	Tensile Test (Aluminum)
	3)	Wrapping Test (Aluminum)
	4)	Resistance test
B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IS: 1554 / 7098)		
	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 surface defects
C) For PVC / XLPE insulation & PVC Sheath (as per sampling plan mentioned in IS: 1554 / 7098)		
	1)	Test for thickness
	2)	Tensile strength & Elongation before ageing (for tests after ageing see “D”)
	3)	Hot set test (For XLPE insulation)
D) Ageing test:		

	Criteria	Condition	Test Requirements	Remarks
PVC insulation & outer sheath:	Samples as per relevant IS, from each size of cables in the offered lot, shall be tested for tensile strength & elongation (before ageing). **Tensile & elongation testing shall preferably be done with a computerized machine.** The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/ - 15% of the corresponding values of Type Test report. (Please note that test values should be more than the minimum values indicated in relevant standard).	All sizes which meet the criteria	The size which has maximum negative deviation from type test report values will be put on accelerated ageing test. The samples shall be aged in air oven at temperature of 130°c+/- 2°c for 5 hours and tested for TS & elongation. Acceptance norms shall be as per IS.	In case the size does not meet the requirement in accelerated ageing test **then all sizes (which had met the criteria) will be put on ageing test as per IS.**
		Sizes which do not meet the criteria	Every size will be put on ageing test as per IS.	----
XLPE insulation	Samples as per relevant IS, from each size of cables in the offered lot,will be put on ageing test as per IS.			

E) Following tests will be carried out on completed cables as per IS on each size of each type (PVC / XLPE insulated)		
	1)	Insulation resistance test (Volume resistivity method)
	2)	High voltage test
F) Following tests shall be carried out on only one size of offered lot (comprising of all sizes & types)		
	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
	4)	Acid gas generation test on outer sheath

G) Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cables as per following sampling plan:		
		This test will be carried out using composite sampling i.e. irrespective of size; cables of one particular type (i.e. armoured PVC insulated, unarmoured PVC insulated, armoured XLPE insulated, unarmoured XLPE insulated) will be bunched together, as per calculations in line with the IEC. All sizes of PVC & XLPE insulated, armoured & unarmoured cables shall be covered. For one particular type, cables with OD less than or equal to 30 mm shall be clubbed together in touching formation while cables with OD greater than 30 mm shall be clubbed together leaving a gap equal to OD of cable having least diameter. Cable OD shall be taken as nominal overall diameter as per NTPC approved datasheet.
H) Following tests shall be carried on one length of each size of each type (PVC / XLPE insulated) of offered lot:		
	1)	Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, drum / Batch (outer sheath extrusion batch)number marking on sheath
	2)	Measurement of Eccentricity & Ovality

	TITLE	SPECIFICATION NO.
	MOTOR	VOLUME II B
		SECTION
	DATA SHEET	REV NO. 00 DATE MAY 18
		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			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	SPECIFICATION NO.
	MOTOR	VOLUME II B
		SECTION
	DATA SHEET	REV NO. 00 DATE MAY 18
		SHEET 2 OF 2

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	

NAME OF VENDOR				REV.	
NAME	SIGNATURE	DATE	SEAL		

SUB SECTION-IC

TECHNICAL DATA SHEET A

TECHNICAL DATA SHEET FOR SINGLE GIRDER EOT CRANE

S.N.	Description	Technical Particulars
1.0.0	GENERAL	
1.1.0	Name of Manufacturer	
	a) EOT Crane	*
	b) Crane motors	*
	c) Control Equipments	*
	d) Runway conductors	*
1.2.0	WEIGHT OF EQUIPMENTS	
	a) Crane weight (Kgs.)*	*
	b) Weight of DSL (Kgs.)*	*
1.3.0	Design, fabrication and testing of crane conform to standard / code	IS-3177 & 807 (latest edition)
1.4.0	Number of cranes	FOUR (4)
1.5.0	Crane Classification	Group M5 of IS: 3177 – 2020 for structure and machinery.
1.6.0	Type of service	----------Indoor----------
1.7.0	Type of Crane	EOT/UNDERSLUNG
1.8.0	Capacity (SWC)	AS PER CCD
1.9.0	Span	AS PER CCD
1.10.0	Lift	AS PER CCD
1.11.0	Over Load Test	(125% of rated capacity-SWC)
1.12.0	Crane structure	Single girder box construction
1.13.0	Design ambient temperature	50^0 C
1.14.0	Runway Rail	By Bidder
1.14.1	Type & Size	Rolled section as per IS 3443.
1.14.2	Material	As per IS 3177.
1.14.3	Weight per metre	*
1.15.0	End carriage	
1.15.1	Material	M.S. as per IS: 2062, GR B

1.15.2	Manufacturer	*
1.16.0	Main girder	
1.16.1	Type & Size	Plate box type
1.16.2	Material	M.S. as per IS: 2062, GR B
1.16.3	Vertical Deflection	1/800 of span
1.16.4	Manufacturer	As per Sub-vendor list
1.17.0	**Power supply**	415V +/- 10%, 3 phase, 4 wire, 50 Hz+3% -5% variation. Combined voltage and frequency variation 10% (Shall be arranged by Purchaser at 1.5 M above floor level / operating level)
1.18.0	Control Supply	24 V/110V (Shall be arranged by vendor)
1.19.0	Load test	As per IS: 3177
2.0.0	**CRANE PERFORMANCE**	
2.1.0	**Operation**	Electrical -- From floor by means of Pendant Push Button controller suspended from panel
2.2.0	**Crane speed with full load**	
	a) Hoist (Full speed)	1.6 M/Min
	b) Hoist (Creep speed)	(10% of main speed through VVVF drive)
	c) Cross travel (CT)	4.0 M/min
	Cross travel (creep speed)	(10% of main speed through VVVF drive)
	d) Longitudinal bridge travel (LT)	8.0 M/min
	Longitudinal bridge travel (LT)	(10% of main speed through VVVF drive)
2.3.0	**Hoisting Mechanism**	Gear
2.4.0	**Type of power transmission**	Gear
2.5.0	**WIRE ROPE**	
2.5.1	Make	As per Sub-vendor list
2.5.2	Core / Construction	Steel core as per IS-2266 / 6 X 36
2.5.3	Wire rope dia. (mm)	*
2.5.4	Wire rope fall	*
2.5.5	Material	Plough steel
2.5.6	Tensile strength	160-180 Kg /mm
2.5.7	Min. Breaking load	*
2.5.8	Conform to (Std. / code)	IS-2266

2.5.9	Factor of safety	6		
2.6.0	**LOAD HOOK / HOOK BLOCK**			
2.6.1	Make	As per sub-vendor list		
2.6.2	Type of load hook	Plain shank, Trapezoidal section-forged as per IS: 15560, with safety latch.		
2.6.3	Material of load hook	Forged steel		
2.6.4	Type of Bearing of hook suspension	Thrust ball bearing		
2.6.5	Make of Bearing of hook suspension	*		
2.6.6	Type and Material of hook suspension.	M.S. Fabricated		
2.7.0	**ELECTRIC HOIST**			
2.7.1	Model No.	*		
2.7.2	Duty	Class II (M5) as per IS: 3938 (latest edition)		
2.8.0	Type of DSL			
2.8.1	Long travel	PVC shrouded bus bar conductor type		
2.8.2	Cross traverse	Flexible cable with Taut wire / Festoon cable arrangement		
2.9.0	**MOTORS**	M.H	C.T.	L.T.
2.9.1	Make	As per Sub Vendor List		
2.9.2	Rating (KW)	*		
2.9.3	RPM	*		
2.9.4	Qty.	1	1	2
2.9.5	Maximum number of poles	6	6	6
2.9.6	Type	TEFC, Sq. cage induction type,S4 duty, 40%CDF		
2.9.7	Enclosure	IP-55		
2.9.8	Number of start	150 starts/Hr.		
2.9.9	Insulation	70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.		
2.9.10	Margin	Maximum continuous motor ratings shall be 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.		
2.9.11	Over load protection provided	YES		
2.9.12	Ambient Design temperature	50^{o}C		
2.10.0	**LIMIT SWITCHES**			

2.10.1	Location	M.H.	C.T.	L.T
2.10.2	Qty.	1+1	1	1
2.10.3	Type	Gravity / Rotary gear	Two way lever	Two way lever
2.10.4	Method of actuation	Snap action	Shunt type	Shunt type
2.10.5	Material of contact	Silver Cadmium		
2.10.6	Make	As per Sub Vendor List		
2.10.7	Control Voltage	110V		
2.11.0	**Control panel**	A suitable control panel will be provided comprising of main contractor, motor contactor, single phase preventor with overload relays, transformer, fuses, MCCB's, etc. Rectifier panel for brake shall also be provided		
2.12.0	**BRAKES**			
2.12.1	Location	M.H.	C.T.	L.T.
2.12.2	Qty. / Motor	1+1	1	1
2.12.4	Type	EM+EHT	EHT	EHT
2.12.5	Capacity	150% FLT		
2.12.6	Size / rating	*		
2.12.7	Make	As per Sub Vendor List		
2.13.0	**GEAR (HOISTING)**			
2.13.1	Make	As per Sub Vendor List		
2.13.2	Type	Spur / Helical		
2.13.3	Material	Gear: EN8 / 20 Mn Cr5 / 16 Mn Cr5 Pinion: EN9		
2.13.4	Lubrication	Grease / Oil splash		
2.13.5	Reduction	*		
2.13.6	Bearing Make	*		
2.13.7	Bearing Type	Antifriction deep groove ball / roller bearing		
2.13.8	Hardness (BHN)	As per IS 3177 (Latest Edition)		
2.14.0	**GEAR (L.T. & C.T.)**			
2.14.1	Location	C.T.	L.T.	
2.14.2	Make	As per Sub Vendor List		
2.14.3	Type	Spur / Helical	Spur / Helical	

2.14.4	Material	Gear: EN8 / 20 Mn Cr5 / 16 Mn Cr5 Pinion: EN9	Gear: EN8 / 20 Mn Cr5 / 16 Mn Cr5 Pinion: EN9
2.14.5	Lubrication	Grease / Oil splash	Grease / Oil splash
2.14.6	Reduction	*	*
2.14.7	Bearing Make	As per Sub Vendor List	
2.14.8	Bearing Type	Antifriction deep groove ball / roller bearing	Antifriction deep groove ball / roller bearing
2.14.9	Hardness (BHN)	As per IS 3177 (Latest Edition)	
2.15.0	**WIRE ROPE DRUM**		
	Material	Fabricated from M.S. as per IS: 2062, Gr B and stress relieved or seamless pipe ASTM A106 Gr B	
	Diameter	*	
	Length	*	
	Type	Flanged	
	Type of grooves	*	
2.16.0	**WHEELS**		
	Location	C.T.	L.T.
	Diameter (mm)	*	*
	Qty	*	*
	Hardness	200 BHN (Max.)	As per IS 3177.
	Material	EN8 / EN9	EN8 / EN9
2.16.6	Bearing make		
	Bearing Type	Antifriction deep groove ball bearing	Antifriction deep groove ball bearing
	Flange	Single	double flanged
2.16.8.1	Conform to IS	3177	
2.16.8.2	Wheel Base	*	
2.17.0	**SHEEVE**		
	Material	Cast steel	
	Groove dia/ O.D. .(mm)	*	
	Bearing make	As per Sub Vendor List	
	Bearing Type	Antifriction deep groove ball bearing	

2.18.0	CONTROL PANEL	* Fabricated from CRCA steel sheet min 2 mm thick. * Degree of protection shall be IP 55. * 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 thickness shall be minimum 3mm. * Gland plate shall be double brass compression type.	
	Qty	One	
	Make	As per Sub Vendor List	
	Location	On the crane	
	Size	*	
	Thickness of sheet	2 mm	
2.19.0	ISOLATING SWITCH		
2.19.1	Qty	One (1) no at 1.5 m from operating floor.	
2.19.2	Make	As per Sub Vendor List	
2.19.3	Rating	*	
2.20.0	PENDANT PUSH BUTTON	Up /down / forward / Reverse push buttons (glow type). Indicative marking for easy operation shall be provided	
2.21.0	Cables	Power	Control
	Make	As per Sub Vendor List	
	Material	As per requirement detailed elsewhere in specification.	
	Type	*	*
	Dearing factor to be considered	YES	YES
	Voltage grade	1100V	
2.22.0	END STOPPER		
2.22.1	Qty.	4 Nos.	
2.22.2	Material	As per IS 2062	
2.23.0	BUFFER		
2.23.1	Location	CT	LT
2.23.2	Qty	Two	Four
2.23.3	Material	Rubber/Spring	Rubber/Spring

2.24.0	PAINTING	Refer painting specification
2.25.0	Control for Hoisting/CT/LT operations	Thru' VVVF drives
a.	Speed Control	Thru' VVVF with minimum 6 pulse design
b.	Starting torque of VVVF	Upto 400% typical
c.	Starting current	Less than 150 % of rated torque
d.	Temperature	Capable of withstanding upto 50°C without derating

Note:

- Bidder to confirm the compliance of technical details as mentioned against each item. Deviation, if any shall be brought out clearly.
- The bidder shall fill Technical details against each item marked (*), during detailed engineering only.
- In case of discrepancy between the Data sheet and requirement given elsewhere in the technical specification, the more stringent of the two as per the interpretation of purchaser shall be applicable.

SUB SECTION-IIA

STANDARD TECHNICAL REQUIREMENT (MECHANICAL)

SINGLE GIRDER EOT CRANE

1.0.0 SCOPE

This specification covers the design, material, manufacture, assembly, inspection and testing at manufacturer works for single girder EOT crane. The equipment shall include all the accessories required for the trouble free operation.

The crane shall be complete with trolley and truck, wheels and axles, Drive mechanisms, Hoisting Drums, Brakes, Creep Speed Arrangement, Lifting tackles, Buffers, Electric Motors, Controls, Switch Board and cabling, horns, warning lights, Limit switches etc. Any item not mentioned herein but required to make the system complete for the satisfactory performance of the crane shall also be included.

2.0.0 CODES AND STANDARDS

The equipment to be supplied under this specification shall conform to the following codes and standards (latest revisions) unless otherwise specified hereinafter.

a)	IS 807	Codes of Practice for Design, Manufacture, Erection and Testing (Structural Portion) of cranes and hoists
b)	IS: 3177	Code of Practice for Design of Overhead Travelling Cranes and Gantry Cranes other than steel work cranes
c)	IS: 2266	Specification for steel wire ropes for general Engineering purposes.
d)	IS: 4029	Guide for testing induction motor (for temperature rise)
e)	IS: 15560	Steel hooks for standard shank design
f)	IS: 1554 Part I	PVC insulated (Heavy-duty) electric cables for working voltages up to and including 1100 volts.
g)	IS: 325	Three phase induction motors.
h)	IS: 900	Code of practice for installation and maintenance of induction motors
i)	IS: 694 (Part-I)	Copper conductors PVC insulated cables for voltage up to 1000 V.
k)	IS: 434 (Pt I)	Copper conductors rubber insulated cables for voltage up to 1000V.
m)	IS: 691	Flexible trailing cables rubber insulated.

n)	IS 3043	Code of practice Earthing.
o)	IS: 3938	Electric Wire Rope Hoists.
p)	IS: 2147	Degree of protection provided by enclosures for Low voltage switchgear and control gear.
q)	IS: 1554	Polyethylene insulated PVC sheathed cables.

Indian electricity rules - 1956.

In the event of any conflict between the specification and standards mentioned above, the specification shall govern.

3.0.0 **SINGLE GIRDER EOT CRANE**

3.1.0 **DESIGN REQUIREMENTS**

3.1.1 The crane shall be designed in accordance with the latest edition of IS-3177/IS-807 & hoist block shall be as per IS-3938 and any other standard as referred there in and subject to any modification and requirement as specified herein after.

Class of crane mechanism shall correspond to that of the crane requirement and as specified elsewhere.

3.1.2 Safety devices should be provided with all equipment/parts covered under this specification.

3.1.3 Parts requiring replacement or lubrication shall easily be accessible without dismantling the other equipment or structures. All electrical cables shall be laid to comply with recognized standards and purchaser's requirements.

3.1.4 For welded construction such as bridge girders, end carriages, rope drum, gearboxes etc; steel shall be conforming to IS-2062 quality.

3.1.5 No cast iron part shall be used on the crane.

3.1.6 Guard shall be provided on crane to prevent the hoist ropes coming in contact with down shop leads. Guards of an approved design, which will push forward or off the track any object such as a person foot or arm, placed across it. Guards shall be attached to each end of the end carriages. Suitable guards shall be provided to revolving shafts, coupling etc.

3.1.7 All cables shall be clamped individually. All trailing cables shall be clamped with PVC or non-metallic clamp.

3.1.8 All wheels, couplings, open gear etc. shall be provided with covers.

3.1.9 All bolts except those with locknut shall be provided with grip lock nuts or spring washers.

3.1.10 Fasteners for pedestal blocks, motors, gearboxes etc. shall be easily removable from the top. Studs shall not be used as fasteners for mechanical items except for fixing covers.

3.1.11 Defects in the material like fractures, cracks, blowholes, pitting etc. are not allowed. Rectification of any such flaw is permissible only with the approval of the purchaser.

3.1.12 All parts of the crane shall be thoroughly cleaned of mill scales, rust or foreign matter and then painted as per the specification requirements

3.1.13 The crane shall be manufactured as per the tolerances specified below

a)	Span over LT wheels	± 3mm
b)	Diagonal on wheels	± 3mm
c)	Long travel wheel alignment	± 1mm
d)	Tilt of wheels or balancer axle	±1/1000mm(horizontal and vertical)
e)	Permissible variation in Speeds at full notch with rated load, voltage and frequency shall be as follows.	
	i) Travelling and traversing	±10%
	ii) Hoisting Lowering	±10%

3.1.14 Proper allowance shall be made for impact and wear in the design of the crane and in no case shall the factor of safety in any part be less than six (6), as per IS: 3177 based on the ultimate strength of the materials used at design duty.

3.2.0 **STRUCTURAL DETAILS**

3.2.1 Crane structure shall be designed in accordance with the latest edition of IS-807 after taking the following additions/deviations as applicable.

3.2.1.1 Black bolts shall not be used in the main structure of the crane. The calculated strength of other bolted joints in structural members shall not be less than net strength of member plus 25%.

3.2.1.2 The calculated strength of riveted joint or joints made by friction grip bolts in structure members shall be not less than the calculated net strength of the member.

3.2.1.3 Bolts used in shear shall be fitted in to reamed hole.

3.2.1.4 Transverse filled welding on load carrying member shall be avoided.

3.2.1.5 All butt welds on structural members subjected to tensile stress shall be X - rayed.

3.2.1.6 Fillet welding on load carrying members shall be avoided.

3.2.1.7 Plates, angles and other rolled section used in the load bearing members of the structure shall not be less than 6mm thick.

3.2.1.8 The cranes working out door or in corrosive environment, an allowance of 1.5 mm shall be added to the calculated thickness.

3.2.1.9 Minimum thickness of chequered plates for platform shall be over 5mm over plain. Chequered plates shall not be considered for strength calculations of load carrying member.

3.1.1.10 The material of construction of the major components shall be as specified in the specification/data sheet. Manufacturer are however free to use alternate material which are

superior for the intended service. But in all the cases, prior concurrence of the purchaser is must.

3.2.2 **Girder / Beam**

3.2.2.1 The girder / beam shall be fabricated from rolled steel (Box section/ I-section) and shall be of adequate strength to withstand the rolling loads and other stresses it is subjected to. The design of the girder shall be in accordance with latest edition of IS- 807 with the following deletion / addition as applicable.

3.2.2.2 The maximum vertical deflection of the girder produced by the dead load, the weight of the trolley and the rated load shall not exceed 1/750 of the span of the crane (if the span of the cranes is more than 12m), and 1/600 of the span (if the span of the crane is less than 12m) as per IS 807 (latest edition). Girders shall be cambered to an amount approximately equal to the dead load maximum deflection plus one-half the live load deflection.

3.2.3 **End carriage**

3.2.3.1 End carriages shall be fabricated from rolled steel section or plates or as the case may be. End carriage shall be of ample strength to resist all stresses likely to be imposed on them under service conditions including collision with other cranes or stops.

3.3.0 **MECHANICAL**

3.3.1 Rope drums

Rope drums shall be of mild steel plate fabricated/ of seamless pipe or of cast steel. Seamless pipe shall be procured from BHEL approved makes & TC shall be furnished. All fabricated rope drums shall be stress relieved. The drum shall be so designed to take full length of hoisting rope in single layers. The end of the rope shall be anchored to the drum in such a way that the charger in readily accessible. Each rope shall have not less than two (2) full turns on the drum when the hook is at lowest position not taking into consideration the turns covered by the rope in charge. There shall be one spare groove for each rope lead when the hook is at the highest position. Each rope end shall be clamped with minimum two clamping wedges with at least two bolts on each clamping arrangement.

The pitch diameter of the drum shall be as per IS -3177 or as specified elsewhere. The depth of the grove shall not be less than 0.35 times the rope diameter. Each rope shall be clamped to drum with two clamp wedges with at least two numbers of bolts on each clamping arrangement.

3.3.2 Hoist ropes

Ropes of steel core as specified in Data Sheet – A/B shall be of right hand lay, of 6x36 construction of best plough steel having minimum tensile strength as 160-180 kg/mm2. Left hand lay wire ropes shall not be used (Reverse bend ropes shall be avoided as far as possible).

3.3.3 Rope sheaves

Sheaves shall be of cast steel. All sheaves shall be identical, however, exception may be made for equalizer sheave. Sheave groove shall be ground finished for getting increase rope life. Equalizer sheave shall be arranged to turn and swivel in order to maintain rope alignment under all circumstances.

3.3.4 Wheels

LT wheels shall be single flanged for underslung EOT crane and double flanged with tread (to suit the rail) for overhead EOT cranes. The wheels shall be capable of taking up misalignment in span as specified. Solid wheel shall either be of forged steel or as specified. The wheel shall be with hardness of BHN 300-350 for overhead EOT cranes and BHN 200 (max) for underslung EOT cranes. Contact stresses between wheels and rails should be within permissible limits.

3.3.5 Buffer

Each End carriage shall be provided with buffer as per data sheet ‘A’. Buffers should be so located that removal is not required while changing wheels or bogies. Buffers shall have sufficient tension on energy absorption capacity to bring the unloaded crane to rest from the speed of 50% of the rated speed to zero speed.

3.3.6 LT drive

One pair of wheels in each end carriage shall be driven by motor through reduction gear.

3.3.7 CT drive

The CT mechanism of the electric hoist shall consist of 2pairs of wheels which shall be driven by motor through reduction gear.

3.3.8. Gearing

Spur and helical gearing shall normally be used for all motions. Worms and bevel gears shall not be used. First high-speed reduction shall be through helical gears. All gears shall be hardened and tempered and of alloy steel with machine cut teeth. Surface hardening of teeth is not acceptable. Gear teeth shall preferably be cut in metric module system. Gears shall be

designed to meet requirement of crane duty as per IS: 3177. The ratings of gears shall be established as per IS: 4660.

3.3.9 Gear Box

3.3.9.1 All gears shall be completely covered and enclosed in oil tight casing & sealed with gasket.

3.3.9.2 The gearboxes shall be of mild steel or cast steel. All fabricated gearboxes shall be stress relieved.

3.3.10 Bearing

3.3.10.1 Ball and roller antifriction bearing of FAG, SKF, NBC, NORMA make shall be used throughout, except where specified otherwise. Rated life of ball and roller bearing shall be not less than total working life as per relevant codes. Life of bearing shall be calculated in accordance with manufacturers recommendations.

3.3.10.2 Provision shall be made for service lubrication of all bearings. Bearing enclosures shall be designed as far as possible to exclude dirt and prevent oil leakage.

3.3.11. Couplings

3.3.11.1Motor shafts shall be connected to gear box input extension shafts through flexible gear coupling. Solid coupling shall be used for connecting intermediate lengths of long travel shafts, if applicable.

3.3.12 Lifting hook

Standard hooks shall be used unless otherwise specified. These hooks shall conform to the latest edition of IS 15560 as specified in the data sheet “A”.

3.3.13 Brakes

3.3.13.1 Selection and design of brakes shall be such as to meet the requirement. Brakes shall be designed to suit 150% FLT of motor for the hoist motion and 125 % FLT of motor for LT/CT motion. Brakes shall be provided as specified in Data Sheet ‘A’

3.4.0 **ELECTRICAL**

3.4.1 The scope of supply shall cover all electrical equipments comprising from Main isolating switch, down shop leads, trolley conductors, current collectors etc.

3.4.1.1 Main isolating Switch fuse unit shall be provided at 1.5M above the operating floor level at one end of bay length or in the middle as specified in the data sheet A. Supply of cable from switch to down shop leads shall be included in the bidder’s scope of work.. The switch shall be provided with Power ON Red indication lamp.

3.4.1.2 Run way conductors (Down shop leads) shrouded conductor as specified in the data sheet A shall have four conductors. One of the conductors shall be connected to earth grid for earthing connections of all electrical equipments on the crane and shall be connected to suitable

collecting gear of earth conductor. Voltage drop across the down shop leads shall be less than 2%. Maintenance cradle for DSL shall be provided on crane if asked in Data Sheet 'A'. Sufficient allowance of min. 10% for wear & tear shall be considered while sizing the conductor. The runway conductors shall be supported on brackets and insulators.

3.4.1.3 The current collectors shall be of adequate current carrying capacity and shall maintain adequate contact pressure. Spacing between current collectors shall be such as to provide sufficient quenching area for sparks coming out of collectors surface. The collector system per conductor shall be top-running type having spring loaded CI/carbon metallic shoes to maintain adequate contact pressure.

3.4.1.4 The cable, supplying power to crane trolley / electric hoist shall be flexible trailing cable as per IS-9968 Part I (latest edition) and mounted on retracting supports (festoon type)

3.4.2 **DRIVE MOTORS**

3.4.2.1 Crane motors shall be totally enclosed, fan cooled and as per data sheet 'A'. The break down torque of the motors shall not be less than 225 percent of the full load torque with rated voltage and frequency applied and pull out torque shall not be less than 250% of the rated full load torque of motor.

3.4.2.2 Ambient correction factors as well as voltage /frequency correction factors depending upon the ambient temperature and voltage /frequency variation shall be applied to derate the motors. The minimum margin of 10% or as specified in the section C of specification shall be considered over the calculated rating of the motor. The protection class of the motors shall be as per data sheet A. Motors shall be tested at manufacturer's works in accordance with IS-325/as per agreed Quality plan & Reports shall be submitted for approval. Motors shall comply with the requirement of IS-325-1978 or as per the motor specification if enclosed here with.

3.4.2.3 All the motors shall be provided with lifting lugs, two earth terminals of adequate size to accept the earthing conductors shall be provided at diametrically opposite points unless specifically designed for higher speeds, motors shall be capable of withstanding 2.5 times the rated speed.

3.4.3 **Limit Switch**

The hoist mechanism of the crane shall be provided with rotary/gravity/snap action type limit switch to open the control circuit and in order to prevent the crane hook from over hoisting and over lowering. One gravity type back-up limit switch of hand-reset type shall be provided. This switch shall operate in the event of failure of main limit switch if called for in data sheet "A".

Lever operated limit switches shall be provided at both ends of longitude travel and cross traverse. These limit switches shall be self-reset type.

3.4.8 **Protective Panel / Controls**

3.4.8.1 The electrical protective panel shall be a cubicle fabricated from 2 mm thick sheet steel with lockable-hinged door. It shall be dust and vermin proof with degree of protection as IP-55 or as specified in data sheet A. All the equipment inside the panel shall have permanent identification. The panels shall be front connected type with front-hinged door for access to wiring and terminals. Engraved nameplate shall be furnished for all panels and also for the equipments and devices mounted there on.

The following minimum equipments shall be provided.

a) One triple pole air break type main contactor with thermal overload relay.

b) One triple pole main line connecting/disconnecting switch.

c) Switch fuse unit with D.O.L. starter for each motion.

d) Thermal overload relay for each drive. It shall be ambient temperature compensated and adjustable type.

e) Contactors, timer and auxiliary contactors.

f) Control transformer with fuses.

g) Indicating lamps to indicate the live condition of all three phases.

h) Other equipments as per supplier's standard practice. Air break contactors shall conform to category AC-4 duty. The contactor drop off voltage shall be between 45-50% of rated voltage.

i) All internal wiring shall be identified with numbering ferrules at both ends as per the relevant wiring diagram.

3.4.9 **Pendent Push button station**

It shall be suspended by wire rope to prevent pull on the cables. The following minimum push buttons key operated type.

a) Main" ON", "OFF" push button key operated and lockable in "OFF" position.

This push button will operate the main contactor.

b) Hoist and lower directions. (2Nos.)

c) Trolley travels both directions. (2 Nos.)

d) Bridge travels both directions. (2 Nos.)

e) Inching speed for hoisting & lowering

f) Inching speed for bridge motion.

g) Inching speed for trolley motion.

h) Creep speeds

i) Emergency stop push button (mushroom type).

j) Alarm bell push button.

3.4.10 **Grounding**

3.4.10.1 The crane structure, motor frame and all other electrical equipments shall be grounded in accordance with the Indian Electricity Rules. The connections from Crane Bridge to 4th conductor of down shop leads shall be by means of current collector.

3.4.10.2 The equipment fed by flexible cables shall be grounded by means of fourth core provided in the flexible trailing cable. Pendent push button station shall be earthed separately.

3.4.10.3 Red warning light 3 Nos. shall be provided at both ends of the gantry girder to indicate the aliveness of DSL.

3.4.11 **WIRING SYSTEM**

The supplier shall furnish all power, control and auxiliary circuit wiring of the equipment and the panel located on the trolley or bridge.

The wiring shall be complete in all respect to ensure the proper functioning of the equipment.

Power wiring to any motor shall be done with 1100V grade Cu conductor, PVC insulated / armoured /FRLS cable of suitable sizes as specified in Data Sheet A.

d) For selecting the cable rating, cable for power wiring, consideration shall be given to the motor duty, ambient temperature grouping and disposition of the cables voltage drop etc.

e) All control and auxiliary external circuit wiring shall be done with PVC insulated FRLS type 2.5mm stranded copper conductor.

f) Armoured cables or un-armoured running through the flexible conduits may be used for power wiring / control and auxiliary circuit wiring shall run through flexible conduits.

g) Each motor shall be wired independently. Power and control wiring shall be effectively separated.

h) Each wire shall be identified at both ends with wire designation in accordance with circuit wiring diagram.

i) All wire termination to the panels shall be provided with clamp type connections screw. Type terminals with screw directly impinging on conductors are not acceptable.

j) Multi-way terminal blocks complete with screw nut, washer and marking strips shall be furnished for terminating the panel wiring and outgoing.

k) Not more than two wires shall be connected to any terminal on either side of terminal block. If necessary number of terminals shall be jumped together to provide the wiring points

l) Each terminal block shall be marked with designation in accordance with conductors wiring diagram.

4.0.0 **LOAD INDICATION:**

The crane shall have a permanent inscription of English on each side, readily visible from the ground level, stating the safe working loads in tonnes, year of manufacture, crane serial number and manufacturer's name.

TECHNICAL SPECIFICATION FOR VVVF DRIVE

1.0 General

a) This part of the specification describes the general requirements for the Variable Voltage Variable frequency Drives, herein referred to as AC Drives, for use with standard IEC design AC squirrel cage induction motors. The nominal values, the standard documents and the drive's minimum performance are defined in this part. **To avoid any mismatch between the motor and its control equipment, the AC Drive shall be capable of auto adjustment by automatic measurement of the motor parameters with/without motor rotation.**

i. Speed control of EOT crane shall be through Variable Voltage Variable Frequency System (VVVF) with minimum 6 (six) pulse design.

ii. Necessary input & output devices to be provided to reduce harmonics, as per IEE519, at supply side of the drive at the switchgear.

iii. All necessary protections e.g. Input Phase Loss, Earth Fault, Over Voltage, Output Short Circuit, Load Loss, Input Transient Protection, Overload etc. to be provided.

iv. VVVF system shall be capable of generating suitable starting torque (220% typical) with / without encoder, however starting current shall not exceed 150% of the rated torque.

v. VVVF system shall be capable of withstanding upto 50 deg C. ambient temp without derating

vi. Squirrel cage Induction motor with VPI insulation shall be provided with VVVF system.

vii. Protective Pane Provided with isolating switch, power contactor control and indication to switch ON/OFF power to starter panels, control and lighting transformer.

viii. Starter Panel:

Separate VVVF system panels to be provided for CT, LT and hoist motion

(a) Contactors: AC 4 duty for reversing application AC 3 duty for non-reversing application

(b)Switches: AC 23 for motor application, AC 22 for other application.

(c)Fuses: HRC

(d)Overload relay: Temperature compensated, bimetallic with single phasing preventor.

ix. Panel shall be fabricated out of 1.6 mm thick rolled sheet steel. IP 52degreeof protection. Paint shade shall be RAL 9002 for front & rear and RAL 5012 for side covers. Space heaters to be provided.

2.0 User interface

2.1 General

The user interface shall be identical throughout the power range and type to avoid confusion amongst the users and need for training in several different units.

2.2 Inputs and outputs

A. At least, the following standard Inputs and Outputs shall be provided, to be used in interface with the control system:

Analogue Inputs : 1 x Programmable differential voltage input ± 10V,
1 x Programmable current input 0(4) - 20mA
1 x Programmable voltage input 0 – 10V

Analogue Output : 1 x Programmable analogue outputs 0(4) - 20mA or 0 – 10V

Logic inputs : 6 x Programmable logic Inputs isolated from the mains

Relay Outputs : 2 x Programmable Digital outputs with a changeover dry contact

All the control terminals shall be clearly marked.

B. At least, it shall be possible to assigned the following functions to the I/Os:

Analogue input	**Analogue outputs**
Speed reference Summing reference	Motor current Motor frequency Motor torque Motor power
Logic input	**Relay or logic outputs (open collector)**
Forward Reverse Jog Preset speeds Reference switching Ramp switching Parameter sets selection Fast stop Freewheel stop + speed - speed External fault	Ready Drive running High speed attained Drive fault Frequency threshold attained Motor thermal state attained Torque or current limitation attained Brake control

2.3 Programming terminal

A. The AC drive shall have a keypad /display for programming and controlling purposes. An IP54 or IP65 remote mounting shall be possible at a distance of 10m.

B. Password protection shall be provided to avoid unauthorized tampering with the set parameters.

C. The programming terminal shall be able to display the commercial reference of the AC drive and of the options, the software version, the serial number

D. Direct keypad entry shall be provided to observe the following actual parameters. Any one of the following parameters or actual values shall be selected to be always displayed:-

i. Input Voltage
ii. Input Frequency
iii. Output Frequency
iv. Output Power
v. Output Current
vi. Motor Speed

The following parameters shall always be displayed during normal operation:-

i. Drive Status

The following drive control functions at least shall be available from the keypad:-

i. Run
ii. Stop
iii. Local / Remote selection.
iv. Forward/Reverse (if function enabled)
v. Accelerate
vi. Decelerate
vii. Parameter setting

2.4 Application programming

The AC Drive shall be designed for both simple and the most complicated applications, yet it shall be user friendly. It shall be possible to reset the parameter settings back to the original factory settings through the keypad.

2.5 PC Tools

The AC Drive Supplier shall have a Windows based PC software available for monitoring and controlling the AC Drives, and the software shall be offered as an option. The software shall be supplied with the necessary hardware and a provision for connecting a PC with the AC Drives. It shall be possible to set and modify parameters, control the drive, read actual values and make trend analysis using the software.

3.0 Software features

A. Restart

In the event of a fault trip due to over voltage, over current or loss of analogue signal, the AC DRIVE shall be programmable to attempt an automatic restart. For safety reasons, the

maximum number of attempts shall be within a selectable time. If the fault does not clear after the attempts, the drive shall lock out.

B. Brake logic control

The AC Drive shall have a built-in function to control a mechanical brake in order to move the load in a smooth and safe way. The brake logic control shall be adapted to the different movements: hoisting, travel, orientation.

4.0 Preferred makes:

As per attached sub-vendor list.

	3X800 MW PVUNL PATRATU STPP SINGLE GIRDER EOT CRANE	SPECIFICATION No: PE-TS-434-524-A001
		VOLUME: III
		SECTION-III
		SUB-SECTION-IIIA
	DOCUMENTS TO BE SUBMITTED BY BIDDER	REV 00 / DATE OCTOBER,2021

SUB SECTION-IIIA
LIST OF DOCUMENTS TO BE SUBMITTED ALONG WITH BID

	3X800 MW PVUNL PATRATU STPP SINGLE GIRDER EOT CRANE	SPECIFICATION No: PE-TS-434-524-A001
		VOLUME: III
		SECTION-III
		SUB-SECTION-IIIA
	DOCUMENTS TO BE SUBMITTED BY BIDDER	REV 00 / DATE OCTOBER,2021

DRAWINGS / DOCUMENTS TO BE SUBMITTED WITH THE BID:

Bidder shall submit the following drawings / documents along with their bid

a) Deviation schedule with reference to specific clauses of the specification along with reason for such deviation in the format given in GCC. In case of no deviation, bidder to mention “No deviation” on signed and stamped copy of Deviation sheet.

b) Copy of pre-bid clarifications, if any, duly signed & stamped

c) Signed/ Stamped copy of Compliance cum Confirmation Certificate (Vol-III)

d) Un priced copy of price format indicating quoted/ not quoted against each row/column along with cost of withdrawal / price implication format for deviations.

e) Electrical load list, duly signed and stamped

OFFER WILL BE CONSIDERED AS INCOMPLETE IN ABSENCE OF ANY OF ABOVE DOCUMENTS. DOCUMENT OTHER THAN ABOVE, IF ANY, SUBMITTED WITH THE OFFER WILL NOT FORM PART OF CONTRACT AND ACCORDINGLY WILL NOT BE CONSIDERED FOR BID EVALUATION.

	3X800 MW PVUNL PATRATU STPP SINGLE GIRDER EOT CRANE DOCUMENTS TO BE SUBMITTED BY BIDDER	SPECIFICATION No: PE-TS-434-524-A001 VOLUME: III SECTION-III SUB-SECTION-IIIB REV 00 / DATE OCTOBER,2021

SUB SECTION-IIIB
COMPLIANCE CUM CONFIRMATION CERTIFICATE

BHEL	3X800 MW PVUNL PATRATU STPP SINGLE GIRDER EOT CRANE DOCUMENTS TO BE SUBMITTED BY BIDDER	SPECIFICATION No: PE-TS-434-524-A001 VOLUME: III SECTION-III SUB-SECTION-IIIB REV 00 / DATE OCTOBER,2021

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” 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 not be taken cognizance

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) Guarantee for plant/equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions.

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 within the scope of work as tender specification. 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.

m) 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.

n) 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.

o) 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.

	3X800 MW PVUNL PATRATU STPP SINGLE GIRDER EOT CRANE	SPECIFICATION No: PE-TS-434-524-A001
		VOLUME: III
		SECTION-III
		SUB-SECTION-IIIC
	DOCUMENTS TO BE SUBMITTED BY BIDDER	REV 00 / DATE OCTOBER,2021

SUB SECTION-IIIC
ELECTRICAL LOAD DATA

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
SG EOT CRANES																		
COMPRESSOR HOUSE CRANE		8 KW	S	1	0	D	S	N	I	N	Compressor House							
CEP HANDLING CRANE		12.5 KW	S	3	0	D	S	N	I	N	CEP AREA							

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 (cc): 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.	434	ORIGINATING AGENCY		PEM (ELECTRICAL)	
		PROJECT TITLE	3X800 MW PATRATU STPP	NAME		DATA FILLED UP ON	
		SYSTEM	CRANES & HOISTS	SIGN.		DATA ENTERED ON	
		DEPTT. / SECTION	ELECTRICAL	SHEET 1 OF 1	REV. 01	DE'S SIGN. & DATE	

BHEL	3X800 MW PVUNL PATRATU STPP SINGLE GIRDER EOT CRANE DOCUMENTS TO BE SUBMITTED BY BIDDER	SPECIFICATION No: PE-TS-434-524-A001 VOLUME: III SECTION-III SUB-SECTION-IIID REV 00 / DATE OCTOBER,2021

SUB SECTION-IIID
PRE BID CLARIFICATION SCHEDULE

	3X800 MW PVUNL PATRATU STPP SINGLE GIRDER EOT CRANE DOCUMENTS TO BE SUBMITTED BY BIDDER	SPECIFICATION No: PE-TS-434-524-A001 VOLUME: III SECTION-III SUB-SECTION-IIID REV 00 / DATE OCTOBER,2021

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

DEVIATION SHEET (COST OF WITHDRAWAL)

PROJECT:-3 X 800 MW PATRATU STP PHAE-I

PACKAGE:- SINGLE GIRDER CRANE

TENDER ENQUIRY REFERENCE:-

SPECIFICATION NO PE-TS-434-524-A001 VOLUME III

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION / 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									
		In case of no deviation, the same is to be mentioned here. Otherwise, clause wise deviaitons along with cost of withdrawal of deviation, if applicable shall be furnished in sealed envelope along with Original price bid. However, the same shall be indicated as 'Quoted' under column 'Cost of Withdrawal of Deviation' along with technical offer/ un-priced bid.							
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 of
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.

DELIVERY SCHEDULE

PROJECT: - 3 x 800 MW PVUNL PATRATU TPP PHASE-I

PACKAGE: - SINGLE GIRDER EOT / HOT MISC. CRANE

1. **Delivery Period:**
   Delivery period for sake of GeM bid is chosen as 999 days (maximum allowable delivery time) from PO date. However, this period shall not be considered for Delivery and Delay analysis purpose.
   For Delivery and delay analysis (LD) purpose, delivery schedule shall be as per Standard Delivery schedule – Annexure-I

   Further, please note the following :-
   a) The end period specified is for completion of the deliveries. Deliveries to start progressively so as to meet the completion schedule.
   b) The delivery conditions specified are for contractual LD purposes, however, BHEL may ask for early deliveries without any compensation thereof.
   c) Non-applicable drawings shall be decided during bid evaluation.
   d) Wherever schedule of drawings / documents submission / re-submission is stipulated in the Technical Specifications, same shall be superseded by delivery specified in NIT.

DELIVERY SCHEDULE - ANNEXURE-I

Sl. No.	Package Code	Package name	Deptt.	BHEL Drawing No	Drawing Title	Primary/ Secondary	BHEL Inputs	Drg Sch for Vendors	Standard Delivery Terms for Supply Portion	Scope of Services, (if any, as per Indent) and corresponding schedule for rendering the services
5	524A	SINGLE GIRDER / MISC. CRANES	MAX	PE-V0-XXX-524-A001	Manufacturing Quality Plan with sub vendor list OF SG CRANE	Primary		R-0 within 21 days from PO & subsequent revisions within 10 days of comments received from BHEL. BHEL shall furnish comments / approval on each submission within 18 days from receipt.	Within Six (06) months from date of CAT-1 approval of Primary drawing/documents, subjected to drawing/document submission/re-submission schedule as stipulated, in case of any delay in submission/re-submission of Primary drawing/documents, then same shall be reduced from the given delivery period. Delay in BHEL's comments/approval beyond 18 days shall also be considered for delay analysis.	Supervision of E&C: Vendor to depute its service engineer for Supervision of E&C within 15 days from BHEL's intimation (for deputing service engineer). For delay in deputing service engineer, LD on Supervision of E&C portion shall be applicable @ ½% of the total Supervision of E&C portion contract value (excluding element of taxes) per week or part thereof, with applicable GST. However, total LD (supply + Supervision of E&C) shall be limited to 10% of cumulative total contract value excluding taxes and freight (supply + Supervision of E&C).
				PE-V0-XXX-524-A002	Data sheet of Single Girder Crane with painting details	Primary				
				PE-V0-XXX-524-A004	Mechanism Sizing Calculation OF SG CRANE	Primary				
				PE-V0-XXX-524-A008	Schematic Circuit Diagram for a) Main Protective panel & BOM b) Main hoist panel & BOM c) Cross Traverseand Long Travel panel & BOM d) Pendant and earthing.	Primary				
				PE-V0-XXX-524-A003	G.A.of Single Girder CRANE with CT DSL arrangement OF SG CRANE	Primary				
				PE-V0-XXX-524-A015	Sea worthy packing(if applicable) OF SG CRANE	Secondary				
				PE-V0-XXX-524-A009	Long travelMachineryAssembly with LT wheel assembly OF SG CRANE	Secondary		R-0 within 30 days from PO & subsequent revisions within 10 days of comments received from BHEL. BHEL shall furnish comments / approval on each submission within 18 days from receipt.		
				PE-V0-XXX-524-A016	Erection procedure OF SG CRANE	Secondary				
				PE-V0-XXX-524-A012	Cable sizing calculation and schedule OF SG CRANE	Secondary				
				PE-V0-XXX-524-A010	Detailed BOM/BOQ for crane	Secondary				
				PE-V0-XXX-524-A007	General arrangement for LT cable trailing/ DSL system for Single Girder crane	Secondary				
				PE-V0-XXX-524-A006	Bottom Block assembly OF SG CRANE	Secondary				
				PE-V0-XXX-524-A014	Mandatory spare parts list (if applicable) OF SG CRANE	Secondary				
				PE-V0-XXX-524-A005	G.A. drg of Hoist with trolley wheel assembly OF SG CRANE	Secondary				
				PE-V0-XXX-524-A019	O&M Manual	Secondary		within 30 days of issuance of MDCC		

Letter head of Company (<Rs. 10 Cr value)

Ref……. Date…….

To,

Bharat Heavy Electricals Limited

PEM, PPEI Building, Plot No 25,

Sector -16A, Noida (U.P)-201301

Subject: - Certification regarding local content

Reference: Tender Enquiry No-……

Name of Package: …….

Dear Sir,

We hereby certify that items offered by us of ……..(package name)……..……for……(Project Name/Rate contract)…….. meets the requirement of minimum local content in line with Cl. No……. of NIT No……. dated……. and the Public Procurement (Preference to Make in India), Order 2017 dated-15.06.2017, 28.05.2018 & 29.05.2019.

We further confirms that details of location at which the local value addition is made will be our registered works at ……(address of the works)

Yours very truly

…….. (authorized signatory of company)

…… (firm name)

authorized signatory of company

An undertaking regarding Model Clauses (To be provided alongwith bid)

Reference:

RA/Bid no:

Item:

Project:

TO WHOM SO IT MAY CONCERN

This is with reference to Ministry of Finance circular dated 23.07.20 reg. restriction under rule 144 (xi) of GFR.

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India. I hereby certify that M/s ……..is not from such a country and is eligible to be considered against Bid/RA no: ……."

Sign & Signature

Date:

Place: