NTPC LIMITED

(A Govt. of India Enterprise)

NORTH KARANPURA SUPER THERMAL POWER PROJECT (3X660 MW).

TECHNICAL SPECIFICATION
FOR
WORKSHOP EQUIPMENT

SPECIFICATION NO: PE-TS-405-568-A003

BHARAT HEAVY ELECTRICALS LIMITED

(A Govt. of India Undertaking)
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, U.P
INDIA

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SECTION - A

SCOPE OF ENQUIRY

1.0 SCOPE OF ENQUIRY/ INTENT OF SPECIFICATION

1.1 The specification is intended to cover design, engineering, manufacture, inspection and testing at vendor's/ sub-vendor's works, painting, proper packing and supply and dispatch to power station site, Performance and guarantee testing and handing over of **WORKSHOP EQUIPMENTS** as per details in different sections / volumes of this specification for **3 X 660 MW NORTH KARANPURA STPS.**

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 vendor from the responsibility of providing such facilities to complete the supply of **WORKSHOP EQUIPMENTS**.

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

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

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

1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification. 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 schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.

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

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

VOLUME - IIB

SECTION – B

PROJECT INFORMATION

SUB-SECTION–I-B

PROJECT INFORMATION

1.00.00 **BACKGROUND**

North Karanpura Super Thermal Power Project (3x660 MW), a pit head coal based thermal power project, is located in Hazaribagh and Chatra districts of Jharkhand State. Basic inputs i.e. coal, water and land have already been tied up. The project is proposed for the States & Union Territories of Northern, Western and Eastern Regions and the State of Jharkhand.

The capacity of the project is 1980 MW comprising of three (3) units of 660 MW each.

1.01.00 **Location and Approach**

The power project is proposed to be located near Tandwa town in Chatra districts in the state of Jharkhand on Hazaribagh-Chatra State highway at a distance of about 50 kms from Hazaribagh city. The nearest commercial airport is Ranchi at a distance of 150 kms from project site. The nearest railhead Khalari Railway Station on Ranchi-Garhwa section of Eastern Railways is about 40 kms from project site.
Major rail/road distances from the project site are as under:

City		Distance Approx. (kms)
Ranchi	:	150
Khalari	:	40

The site is located near Tandwa town having latitude and longitude of about 23^0 50' N to 23º 52' N and 84^0 59' E to 85º 2' E respectively. The Vicinity Plan of the project is placed at **Annexure-I.**

Further to the information given in this sub-section, Bidders are also advised to visit the project site and collect data on local site conditions.

1.02.00 **Land**

About 2245 acres of land is being acquired for the project. About 1500 acres of land is under possession/legal possession and out of 1500 acres, about 890 acres of land is to be used for plant, ash dyke and initial enabling township. No additional land is envisaged to be acquired in plant area. About 15 acres of land is envisaged to be acquired in Hazaribagh city for Township.
Commissioner, Chatra vide dated 25.05.1999 and 14.06.2000 has given in-principle clearance for NKSTPP.

1.03.00 **Water**

Make up water available for this project would be about 22 cusec and will be arranged by constructing a dam/reservoir across river Garhi.

1.04.00 **Fuel (Coal)**

1.04.01 **Coal Requirement, Availability and Linkage**

Coal requirement for the project is estimated as 10.6 Million Tonne/Annum (MTPA), considering a GCV of 3800 kcal/kg. Ministry of Coal vide letter dated 21.10.99 accorded in-principle coal linkage of 10.00 MTPA subject to ratification by Standing Linkage Committee-Long Term (SLC (LT)), of MOC. SLC (LT) in its meeting held on 15.12.2000 firmed up the coal linkage of 10.24 MTPA for the project. Subsequently, the coal linkage was withdrawn by SLC (LT) in its meeting held on 22/23.10.08.

Cabinet Committee on Investment (GOI) in its meeting on 20.02.13 decided in-principle to restore the original coal linkage granted to NKSTPP (i.e. from Magadh Coal Block) with the stipulation that the coal supply will commence during the 13th Five Year Plan. MOC vide letter dated 09.05.2013 restored the coal linkage with the stipulation that the coal supply will commence during the 13th five year plan.

1.04.02 **Coal Transportation**

Coal from Magadh block of North Karanpura Coalfields is proposed to be transported to the project site through conveyor belt system. One external coal handling plant and one internal coal handling plant are envisaged.

1.05.00 **Meteorological Data**

Important meteorological data from nearest observatory at Hazaribag is placed at Annexure-II**.**

1.06.00 **Plant Water Scheme**

The Plant water scheme is described below.

1.06.01 **Condenser Cooling System**

It is proposed to adopt Air Cooled Condenser for the project.

1.06.02 **Equipment Cooling Water (ECW) System (Unit Auxiliaries)**

All plant auxiliaries shall be cooled by De-mineralized water (DM) in a closed circuit. The primary circuit DM water shall be cooled through heat exchangers by auxiliary cooling water system. The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system.

1.06.03 **Ash Water System**

It is proposed to have HCSD (High concentration Slurry Disposal) system for combined fly ash and bottom ash. No recirculation of ash water from ash disposal area is envisaged.

1.06.04 **Other Miscellaneous Water Systems**

(a) Raw water shall be used for meeting the Fly ash and bottom ash system requirement etc.

(b) The service water shall be taken from clarified water tank of Pretreatment plant. Service water (wash water) collected from various areas shall be treated using oil water separators, tube settlers, coal settling pits etc. as per requirement and treated water from liquid effluent treatment plant shall be recycled back to the service water system for re-use.

(c) The drinking water requirement of the plant shall be provided from water treatment plant.

(d) Steam Cycle make-up water, makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water and makeup to the hydrogen generation plant shall be provided from Demineralising plant.

(e) The quality of Raw water is enclosed with this sub-section as Annexure-III.

1.07.00 **Criteria for Earthquake Resistant Design of Structures and Equipment**

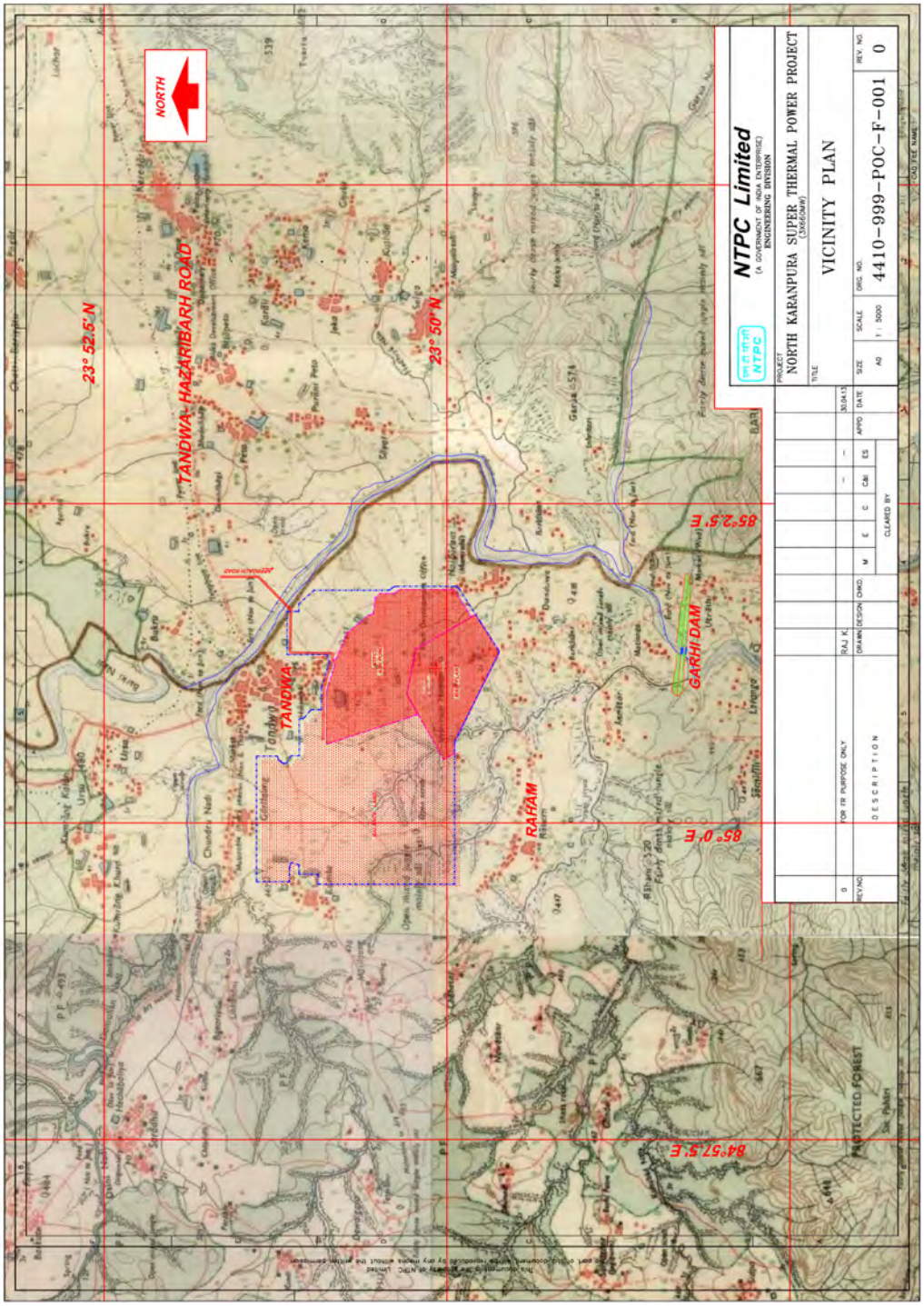
All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in the Part - B of this section.

1.08.00 **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.

Annexure-I

VICINITY PLAN



Annexure-II

CLIMATOLOGICAL TABLE

CLIMATOLOGICAL TABLE

स्टेशन : हजारीबाग STATION : Hazaribagh

अक्षांश LAT 23°59′ N देशांतर LONG 85°22′ E समुद्री तल माध्य से ऊँचाई HEIGHT ABOVE M. S. L. 611 METRES मीटर

1951 से 1980 तक के प्रेक्षणों पर आधारित BASED ON OBSERVATIONS FROM 1951 TO 1980

माह MONTH		स्टेशन का सतह दाब STATION LEVEL PRESSURE एच. पी. ए. hPa	वायु तापमान AIR TEMPERATURE MEAN: शुष्क बल्ब DRY BULB °C	नम बल्ब WET BULB °C	दैनिक अधिक तम DAILY MAX °C	दैनिक न्यून तम DAILY MIN °C	माह में उच्चतम HIGHEST IN THE MONTH °C	माह में निम्नतम LOWEST IN THE MONTH °C	चरम EXTREMES: उच्चतम HIGHEST °C	दिनांक और वर्ष DATE AND YEAR	निम्नतम LOWEST °C	दिनांक और वर्ष DATE AND YEAR	आर्द्रता HUMIDITY: सापेक्ष आर्द्रता RELATIVE HUMIDITY %	वाष्प दाब VAPOUR PRESSURE एच. पी. ए. hPa	मेघ की मात्रा CLOUD AMOUNT: समस्त मेघ ALL CLOUDS आकाश के अष्टमांश Oktas of sky	निम्न मेघ LOW CLOUDS आकाश के अष्टमांश Oktas of sky	वर्षा RAINFALL: मासिक योग MONTHLY TOTAL मि.मि. mm	वर्षा के दिनों की संख्या NO. OF RAINY DAYS	वर्षासहित सबसे सम शुष्क महीने का योग TOTAL IN WETTEST MONTH WITH YEAR मि.मि. mm	वर्षारहित सबसे शुष्क महीने का योग TOTAL IN DRIEST MONTH WITH YEAR मि.मि. mm	24 घंटों में सबसे भारी वर्षा HEAVIEST FALL IN 24 HOURS मि.मि. mm	दिनांक और वर्ष DATE AND YEAR	पवन चाल MEAN WIND SPEED कि.मी. प्र. घं. Km/h
जनवरी JAN	I	947.6	14.7	10.9	22.6	9.3	26.7	4.6	30.6	31 1881	0.9	07 1980	62	10.4	1.4	0.5	23.5	1.7	113.0 1919	0.0	68.1	06 1945	6.2
	II	944.5	18.9	12.8									49	10.4	1.6	0.5							
फरवरी FEB	I	945.7	17.9	12.3	25.7	12.0	30.5	8.9	33.6	22 1967	1.7	08 1974	52	10.3	1.3	0.4	16.2	1.4	117.3 1907	0.0	63.5	23 1927	7.3
	II	942.6	22.6	14.4									39	10.4	1.4	0.6							
मार्च MAR	I	944.0	23.4	15.0	30.8	16.6	35.6	11.4	38.9	27 1892	6.7	04 1898	39	10.8	1.5	0.3	18.4	1.7	164.3 1905	0.0	44.2	20 1946	7.9
	II	940.6	27.8	16.3									29	10.2	1.9	0.5							
अप्रैल APR	I	941.0	28.6	18.2	35.7	21.3	39.3	16.4	41.7	22 1956	10.6	01 1968	36	13.3	1.8	0.3	17.0	1.4	81.6 1952	0.0	60.5	22 1925	8.6
	II	937.1	32.4	18.8									26	11.8	2.2	0.7							
मई MAY	I	937.0	30.7	21.1	37.8	24.0	41.5	19.3	43.9	18 1897	15.6	22 1977	43	18.1	2.5	0.3	43.4	2.9	187.2 1936	0.0	84.1	27 1887	9.1
	II	933.4	34.3	21.2									32	15.7	2.9	0.7							
जून JUN	I	933.4	28.4	23.3	34.1	24.1	40.1	21.0	46.6	14 1975	18.3	02 1975	67	25.0	5.3	1.8	177.1	9.2	774.5 1911	0.5 1905	249.2	24 1911	8.7
	II	930.4	30.4	23.5									60	23.8	5.8	2.5							
जुलाई JUL	I	933.1	25.6	23.8	29.5	23.0	33.2	21.4	39.6	08 1975	19.3	18 1975	86	28.2	6.5	3.8	310.0	16.2	693.2 1930	99.8 1911	221.7	06 1953	7.9
	II	930.5	26.8	24.1									80	28.1	6.4	3.7							
अगस्त AUG	I	934.5	25.2	23.7	29.1	22.7	31.5	21.3	34.2	03 1972	20.0	29 1967	88	28.3	6.4	3.8	320.1	16.2	706.1 1943	83.8 1928	180.1	17 1886	7.6
	II	931.6	28.4	24.3									84	28.7	6.4	3.5							
सितम्बर SEP	I	938.2	25.1	23.1	29.0	22.2	31.5	20.4	33.3	24 1960	17.8	29 1950	85	26.8	5.1	2.9	260.9	11.6	530.9 1893	40.7 1998	167.4	28 1963	7.3
	II	935.1	26.0	23.5									81	27.2	5.6	2.9							
अक्टूबर OCT	I	943.6	23.9	20.4	28.5	18.9	31.3	14.3	34.0	04 1966	9.7	12 1972	73	21.4	2.4	1.2	80.6	4.1	378.6 1963	0.0	149.4	24 1963	5.2
	II	940.6	24.9	20.7									68	21.3	2.9	1.3							
नवम्बर NOV	I	947.0	20.2	15.5	25.8	13.3	28.3	9.0	31.7	01 1896	4.4	25 1879	60	14.3	1.2	0.4	5.5	0.4	160.0 1924	0.0	95.0	06 1924	4.8
	II	943.9	21.4	16.0									56	14.2	1.6	0.5							
दिसम्बर DEC	I	948.2	15.7	11.8	23.1	9.3	26.2	5.1	29.4	20 1950	0.5	24 1961	62	11.1	1.1	0.2	5.2	0.4	81.3 1885	0.0	39.4	13 1885	5.3
	II	945.1	18.7	13.1									52	11.1	1.2	0.2							
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I	941.1	23.3	18.3	29.3	18.1	41.9	3.6	46.6		0.5		63	18.2	3.0	1.3	1277.9	67.2	2146.0 1893	739.6 1968	249.2		7.2
	II	938.0	25.9	19.1									55	17.7	3.3	1.5							
वर्षों की संख्या NUMBER OF YEARS	I	28	27	27	27	28	27	28	83		83		27	27	29	23	29	29	99	99	99		23
	II	28	28	28									28	27	30	22							

Annexure-III

RAW WATER ANALYSIS

Sl. No.	Constituent	as	mg per litre
1.	Calcium	CaCO3	65
2.	Magnesium	CaCO3	41
3.	Sodium	CaCO3	98
4.	Potassium	CaCO3	5
5.	Total Cations	CaCO3	209
6.	Total Alkalinity	CaCO3	150
7.	Chloride	CaCO3	25
8.	Sulphate	CaCO3	34
9.	Total Anions	CaCO3	209
9.	Silica (Reactive)	SiO2	9
11.	Iron	Fe	1.2
12.	pH Value	-	7.6-8.2
13.	Turbidity	NTU	200
14.	Organics(As per KMnO4 method)	Number	2

ANNEXURE-IV-1

TABLE-1

LIGHT DIESEL OIL CHARACTERISTICS
(AS PER IS 15770-2008)

	Characteristics	LDO
1.	Pour Point (max)	21 ℃ & 12℃ for Summer and Winter respectively
2.	Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.0
3.	Sediment percent by mass (max)	0.10
4.	Total sulphur percent by mass (max)	1.5
5.	Ash percentage by mass (max)	0.02
6.	Carbon residue (Rams bottom) percent by pass (max.)	1.50
7.	Acidity inorganic	Nil
8.	Flash point (Min.) - Pensky Martens	66 deg.C
9.	Copper strip corrosion for 3 hours at 100℃	Not worse than No. 2
10.	Water content, % by volume (max)	0.25
11.	GCV(kcal/kg)	10,000

TABLE-2 **ANNEXURE-IV-2**

HIGH SPEED DIESEL OIL CHARACTERISTICS

[AS PER IS **1460-2005 (BS-II)**]

S. No.	Particulars	Unit	Value
1.	PHYSICAL PROPERTIES		
	a. Distillation volume recovery @ 350^0C	% vol. (min)	85
	b. Distillation volume recovery @ 370^0C	% vol. (min)	95
	c. Kinematic Viscosity @ 40 Degree C	cSt	2.0 – 5.0
	d. Density @ 15 Degree C	kg/m^3	820 – 860
	e. Pour Point		
	- Summer	Degree C (max)	15
	- Winter	Degree C (max)	03
	f. Cold Filter Plugging Point		
	- Summer	Degree C (max)	18
	- Winter	Degree C (max)	06
	g. Flash Point (Abal)	Degree C (max)	35
	h. Lubricity WSD 1.4 @ 60 Degree C	Microns (max)	460
2.	HEATING VALUE		
	a. Higher Heating Value (HHV)	Kcal/Kg	11,000
	b. Lower Heating Value (LHV)	Kcal/Kg	10,300
3.	ACIDITY		
	a. Inorganic	mg KOH/g	Nil
	b. Total	mg KOH/g	0.2 (max.)
4.	Copper Strip Corrosion 3 hours @100^0C	No.	1 (max)
5.	RCR on 10% residue	% wt.	0.3 (max)
6.	CONTAMINANTS		
	a. Ash	ppm (wt.)	100 (max)
	b. Sediments	% wt	0.05 (max)
	c. Total Sulphur	% wt	0.05 (max)
	d. Water Content	% volume	0.05 (max)
	e. Trace Metals		
	- Na + K	ppm (wt)	0.30 (max)
	- Vanadium	ppm (wt)	0.50 (max)
	- Lead	ppm (wt)	0.50 (max)
	- Calcium	ppm (wt)	2.0
	- Ni + Zn	ppm (wt)	Nil
7.	Nitrogen content (FBN)	% wt.	0.015

TABLE-3

ANNEXURE-IV-3

PROPOSED COAL CHARACTERISTICS FOR NORTH KARANPURA STPP (3 x 660 MW)

S.No.	Characteristics (as received basis)	Range of 95 % coal supplies			Range of 5 % coal supplies
		Column - 1	Column - 2	Column - 3	
1.0	PROXIMATE ANALYSIS	Design	Worst	Best	
1.1	Total Moisture (%)	15	18	12	12-18
1.2	Ash (%)	40	46	36	33-46
1.3	Volatile Matter (%)	19	18	22	23-18
1.4	Fixed Carbon (%)	26	18	30	31-18
1.5	Total (%)	100	100	100	
2.0	ULTIMATE ANALYSIS				
2.1	Carbon (%)	29.73	23.08	37.32	40.62-23.08
2.2	Hydrogen (%)	3.7	3.54	3.92	4.02-3.54
2.3	Sulphur (%)	0.5	0.6	0.4	0.4-0.6
2.4	Nitrogen(%)	1.8	1.45	1.6	1.4-1.45
2.5	Oxygen(%)(By difference)	8.66	6.7	8.32	8.12-6.7
2.6	Carbonates (%)	0.58	0.6	0.4	0.4-0.6
2.7	Phosphorous(%)	0.03	0.03	0.04	0.04-0.03
2.8	Total Moisture (%)	15	18	12	12-18
2.9	Ash (%)	40	46	36	33-46
	Total	100	100	100	
2.10	GCV (Kcal/Kg)	3300	2800	4000	4300-2800
2.11	Hard Grove Index	55	50	60	50-65
3.0	ASH ANALYSIS				
3.1	Silica (%)	59.79	61.3	56.7	62-56
3.2	Alumina(%)	25.36	28	23.5	28-23
3.3	Iron Oxide (%)	7.2	6	10	6-10
3.4	Titania	1.2	1	1.5	1-1.7
3.5	Phophoric Anhydride (%)	2.6	1.5	3	1-3
3.6	Lime (%)	0.88	0.5	1.5	0.5-1.7
3.7	Magnesia (%)	0.55	0.4	1	0.4-1.1
3.8	Sulphuric Anhydride (%)	1.2	0.5	1.4	0.5-1.7
3.9	Alkalies (by difference)	1.22	0.8	1.4	0.6-1.8
	Total	100	100	100	
4.0	ASH FUSION RANGE				
	REDUCING ATMOSPHERE				
4.1	Initial Deformation Temp.(oC	1100	1100	1100	1100-1150
4.2	Hemispherical Temp. (oC)	1300	1250	1350	1250-1400
4.3	Fusion Temperature (oC)	1400	1400	1400	1400-1450

ANNEXURE-IV-4

TABLE – 4

TYPICAL IMPORTED COAL AND ASH CHARACTERISTICS

Sl.No.	Characteristics (as received basis)	Imported Coal	
		Worst	Best
1.0	**Proximate Analysis**		
1.1	Total Moisture (%)	20	16
1.2	Ash (%)	10	10
1.3	Volatile Matter (%)	30	45
1.4	Fixed Carbon (%)	40	29
1.5	Total (%)	100	100
2.0	**Ultimate Analysis**		
2.1	Carbon (%)	56.4	62.4
2.2	Hydrogen (%)	4.5	4.9
2.3	Sulphur (%)	0.9	0.8
2.4	Nitrogen (%)	0.9	0.5
2.5	Oxygen (%) (By difference)	7.3	5.4
2.6	Carbonates (%)	0	0
2.7	Phosphorous (%)	0	0
2.8	Total Moisture (%)	20	16
2.9	Ash (%)	10	10
	Total	100	100
2.10	GCV (Kcal/Kg)	5800	6500
2.11	Hard Grove Index	45	60
2.12	YGP (mg/kg)	100	70
3.0	**Ash Analysis**		
3.1	Silica (SiO_2) (%)	32.74	34.94
3.2	Alumina(Al_2O_3) (%)	30.5	28.43
3.3	Iron Oxides(Fe_2O_3) (%)	18.2	15.2
3.4	Titania (TiO_2)	1.56	1.76
3.5	Phosphoric Anhydride(P_2O_5) (%)	0.44	0.54
3.6	Lime (CaO) (%)	6.12	7.62
3.7	Magnesia (MgO) (%)	1.83	1.93
3.8	Sulphuric Anhydride (%)	6.95	7.65
3.9	Sodium Oxide (Na_2O) (%)	0.3	0.4
3.10	Balance alkalies (by difference)	1.36	1.56
	Total	100	100
4.0	**Ash Fusion Temperature reducing temperature**		
4.1	Initial deformation Temp (ºC)	1100	1250
4.2	Hemispherical Temp. (ºC)	1300	1350
4.3	Flow Temp. (ºC)	1400	1400

SECTION - C

SPECIFIC TECHNICAL REQUIREMENTS

1.0 **SYSTEM DESCRIPTION AND SCOPE OF WORK**

Following equipment / machines which are included in bidder's scope of work are given under :-

S. N.	EQUIPMENT NAME	TECHNICAL SPECIFICATION	ACCESSORIES	QTY.
1.	Battery operated trolley-1	Capacity 30 Ton for handling motor by road with driver cabin and , Size of Trolley 5 m (Length) and 4.0 m (Width), Battery and charger will be Industrial type heavy duty, Driver Cabin will be provided with steering, Brake, Accelerator, Horn, Flasher & Forward reverse control, Speed of car upto 50 M/min, Battery Use after full Charging minimum 2 Hour, Solid Rubber Wheel	Accessories as per Manufacturer standard	1
1.	Battery operated trolley-2	Capacity 30 Ton for handling motor by road with driver cabin , Size of Trolley 4 m (Length) and 3.0 m (Width), Battery and charger will be Industrial type heavy duty, Driver Cabin will be provided with steering, Brake, Accelerator, Horn, Flasher & Forward reverse control, Speed of car upto 50 M/min, Battery Use after full Charging minimum 2 Hour, Solid Rubber Wheel	Accessories as per Manufacturer standard	1

NOTES:-

1) Maintenance tools and tackles as required for the various machines, commissioning spares for various machines as applicable, first fill lubricant /coolant for each equipment is included in Bidder's scope of work.

2) Machines shall be supplied with the manufacturer's standard accessories & other accessories as indicated above. Bidder shall submit list of all other special accessories in their bid & furnish item wise price in the price bid.

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2.0 **The followings shall also be included in bidder's scope of work:-**

2.1 Required numbers of machines in new / unused condition along with standard accessories and special accessories as listed above in the specification.

2.2 First fill of lubricants, oil, coolants etc. for all machines.

2.3 Painting of equipment shall be done by the bidder before despatch as per the attached painting schedule. Bidder shall also supply adequate quantity of loose touch up paint along with the equipment so that damage in transition, if any, can be taken care.

2.4 Base plates, Support plates, anchor bolts, foundation bolts and nuts, lifting lugs, eye bolts etc. if any. All commissioning spares shall be included in the scope of work of each equipment / item.

2.5 Terminal points for electrical shall be the power supply terminals in respective machines and power cable glands and lugs shall be in bidder's scope.

2.6 The electrical equipment supplied as a part of machine shall include isolating switch for power supply isolation incorporating mechanical safety as required.

2.7 VOID.

2.8 Commissioning spares shall be included in the scope of work of the bidder.

2.9 A complete unused new set of special purpose service / maintenance tools & tackles shall be supplied with each machine. The tools shall be supplied in steel tool box & shall be of the best quality & specially protected against rusting in tropical climate.

2.10 VOID.

2.11 Five (5) metres of power cable (spare) shall be supplied alongwith each machine / item.

2.12 Any other works not covered above but required for the safe operation of the machines.

3.0 CODES & STANDARD

The machines covered under the scope of work shall be new, of streamlined construction, rugged and vibration free in line with the Indian / international standard and practices.

4.0 SERVICES BY CUSTOMER

4.1 Draining arrangement of liquid coolant from source to the nearest drain.

4.2 Construction of Workshop building.

4.3 Pipe trench & cable trenches, doors / windows, rolling shutter, ramp and glass partition wall, if any.

4.4 Cable termination.

4.5 One no. D/G EOT crane of 10 tonnes capacity.

4.6 Erection and commissioning of workshop machines.

5.0 DOCUMENTS AND DATA REQUIRED TO BE SUBMITTED AFTER PLACEMENT OF LOI

Following drawings and documents shall be submitted to BHEL for approval after the placement of LOI:-

a) General arrangement drawing indicating overall dimensions, total weights, foundation details and bill of material for all types of machines including requirement of withdrawal space.

b) Final details of motors (machine wise) indicating guaranteed power consumption as per BHEL's format.

c) Manual calculation for selection of machines including authentic supporting literature (e.g. handbook / standards).

d) Manual calculation for requirement of air / water quantity and pressure including authentic supporting literature (e.g. handbook / standards).

e) Final filled up Data sheet "B" / Data sheet "C"

f) Quality assurance plan being followed for all items of each type of machine starting from raw material to final product including routine and type test being conducted at works.

g) Write - up on working principle and special safety features envisaged for each type of machines.

h) Final requirement of air and water indicating quantity, pressure and terminal points, if any.

i) Painting schedule.

j) O & M manual.

k) List of spares (commissioning).

l) List of Tools and Tackles.

m) Schedule of lubricants indicating quantity, make and trade name of at-least three manufacturers.

n) Data sheet of machines.

NOTE:-

1) The list of drawings and documents to be submitted after placement of order shall be forwarded to the successful bidder after award of contract.

2) Only manual calculation with authentic supporting literature shall be furnished (e.g. Hand book / standards / codes).

3) Drawings and documents not covered above but required to check safety of machines / system shall be submitted during detailed engineering stage without any commercial implication.

6.1 **General requirement**

01. All the drawings shall be prepared in Auto Cad - 2007 version and required number of hardcopies and soft copies of all the drawings, documents, O & M and spare parts manuals shall be furnished to BHEL during detailed engineering stage as per Annexure – II enclosed with the NIT specification.

02. Inspection checklist / quality plan and recommended field quality plan for each machine and submitted to BHEL for approval after placement of order and any changes required by BHEL / CUSTOMER for the same shall be incorporated and adhered by the bidder without any commercial implications.

03. BHEL will require 21 days time to offer their comments on the drawings and documents being submitted by the bidder from the date of receipt.

04. All drawings including general arrangement, civil foundation drawing shall be furnished to BHEL during detailed engineering stage and shall include BOQ / BOM in tabular form indicating all major components including bought out items, standard as well as optional

accessories which are covered under the bidder's scope of supply and their quantity, material of construction indicating its applicable code / standard, weight, make.

05. All drawings of each machine including general arrangement and foundation drawings shall be furnished to BHEL during detailed engineering stage and shall include / indicate the following details for clarity w.r.t. inspection, construction, erection and maintenance etc. :-

a) All drawings and documents shall bear BHEL's title block and drawing / document number. However, BHEL's drawing / document numbering scheme shall be furnished to the successful bidder after the placement of L.O.I.

b) All drawings shall indicate the list of all reference drawings including general arrangement and foundation drawings.

c) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view and all major self manufactured, bought out items, standard as well as optional accessories which are covered under the bidder's scope of supply shall be labelled and included in BOQ / BOM in tabular form.

d) Specification / schedule of coolant / oil for oil cooler / lubricant / paint indicating atleast 3 trade name shall be made as a part of general arrangement drawing of each machine.

e) Extreme location of various items / assembly due to movement shall be shown in dotted lines indicating the dimensions of the same from the extreme point of idle location.

f) Location of motor (s), control panel along with dimensions shall be shown in the drawing.

g) Space required for the door opening of panel shall be shown in dotted lines with dimensions in all the general arrangement drawing.

h) Details of job feeding and withdrawal direction with arrow and its required space shall be shown in dotted lines with dimensions from some reference point like edge / centre of the machine.

i) Location of operator and required space for his movement shall be shown in the general arrangement drawing in dotted lines with dimensions from some reference point like edge / centre of the machine.

j) Requirement of withdrawal space for maintenance, if any, shall be shown in the general arrangement drawing in dotted lines with dimensions from the reference point like edge /centre of the machine.

k) Recommended clearance / maintenance space around the machine shall be shown in the general arrangement drawing in dotted lines with dimensions from the reference point like edge / centre of the machine.

l) Mounting details of each machine indicating size and required number of holes and the distances between them shall be indicated in the general arrangement drawing.

m) Distance between the mounting holes and distances of the same from some reference point like centre line of machine / edge of the machine to ensure correct construction of foundation and to know maximum space required for civil foundation and mechanical equipment.

n) Technical parameters of the machine shall be furnished (gearbox details, job rpm, vibration limit, noise level at a distance of 1.0 metre at a level of 1.5 metres above ground, V - belt details, details of pulley, details of all motors and hydraulics, whether the machine will be dispatched / delivered in the assembled condition or dismantled condition indicating the weight as the case may be, recommended capacity of E.O.T Crane, weight of heaviest (single) part / component of the machine, weight of machine along with accessories, job and total weight shall be furnished separately etc.) in all the general arrangement drawing and those shall be indicated in the drawing with dimensions to the extent possible.

o) Details of cable entry for each machine shall be shown in all the 3 views (plan, elevation and side view).

p) Hardness and type / method of hardening of various parts of each machine shall be indicated in the general arrangement drawing.

06. Manual Calculation for motor (s) sizing shall be furnished to BHEL during detailed engineering stage for approval along with the copy of authentic supporting literature e.g. Hand book, National / international Standards etc in line with the technical specification.

07. O & M manual shall be furnished to BHEL for approval during detailed engineering stage along with the general arrangement drawing.

08. Drawing / data sheet of all accessories shall be furnished to BHEL for approval during detailed engineering stage indicating brief specification.

09. Operational write-up along with safety features and interlock / control details of each machine shall be furnished to BHEL separately for approval during detailed engineering stage.

10. Separate drawing for lifting arrangement of machine during erection shall be furnished to BHEL for approval indicating dimensions and details of lifting lugs, rope etc.

11. Civil foundation drawing of each machine shall be furnished to BHEL for approval during detailed engineering stage showing / including the followings:-

a) Scope of work by BHEL and vendor which shall be indicated with different legend or in the form of note.

b) Weight of moving parts, its frequency and its height from floor shall be furnished.

c) Recommended location of cable trench for feeding cable to machine shall be furnished along with the details of cable entry.

d) Civil loads per bolt (static and dynamic) shall be furnished in tabular form considering weight of maximum size of job and worst cutting force.

12. Separate general arrangement drawing of drive arrangement shall be furnished to BHEL for approval during detailed engineering stage.

13. Characteristic curve of motor shall be furnished to BHEL for approval during detailed engineering stage showing torque, speed, current & voltage.

14. Design of machines shall be such that no cooling water / air from external source shall be required for cooling of any part of machine. Necessary cooling arrangement, as required, shall be provided by the bidder in their machines.

15. First fill of all oil, lubricants, coolants etc. shall be included in scope of work of the bidder for each machine and shall be supplied along with the machine and **price for the same shall be taken care in the price bid, if any**.

16. Filled up sketch indicating various dimensions for the space requirements of each equipment, centre line of job feeding and its dimension from some reference point like the centre line of machine or edge of the machine, location of operator, direction of job feeding & withdrawal and details of cable entry.

17. Bidder has to depute competent designer (s) of each machine at BHEL's office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL. However, minimum 7 days notice shall be served for the same.

18. BLANK

19. Make of various bought items shall be as indicated in the NIT specification. Bidder will seek approval from BHEL during detailed engineering stage for those items which are not appearing in the list but required for the machine. However, Bidder shall not approach BHEL for approval of additional make of any item which is already appearing in the list.

20. Painting specification and schedule shall be provided by the bidder for each machine as indicated in the NIT specification. However, painting specification of those items / equipments which are not covered in the specification, bidder to prepare the painting specification (suitable for sea atmosphere) for each item / machine / equipment and will be submitted to BHEL / CUSTOMER for approval after placement of order and any changes required by BHEL / CUSTOMER for the same shall be incorporated and adhered by the bidder without any commercial implications. Bidder to include adequate quantity of loose touch up paint for each item / equipment / machine which is required to be supplied along with the item / equipment / machine to take care damage during transit and price for the same, if any, shall be taken care in the price bid.

21. Noise level for each machine at a horizontal distance of 1.0 metre from the edge of the machine and at a height of 1.5 metres from the ground shall be limited to 85 dba and the same shall be shown during the "PG" test.

22. Inspection checklist / PG TEST procedure etc. shall be prepared by the bidder and will be submitted to BHEL / CUSTOMER for approval after placement of order and any changes required by BHEL / CUSTOMER for the same shall be incorporated and adhered by the bidder without any commercial implications. Necessary instruments / job material (steel plate / bar etc.) as required for the testing / inspection of machines shall be arranged by the bidder and shall also be included in bidder's scope of work.

23. All foundation nuts, bolts, lock nuts, washers etc. as required for fixing the machine with foundation shall be included in bidder's scope of work for each machine and the same shall be supplied along with the machine and **price for the same shall be taken care in the price bid, if any**.

24. All necessary guards, devices, tools & other means that will effectively protect all personnel from any accidental or injury that may occur while machine is in running

condition shall be in bidder's scope of work and shall be provided and shown in the drawings to be submitted during detail engineering stage.

25. Offered machines shall be suitable for the electrical conditions like voltages, frequencies, variations etc. as indicated in project information of NIT specification.

26. BHEL, will provide one (1) no. feeder per machine. Bidder to note & confirm that they will distribute the power requirement of various motors at their end only for this feeder.

27. Blank.

28. List of maintenance tools / hand tools & tackles in terms of numbers only indicating sizes / ratings etc. in annexure form for each machine shall be submitted during detail engineering stage and the same shall be included in bidder's scope of work. Maintenance tools and tackles shall be supplied along with the tool box(es) and **price for the same shall be taken care in the final price bid, if any.**

29. Blank.

30. List of commissioning spares in terms of numbers only indicating sizes / ratings etc. in annexure form for each machine shall be indicated in the offer and shall be supplied along with the machine. **Price for the same shall be taken care in the final price bid, if any**.

31. One (1) no. EOT Crane of capacity 10 Tonnes shall be provided by BHEL in the workshop building for maintenance of the machines. Bidder to check and confirm that the heaviest part of individual machine shall not exceed 10 Tonnes.

32. Necessary earthing studs / facilities for the machine and cables within the machine shall be provided by the bidder.

33. All machines shall be provided with DOL starter.

34. Bidder to furnish the Signed & stamped copy of quality plan for motors attached with the NIT specification during detail engineering stage.

35. Cable Glands shall be double compression tinned brass type and the cable glands shall be supplied as a part of the each machine and **price for the same shall be taken care in the price bid, if any**.

36. All cable lugs shall be heavy-duty tin-plated crimping type the cable lugs shall be supplied as a part of each machine and **price for the same shall be taken care in the price bid, if any**.

37. All technical parameters of LV motors shall comply data sheet –A for LV motors.

38. Filled up motor data sheet of motor (for each motor) and filled up electrical load data format (enclosed with the NIT specification) for each machine shall be submitted during detail engineering stage**.**

39. All the hand wheels shall be polished / Nickel - Chrome plated.

40. List of standard accessories (which will be supplied free of cost along with the machine) in terms of numbers only for each machine shall be indicated in the offer and included in bidder's scope of work. **Price for the same shall be taken care in the price bid, if any**.

41. Bidder to indicate the material of construction of major parts of the machines indicating relevant IS / BS no.

6.0 SPECIFIC REQUIREMENTS REGARDING ERECTION / TESTING & COMMISSIONING

Field quality plan for all machines shall be prepared by the bidder during detailed engineering stage as per agreed schedule and the same shall be approved by BHEL to facilitate handling of equipment, erection & commissioning.

7.0 BID EVALUATION CRITERIA

The bid shall be evaluated based on the price quoted for main machine, commissioning spares, tools and tackles, manufacturer's standard accessories and special accessories as per specification and any technical loading due to non adherence to the technical specification. However, the price for recommended spares and other special / optional accessories which are not included in bidder's scope of work shall not be considered for evaluation purpose.

8.0 CONDITION OF REJECTION

Bid may be rejected if the data which have asked in clause No. 5.0 above is not properly filled-up and submitted along with the bid with company seal.

9.0 INSPECTION, TESTING AND CODES

9.1 The machine offered shall conform to the latest relevant Indian / international Codes / Standards, their electrical drives shall conform to the latest Indian Electricity Rules and shall comply for the currently applicable statutory regulations and safety codes for the locality where the equipment shall be installed.

9.2 Each machine before despatch shall be shop assembled & tested for its performance in the presence of purchaser's representative. Vendor to ensure the proper quality checks during manufacturing & assembly of machine, including identification, co-relation & verification of material test certificates for critical components like gears, shafts, spindles, sleeves etc. and radiographic tests for welds and ultrasonic tests on forging/castings to ensure defects free components and furnish test procedure, reports & test certificates on shop tests.

10.0 Drawing / document distribution schedule is attached in the NIT specification. Bidder shall follow the same during detail engineering stage.

ANNEXURE - I

MAKES OF SUB VENDORS ITEMS OF WORKSHOP EQUIPMENT

S.N.	ITEM	MAKES
1.0	Bearing	SKF / FAG / TATA / NBC
2.0	V - Belt	Fenner / Dunlop
3.0	Hydraulic Power Pack	Vickers - Perry / Rexroth
4.0	CABLES	
a)	LT XLPE Power Cables	APAR INDUSTRIES LTD., CORDS CABLE INDUSTRIES LTD., CRYSTAL CABLE INDUSTRIES LTD., Diamond Power Infrastructure Ltd, GEMSCAB INDUSTRIES LTD., Govind Cable Industries, GUPTA POWER INFRASTRUCTURE LIMITED, Havells India Limited, KEI INDUSTRIES LTD., KRISHNA ELECTRICAL INDUSTRIES LTD., KEC INTERNATIONAL LIMITED, MANSFIELD CABLES COMPANY LTD., PARAMOUNT COMMUNICATIONS LTD., POLYCAB WIRES PVT. LTD., RAVIN CABLES LIMITED, SUYOG ELECTRICALS LTD., SPECIAL CABLES PVT. LTD., SRIRAM CABLES PVT. LTD., Scot Innovation Wires and Cables Pvt. Ltd., TORRENT CABLES LTD., THERMO CABLES LTD., TIRUPATI PLASTOMATICS PVT. LTD.
b)	LT PVC Power Cables	APAR INDUSTRIES LTD., CORDS CABLE INDUSTRIES LTD., Diamond Power Infrastructure Ltd, GOYOLENE FIBRES (INDIA) PVT.LTD., Govind Cable Industries, GUPTA POWER INFRASTRUCTURE LIMITED, Havells India Limited, KEI INDUSTRIES LTD., KRISHNA ELECTRICAL INDUSTRIES LTD., KEC INTERNATIONAL LIMITED, MANSFIELD CABLES COMPANY LTD., NICCO CORPORATION LTD., PARAMOUNT COMMUNICATIONS LTD., POLYCAB WIRES PVT. LTD., RADIANT CORPORATION PRIVATE LIMITED, RAVIN CABLES LIMITED, SUYOG ELECTRICALS LTD., SRIRAM CABLES PVT. LTD., Scot Innovation Wires and Cables Pvt. Ltd., Sam Cables & Conductors (P) Ltd., THERMO CABLES LTD.
c)	LT XLPE Control cables	APAR INDUSTRIES LTD., CABLE CORPORATION OF INDIA LTD., CRYSTAL CABLE INDUSTRIES LTD., Diamond Power Infrastructure Ltd, GEMSCAB INDUSTRIES LTD., Govind Cable Industries, Havells India Limited, KEI INDUSTRIES LTD., KRISHNA ELECTRICAL INDUSTRIES LTD., KEC

		INTERNATIONAL LIMITED, PARAMOUNT COMMUNICATIONS LTD., POLYCAB WIRES PVT. LTD., RADIANT CORPORATION PRIVATE LIMITED, RAVIN CABLES LIMITED, SUYOG ELECTRICALS LTD., SRIRAM CABLES PVT. LTD., TORRENT CABLES LTD., UNIVERSAL CABLES LTD.
d)	LT PVC Control cables	Advance Cable Technologies (P) Ltd., APAR INDUSTRIES LTD., CMI LTD., CORDS CABLE INDUSTRIES LTD., CRYSTAL CABLE INDUSTRIES LTD., DELTON CABLES LTD., Diamond Power Infrastructure Ltd, ELKAY TELELINKS LTD., GEMSCAB INDUSTRIES LTD., Govind Cable Industries, GUPTA POWER INFRASTRUCTURE LIMITED, Havells India Limited, Incom Cables (P) Ltd., KEI INDUSTRIES LTD., KRISHNA ELECTRICAL INDUSTRIES LTD., KEC INTERNATIONAL LIMITED, MANSFIELD CABLES COMPANY LTD., NICCO CORPORATION LTD., PARAMOUNT COMMUNICATIONS LTD., POLYCAB WIRES PVT. LTD., RAVIN CABLES LIMITED, SUYOG ELECTRICALS LTD., SPECIAL CABLES PVT. LTD., Scot Innovation Wires and Cables Pvt. Ltd., Sam Cables & Conductors (P) Ltd., SPM POWER & TELECOM PVT. LTD, TORRENT CABLES LTD., THERMO CABLES LTD., TIRUPATI PLASTOMATICS PVT. LTD., UNIVERSAL CABLES LTD.
5.0	Pump for coolant	Phulsons, Rajpura / Rajamane Industries Pvt. Ltd., Bangalore
6.0	LT Motors	SIEMENS / NGEF/ CROMPTON / KIRLOSKAR / BHARAT BIJLI / ALSTOM / ABB (NGEF UPTO 15kW only)
7.0	Paint	Asian Paints (I) Ltd., Berger Paints India Ltd, Goodlass Nerolac, Jenson & Nicholson (I) Ltd , CDC carboline (I) Ltd., Shalimar Paints Ltd., Addison Paints Ltd, Grand Polycoat, Bombay Paints, Hemple Paints (Singapore), Jotun Paints

Note:

1. **Make is indicative, subject to customer's / consultant approval during detail engineering. Acceptance/non acceptance of same shall not have any impact on manufacturing, delivery schedule and on cost of the equipment.**

ANNEXURE - II

Drawings / documents distribution schedule and MDL

S.N.	DESCIPTION	CUSTOMER / CONSULTANT	BHEL / Customer SITE	PEM (ENGINEERING)
1)	Drawings / documents during approval stage	10	Nil	6 – hard copy and 1 – soft copy (CD)
2)	Finally approved drawings / documents	10	9	6 – hard copy and 6 - softcopy (CD)
3)	As built drawings / documents	10	9	6 – hard copy and 6 - softcopy (CD)
4)	Approved erection / installation manual	10	9	6 – hard copy and 6 - softcopy (CD)
5)	Approved O & M manuals	10	9	6 – hard copy and 6 - softcopy (CD)

Note: The above requirement is minimum. However, exact quantities of drawings / documents requirement shall be informed to the successful bidder during detailed engineering stage for which no commercial implication shall be entertained by BHEL.

All drawings & documents shall be prepared in Autocad and submitted for review / approval in soft copies also. Catalogues shall be scanned for soft copy.

Note:- Manually prepared drawings are not acceptable.

Soft copy in CD Rom and Reproducible Tracings of all drawings / documents shall be submitted along with Final / As-Built submission.

"Bidder to note that BHEL reserve the right for drg/doc submission through web based Document Management System. Bidder would be provided access to the DMS for drg/doc 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)"

Master Drawing List

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

Sl. No.	BHEL DRG.NO	DRAWING TITLE	REMARKS	SUBMISSION SCHEDULE - WEEK NUMBER FROM DATE OF LOI
1	PE-V0-405-568-A002	Data sheet of machine/equipment with detailed BOM WORKSHOP EQUIPMENT	APPROVAL	2
2	PE-V0-405-568-A003	GA of machine / equipment	APPROVAL	2
3	PE-V0-405-568-A001	Inspection Check List / Manufacturing Quality Plan of machine/equipment	APPROVAL	2
4	PE-V0-405-568-A004	O & M Manual for WORKSHOP EQUIPMENT	INFORMATION	8
5	PE-V0-405-568-A006	Erection Procedure for WORKSHOP EQUIPMENT	INFORMATION	8

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. Every repeat submission within one (1) week. Response time by BHEL within three (3) weeks after receiving of drawing.

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

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

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

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

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

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

SUB-SECTION–A-10

SURFACE PREPARATION & PAINTING

1.00.00 **Specification of surface preparation & painting**

1.01.00 Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.

1.02.00 All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labelled by the manufacturer with the manuacturer's name, type of paint, batch number and colour.

1.03.00 Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.

1.04.00 All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering..

1.05.0 **SURFACE PREPARATION**

1.05.01 All surfaces to be painted shall be thoroughly cleaned of oil. Grease and other foreign material. Surfaces shall be free of moisture and contamination from chemicals and solvents.

1.05.02 The following surface preparation schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer.

SP1	Solvent cleaning
SP2	Application of rust converter (Ruskil or equivalent grade)
SP3	Power tool cleaning
SP4	Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer)
SP4*	Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns
SP5	Shot blasting/ abrasive blasting.
SP6	Emery sheet cleaning/Manual wire brush cleaning.

1.06.00 **APPLICATION OF PRIMER/PAINT**

1.06.01 The paint/primer manuacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.

1.06.02 Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.

1.06.03 Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats.When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.

1.06.04 Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected.Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.

1.06.05 Following are the Primer/painting schemes envisaged herein:

PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104.

PS3* - Zinc Chrome primer (Alkyd base) by dip coat.

PS4 - Synthetic Enamel (long oil alkyd) to IS2932.

PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744

PS9 - Aluminium paint to IS 2339.

PS9* - Heat resistant Aluminium paint to IS-13183 Gr.-1

PS13 - Rust preventive fluid by spray, dip or brush.

PS14 - weldable primer-Deoxaluminate or equivalent.

PS16 - High Build Epoxy CDC mastic `15' .

PS17 - Aliphatic Acrylic Polyurethane CDE134 ,%V=40.0(min.)

PS18 - Epoxy based TiO2 pigmented coat

PS19 - Epoxy Zinc rich primer (92% zinc in dry film (min.), %VS=40.0(min.)

PS-20 - Epoxy based finish paint

1.06.06 All weld edge preparation for site welding shall be applied w ith one coat of wieldable primer.

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

1.06.08 SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.

1.06.09 a) all un -insulated eq uipments, pipes, valves etc covered in s ub-section A-06 (Steam Turbine & Auxiliary system) shall be painted with paint not inferior to Epoxy resin based paints with minimum DFT of 150 micron.
The pai nt shall be a pplied in thre e stages i.e. pri mer, interme diate an d fini sh coats in following manner:

- Primer coat – Epoxy based zinc phosphate
- Intermediate - Epoxy based TiO2 pigmented coat
- Finish coat - Epoxy based finish coat

b) Equip ment, pipes etc. with high tempe rature shall be pai nted with heat resistant aluminum pai nt (to be selected based on the service condition o f component as per IS-13183). Two coats of paint shall be applied with total DFT 40 micron.

c) S urface preparation before p ainting shall be carried out according to requi rement indicated in this sub-section and international standard

1.06.10 A) Specification for the a pplication of Epo xy coati ng for internal protection of D M tank & other vessels/tanks (as applicable) shall be as follows:

Primer : One coat of unmodified epoxy resin along with polymide hardener.

Paint : Two (2) coats unmodified epoxy resin along with Aromatic adduct hardener.

Total thickness of primer and paint should not be less than 400 microns.

B) Spec ification for application of chl orinated Rubber pa int for e xternal protecti on ve ssel, tanks, piping, valves & other equipments shall be as follows:

i) For Indoor vessel, tanks, piping, valves & other equipments:

(a) Surface preparation shall be done either manually or by any other approved method.

(b) Primer coat shall consist of one coat of chlorinated rubber based zinc phosphate primer having minimum DFT of 50 microns.

(c) Intermediate coat (or under coat) shall consist of one coat of chlorinated rubber based paint pigmented with Titanium dioxide with minimum DFT of 50 microns.

(d) Top coat shall consist of one coat of chlorinated rubber paint of approved shade and colour with glossy finish and DFT of 50 microns.

Total DFT of paint system shall not be less than 150 microns.

ii) For Outdoor vessel, tanks, piping, valves & other equipments:

(a) Surface preparation shall be blast cleared using non-siliceous abrasive after usual wire brushing, which shall conform to Sa 2-1/2 Swiss Standard.

(b) Primer coat shall consist of one coat of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns.

(c) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns.

(d) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided.

The paint may be applied in one coat, in case high built paint is used, otherwise two coats shall be applied.

Total DFT shall not be less than 300 microns.

1.19.00 LOADS OUTSIDE PLANT BOUNDARY

Following loads outside plant boundary shall be fed through following over head lines/cables:

a) AWRS/Seepage pump house including peripheral lighting of Ash Dyke.

The Single Circuit overhead lines shall generally be laid along the AWRS pipe route. Wherever overhead lines on single circuit poles/ towers are not feasible, double circuit towers/ buried cables shall be used. However exact routing shall be decided during detailed engineering.

1.20.00 PAINTING FOR ELECTRICAL EQUIPMENT

Unless explicitly stated in relevant chapters of the specification, the painting of all electrical equipment shall be as follows:

Epoxy based with suitable additives. The thickness of finish coat shall be minimum 50 microns (minimum total DFT shall be 100 microns). However in case electrostatic process of painting is offered for any electrical equipment, minimum paint thickness of 50 microns shall be acceptable for finish coat. Paint shade shall be as per technical specification.

1.21.00 Type Test

Contractor shall carry out all type tests on electrical equipments as stipulated in relevant chapters of technical specifications.

1.22.00 Mandatory Spares

Contractors scope shall include Mandatory Spares of all equipments as mentioned in the relevant portion of Technical Specification.

1.23.00 Electrical Lab and Electrical Workshop

Electrical Testing Lab, with an air conditioned space of approx. 200sq.m, shall be provided in the Switchyard Control Room/ Auxiliary Building. The list of equipments to be provided in the Electrical Lab in indicated in Sub-Section-VII Workshop, Lab, M&C Equipments Annexure-II.

Electrical Workshop shall be part of O&M workshop with an area of approx 50m X 25m. The list of equipments to be provided in Electrical Workshop is indicated in Sub-Section-VII Workshop, Lab, M&C Equipments Annexure-II

ANNEXURE-IV

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
			REV.NO.:	CONTRACT NO. :
		SUB-SYSTEM:	DATE:	MAIN-SUPPLIER:
			PAGE: …. OF….	

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C / N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.		11.

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** **M:** MANUFACTURER/SUB-SUPPLIER C**:** MAIN SUPPLIER, **N**: NTPC **P:** PERFORM **W**: WITNESS AND **V:** VERIFICATION. AS APPROPRIATE, **CHP:** NTPC SHALL IDENTIFY IN COLUM "N" AS ' W"	एनटीपीसी NTPC	DOC. NO.:		REV…… CAT…..
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER		FOR NTPC USE			
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL

FORMAT NO.: QS-01-QAI-P-09/F1-R1 **1/1** **ENGG. DIV./QA&I**

SUPPLIER'S LOGO	SUPPLIER'S NAME AND ADDRESS	FIELD QUALITY PLAN		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
			REV. NO.:	CONTRACT NO. :
		SUB-SYSTEM:	DATE:	MAIN-SUPPLIER:
			PAGE: …. OF….	

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. **LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A'** SHALL BE WITNESSED BY NTPC FQA, **'B'** SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND **'C'** SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)	एनटीपीसी NTPC	DOC. NO.:		REV……
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER		FOR NTPC USE			
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL

FORMAT NO.: QS-01-QAI-P-09/F2-R1 **1/1** **ENGG. DIV./QA&I**

VOL - II B

ELECTRICAL

TECHNICAL SPECIFICATION
FOR
WORKSHOP EQUIPMENT
(ELECTRICAL PORTION)

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 workshop equipment 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) Electrical load requirement for workshop equipment**.**
e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
f) 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
g) 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.
h) Motor shall meet minimum requirement of motor 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 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.

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.

3.0 List of enclosures :
a) Electrical scope between BHEL & vendor (Annexure –I)
b) Technical specification for motors.
c) Datasheets & quality plan for motors.
d) Electrical Load data format (Annexure –II)

PACKAGE : WORKSHOP EQUIPMENT
SCOPE OF VENDOR: SUPPLY
PROJECT : 3X660 MW North Karanpura STPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Power cables	BHEL	BHEL	Cable size shall be derived by BHEL based on Electrical load data & shall be informed to vendor at contract stage. Vendor shall provide lugs & glands accordingly.
3	Any other/special type of cable like control, screened control, compensating, co-axial, prefab, MICC, fibre Optic cables etc.	Vendor	BHEL	
4	Cabling material (Cable trays, accessories ,cable tray supporting system, conduits etc.)	BHEL	BHEL	
5	Cable glands ,lugs, and bimetallic strip for equipment supplied by Vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
6	Motors alongwith fixing accessories	Vendor	-	Makes shall be subject to customer/ BHEL approval at contract stage.
7	Mandatory spares	Vendor	-	Vendor to quote as per specification.
8	Recommended O & M spares	Vendor	-	As per specification

NOTES:

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

SUB–SECTION – B-07

MOTORS

MOTORS

1.00.00 GENERAL REQUIREMENTS

1.01.00 For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.

1.02.00 All equipments shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.

1.03.00 Contractor shall provide fully compatible electrical system, equipments, accessories and services.

1.04.00 All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.

1.05.00 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 IS:4691, 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:325, IEC:60034
2)	Single phase AC motors	:	IS:996, IEC:60034
3)	Crane duty motors	:	IS:3177, IEC:60034
4)	DC motors/generators	:	IS:4722
5)	Energy Efficient motors	:	IS 12615, IEC:60034-30

3.00.00 **TYPE**

3.01.00 **AC Motors:**

a) Squirrel cage induction motor suitable for direct-on-line starting.

b) Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature), shall be **Premium Efficiency class-IE3**, conforming to IS 12615, or IEC:60034-30.

c) Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.

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 60 MVA.

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.

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) 85% below 110 KW

(b) 80% from 110 KW to 200 KW

(c) 85% above 200 KW to 1000 KW

(d) 80% from 1001 KW to 4000 KW

(e) 75% above 4000KW

Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%.

7.00.00 DESIGN AND CONSTRUCTIONAL FEATURES

7.01.00 Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors , space heater terminals inside the main terminal box may be acceptable.

7.02.00 All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). 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 Presure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15
	(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.

7.05.00 Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.

7.06.00 Noise level for all the motors shall be limited to 85dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.

7.07.00 In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.

7.08.00 Motor body shall have two earthing points on opposite sides.

7.09.00 11 KV motors shall be offered with Separate Insulated Connector (Elastimould or Equivalent make) as per IEEE 386. The offered Elastimould terminations shall be provided with protective cover and trifurcating sleeves. Elastimould 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 & centre 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.

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 : 10.0

(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

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 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/Employers 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

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/Employers 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.

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:

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

Cable glands

Cable shall be terminated using double compression type cable glands. Testing requirements of Cable glands shall conform to BS:6121 and gland shall be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.

Cable lugs

Cable lugs for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs shall conform to relevant standard

1.	Design ambient temperature	:	50 ºC
2.	Maximum acceptable kW rating of LV motor	:	≤200KW
3.	Installation (Indoors/ Outdoors)	:	As required
4.	Degree Of Protection (Indoor/Outdoor)	:	IP54/IP55
5.	Type of Cooling	:	TEFC/CACA/TETV
6.	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		
	110kW & Above (Breaker controlled)	:	50 kA for 1 sec
	Below 110kW (SFU+ Contactor controlled)	:	50 KA for 0.20 sec
	f) LV System grounding	:	Solidly
7.	Class of insulation	:	Thermal Class(B) or better
8.	Minimum voltage for starting (As percentage of rated voltage)	:	85% below 110KW 80% from 110KW to 200 KW
9.	Power cables data	:	Shall be given during detailed engg.
10.	Earth Conductor Size & Material	:	Shall be given during detailed engg.
11.	Space heater supply	:	240 V, 1Φ, 50 Hz
12.	Rating up to which Single phase motor	:	Acceptable upto 0.20 kW
13.	Tests	:	As per Customer motor spec. (enclosed)
14.	Special requirement	:	Continuous duty LT motors upto 160 KW output rating (at 50 deg C) shall be Premium Efficiency class – IE3 conforming to IS 12615/IEC:60034-30.
15.	Maximum Ratio of locked rotor KVA at rated voltage to rated KW	:	Below 110 KW - 10.0 :From 110KW to upto 200KW - 9.0

- **Also detail Customer spec. for Motors to be referred as enclosed with spec.**

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		

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	

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

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Y1 = for HT Motor / Machines only.

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.	VERIFICATION FROM MOTOR DATASHEET (Y/N)
	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	20
ANNEXURE-II																			

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)/ CUSTOMER
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.	405	ORIGINATING AGENCY		PEM (ELECTRICAL)	
	PROJECT TITLE	3X660 MW NORTH KARANPURA	NAME		DATA FILLED UP ON	
	SYSTEM		SIGN.		DATA ENTERED ON	
	DEPTT. / SECTION	MAX	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE	

एनटीपीसी NTPC	Project : NORTH KARANPURA Package : 3 x 660 MW EPC -TG& AUX Contractor : BHEL, Hyderabad Contract No.: CS- 4410-001-2	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUBCONTRACTOR APPROVAL SUB SYSTEM: BFP, Drive Turbine, Heaters (HP, LP) Drain Cooler and Deaerator	Ref No. Revision No / 00 Date: 19-12-2013

SN	ITEM	QP/ INS-PN CAT *	QP No. xxxx-110	OP SUB-MISSION SCHEDULE	QP APPL SCHEDULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB-SCHEDULE	SC APPL SCHEDULE	REMARKS
67	LT MOTORS UPTO 200 KW	I				BHARAT BIJLEE	MUMBAI	A			UPTO 160KW
	(REFER NOTE-1)	I				KEC	BANGALORE/ HUBLI*	A			* UPTO 90 KW
		I				MARATHON	KOLKATA	A			
		I				CGL	AHMEDNAGAR	A			
		I				ABB	FARIDABAD*/ BANGALORE	A			* UPTO 55 KW

APPENDIX B
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S. No.	Item	Sub- suppliers	Place
1	Cable gland	M/s Sunil & Co	Kolkata
		M/s Arup Engg	Kolkata
		M/s Comet	Mumbai
		M/s Quality Precision	Kolkata
		M/s standard Metal Industries	Mumbai
		M/s Braco	Mumbai
2.	Cable Lugs/ferrules	M/s Dowell	Mumbai
		3D	Umbergaon
		Chetna	Nasik
3.	PVC Conduit	BIS Licensee/ISI marked with valid CML number	

VOL - III

DOCUMENTS TO BE FURNISHED WITH OFFER FOR TECHNICAL EVALUATION

1) DEVIATION SHEET (COST OF WITHDRAWAL)
2) SIGNED AND STAMPED COPY OF COMPLIANCE CUM CONFIRMATION CERTIFICATE.
3) Compliance certificate of electrical load data
4) Commissioning spares in terms of numbers indicating sizes / ratings furnished and included in bidder's scope.
5) Unpriced format, duly mentioned 'Quoted'.
6) Signed and stamped copy of STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

NOTE:

i) NO OTHER DOCUMENTS OTHER THAN THOSE LISTED ABOVE ARE REQUIRED TO BE S UBMITTED FOR TECHNICAL EVALUATION. IN CASE ANY OTHER DOCUMENT IS FURNISHED, THE SAME WILL NOT BE TAKEN INTO CONSIDERATION FOR TECHNICAL EVALAUATION.

COMPLIANCE CUM CONFIRMATION CERTIFICATE

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

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

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

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

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

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

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

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

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

h) 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 and within purview of the tender specification even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities.

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.

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.	VERIFICATION FROM MOTOR DATASHEET (Y/N)	KKS 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	20	21
ANNEXURE-II																				
Battery operated trolley-1		32 A	S	1	0	D	S		I											
Battery operated trolley-2		32 A	S	1	0	D	S		I											

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	DEPTT. / SECTION	MAX	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE