NTPC LTD.
1X500 MW FGUTPP,STAGE-IV

TECHNICAL SPECIFICATION
OF
MILL REJECT HANDLING SYSTEM

SPECIFICATION NO.: PE-TS-401-160-A001

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA, INDIA

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VOLUME – II B

SECTION - A

INTENT OF SPECIFICATION

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, forwarding, proper packing and shipment and delivery at site, unloading, handling & transportation at site, mandatory spares, E&C spares and special maintenance tools and tackles, Erection & Commissioning, structural & minor civil works as required Performance and guarantee testing and handing over of **Mill Reject Handling System** as per details in different sections of this specification for 1**X500 MW UNCHAHAR THERMAL POWER PLANT AT RAEBARELI, UP.**

1.2 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 judgment is not in full accordance herewith.

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

1.4 The general term and conditions, instructions to tendered 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.

1.5 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 requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification **within 10 days of receipt of tender documents.** In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Normally, in case of any contradiction in requirements between section-C and section-D, the requirements in Sec-C shall govern. 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.

1.6 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.

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

Note: Wherever in the specification 1x500 MW Singrauli STPP has been indicated ,same shall be read as 1X500 MW Unchahar TPP.

VOLUME – II B

SECTION - B

PROJECT INFORMATION

1.00.00 **BACKGROUND**

Feroze Gandhi Unchahar Thermal Power Station, FGUTPS was conceived as a Load Centre coal based Power Station of 1050 MW capacity by UPSEB. The land for the project was acquired and stage-I (2x210MW) was implemented by UPSEB. The 2x210 MW Unchahar station was taken over by NTPC from Uttar Pradesh Rajya Vidyut Utpadan Nigam of Uttar Pradesh in 1992. Thereafter, NTPC implemented Stage- II (2x210 MW) and Stage-III (1X 210 MW).

The present expansion proposal is to install one additional unit of 500 MW under Stage-IV thus making the ultimate capacity of the FGUTPP 1550 MW.

1.01.00 **LOCATION AND APPROACH**

The plant is located in Raebareli district of Uttar Pradesh, having latitude and longitude of 25°54'50"N and 81°19'50"E respectively. It is bounded by villages Khnapur, Faridpur and Khaliqpur Khurd. Mustafabad town is located at a distance of about 3 Kms from the plant. Unchahar railway station on Allahabad-Raebareli broad gauge (BG) section of Northern Railway (NR) is 2 Kms away. The nearest airport is located at Lucknow a distance of approximately 110 km from the project site.

Vicinity Plan of the project is placed at **Annexure-I**

1.02.00 **LAND REQUIREMENT**

During the implementation of FGUTPS, Stage-I, II & III total area of about 2203 acres of land was acquired. The plant facilities, ash disposal and township for this expansion Stage-IV (1x500 MW) would be accommodated within the available land with dismantling and relocation of some buildings. No additional land has been envisaged to be acquired for this expansion project.

1.03.00 **WATER**

As per agreement between NTPC & Irrigation department, 105 Cusec of water is supplied through S.S Canal to NTPC-Unchahar. The Stage-IV (500MW) consumptive water requirement shall be accommodated within the existing commitment of water to FGUTPP. Sharda sahayak canal and Dalmau Pump House (DPH) on Purwa Branch Canal are available sources of water for the project and therefore, the make up water requirement for the plant is proposed to be drawn from these sources.

1.04.00 **COAL AVAILABILITY AND TRANSPORTATION**

1.04.01 **Coal Availability**

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The coal requirement shall be about 2.7 Million tonnes per year.

The matter has been taken up with Ministry of Coal, Govt. of India for Long Term Coal Linkage for Stage-IV (1x500 MW)..Coal requirement for FGUTPP, Stage-I ,II & III is being met from North Karanpura Coal fields of CCL. For FR purposes, coal from North Karanpura Coal fields of CCL has been considered.

1.04.02 **Coal Transportation**

The envisaged mode of coal transportation from the coal mines to the power plant is by Indian Railways rakes. The rakes shall be unloaded at the track hopper.

1.04.03 **Coal Quality Parameters and Fuel Oil Characteristics**

The Coal quality parameters and Fuel Oil Characteristics are enclosed as **Annexures-II-1 and II-2** to this subsection.

1.05.00 **CAPACITY & POWER EVACUATION**

Stage- I	:	2x210 MW	Under Commercial Operation
Stage-II	:	2x210 MW	Under Commercial Operation
Stage-III	:	1x210 MW	Under Commercial Operation
Stage-IV		1x 500 MW	Present proposal

The existing capacity of plant is 1050 MW Step up/ power evacuation voltage for station is 220 KV. Presently 1000 MW is already being evacuated at 220 KV, addition of another 500 MW at 220 KV may cause overloading of 220 KV systems and lead to increase in fault levels at 220 KV system. Considering this 400 KV has been considered as step-up/power evacuation voltage for Stage-IV. Power Generated from FGUTPP- Stage IV, 500 MW unit would be stepped up to the evacuation voltage level through suitably rated Generator Transformer.

The power generated from Stage-IV is envisaged to be absorbed by Northern Region beneficiaries. For finalisation of Associated Transmission System (ATS) of the project, the matter would be taken up with Power Grid Corporation of India Ltd. (PGCIL)/CEA/appropriate authority depending on the various routes/options of power sale envisaged for the project.

1.06.00 **METEOROLOGICAL DATA**

Important meteorological data from nearest observatory at **Allahabad** is placed at **Annexure - III.**

1.07.00 **PLANT WATER SCHEME**

The Plant water scheme is described below.

1.07.01 **Source of Water**

The source of water for the project is normally from the Allahabad branch canal of the Sharda Sahayak link canal. During the canal closure period, water will be drawn from the Dalmau canal.

1.07.02 **Water Requirement**

Normal Make up water requirement for this project would be about 2000 Cu.M/hr with ash water re-circulation system in operation. However, whenever ash water system needs to be operated in once thru mode, water drawl shall be of the order of 3300 cum/hr.

1.07.03 **Raw Water System**

Raw water shall be drawn from the source by a gravity channel upto raw water pump house located inside the plant. It is envisaged to provide three (3) numbers (3 x 50 % Capacity) of raw water pumps for supplying water to Water PT Plant in the raw water pump house. In addition two (2) numbers (2 x 100% capacity) of pumps shall be provided to supply raw water for ash handling plant which shall be operated as and when required. Separate set of pipelines of carbon steel construction shall be provided from respective raw water pumps to Water treatment plant and Ash Water tanks.

1.07.04 The quality of Raw water and Clarified water is enclosed with this sub-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 in Sub-Section- D-01, Part-B, Section-VI, i.e. Technical Specification for Civil and Structural Works.

1.09.00 **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 Sub-Section- D-01, Part-B, Section-VI, i.e. Technical Specification for Civil and Structural Works.

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DESIGN RAW WATER ANALYSIS

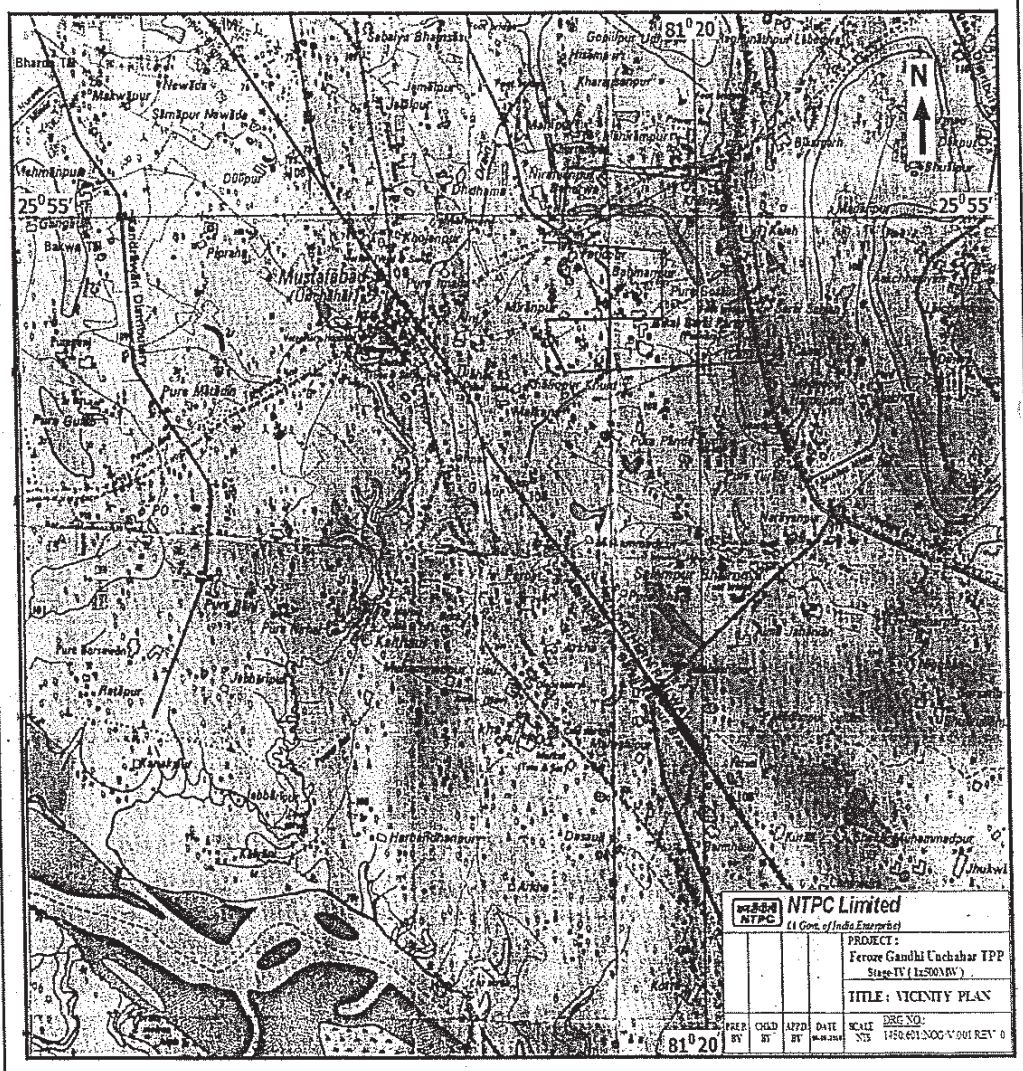
S.No	Constituent	As	mg/l
1	Calcium	CaCo3	110
2	Magnesium	CaCo3	95
3	Sodium+ Potassium	CaCo3	130
4	Total cations	CaCo3	335
5	Bicarbonates	CaCo3	250
6	Chloride	CaCo3	50
7	Sulphate	CaCo3	35
8	Total Anions	CaCo3	335
9	Silica	As SiO2	12
10	Iron	Fe	1
11	pH Value	-	7.7-8.3
12	Turbidity (NTU)	NTU	Upto 700
13	Organic Matter(As per KMnO4 method)	Number	7.2

DESIGN CLARIFIED WATER ANALYSIS FOR DM PLANT

S.No	Constituent	As	mg/l
1	Calcium	CaCo3	135.2
2	Magnesium	CaCo3	95
3	Sodium+ Potassium	CaCo3	130
4	Total cations	CaCo3	360.2
5	Bicarbonates	CaCo3	245.7
6	Chloride	CaCo3	57
7	Sulphate	CaCo3	57.5
8	Total Anions	CaCo3	360.2
9	Silica	As SiO2	12
10	Iron	Fe	0.3
11	pH Value	-	7.0-8.2
12	Turbidity (NTU)	NTU	10

VICINITY PLAN

ANNEXURE- I



ANNEXURE-II-1 (PAGE 1 OF 2)

TABLE – 1 COAL CHARACTERISTICS

Sl. No.	Description	Unit	Range of 95% coal Supplies			Range of Adequacy
			Design Coal	Worst Coal	Best Coal	
1	2	3	4	5	6	7
A.	**PROXIMATE ANALYSIS (As received basis)**					
1.	Total Moisture	%	13.00	15.00	10.00	16 - 9
2.	Ash	%	40.00	45.00	38.00	46 - 37
3.	Volatile matter	%	22.00	19.00	25.00	18 - 26
4.	Fixed carbon	%	25.00	21.00	27.00	20 - 28
B.	**ULTIMATE ANALYSIS (As received basis)**					
1.	Carbon	C%	34.6	30.00	40.39	29-41.39
2.	Hydrogen	H2%	3.1	2.42	3.2	2.32-3.3
3.	Nitrogen	N2%	1.2	0.47	0.63	0.37 – 0.73
4.	Oxygen	O2%	7.31	6.25	7.23	6.15 - 7.33
5.	Sulphur	S%	0.4	0.6	0.36	0.6 - 0.36
6.	Carbonates	CO3%	0.2	0.21	0.1	0.21 - 0.1
7.	Phosphorous	P2%	0.19	0.05	0.09	0.05 - 0.09
8.	Total Moisture	H2O%	13	15	10	15.3 – 9.7
9.	Ash	%	40	45	38	46-37
10.	Total	%	100	100	100	
11.	Gross Calorific Value	KCal/Kg	3400	3000	4000	2800 - 4200
12.	Hard grove index		55	50	60	48 – 62
C.	**ASH ANALYSIS**					
1.	Silica	(SiO2)%	58.58	59.15	58.1	59.15-58.1
2.	Alumina	(Al2O3)%	28.87	28.95	28.2	28.95-28.2
3.	Iron Oxide	(Fe2O3)%	5.5	6.9	4.5	6.9-4.5
4.	Titania	(TiO2)%	1.8	1.1	2.2	1.1 – 2.2

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Sl. No.	Description	Unit	Range of 95% coal Supplies			Range of Adequacy
			Design Coal	Worst Coal	Best Coal	
1	2	3	4	5	6	7
5.	Phosphoric Anhydride	(P2O5)%	0.7	0.5	1.2	0.5-1.2
6.	Lime	(CaO)%	1.5	1	2.35	1.0 – 2.35
7.	Magnesia	(MgO)%	1.3	1.1	1.4	1.1-1.4
8.	Sulphuric Anhydride	(SO3)%	0.5	0.4	0.6	0.4 - 0.6
9.	Alkalies (By diff.)	Na2O + K2O%	1.25	0.9	1.45	0.9 – 1.45
D.	**ASH FUSION RANGE (Under reducing atmosphere)**					
a)	Initial Deformation Temperature	(IDT) °C	1100	1100	1100	1100
b)	Hemispherical temperature	°C	1300	1300	1300	1300
c)	Fusion temperature	°C	1400	1400	1400	1400
E.	ASH FUSION RANGE (Under oxidising atmosphere)					
a)	Initial Deformation Temperature	(IDT) °C	1100	1100	1100	1100
b)	Hemispherical temperature	°C	1300	1300	1300	1300
c)	Fusion temperature	°C	1400	1400	1400	1400-1450

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ANNEXURE-II-2 (PAGE 1 OF 2)

FUEL OIL CHARACTERISTICS

Sl. No.	Characteristics	Heavy Furnace Oil Grade HV IS-1593-1982	Low Sulphur Heavy Stock (LSHS) IS-11489-1985	Heavy Petroleum Stock (HPS) IS-11489-1985
1.	Total sulphur content	4.5% Max.	1.0% Max.	4.5% Max.
2.	Gross calorific value (KCal/kg)	of the order of 10,000	of the order of 10,000	of the order of 10,000
3.	Flash Point (Min)	66 deg C	66 deg C	72 deg C
4.	Water content by volume (Max)	1.0%	1.0%	1.0%
5.	Sediment by weight (Max)	0.25%	0.25%	0.25%
6.	Asphaltene content by weight (Max.)	2.5%	2.5%	2.5%
7.	Kinematic viscosity in Centistokes at - (Max)	370 at 50deg C	100 at 100deg C	100 at 100deg C
8.	Ash Content by weight (Max.)	0.1%	0.1%	0.1%
9.	Acidity (inorganic)	Nil	Nil	Nil
10.	Pour Point (Max.)	57 deg C	66 deg C	72 deg C
11.	Sodium content	—	—	100 ppm
12.	Vanadium content	25 ppm	25 ppm	25 ppm
13.	Specific heat below pour point (KCal/Kg °C)		0.65	

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ANNEXURE-II-2 (PAGE 2 OF 2)

LIGHT DIESEL OIL CHARACTERISTICS

AS PER IS 1460-2000

Characteristics		LDO
1.	Pour Point (max)	21 °C & 12°C for Summer and Winter respectively
2.	Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.7
3.	Sediment percent by mass (max)	0.10
4.	Total sulphur percent by mass (max)	1.8
5.	Ash percentage by mass (max)	0.02
6.	Carbon residue (Rans 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°C	Not worse than No. 2
10.	Water content, % by volume (max)	0.25

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CLIMATOLOGICAL TABLE

ANNEXURE-III
(PAGE 1 OF 2)

जलवायवी सारणी
CLIMATOLOGICAL TABLE

इलाहाबाद :Allahabad | अक्षांश LAT 25°27′ N | देशांतर LONG 81°44′ E | समुद्री तल माध्य से ऊँचाई HEIGHT ABOVE M. S. L. 98 मीटर METRES

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

Month		स्टेशन का सतह दाब STATION LEVEL PRESSURE (एच.पी.ए. hPa)	शुष्क बल्ब DRY BULB (डि.से. °C)	नम बल्ब WET BULB (डि.से. °C)	दैनिक अधिक तम DAILY MAX (डि.से. °C)	दैनिक न्यून तम DAILY MIN (डि.से. °C)	माह में उच्चतम HIGHEST IN THE MONTH (डि.से. °C)	माह में निम्नतम LOWEST IN THE MONTH (डि.से. °C)	उच्चतम HIGHEST (डि.से. °C)	दिनांक और वर्ष DATE AND YEAR	निम्नतम LOWEST (डि.से. °C)	दिनांक और वर्ष DATE AND YEAR	सापेक्ष आर्द्रता RELATIVE HUMIDITY (प्रतिशत %)	वाष्प दाब VAPOUR PRESSURE (एच.पी.ए. hPa)	समस्त मेघ ALL CLOUDS (आकाश के अष्टमांश Oktas of sky)	निम्न मेघ LOW CLOUDS (आकाश के अष्टमांश Oktas of sky)	मासिक योग MONTHLY TOTAL (मि.मि. mm)	वर्षा के दिनों की संख्या NO. OF RAINY DAYS	वर्षसहित सबसे नम महीने का योग TOTAL IN WETTEST MONTH WITH YEAR (मि.मि. mm)	वर्षसहित शुष्कतम महीने का योग TOTAL IN DRIEST MONTH WITH YEAR (मि.मि. mm)	24 घंटों की सबसे भारी वर्षा HEAVIEST FALL IN 24 HOURS (मि.मि. mm)	दिनांक और वर्ष DATE AND YEAR	माध्य पवन गति MEAN WIND SPEED (कि.मी. प्र. घं. Kmph)
		वायु तापमान AIR TEMPERATURE: माध्य MEAN							चरम EXTREMES				आर्द्रता HUMIDITY		मेघ की मात्रा CLOUD AMOUNT		वर्षा RAINFALL						
[illegible]	I	1006.2	12.5	10.6	23.6	8.7	27.9	4.5	31.1	29 1934	2.0	07 1972	78	11.3	2.1	0.7	19.2	1.6	126.0 1900	0.0	70.9	24 1900	3.4
	II	1003.1	20.6	15.0									53	12.7	2.0	0.5							
[illegible]	I	1003.8	16.0	12.6	27.2	11.2	32.4	6.1	30.1	27 1896	1.1	02 1905	66	11.9	1.7	0.6	15.6	1.4	103.9 1920	0.0	51.3	11 1898	4.1
	II	1000.6	24.8	16.6									40	12.1	1.9	0.6							
[illegible]	I	1000.8	23.8	16.0	33.6	10.5	39.0	10.9	42.5	30 1973	7.2	02 1900	46	12.6	1.8	0.4	9.2	0.9	81.0 1944	0.0	35.6	11 1978	4.8
	II	996.9	31.4	18.8									26	10.8	2.0	0.5							
[illegible]	I	996.5	30.2	19.1	39.4	22.5	43.5	17.3	45.1	29 1979	12.7	01 1965	32	13.1	1.5	0.2	5.7	0.6	43.7 1933	0.0	20.8	01 1985	5.9
	II	992.3	37.3	20.5									18	10.6	1.9	0.5							
[illegible]	I	991.0	33.6	22.2	42.3	26.7	49.0	22.5	47.3	20 1960	17.2	11 1924	36	17.4	1.4	0.5	9.9	0.7	62.3 1971	0.0	54.0	18 1971	7.0
	II	987.4	40.1	22.0									20	13.6	1.5	0.6							
[illegible]	I	988.0	32.8	25.3	40.1	28.5	45.2	24.0	48.8	08 1979	19.4	21 1930	55	25.0	3.8	1.4	95.4	4.4	526.5 1918	0.0	176.0	23 1916	8.0
	II	984.2	37.3	25.6									41	23.2	4.2	2.1							
[illegible]	I	988.0	29.2	26.4	34.1	26.4	39.3	23.5	45.6	01 1901	22.0	22 1975	80	32.1	6.4	3.6	300.1	12.8	702.1 1925	26.2 1918	229.4	15 1963	7.4
	II	985.0	31.5	27.0									71	32.0	6.5	3.7							
[illegible]	I	989.7	28.3	26.3	32.7	25.7	30.5	23.6	42.7	03 1972	21.1	23 1953	85	32.5	6.6	3.9	307.6	14.4	914.7 1953	53.3 1903	335.3	20 1953	6.2
	II	986.5	30.2	26.9									77	32.7	6.6	3.8							
[illegible]	I	993.0	28.2	25.5	33.2	24.7	38.2	22.3	39.6	11 1960	18.3	22 1912	80	30.4	4.8	2.8	189.8	8.7	781.5 1970	0.5 1907	206.2	04 1936	5.7
	II	990.6	30.4	26.1									71	30.4	5.0	2.9							
[illegible]	I	1000.0	25.9	21.6	33.1	20.5	35.8	15.9	40.6	03 1898	11.7	31 1898	69	23.1	1.9	0.8	40.1	2.2	576.8 1894	0.0	160.3	04 1894	3.4
	II	996.7	29.7	22.9									55	22.5	2.0	1.0							
[illegible]	I	1004.0	19.8	15.8	29.7	13.8	32.7	9.6	35.9	07 1965	5.6	30 1941	85	15.0	1.3	0.2	11.7	0.5	110.1 1956	0.0	96.0	01 1956	2.4
	II	1001.4	25.2	18.4									49	15.8	1.4	0.3							
[illegible]	I	1006.6	14.0	11.7	24.8	9.3	28.4	6.3	31.1	02 1946	-0.7	26 1981	75	12.1	1.6	0.3	3.4	0.6	66.3 1885	0.0	54.8	11 1886	2.6
	II	1003.8	20.7	15.6									50	13.8	1.7	0.3							
[illegible] ...YR	I	997.6	24.5	19.4	32.8	19.5	46.1	3.0	48.8		-0.7		64	19.8	2.0	1.3	1017.7	48.8	1835.5	410.5	335.3		* 6.1
	II	994.0	29.9	21.3									40	19.2	3.1	1.4			1894	1968			
[illegible] ...ARS	I	30	30	30	30	30	30	30	100		100		30	30	30	21	29	29	99	99	99		24
	II	30	30	30									30	30	30	21							

CLIMATOLOGICAL TABLE

ANNEXURE-III (PAGE 2 OF 2)

जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्टेशन : इलाहाबाद
STATION : Allahabad

मौसम परिघटना / WEATHER PHENOMENA — के साथ दिनों की संख्या / No. OF DAYS WITH

माह MONTH	वर्षा 0.3 मि.मि.या अधिक PPT 0.3mm or more	ओले HAIL	गर्जन THUNDER	कुहरा FOG	धूल भरी आंधी DUST STORM	चंड वात SQUALL
जनवरी JAN	3.0	0.2	1.3	4.6	0.1	0.1
फरवरी FEB	2.8	0.1	2.3	1.3	0.0	0.2
मार्च MAR	1.7	0.0	2.0	0.1	0.4	0.7
अप्रैल APR	1.0	0.1	2.3	0.0	0.9	0.4
मई MAY	1.3	0.0	2.7	0.0	1.5	0.5
जून JUN	6.5	0.0	0.0	0.0	2.7	1.1
जुलाई JUL	16.8	0.0	12.0	0.0	0.2	0.4
अगस्त AUG	18.2	0.0	12.0	0.0	0.5	0.4
सितम्बर SEP	11.5	0.0	8.4	0.1	0.0	0.6
अक्तूबर OCT	3.5	0.0	2.7	0.4	0.1	0.2
नवम्बर NOV	0.8	0.0	0.2	0.4	0.0	0.0
दिसम्बर DEC	0.9	0.0	0.4	3.7	0.0	0.0
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	68.0	0.4	55.2	10.5	6.4	4.6
वर्षों की सं. NUMBER OF YEARS			26			

पवन / WIND

माह MONTH		No. OF DAYS WITH WIND SPEED (Km. p. h.) 62 or more	20-61	1-19	0	PERCENTAGE No. OF DAYS WIND FROM N	NE	E	SE	S	SW	W	NW	CALM
जनवरी JAN	I	0	0	19	12	2	5	9	4	5	10	25	3	31
	II	0	0	18	13	8	11	8	2	0	1	21	16	35
फरवरी FEB	I	0	0	19	9	4	4	6	4	4	18	29	5	26
	II	0	1	22	5	0	9	5	1	2	2	31	25	16
मार्च MAR	I	0	1	25	5	4	4	6	5	6	19	30	7	15
	II	0	2	26	3	12	6	3	1	1	2	29	38	8
अप्रैल APR	I	0	2	24	4	2	6	10	6	8	16	32	10	11
	II	0	4	24	2	13	6	3	1	1	2	26	45	2
मई MAY	I	0	2	24	5	8	10	19	8	5	9	27	9	11
	II	0	3	26	2	18	15	5	1	2	3	18	30	2
जून JUN	I	0	4	23	3	3	11	21	6	5	12	25	9	8
	II	0	5	24	1	12	19	14	3	3	6	18	21	4
जुलाई JUL	I	0	3	25	3	2	8	23	6	10	17	21	4	9
	II	0	2	25	4	5	12	16	6	8	13	20	8	10
अगस्त AUG	I	0	2	25	4	2	9	23	7	7	12	19	6	15
	II	0	1	25	5	7	14	17	4	6	9	23	8	13
सितम्बर SEP	I	0	2	24	4	4	9	20	0	6	11	23	7	14
	II	0	1	22	7	10	13	16	3	2	6	17	15	16
अक्तूबर OCT	I	0	0	20	11	3	7	10	6	8	10	20	6	32
	II	0	1	14	16	11	9	7	1	0	2	7	14	49
नवम्बर NOV	I	0	0	15	15	2	3	3	3	3	11	28	5	42
	II	0	0	10	20	9	4	2	0	0	0	8	12	65
दिसम्बर DEC	I	0	0	17	14	1	2	6	2	3	13	29	3	42
	II	0	0	10	21	0	8	4	0	0	0	12	9	63
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I	0	16	260	89	3	8	13	5	6	14	26	8	21
	II	0	20	246	99	10	11	8	2	2	4	19	21	23
वर्षों की सं. NUMBER OF YEARS	I	24				30								
	II	24				30								

मेघ / CLOUD

माह MONTH		No. OF DAYS WITH CLOUD AMOUNT (ALL CLOUDS) OKTAS 0	T-2	3-5	6-7	8	No. OF DAYS WITH LOW CLOUD AMOUNT OKTAS 0	T-2	3-5	6-7	8	FOG 8
जनवरी JAN	I	16	6	4	3	3	25	2	2	1	1	0
	II	15	7	4	4	1	24	4	2	1	0	0
फरवरी FEB	I	16	4	4	3	1	23	2	2	1	0	0
	II	15	5	4	3	1	22	3	2	1	0	0
मार्च MAR	I	16	6	5	3	1	26	3	2	0	0	0
	II	14	6	5	5	1	25	4	2	0	0	0
अप्रैल APR	I	18	5	4	3	0	27	2	1	0	0	0
	II	15	6	5	3	1	23	6	2	0	0	0
मई MAY	I	18	6	4	3	0	26	3	2	0	0	0
	II	9	10	6	4	2	20	6	5	0	0	0
जून JUN	I	7	5	7	7	4	15	7	5	2	1	0
	II	0	4	10	11	5	10	9	10	1	0	0
जुलाई JUL	I	0	2	5	13	11	5	7	11	7	1	0
	II	0	1	5	16	9	1	7	17	5	1	0
अगस्त AUG	I	0	1	4	15	11	4	5	12	9	1	0
	II	1	0	5	16	8	1	7	17	5	1	0
सितम्बर SEP	I	4	4	6	10	6	9	6	8	6	1	0
	II	2	4	8	11	5	3	10	12	4	1	0
अक्तूबर OCT	I	16	6	4	3	2	24	3	3	1	0	0
	II	12	9	5	3	2	16	10	4	1	0	0
नवम्बर NOV	I	19	5	3	2	1	28	1	1	0	0	0
	II	17	7	3	2	1	27	2	1	0	0	0
दिसम्बर DEC	I	19	5	3	3	1	29	1	1	0	0	0
	II	16	7	4	3	1	28	2	1	0	0	0
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I	149	64	53	68	41	241	42	50	27	5	0
	II	118	68	64	61	38	200	69	75	18	3	0
वर्षों की सं. NUMBER OF YEARS	I	27					27					
	II	27					27					

दृश्यता / VISIBILITY — दृश्यता सहित दिनों की संख्या / No. OF DAYS WITH VISIBILITY

माह MONTH		UPTO 1 Km	1-4 Kms	4-10 Kms	10-20 Kms	OVER 20 Kms
जनवरी JAN	I	1.8	12.7	14.8	0.5	1.2
	II	0.1	2.0	26.9	2.0	0.0
फरवरी FEB	I	0.6	6.3	20.7	0.4	0.0
	II	0.0	1.3	20.3	5.2	1.2
मार्च MAR	I	0.0	2.0	27.0	2.0	0.0
	II	0.0	1.3	21.0	0.7	0.0
अप्रैल APR	I	0.0	3.0	24.7	2.3	0.0
	II	0.0	1.0	22.5	5.0	0.6
मई MAY	I	0.0	3.7	22.5	3.6	1.2
	II	0.1	3.6	23.8	3.5	0.0
जून JUN	I	0.1	2.2	24.7	3.0	0.0
	II	0.3	3.1	23.1	3.5	0.0
जुलाई JUL	I	0.0	0.9	24.5	5.6	0.0
	II	0.2	1.8	22.1	6.9	0.0
अगस्त AUG	I	0.0	1.3	23.1	6.4	0.2
	II	0.0	0.9	19.6	10.4	0.1
सितम्बर SEP	I	0.0	0.8	21.7	7.3	0.2
	II	0.0	0.8	17.5	10.6	1.1
अक्तूबर OCT	I	0.0	1.2	23.7	6.1	0.0
	II	0.0	0.2	21.2	8.9	0.7
नवम्बर NOV	I	0.0	7.6	21.5	0.9	0.0
	II	0.0	1.3	26.5	2.2	0.0
दिसम्बर DEC	I	1.3	15.7	13.0	0.1	0.0
	II	0.0	2.9	25.0	2.2	0.0
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I	3.8	67.4	282.0	39.2	2.0
	II	0.7	21.1	270.4	69.1	3.7
वर्षों की सं. NUMBER OF YEARS	I	27				
	II	27				

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ANNEXURE - EQ

CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

All structures shall be designed for seismic forces adopting the site specific seismic information provided in this document and using the other provisions in accordance with IS:1893 (Part 1):2002. Pending finalisation of Parts 2 to 5 of IS:1893, provisions of part 1 shall be read along with the relevant clauses of IS:1893:1984, for structures other than the buildings.

A site specific seismic study has been conducted for the project site. The peak ground horizontal acceleration for the project site, the site specific acceleration spectral coefficients (in units of gravity acceleration 'g') in the horizontal direction for the various damping values and the multiplying factor (to be used over the spectral coefficients) for evaluating the design acceleration spectra are as given at Annexure-EQ1.

Vertical acceleration spectral values shall be taken as 2/3rd of the corresponding horizontal values.

The site specific design acceleration spectra shall be used in place of the response acceleration spectra, given at figure-2 in IS:1893 (Part 1). The site specific acceleration spectra along with multiplying factors specified in Annexure-EQ1 includes the effect of the seismic environment of the site, the importance factor related to the structures and the response reduction factor. Hence, the design spectra do not require any further consideration of the zone factor (Z), the importance factor (I) and response reduction factor (R) as used in the IS:1893 (Part 1).

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

a)	Steel structures	:	2%
b)	Concrete structures and brick structures in cement mortar	:	5%
c)	Concrete Stacks / ND Cooling Towers	:	2%
d)	Steel stacks	:	As per IS:6533 & CICIND Model Code, whichever is more critical.

Method of Analysis

Since most structures in a power plant are irregular in shape and have irregular distribution of mass and stiffness, dynamic analysis for obtaining the design seismic forces shall be carried out using the response spectrum method. The number of vibration modes used in the analysis should be such that the sum total of modal masses of all modes considered is at least 90 percent of the total seismic mass and shall also meet requirements of IS:1893 (Part 1). Modal combination of the peak response quantities shall be performed as per Complete Quadratic Combination (CQC) method or by an acceptable alternative as per IS:1893 (Part 1).

If the design base shear (V_B) , obtained from modal combination, is less than the base shear ($\bar{V}_B$), computed using the approximate fundamental period (T_a) given in IS:1893:Part 1 and using site specific acceleration spectra with appropriate multiplying factor, the response quantities (e.g. member forces, displacements, storey forces, storey shears and base reactions) shall be enhanced in the ratio of $\bar{V}_B / V_B$. However, no reduction is permitted if $\bar{V}_B$ is less than V_B.

For building less than 12m in height, design seismic base shear and its distribution to different floor levels along the height of the building may be carried out as specified under clause 7.5, 7.6 & 7.7 of IS:1893 (Part 1) and using site specific design acceleration spectra. The design horizontal acceleration spectrum value (A_h) shall be computed for the fundamental natural period as per clause 7.6 of IS:1893 (Part 1) using site specific spectral acceleration coefficients with appropriate multiplying factor given in Annexure-EQ1.

Further, the spectral acceleration coefficient shall get restricted to the peak spectral value if the fundamental natural period of the structure falls to the left of the peak in the spectral acceleration curve.

Design/Detailing for Ductility

The site specific design acceleration spectra is a reduced spectra and has an in-built allowance for ductility. Structures shall be engineered and detailed in accordance with relevant Indian/International standards to achieve ductility.

ANNEXURE – EQ1

SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT

The various site specific seismic parameters for the project site shall be as follows:

1)	Peak ground horizontal acceleration	: 0.26g
2)	Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') to obtain the design acceleration spectra	
a)	for moment resisting steel frames designed and detailed as per IS:800 and moment resisting RC frames designed and detailed as per IS:456	: 0.091
b)	for braced steel frames designed and detailed as per IS:800	: 0.068
c)	for moment resisting RC frames designed and detailed as per IS:456 and IS:13920	: 0.055
d)	for design of structures not covered under 2 (a) to 2 (c) above and under 3 below	: 0.091
3)	Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') for design of equipment and structures where inelastic action is not relevant or not permitted	: 0.13

Note: g = Acceleration due to gravity

The horizontal seismic acceleration spectral coefficients are furnished in subsequent pages.

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
In units of 'g'

Time Period (Sec)	Damping Factor (as a percentage of critical damping)	
	2%	5%
0.000	1.000	1.000
0.030	1.000	1.000
0.050	1.645	1.445
0.100	3.231	2.379
0.120	3.868	2.713
0.123	3.868	2.755
0.125	3.868	2.755
0.150	3.868	2.755
0.200	3.868	2.755
0.250	3.868	2.755
0.300	3.868	2.755
0.350	3.868	2.755
0.400	3.868	2.755
0.450	3.868	2.755
0.500	3.868	2.755
0.550	3.868	2.755
0.561	3.868	2.755
0.598	3.868	2.755
0.602	3.868	2.755
0.613	3.795	2.755
0.630	3.695	2.683
0.650	3.582	2.600
0.675	3.449	2.504
0.700	3.326	2.414
0.750	3.104	2.253
0.800	2.910	2.113
0.850	2.739	1.988
0.900	2.587	1.878
0.950	2.451	1.779
1.000	2.328	1.690
1.050	2.217	1.610
1.100	2.116	1.536
1.150	2.024	1.470
1.200	1.940	1.408
1.250	1.862	1.352

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
In units of 'g'

Time Period (Sec)	Damping Factor (as a percentage of critical damping)	
	2%	5%
1.300	1.791	1.300
1.350	1.724	1.252
1.400	1.663	1.207
1.450	1.606	1.166
1.500	1.552	1.127
1.550	1.502	1.090
1.600	1.455	1.056
1.650	1.411	1.024
1.700	1.369	0.994
1.750	1.330	0.966
1.800	1.293	0.939
1.850	1.258	0.914
1.900	1.225	0.889
1.950	1.194	0.867
2.000	1.164	0.845
2.050	1.136	0.824
2.100	1.109	0.805
2.150	1.083	0.786
2.200	1.058	0.768
2.250	1.035	0.751
2.300	1.012	0.735
2.350	0.991	0.719
2.400	0.970	0.704
2.450	0.950	0.690
2.500	0.931	0.676
2.550	0.913	0.663
2.600	0.895	0.650
2.650	0.878	0.638
2.700	0.862	0.626
2.750	0.847	0.615
2.800	0.831	0.604
2.850	0.817	0.593
2.900	0.803	0.583
2.950	0.789	0.573
3.000	0.776	0.563
3.050	0.763	0.554

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
In units of 'g'

Time Period (Sec)	Damping Factor (as a percentage of critical damping)	
	2%	5%
3.100	0.751	0.545
3.150	0.739	0.537
3.200	0.728	0.528
3.250	0.716	0.520
3.300	0.705	0.512
3.350	0.695	0.504
3.400	0.685	0.497
3.450	0.675	0.490
3.500	0.665	0.483
3.550	0.656	0.476
3.600	0.647	0.469
3.650	0.638	0.463
3.700	0.629	0.457
3.750	0.621	0.451
3.800	0.613	0.445
3.850	0.605	0.439
3.900	0.597	0.433
3.950	0.589	0.428
4.000	0.582	0.423

VOLUME-II B

SECTION – C

SPECIFIC TECHNICAL REQUIREMENTS

1.0 SCOPE OF WORK

Design, engineering, manufacture, inspection and testing at vendor's/ sub-vendor's works, painting, forwarding, proper packing, shipment and delivery at site, unloading, handling & transportation at site, Erection & Commissioning, structural & minor civil works as required, Performance and guarantee testing and handing over of Mill Reject Handling System as per details in different sections of this specification.

Detailed system write-up & control philosophy shall be furnished by the successful bidder during detail engineering & the same shall be subject to customer approval during detail engineering.

1.1 SCOPE OF SUPPLY

Scope of supply shall comprise of but not necessarily limited to the following:

a) 9 nos. of pneumatic Cylinder operated knife gate valve (200 Nb) with open and close limit switches at mill outlet/pyrite hopper inlet.

b) 9 nos. of pyrite hoppers complete with sizing grid, flexible/expansion joint at its inlet, rupture disc, by pass chute, oversize material chute, water spray nozzles & supporting structures with approach platform.

c) 18 nos. (2 Nos. per pyrite hopper) of Level probes for pyrite hoppers.

d) 9 nos. of Temperature Switches for pyrite hoppers.

e) 9 nos. of manual operated knife gate valve (200 Nb) at pyrite hopper outlet for pyrite hopper isolation.

f) 9 nos. of pneumatic operated knife gate valve (200 Nb) at oversize discharge chute of pyrite hopper provided with open & close limit switches for interlock with pyrite hopper inlet knife gate valve.

g) 9 nos. of pneumatic Cylinder operated knife gate valve (200 Nb) at by pass chute of pyrite hopper provided with open & close limit switches for interlock with pyrite hopper inlet knife gate valve.

h) 9 nos. of transporter vessel / denseveyor complete with pneumatically operated dome/ material handling valve, Alloy CI outlet bend, local control panel etc.

i) 9 sets of MS ERW Heavy grade pipe for mill reject conveying from denseveyor/ transporter vessel to Mill Reject Storage bunker.

j) One lot of Alloy CI bends (400BHN).

k) As per layout requirement (min. 2Nos.) terminal boxes with up stand on bunker top for terminating the reject convening pipes.

l) One (1) no. mill reject bunker of 90T capacity along with structure, complete with SS-304 lining and lever operated bunker discharge gate with telescopic chute at bunker outlet , staircase, operating & maintenance platform, hand railing , bag filter, level probe(RF type level Probe), pressure relieve valve, chain pulley block with traveling trolley and monorail

arrangement etc. Refer Cl.No.3.03.04 of NTPC's Section VI, Part-B (Sub-section D-01, Civil Works) attached with this specification.

m) 2 nos. (1W+1S) microprocessor/PLC based non lubricated reciprocating type skid mounted air compressor with drive motor, instruments and all other accessories.

n) Three (3) nos. air receivers complete with drain traps, safety relief valve, instruments and all accessories.

o) Two (2) Nos. fixed type sump pump complete with discharge hose (min 10 m long) for pumping out water drains from local pit to nearest plant drain, control panel, instruments and all other accessories.

p) 1 lot of piping , fittings, valves & instruments for conveying air, instrument air, cooling water for dome valve top plate (if applicable), cooling water quenching in the pyrite hopper, cooling water for air compressor etc

q) 1 lot of Local Control Panel/pneumatic panels/JBs (1 no. for each pyrite hopper) properly mounted on rack. (supplier's scope)

r) 1 lot of insulation & cladding, if required, to maintain surface temperature of pyrite hopper within 60° C

s) All structures including pipe cum cable rack required for supporting of various pipes in bidder's scope. Bidder may take support from existing mill bunker bay structures wherever possible.

t) All insert plates, embedment plates, foundation bolts/ anchor bolts etc. required for bidder's equipment.

u) Initial charge of all lubricants and fluids.

v) Electrical and C&I scope as per enclosure elsewhere in the specification.

w) One set of Erection & commissioning spares as required for the complete system.

x) One set of mandatory spares as per annexure VII.

y) One set of maintenance tools & tackles, if any. These tools shall not be used for erection/ commissioning purposes and shall be in an unused and new condition when they are handed over to the customer at site. Each tool shall be stamped so as to be identified easily for its use. The tools shall be supplied in a steel toolbox.

z) All counter- flanges with nuts, bolts and gaskets at all the terminal points.

aa) Relevant scope of supply as per GTR, GCC & SCC.

bb) Any other instrument, item required for making the installation complete in all respect within battery limits and for satisfactory operation of the system, unless specifically EXCLUDED from scope under Clause No. 2.0 below.

cc) DCS based control system as specified in C&I specification.(DCS is not in bidders scope)

1.2 SCOPE OF SERVICES

Scope of services shall include but not necessarily limited to the following:

a) Unloading, Storage, handling and transportation at site

b) Minor civil work like pinning, chipping of foundation, grouting etc.

c) Pre-Commissioning work such as flushing, hydraulic testing etc. Necessary instrumentation for pre-commissioning activities shall be arranged by the successful bidder at their own cost.

d) Erection & Commissioning of Mill Reject Handling System.

e) Inspection & testing, PG test/Functional Guarantee (FG) test

f) Painting of all equipment within the battery limit

g) Electrical scope of services as per enclosure elsewhere in the specification

h) Preparation of Civil input drawings & documents for foundation details (including load data, GA, foundation pocket details etc.) of storage bunkers/silos, compressors, air receivers, pipe rack and pit / trench details for denseveyor / transporter vessel and reject conveying pipes.

i) Review of Civil drawings prepared by BHEL based on civil input drawing furnished by the successful bidder.

j) Preparation of all necessary drawings/data/ documents for obtaining necessary approval of statutory authorities on behalf of the customer. Necessary fee for obtaining such approval shall also be borne by the bidder.

k) Relevant scope of services as per GTR, GCC, ECC & SCC.

l) Any other service required for making the installation complete in all respect within battery limits and for satisfactory erection & commissioning of the system, unless specifically EXCLUDED from scope under Clause .No. 2.0 below.

2.0 EXCLUSION

a) Civil work for Mill Reject Handling system including
   i) Road approach for various facilities related to Mill Reject Handling System.
   ii) Denseveyor/ Transporter vessel foundation
   iii) Pit & Trench as required in mill bay
   iv) Mill Reject compressor & Air receiver foundation
   v) Mill Reject bunker foundation
   vi) Various cable trenches, pipe pedestals & pipe rack foundation.

However, location, sizing and loads and any other input related to above as applicable for above shall be given by the successful bidder within 8 weeks of placement of LOI.

b) Fire Protection system for compressor house

c) Lighting of Mill bay, Compressor house & bunker area

d) Electrical exclusion as per Electrical scope sheet enclosed elsewhere in the specification

e) Relevant exclusion as per GTR, GCC, SCC & ECC.

3.0 SERVICES TO BE PROVIDED BY THE CUSTOMER

(A) **Instrument air:** Tapping terminated with an isolation valve for Instrument air shall be provided at first column of each bunker bay at pressure of 5-7 Kg/Sq cm.

(B) **Service water:** Tapping terminated with an isolation valve for service water shall be provided at first column of each bunker bay at pressure of 2.5-3 Kg/ Sq. cm.

(C) **Equipment Cooling Water**: Water: Supply and return water Tapping terminated with an isolation valve for ECW circuit. Equipment water shall be provided at 5m from compressor House at a pressure of 5 Kg/ sq. cm (Approx). Pressure drop & temperature rise shall be of 10 MWC & 10 degree respectively across the compressor.

4.0 TERMINAL POINT

Mill Reject inlet towards pyrite hopper side	:	Mill reject spout (tramp iron) as per details indicated in enclosed GA of Mills. Work downstream up to mill reject bunker outlet with canvas chute and discharge gate is by bidder.
Mill Reject outlet towards road tanker	:	Mill reject bunker outlet with canvas chute. Bidder shall terminate his work with the canvas chute and lever operated discharge gate.
Cooling water (ACW)	:	At Inlet & Outlet header at distance of 5m from Main compressor house (Location)
Service Water	:	At First Col of each mill bay
Instrument Air	:	At First Col of each mill bay.

5.0 PERFORMANCE /FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES

PG /FG test shall comprise of

Category – I Guarantees (Liquidated damages are applicable for these guarantees).

i) Guaranteed auxiliary power consumption for each conveying air compressor at its rated duty point (refer Annex-V of suggestive price format- Vol III)
If the contractor is not able to demonstrate the guarantees, CLIENT/ BHEL will have the right to Reject the equipment / system / plant and recover the payments already made or accept the equipment / system after levying liquidated damages.

Category – III Guarantees

i) Continuous effective discharge and conveying at the rated capacity of the mill rejects without spillage or blockage in the system.
ii) Capacity and discharge pressure of each air compressor

iii) Particulate emission rate from bag filters less than 50 mg/nm^3 of air shall be demonstrated at site

iv) Vibration and noise level of each compressor and any other rotating equipment shall be demonstrated at site.

All the plant, equipment and systems covered under this specification shall perform continuously without exceeding the noise level over the entire range of output and operating frequency.

Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 651 or BS 5969 or IS 9779.

The equivalent 'A' weighted sound pressure level measured at a height of 1.5 m above floor level in elevation and at a distance of one (1) metre horizontally from the nearest surface of any equipment / machine, furnished and installed under these specifications, expressed in decibels to a reference of 0.0002 microbar, shall not exceed 85 dBA

A minimum of 6 points around each equipment shall be covered for measurement. Additional measurement points shall be considered based on the applicable standards and the size of the equipment. The measurement shall be done with slow response on the A - weighting scale. The average of A-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar, shall not exceed the guaranteed value. Corrections for background noise shall be considered in line with the applicable standards. All the necessary data for determining these corrections, in line with the applicable standards, shall be collected during the tests.

In case during test it is found that the equipment/system has failed to meet the guarantees, the contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer. However, if the contractor is not able to demonstrate the guarantees, even after the above modifications/replacements within a reasonable period allowed by CLIENT/BHEL, after the tests have been completed, CLIENT/BHEL will have the right to Reject the equipment / system / plant and recover the payments already made or accept the equipment / system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by Client/BHEL.

6.0 ERECTION, PRE-OPERATIONAL TESTING/STARTUP & COMMISSIONING PROCEDURE

This shall be as furnished by the successful bidder during detail engineering for customer's review and acceptance.

7.0 PAINTING / CORROSION PROTECTION REQUIREMENT

Successful bidder shall furnish detailed Painting Schedule for Mill Reject System (based on painting schedule attached with specification elsewhere) for customer / client approval during detail engineering

8.0 LAYOUT REQUIREMENTS

Piping and equipment installation shall be according to the regulations and recommendations of recognized Indian / International Standards, Codes and Statutes, as and where applicable, practice in vogue (to be supported with back up document to the satisfaction of customer)

The mill reject compressors will be located in Main Plant Compressor room. Area required for locating the same shall be indicated by the bidder in their bid.

9.0 EQUIPMENT DESIGN CRITERIA

9.0.1 The minimum design criteria to be followed for various equipment shall be as per requirements indicated under Annexure-II, standard technical specifications & Data Sheet-A for Mill Reject Handling System. In case of *any contradictory requirement* in specification of particular equipment, the requirement given in section C shall prevail over those indicated in Section-D. Further in case of any contradictory requirement within the same section and clarifications not having been sought by the bidders wrt the same within the stipulated period, the most stringent requirement as per interpretation of the customer will prevail. Successful bidder will furnish detailed data sheets/ specifications/design calculations for various equipment for customer / consultant's approval during detail engineering. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.

9.0.2 Technical details (constructional features, MOC etc) of non-lubricated reciprocating conveying air compressor, if being offered by any of the bidders, shall be finalized during detail engineering and the same shall be subject to customer's /client's acceptance without any commercial implication.

9.0.3 Properties of Mill Rejects to be considered for sizing /selection /design of various equipments shall be as follows:

Normal size	:	(-) 25 mm (about 80% of total reject)
Maximum size to be handled pneumatically	:	40 mm (about 10% of total reject)
Maximum size rejected by mill	:	50 mm (about 10% of total reject)
Temperature °C (Normal/Design)	:	180/200 (**)
Bulk density	:	1.6 T/m3 for volumetric calculation
	:	2.4 T/m3 for structural calculation

(**) Note: Mill Reject System design shall also consider the presence of occasional burning coal particles along with the rejects, which would increase the reject temperature.

Note: All pipe sizing and equipment sizing, capacity of pyrite hopper and pyrite vessel shall be subject to customer's approval during detail engineering without any cost implication to the customer.

10.0 QUALITY PLANS, INSPECTION & TESTING PROCEDURE

All QPs / CLs shall be submitted by the bidder for Customer/Consultant's review and approval. All comments made by customer/ consultant shall be incorporated by the successful bidder without any commercial and delivery implication.

11.0 DRAWINGS/ DOCUMENTS REQUIRED WITH THE BID

The drawings and documents to be submitted with the bid shall strictly be as per clause 15.0.1 below. Any documents other than those indicated therein will not be reviewed and will not form part of contract.

12.0 DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

The tentative list of drawings and documents required during detail engineering shall be minimum as per clause 15.0.2 below. The list, however, will be finalized with the successful bidder prior to start of detail engineering.

13.0 DRAWING/DOCUMENT DISTRIBUTION SCHEDULE

Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc 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)"
- DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.
- For quick access bidder may refer the link http://bhelpem.com/DMSManuals/DMSManuals.html

For final distribution of O&M manual, 20 print sets and 3 CDs are required.

14.0 DRAWINGS ENCLOSED WITH THE SPECIFICATION

The following drawings/ sketches enclosed will form part of the specification.

a) Flow Diagram - Mill Reject Handling System
b) Main Equipment Plan
c) General Arrangement of XRP 1003MILL (with planetary gear box)
d) Tentative Compressor House Drawing

The flow diagram shows the minimum requirement to be followed including minimum requirement of instruments. Any additional equipment/instruments required for safe, efficient & reliable operation of the system within the battery limit shall also be considered as included in

bidder's scope without any commercial/ cost implication to BHEL.

15.0.1 LIST OF DRAWINGS / DOCUMENTS TO BE FURNISHED ALONG WITH OFFER

Refer Volume III – Annexure VI

15.0.2 LIST OF DRAWING/DOCUMENTS TO BE FURNISHED AFTER PLACEMENT OF LOI

Refer Volume III – Annexure VII

MILL REJECT HANDLING SYSTEM

1.00.00 To handle the mill rejects on a continuous basis, the bidder shall include a mill reject handling system in his offer. The mill reject handling system shall comprise a pneumatic conveying system. The rejects shall be stored in a storage silo having 16 hours storage capacity. ***From storage silo*** the mill rejects shall be disposed off in trucks.

1.01.00 The scope of supply for mill reject handling system shall include but not limited to the following:

i) One (1) no. pyrite hopper discharge chute with liners, emergency discharge outlet with gate, oversize bypass outlet with gate, etc. for each mill.

ii) One (1) no. pneumatically operated isolation gate at inlet and one (1 no.) manually operated isolation gate at outlet of pyrite hoppers complete with compressed air pipe work, solenoid valves & supporting arrangement for each pyrite hopper.

iii) Conveying pipe work from individual mill reject handling equipment to the reject storage hopper with all accessories such as bends, fittings, flange joints, structural steel supports, anchors/inserts, trestles, walkways etc. as required.

iv) One (1) no. mill reject storage silo in steel construction each having an effective storage capacity of sixteen (16) hrs. Necessary supporting steel structure, platforms, staircase, manual operated unloading gate, 3 mm thick SS plate liners level switches, air relief devices, etc. shall also be provided.

The storage silos shall be designed to provide a clear access of 4.5 m for a Road Tanker/Trucks to come under the silo & receive the rejects using telescopic chute.

v) Suitable spray quenching system, to cool the mill reject in pyrite hoppers.

vi) Two nos. (1 no. working + 1 no. stand by) air compressors ***with drive motors*** to cater the conveying air requirements of mill reject handling system.

vi) Three(3) ***Nos. air receivers (one for each compressor)*** of adequate capacity with all accessories, ***interconnecting piping*** supports etc.

viii) Necessary lifting devices of adequate capacity to handle the mill reject handling equipment.

ix) Complete instrumentation of plant.

x) Local panels for each transporter vessel, complete with all hardware, relays, fuses, wiring, tubing, space heaters etc.

xi) Necessary electrical equipment as required/specified.

CLAUSE NO.	CIVIL WORKS
3.03.04	Shop connections will be all welded type and field connections will generally be bolted unless otherwise specified. Field bolts wherever provided will be high tensile friction grip bolts of 20 mm dia or higher and of property class 8.8(min) as per 1367 for all major connections. The bolted joints will be designed for friction type connection and H.T. bolts will be tightened to develop the required pretension during their installation. However, nominal connections in the field like purlins, stairs, wall beams will be done by means of M.S. black bolts of grade 4.6 conforming to IS-1363. Following connections will be provided during erection 1. Welded connection a) connection of secondary beam to main beam b) connection of bracing to column c) connection of bracing to the longitudinal beam d) connection of longitudinal tie beam to column e) connection of spandrel beam to column f) connection of their secondary structures 2. HSFG connection a) splicing of column/transverse frame beam/longitudinal tie beam b) connection of frame beam to column c) connection of crane girder to column d) connection between crane girders e) connection of brackets from columns f) connection of members where tension will be in the fasteners g) other major connections

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CLAUSE NO.	TECHNICAL REQUIREMENTS

1.00.00 MILL REJECT HANDLING SYSTEM

Dense phase pneumatic conveying system shall be employed for handling of the mill rejects. Each mill reject discharge hopper shall be fitted with a positive pressure pneumatic conveying vessel which shall discharge the mill rejects through pipe line to a storage Silo. Silo shall have a collection capacity of 16 effective hours. The transmitting vessel shall operate on level probe mode with timer back-up.

100% standby capacity compressor shall be provided by the bidder. The capacity of each compressor shall be selected considering maximum numbers of the working mills of the unit in operation and rejecting @ of 1% of mill capacity for the worst coal conditions or maximum actual, whichever is higher.

2.00.00 MILL REJECT HANDLING SYSTEM OF PNEUMATIC TYPE MEETING THE FOLLOWING REQUIRMENT SHALL BE PROVIDED.

Sl. No.	System	Parameter
1.	Duty	Continuous
2.	Number of mill reject silos & capacity	One(1) no. to store mill rejects for 16 effective running hours considering all the working mills of the unit in operation and rejecting @ of 1% of mill capacity for the worst coal conditions or maximum actual, whichever is higher.
3.	Number of mills working per boiler	As specified by Boiler/ Mill manufacturer
4.	Design value of reject	1% of the mill design capacity for the worst coal condition or maximum actual, whichever is higher.
5.	Maximum temp. of rejects	As specified by boiler/ mill manufacturer.
6.	Maximum size of mill reject to be handled	(-) 40 mm *
7.	Bulk density of mill rejects for volumetric computation	1600 kg/m^3

8.	Bulk density of mill rejects for LOADS/STRENGTH computation	2400 kg/m^3
9.	Inlet valve of the vessel	Plate valve/dome valve/butterfly valve/cone valve.
10.	Sizing grid	Yes (To separate over size rejects/to give control feed to crushers, if proposed)
11.	Emergency ** discharge chute with knife edge gate valves	Yes.
12.	Piping	MS IS:3589/ MS ERW IS 1239 heavy grade
13.	Bends/Fittings Laterals	Alloy CI Minimum hardness 400 BHN

* In case the bidder expects higher size from pyrite hopper outlet then suitable capacity crusher shall be provided to bring down the size of reject to (-) 40 mm for pneumatic type system offered, which shall be base offer.

** The wearing parts of all the valves shall be provided with abrasion resistant material of hardness of 350-400 BHN.

FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE AND GUARANTEE TESTS

The term "Performance Guarantees" wherever appears in this Sub-Section-V shall have the same meaning and shall be synonymous to "Functional Guarantees". Similarly the term "Performance Tests" wherever appears in this Sub-Section-V shall have the same meaning and shall be synonymous to "Guarantee Test(s)".

The term "BMCR" (Boiler Maximum Continuous Rating) appearing in the Technical Specification shall mean the maximum continuous steam output of Steam Generator at superheater outlet at rated parameters.

The term "TMCR" (Turbine maximum continuous rating) appearing in the technical specification shall mean 500 MW electrical power output at generator terminals (power at generator terminals as per clause indicated in this sub-section) under 0% cycle make-up and design condenser pressure unless used in conjunction with a different cycle make-up and/or a different condenser pressure.

1.00.00 **PERFORMANCE GUARANTEES**

1.00.01 **General Requirements**

a) The Contractor shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment covered in these specifications.

b) The guaranteed performance parameters furnished by the bidder in his offer, shall be without any tolerance values whatsoever and all margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures.

c) The Contractor shall conduct performance test and demonstrate all the guarantees covered herein, during performance guarantee/acceptance test. The various tests which are to be carried out during performance guarantee/acceptance test are listed in this Sub-section. The guarantee tests shall be conducted by the Contractor at site in presence of Employer on each unit individually.

d) All costs associated with the tests including cost associated with the supply, calibration, installation and removal of the test instrumentation, shall be included in the bid price.

e) i) Bidder shall quote the steam generator efficiency as per the requirements of BS EN 12952-15:2003 (by loss method and based on GCV of Coal) and other specification stipulations.

ii) The guaranteed efficiency quoted by the Bidder shall comply with following limiting parameters with design coal firing:

a)	Excess air at economizer outlet (at 100% TMCR load)	: 20% (min.)
b)	Corrected flue gas temperature at air preheater outlet (at 100% TMCR load)	:125^{O}C or as predicted by the bidder whichever is higher
c)	Loss due to unburnt carbon in ash (at all two guarantee point loads i.e. 80% and 100% TMCR)	: 1.5% (min.)

Bidder/Contractor to note that no credit shall be given in the bid evaluation or in the evaluation of the results of the guarantee tests for performance predictions/ guarantees etc. if the values considered by the bidder/Contractor for parameters indicated at a), b) & c) above are lower than those specified above.

iii) For the purposes of guaranteed efficiency of steam generator the ambient air temperature and relative humidity shall be taken as 27^{O}C and 60% respectively. Further, these guarantees shall be based on design coal firing with coal/ ash analysis as given in Subsection-II (Project Information) of Part-A, Section-VI.

iv) Category-III Guarantees under Cl. No. 1.03.05 of this sub-section for various systems/ equipment for steam generator and auxiliaries shall be based on and demonstrated corresponding to ambient air condition of 27 deg. C temperature & 60% RH.

f) In case during performance guarantee tests it is found that the equipment/system has failed to meet the guarantees, the contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the performance guarantee test(s) with Employer's consent. However if the specified performance guarantee(s) are still not met but are achieved within the Acceptable Shortfall Limit specified at clause 1.01.02 of this subsection, Employer will accept the equipment/system/plant after levying liquidated damages as per clause 1.01.02 of this sub-section. If, however, the demonstrated guarantee(s) continue to be more than the stipulated Acceptable Shortfall Limit, even after the above modifications/replacements within ninety (90) days or a reasonable period allowed by the Employer, after the tests have been completed, the Employer will have the right to either of the following:

i) **For Category-I Guarantees**

Reject the equipment/system/plant and recover from the Contractor the payments already made

OR

Accept the equipment/system/plant after levying Liquidated Damages as specified hereunder. The liquidated damages, for shortfall in performance indicated in clause 1.01.02 for this sub-section shall be levied separately for each unit. The rates indicated in clause 1.01.02 of this sub-section are on per unit basis except for the rate indicated for station auxiliary power consumption which are on station basis. The liquidated damages shall be prorated for the fractional parts of the deficiencies. The performance guarantees coming under this category shall be called `Category - I' Guarantees.

ii) **For Category-II Guarantees**

Reject the equipment/plant/system and recover from the Contractor the payments already made. The performance guarantees under this category shall be called 'Category - II ' Guarantees. Conformance to the performance requirements under Category -II is mandatory.

iii) **For Category-III Guarantees**

Reject the equipment / system/plant & recover from the Contractor the payments already made.

OR

Accept the equipment/system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the EMPLOYER. Such damages shall, however be limited to the cost of replacement of the equipment(s) / system(s) replacement of which shall remove the deficiency so as to achieve the guarantee performance. These parameters/capacities shall be termed as category - III, guarantees.

1.01.00 **GUARANTEES UNDER CATEGORY I**

1.01.01 The performance guarantees which attract liquidated damages are as follows:

i) **Turbine Cycle Heat Rate**

a) Turbine Cycle Heat rate in kcal/kWhr under rated steam conditions at design condenser pressure with zero make up at 500 MW unit load.

1.01.02 **AMOUNT OF LIQUIDATED DAMAGES APPLICABLE FOR CATEGORY-I GUARANTEES**

If the performance guarantee(s) specified at clause 1.01.01 are not met by the Contractor even after the modifications and/or replacements mentioned at clause 1.00.01 of this Sub-section but are achieved within the stipulated Acceptable Shortfall Limit as indicated in this clause, Employer will accept the equipment/system/plant after levying liquidated damages as indicated here under. The liquidated damages shall be prorated for the fractional parts of the deficiencies. However, if the demonstrated guarantee(s) continue to be more than the stipulated Acceptable Shortfall Limit, the Employer may at his discretion reject the equipment/system and recover the payment already made or accept the equipment/system only after levying liquidated damages against the Contractor, at the rates listed herein, and such liquidated damages shall be deducted from the Contract Price:

S. No	Guarantee	Rate of Liquidated Damages (LD)	Acceptable Shortfall with LD
i)	For Increase in the Guaranteed Turbine Cycle Heat rate		
	a) At 100% TMCR (500MW) Unit Load	US $ 368,155 (US Dollar Three Hundred Sixty Eight Thousand One Hundred Fifty Five only) per 1 Kcal/Kwhr increase in heat rate	(+) 1.0% of the guaranteed turbine cycle heat rate
	b) At 80% TMCR (400MW) Unit Load	US $ 294,524 (US Dollar Two Hundred Ninety Four Thousand Five Hundred Twenty Four only) per 1 Kcal/Kwhr increase in heat rate	(+) 1.0% of the guaranteed turbine cycle heat rate
ii)	For deficiency in Turbine Generator Output	US $ 1,316 (US Dollar One Thousand Three Hundred Sixteen only) per 1 KW shortfall in TG output	(-) 1.0% of the guaranteed Turbine Generator output
iii)	For deficiency in condenser pressure	US $ 843038 (US Dollar Eight Hundred Forty Three Thousand Thirty Eight only) per 1 mm Hg increase in condenser pressure.	(+) 2.5% of the guaranteed condenser pressure

S. No	Guarantee	Rate of Liquidated Damages (LD)	Acceptable Shortfall with LD
iv)	Efficiency of the Steam Generator For shortfall in guaranteed steam generator efficiency in percentage points under conditions stipulated in clause no. 1.01.01 (vi) of this sub section and elsewhere in this specification:		
	a) 100 % TMCR (500MW) unit load	US $ 865,033 (US Dollar Eight Hundred Sixty Five Thousand Thirty Three only) for every 0.1% point shortfall in guaranteed efficiency.	(-) 0.5% points from the guaranteed efficiency.
	b) 80% TMCR (400MW) unit load	US $ 706,332 (US Dollar Seven Hundred Six Thousand Three Hundred Thirty Two only) for every 0.1% point shortfall in guaranteed efficiency.	(-) 0.5% points from the guaranteed efficiency.
v)	Steam generator capacity For shortfall in the guaranteed steam generating capacity in T/Hr of steam at rated parameters at superheater outlet and rated steam temperature at reheater outlet (with any combination of mills working as per Employer's choice), the coal being fired from within the range specified.	US $ 413,697 (US Dollar Four Hundred Thirteen Thousand Six Hundred Ninety Seven only) for every 1 T/hr short fall in steam output from the guaranteed value.	(-) 1% of the guaranteed Steam Generator Capacity.

S. No	Guarantee	Rate of Liquidated Damages (LD)	Acceptable Shortfall with LD
vi)	Coal Pulveriser wear parts warranty Life of Coal Pulveriser wear parts in hours of operation.	To be calculated as per clause 2.03.00 of this sub-section.	(-) 500 hours
vii)	ESP dust emission efficiency For shortfall in guaranteed ESP efficiency in percentage points under conditions stipulated In 1.01.01 (ix) of this Sub-section and elsewhere in this specification.	US $ 575,621 (US Dollar Five Hundred Seventy Five Thousand Six Hundred Twenty One only) for every 0.01% point shortfall in ESP Efficiency from the guaranteed value.	(-) 0.05% point from the guaranteed ESP efficiency.
viii)	Unit auxiliary power consumption		
	a) Unit Auxiliary Power Consumption at 100% TMCR (500MW) unit load. For increase in the auxiliary power consumption in KW guaranteed as per the requirements of Clause.1.01.01 (x) (a) of this Sub Section.	US $ 2,981 (US Dollar Two Thousand Nine Hundred Eighty One only) per 1 KW increase in Auxiliary Power Consumption.	(+) 1% of the guaranteed auxiliary power consumption
	b) Unit Auxiliary Power Consumption at 80% TMCR (400MW) unit load. For increase in the auxiliary power consumption in KW guaranteed as per the requirements of Clause.1.01.01 (x) (b) of this Sub	US $ 1,665 (US Dollar One Thousand Six Hundred Sixty Five only) per 1 KW increase in Auxiliary Power Consumption.	(+) 1% of the guaranteed auxiliary power consumption

S. No	Guarantee	Rate of Liquidated Damages (LD)	Acceptable Shortfall with LD
	Section.		
ix)	Station auxiliary power consumption For increase in the auxiliary power consumption in KW guaranteed as per the requirements of Clause.1.01.01 (xi) of this Sub Section.	US $ 4,646 (US Dollar Four Thousand Six Hundred Forty Six only) per 1 KW increase in Auxiliary Power Consumption.	(+) 1% of the guaranteed auxiliary power consumption

NOTE:

i) Each of the liquidated damages specified above shall be independent and these liquidated damages shall be levied concurrently as applicable.

ii) If the contract currency is other than US dollars, then the liquidated damages shall be in equivalent amount in contract currency based on Bill selling exchange rate of State Bank of India prevailing on the date of award of contract.

iii) All these liquidated damages for short fall in performance shall be deducted from the contract price as detailed in accompanying General Conditions of Contract (GCC)/ Special Conditions of Contract (SCC)

iv) Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantee shall not exceed twenty five percent (25%) of the Contract Price.

S. No	Guarantee	Rate of Liquidated Damages (LD)	Acceptable Shortfall with LD
	guaranteed as per the requirements of Clause.1.01.01 (xi) of this Sub Section.	only) per 1 KW increase in Auxiliary Power Consumption.	

NOTE:

i) Each of the liquidated damages specified above shall be independent and these liquidated damages shall be levied concurrently as applicable.

ii) If the contract currency is other than US dollars, then the liquidated damages shall be in equivalent amount in contract currency based on Bill selling exchange rate of State Bank of India prevailing on the date of award of contract.

iii) All these liquidated damages for short fall in performance shall be deducted from the contract price as detailed in accompanying General Conditions of Contract (GCC)/ Special Conditions of Contract (SCC)

iv) Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantee shall not exceed twenty five percent (25%) of the Contract Price.

1.01.03 **AUXILIARY POWER CONSUMPTION**

1.01.03.01 **Unit Auxiliary Power Consumption**

The Unit auxiliary power consumption shall be calculated using the following relationship.

$P_a = P_u + T_L$

P_a = Guaranteed Auxiliary Power Consumption.

P_u = Power consumed by the auxiliaries of the unit under test.

T_L = Losses of the transformers supplied by bidder based on works test reports.

While guaranteeing the auxiliary power consumption the bidder shall necessarily include all continuously operating unit auxiliaries. The auxiliaries to be considered shall include but not be limited to the following:

i. UNIT AUXILIARIES (To be considered for calculating Pu)

a) Turbine Unit Oil purifier.

b) Turbine Unit control oil purifier

c) Electric oil heater for Turbine lube oil.

d) Feed and discharge pumps of Turbine oil purification system.

e) Condenser air evacuation pumps.

f) Condenser tube cleaning system pumps.

g) Condensate extraction pumps.

h) Drip pumps if envisaged.

i) Hydrazine dosing pumps.

j) Ammonia dosing pumps.

k) Oil purifiers of 2x50% TDBFPs, and their feed and discharge pumps.

l) Lube oil pumps of 2x50% TDBFPs and the electrical oil heater for lube oil.

m) Auxiliary oil pump for MDBFP.

n) Oil pumps for HP-LP bypass system.

o) Motor Driven Boiler Feed Pump (for this purpose only 15% of the deemed power consumed by the MDBFP at 100% TMCR unit load shall be considered. However, at 80% of TMCR unit load, auxiliary power consumed by MDBFP shall not be taken into consideration).

p) Mills.

q) PA Fans.

r) FD Fans.

s) ID Fans.