

**GUJARAT STATE ELECTRICITY CORPORATION LIMITED
VADODARA, GUJARAT.**



1X800 MW WANAKBORI TPS. UNIT # 8

**TECHNICAL SPECIFICATION
OF
MILL REJECT HANDLING SYSTEM**

SPECIFICATION NO.: PE-TS-408-160-A001



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



**1x800 MW WANAKBORI STPP
MILL REJECTS HANDLING SYSTEM
INDEX**

SPECIFICATION No: PE-TS-408-160-A001

VOLUME: II B & III

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TITLE:
**TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM**

1X800 MW WANAKBORI TPS

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SECTION – A

INTENT OF SPECIFICATION

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SCOPE OF ENQUIRY / INTENT OF SPECIFICATION

- 1.1 This specification includes, but not limited to, design, engineering, manufacturing, inspection and testing, painting, supply/delivery duly packed at project site including freight, unloading, storage and handling at site, erection and commissioning, trial run at site, demonstration testing and handing over to the customer in line with drawings/ documents/ test procedures approved by BHEL/Customer for **Mill Reject Handling System** including mandatory spares, erection and commissioning spares and tools and tackles.
- 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 responsibility of providing such facilities to complete the supply, erection and commissioning.
- 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 terms 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 deviation schedule along with cost of withdrawal; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.
- 1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.10 The standard quality plan is included in this specification to enable the bidder to understand the extent of inspection and testing requirements to execute this job. The successful bidder has to follow the quality plan as minimum requirement during manufacturing and testing.



TITLE:
**TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM**

1X800 MW WANAKBOERI TPS

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

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SECTION -B

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VOLUME – II B
SECTION - B
PROJECT INFORMATION

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3.00.00	LAND
4.00.00	SOURCE OF COAL
5.00.00	SOURCE OF WATER
6.00.00	ASH DISPOSAL AREA
7.00.00	SALIENT DESIGN DATA

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SECTION-II

PROJECT SYNOPSIS AND GENERAL INFORMATION

1.00.00 INTRODUCTION

The proposed 1x800 MW Supercritical Thermal Power Project would be set up by Gujarat State Electricity Corporation Limited (GSECL) at Kheda district of Gujarat.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on the Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

2.00.00 APPROACH TO SITE

The proposed site is located in Kheda district about 13 kilometers from the nearest commercial town of Balasinor & 10 kilometers from Sevalia town. The National Highway, NH-08, connecting Dakor – Godhra is about 10 kilometers from the site. The State Highway SH – 59 connecting Balasinor – Sevalia is about 2 Kilometers from the site. Nearest railway station to the existing site is Sevalia, located about 8 kilometers from the site on Anand – Godhara main broad gauge line of Western Railway.

Nearby Air Ports are Ahmedabad at a distance of about 110 kilometers from the site and Vadodara at a distance of about 85 kilometers from the site.

3.00.00 LAND

The proposed extension unit will be developed in the existing Wanakbori Thermal Power Station and will be located north east side of the existing plot in the Kheda District of Gujarat. The land of the proposed plant will be filled in upto a desired level. Existing Ash Pond/ Dyke area will be utilized for the extension unit.

4.00.00 SOURCE OF COAL

Indian coal would be sourced from captive mines Machha Kata in Talcher, State – Orissa which are situated about 1800 Kms from the project site. GSECL will arrange for transportation of the coal required for the extension unit from these captive mines by the existing railway facilities for delivery of coal supply to the Wanakbori power station.

5.00.00 SOURCE OF WATER

The water required for the new unit shall be obtained from River Mahi, flowing by the side of the existing Wanakbori Power Station.

One (1) new jackwell will be installed on Mahi river for supply of water for new plant. In addition, existing Canal Water and Jackwell Water will have interconnection with new plant to cater plant water requirement of new plant.

6.00.00 ASH DISPOSAL AREA

Existing Ash Pond / Dyke area will be utilized for the extension unit. Fly ash silos will be located outside plant boundary wall (but within GSECL land) in the vicinity of the Ash Dyke area.

7.00.00 SALIENT DESIGN DATA

7.01.00 Meteorological data of site is given below:-

Elevation above MSL	:	72 M
Max. daily average temp	:	34 °C
Min. daily average temp	:	11.7 °C
Max. Ambient air temp. (daily)	:	34°C
Max. Ambient air temp. (yearly)	:	30°C
Max. Ambient air temp.	:	42°C
Wet bulb temperature	:	28°C
Relative Humidity	:	RH varies within a range from 50% to 95%.
Average annual rainfall	:	750 mm

[Metrological data of Vadodara is attached for reference].

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SECTION-IX

SALIENT DESIGN DATA

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TABLE-VI	FUEL OIL ANALYSIS
TABLE-VII	CLIMATOLOGICAL TABLE OF BARODA

TABLE-I

CLARIFIED WATER ANALYSIS
(As Received)

Page 1 of 2

CONSTITUENTS	As	CONTENT	Jan-March	April-June	July-Sept	Oct-Dec
Calcium Hardness	CaCO3	ppm	70	62	57	64
Magnesium Hardness	CaCO3	ppm	63	78	52	65
Sodium + Potassium	CaCO3	ppm	-	-	-	-
Iron in Solution.	CaCO3	ppm	0.032	0.030	0.025	0.032
Manganese in Solution	CaCO3	ppm	-	-	-	-
Hydrogen (FMA)	CaCO3	ppm	64	68	36	40
TOTAL CATIONS	CaCO3	ppm	180	197	147	165
Bicarbonate	CaCO3	ppm	137	145	105	123
Carbonate	CaCO3	ppm	0	0	0	0
Hydroxide	CaCO3	ppm	-	-	-	-
Sulphate	CaCO3	ppm	14	16	18	14
Chloride	CaCO3	ppm	29	35	24	28
Nitrate	CaCO3	ppm	-	-	-	-
Fluoride	CaCO3	ppm	-	-	-	-
TOTAL ANIONS	CaCO3	ppm	200	215	160	185
Colloidal Silica	SiO ₂	ppm	-	-	-	-
Dissolved Silica	SiO ₂	ppm	18	16	12	20
Conductivity at 25 ⁰ C	-	Micro siemens/cm (maximum)	367	400	302	321
pH value at 25 ⁰ C	-		7.87	7.76	7.71	7.75
Total Suspended solids	-	ppm (maximum)	294	320	242	257
Turbidity		NTU (maximum)	2	2	5	2

TABLE-I
CLARIFIED WATER ANALYSIS

CONSTITUENTS	As	CONTENT
Calcium	CaCO ₃	85.0 ppm
Magnesium	CaCO ₃	94.0 ppm
Sodium + Potassium	CaCO ₃	75.0 ppm
	CaCO ₃	
Iron in Solution.	Fe	0.05 ppm
Hydrogen (FMA)	CaCO ₃	- ppm
TOTAL CATIONS (except iron)	CaCO ₃	254.0 ppm
Bicarbonate	CaCO ₃	160.0 ppm
Carbonate	CaCO ₃	- ppm
Hydroxide	CaCO ₃	- ppm
Sulphate	CaCO ₃	20.0 ppm
Chloride	CaCO ₃	52.0 ppm
Nitrate	CaCO ₃	22.0 ppm
Phosphate		- ppm
Fluoride	CaCO ₃	0.0 ppm
TOTAL ANIONS	CaCO ₃	254.0 ppm
Reactive Silica	SiO ₂	22.0 ppm
Colloidal Silica	SiO ₂	0.0 ppm
Conductivity at 25 ^o C	-	440 Micro siemens/cm (maximum)
pH value at 25 ^o C	-	7.5 – 8.0
Turbidity		Not to exceed 15 NTU (maximum)

Note: The above Clarified Water Analysis shall be considered for DM Plant Design.

TABLE-II

RAW WATER ANALYSIS
(As Received)

Source : River Mahi (Jack-well/ canal)

Page 1 of 2

(1) Jack-well/Canal Water Parameters

Sl. No.	Parameter	Unit	Result
1	pH	Unit	8.42
2	Turbidity	NTU	2.2
3	Conductivity	μ Mhos/cm	440
4	Total alkalinity as CaCO ₃	ppm	152
5	Chloride as Cl	ppm	33
6	Total hardness as CaCO ₃	ppm	134
7	Calcium Hardness as CaCO ₃	ppm	52
8	Magnesium Hardness as CaCO ₃	ppm	82
9	Silica as SiO ₂	ppm	20
10	Total Dissolved solids as such	ppm	308.42
11	Sulphate as SO ₄	ppm	12
12	Iron as Fe	ppm	0.031
13	Potassium		Not present
14	TSS	ppm	1-2

(2) Hypothetical Combination of Ions

Page 2 of 2

Sl. No.	Parameter	As	CONTENT ppm
1	Calcium Hardness	CaCO ₃	52
2	Magnesium Hardness	CaCO ₃	82
3	Sodium	CaCO ₃	79
4	Iron in Solution.	Fe	-
5	Manganese in solution	CaCO ₃	-
6	Total Cations	CaCO ₃	213
7	Bicarbonate	CaCO ₃	152
8	Carbonate	CaCO ₃	2
9	Hydroxide		-
10	Sulphate	SO ₄	12.5
11	Chloride	CaCO ₃	46.48
12	Nitrate	NO ₃	-
12	Fluoride	-	-
13	Total Anions	-	213

TABLE-III
ESTIMATION OF CONSUMPTIVE WATER REQUIREMENT

Sl. No.	Consumption Points	DM Water (m3/hr)	Filtered Water (m3/hr)	Clarified Water (m3/hr)	Raw Water (m3/hr)	REMARKS
1.	a. Heat Cycle Make-up	72*				<i>*Note: Heat Cycle Make-up is 3% of BMCR steam flow.</i>
	b. Make-up Requirement for DMCW System	0.5				
	c. Chemical Feed System	0.5				
	d. Condensate Polishing Unit	4				
	e. Neutralisation Pit	6				
	Sub-Total (a to e)	83	83			
2.	a. Potable Water Requirement		2			
	b. Backwash of Filter		2			
	Sub-Total (1 + 2)		87	87		
3.	a. Ventilation System Requirement			17		C.O.C : 5 CTBD : 372
	b. AC Plant Requirement			10		
	c. Fire Water System			-		
	d. AHP Gland Sealing System			90		
	e. Backwash Return			(-) 2		
	Sub-Total (1 + 2 + 3)			202	202	
4.	a. Service Water				25	
	b. CT Make-up requirement				1884	
	GRAND TOTAL (1 to 4)				2111	(Say 21.0 Cusec)

TABLE-IV

ANALYSIS OF COAL

PROXYMATE ANALYSIS

No.	Description	Designed Coal	Worst Coal
1.	Fixed Carbon	28.83%	26%
2.	Volatile Matter (VM)	26.61%	22.00%
3.	Moisture	10.80%	10.0%
4.	Ash	33.76%	42.00%
5.	Gross calorific value	3850 Kcal/kg	3500 Kcal/kg

ULTIMATE ANALYSIS

No.	Description	Designed Coal	Worst Coal
1.	Carbon	40.34%	35.87%
2.	Hydrogen	2.61%	2.66%
3.	Sulphur	0.80%	0.90%
4.	Nitrogen	0.97%	0.72%
5.	Oxygen (by diff.)	10.72%	7.85%
6.	Moisture	10.8%	10%
7.	Ash	33.76%	42.00%
8.	Grindability Index (HGI)	66	50
9.	Ash Fusion Temperature (deg C) (IDT)	1350	1160

TABLE-V

ASH ANALYSIS
(As Received)

Sl. No.	Characteristic	Result
1.	Silicon dioxide (SiO ₂) plus Aluminium Oxide (Al ₂ O ₃) plus Iron Oxide (Fe ₂ O ₃) present by mass Min.	93.3 – 95.7
2.	Silicon dioxide (SiO ₂), percent by mass Min.	58.4 – 63.0
3.	Total sulphur as sulphur trioxide (SO ₃) percent by mass Max.	0.31 – 0.76
4.	Available alkalis as sodium Oxide (Na ₂ O) in percent by mass Max.	Nil
5.	Loss on ignition, in percent by mass Max.	0.31 – 0.87
6.	Moisture content %	0.026 – 0.132
7.	Ash fusion temp. (Deg C) (IDT)	1350 / 1160
8.	Hemispherical (Deg C)	1400
9.	Fusion temp. (Deg C)	1400
10.	Lead (as pb)	0.14 µg/g
11.	Arsenic (as As)	0.01 µg/g
12.	Mercury (as Hg)	0.04 µg/g

TABLE-VI
FUEL OIL ANALYSIS

Page 1 of 2

Sl. No.	Parameters	Unit	LDO	LSHS	HSD
1.0	Density at 15 degC	gm/l	0.8682	0.9708	0.8297
2.0	Water Content	%v/v	0.15	0.10	0.05
3.0	Sediment	%w/w	0.06	0.04	0.02
4.0	Total Sediment	mg/100ml	-----	-----	0.94
5.0	Redwood Vis. 37.8	Second	30.0	-----	-----
6.0	Kinematics Vis 38	cst	6.80	-----	-----
7.0	Kinematics Vis 100 C	cst	-----	68.00	-----
8.0	Kinematics Vis 40 C	cst	-----	-----	2.08
9.0	Flash Point (PMCC)	Deg. C	75	>93	41
10.0	Pour Point	Deg. C	9	27	6
11.0	Acidity -Inorganic	mg KOH/g	Nil	-----	Nil
12.0	Acidity -Total	mg KOH/g	-----	-----	0.13
13.0	Ash	%wt	0.01	0.01	-----
14.0	Sulphur Cont. Total	%Mass	0.46	1.14	0.11
15.0	C RES RAMSBOTT. MTD	%Mass	0.53	-----	0.21
16.0	Smoke Point	Mm	7.00	-----	-----
17.0	Gross C.V	Kcal/Kg	-----	-----	-----

TABLE-VI

FUEL OIL ANALYSIS – FURNACE OIL FO

Page 2 of 2

Sl. No.	Parameters	Unit	FO
1.0	Acidity –Inorganic in mg. KOH/g	mg. KOH/g	0.0000
2.0	Ash	Wt%	0.059
3.0	Density at 15 degC	Kg/m ³	954.8
4.0	Flash Point (PMCC)	Cell	69.0
5.0	Calorific Value Net in	Kcal / Kg	9818
6.0	Gross Calorific Value	Kcal/kg.	10402
7.0	Water Content	Vol%	0.20
8.0	Kinematics Viscosity @50°C summer	cst	134.0
9.0	Pour Point Summer	Cel	18.0
10.0	Sediment	Wt%	0.10
11.0	Sulphur Total	Wt%	0.680

TABLE-VII
CLIMATOLOGICAL TABLE OF BARODA

STATION : Baroda

42747 LAT: 22 18 N LONG: 73 15 E HT. ABOVE M.S.L. 34 METERS DATA 1951 TO 1980

MN	SLP	Mean Temperature						Extremes			Cloud				Rainfall				
		DB	WB	MAX	MIN	HIGH	LOW	MAX DT	MIN DT	RH	VP	TOT	LOW	TOT RAINY	WET	DRY	HEAVY	DAY	WS
1	1011.8 1008.5	13.8 27.9	10.9 17.8	30.3	12.0	34.3	7.5	36.2 25 1961	-1.1 15 1935	67 10.7 33 12.4	1.1 0.3 1.1 0.1	1.2	0.1	53.6 1920	0.0	33.0	05	4.0	
2	1010.3 1006.7	16.2 31.4	12.3 18.7	33.0	13.8	37.9	8.9	41.7 28 1953	1.7 10 1950	61 11.2 25 11.3	0.9 0.2 0.9 0.2	0.6	0.1	33.0 1898	0.0	33.0	10	4.1	
3	1008.5 1004.3	22.1 35.8	16.3 20.5	37.1	18.4	41.5	13.1	44.4 26 1973	6.7 03 1936	53 13.8 20 11.7	1.1 0.2 1.2 0.2	2.2	0.2	44.3 1967	0.0	21.0	23	4.2	
4	1005.9 1001.4	27.3 39.1	20.7 22.5	40.2	22.9	43.9	18.4	45.9 25 * 1979	11.7 16 1955	53 19.2 20 14.1	1.1 0.2 1.2 0.2	0.9	0.1	83.3 1947	0.0	71.4	18	4.8	
5	1003.1 998.3	29.9 39.8	24.6 24.9	40.9	26.5	44.5	23.2	46.7 11 1960	18.9 05 1939	64 26.8 27 19.3	1.7 1.2 0.7 0.3	4.4	0.3	153.9 1917	0.0	59.7	29	8.7	
6	999.4 995.4	29.3 35.3	26.0 26.6	37.1	27.0	41.5	23.5	45.6 06 * 1979	20.2 19 1978	76 30.9 51 27.8	4.5 2.9 3.4 2.0	146.8	5.6	527.8 1913	0.0	177.4	06	10.3	
7	998.1 995.3	27.4 30.8	25.8 26.5	32.7	25.7	36.9	23.5	40.6 05 1962	21.1 19 1943	88 31.8 72 31.1	6.5 4.0 6.4 4.0	297.6	13.8	899.0 1950	4.8	247.4	24	8.4	
8	999.8 997.0	26.4 29.9	25.1 26.1	31.5	25.0	34.6	23.4	37.4 30 1979	22.2 01 1976	90 30.9 74 30.6	6.7 3.8 6.5 3.9	284.7	12.0	748.5 1933	0.3	250.7	05	7.1	
9	1003.6 1000.2	26.3 31.5	24.5 25.7	33.2	24.3	37.0	22.4	41.1 30 * 1951	18.9 29 1938	86 29.4 63 28.2	4.3 2.4 4.0 2.4	141.7	7.1	575.4 1945	0.0	372.1	24	5.1	
10	1007.5 1004.0	25.0 33.3	21.5 23.9	36.0	21.3	38.5	16.7	41.7 13 1951	11.7 30 1955	72 22.9 44 22.2	1.5 0.6 1.4 0.6	22.0	1.3	272.3 1917	0.0	153.2	29	3.0	
11	1010.5 1007.2	20.4 30.5	16.4 21.2	34.3	16.7	37.2	12.9	39.6 02 1966	7.2 30 1938	64 15.5 41 17.8	1.3 0.4 1.3 0.4	16.2	0.7	212.4 1979	0.0	64.6	22	3.0	
12	1011.9 1008.7	15.6 28.0	12.7 19.1	31.4	13.4	34.5	9.6	36.8 01 1980	3.3 22 1937	70 12.5 40 15.1	1.3 0.2 1.3 0.2	4.4	0.2	43.4 1978	0.0	43.4	01	3.6	
YR LY	1005.9 1002.3	23.3 32.8	19.7 22.8	34.8	20.6	44.8	6.9	46.7	-1.1	70 21.3 43 20.1	2.7 1.4 2.5 1.2	922.7	41.5	1666.0 1976	133.1	372.1		5.5	
YRS	30 30	30 30	30 30	30	30	30	30	48	48	30 29 30 29	30 22 30 22	30	30	93	93	93		30	

* Occurred More Than Once

STATION : Baroda 42747 .. contd

MN	Weather						Wind speed				% Wind Direction					Total Cloud					Low cloud					Visibility									
	PPT	HAIL	THUN	FOG	D.STM	SQUA	62	61	19	0	N	NE	E	SE	S	SW	W	NW	0	0	T-2	3-5	6-7	8	0	T-2	3-5	6-7	8	F8	<1	1-4	4-10	10-20	>20
1	0.3	0.0	0.1	0.5	0.0	0.0	0	0	19	12	13	39	2	2	1	3	1	3	36	20	5	3	2	1	28	2	1	0	0	0	0.3	1.7	2.0	25.6	1.4
							0	0	25	6	12	30	2	0	0	3	8	23	22	19	6	3	2	1	28	2	1	0	0	0	0.0	0.0	0.0	1.9	29.1
2	0.3	0.0	0.1	0.2	0.0	0.0	0	0	17	11	10	31	1	2	2	7	2	4	41	20	4	3	1	0	26	1	1	0	0	0	0.2	1.6	2.3	23.9	0.0
							0	0	24	4	10	21	2	2	0	9	12	28	16	19	5	2	2	0	25	2	1	0	0	0	0.0	0.0	0.0	1.7	26.3
3	0.2	0.0	0.2	0.0	0.0	0.0	0	0	19	12	7	15	1	3	5	16	5	7	41	20	5	4	2	0	29	1	1	0	0	0	0.0	0.5	0.7	29.8	0.0
							0	0	27	4	7	13	2	1	1	15	16	32	13	20	6	3	2	0	28	2	1	0	0	0	0.0	0.0	0.0	1.5	29.5
4	0.2	0.0	0.5	0.0	0.0	0.0	0	0	22	8	5	5	1	2	6	29	10	12	30	19	5	3	2	1	27	2	1	0	0	0	0.0	0.1	0.1	29.7	0.1
							0	0	27	3	4	4	1	0	1	20	26	35	9	16	7	3	3	1	25	4	1	0	0	0	0.0	0.0	0.0	0.3	29.7
5	0.4	0.0	0.6	0.0	0.3	0.0	0	0	28	3	1	1	1	1	5	57	17	7	10	15	6	7	3	0	19	4	6	2	0	0	0.0	0.0	0.0	30.8	0.2
							0	1	29	1	1	2	0	1	2	45	30	14	5	21	8	1	1	0	24	6	1	0	0	0	0.0	0.0	0.0	1.7	29.3
6	7.6	0.0	3.3	0.0	0.1	0.2	0	0	28	2	0	1	0	2	10	61	16	1	9	2	6	9	7	6	6	8	12	4	0	0	0.0	0.0	0.3	29.6	0.1
							0	2	27	1	0	1	0	2	7	61	21	3	5	4	9	6	6	5	8	11	8	3	0	0	0.0	0.0	0.3	1.8	27.9
7	18.8	0.0	2.1	0.0	0.0	0.1	0	0	27	4	0	0	0	1	8	62	14	0	15	0	2	5	8	16	4	4	14	8	1	0	0.0	0.0	0.2	30.8	0.0
							0	1	27	3	0	0	0	2	8	60	18	3	9	1	1	5	11	13	1	7	13	9	1	0	0.0	0.0	0.3	4.3	26.4
8	17.8	0.0	1.8	0.0	0.0	0.0	0	0	26	5	1	0	0	0	7	55	20	1	16	0	1	4	8	18	4	4	13	9	1	0	0.0	0.1	0.8	29.2	0.9
							0	1	27	3	0	1	0	1	6	55	21	4	12	0	2	5	11	13	1	7	14	8	1	0	0.0	1.1	0.4	5.0	24.5
9	10.2	0.0	2.6	0.0	0.0	0.0	0	0	23	7	2	3	0	2	5	37	18	6	27	4	6	6	6	8	12	4	8	5	1	0	0.0	0.1	0.2	29.3	0.4
							0	0	25	5	2	3	1	1	3	32	26	15	17	2	9	6	8	5	6	12	8	4	0	0	0.0	0.0	0.1	2.6	27.3
10	1.6	0.0	1.4	0.2	0.0	0.0	0	0	17	14	6	16	3	6	4	12	3	3	47	17	7	4	2	1	26	2	2	1	0	0	0.0	0.2	0.3	29.7	0.8
							0	0	20	11	9	15	3	2	1	8	10	16	36	14	11	3	2	1	20	9	2	0	0	0	0.0	0.0	0.0	0.5	30.5
11	1.1	0.0	0.3	0.2	0.0	0.0	0	0	17	13	11	33	4	3	1	2	0	1	45	18	6	3	2	1	27	1	2	0	0	0	0.1	0.3	0.4	28.3	0.9
							0	0	18	12	11	24	4	1	0	2	3	13	42	17	7	3	2	1	25	3	2	0	0	0	0.0	0.0	0.0	0.7	29.3
12	0.3	0.0	0.2	0.2	0.0	0.0	0	0	20	11	12	43	3	1	1	1	0	1	38	19	5	4	2	1	29	1	1	0	0	0	0.0	1.3	1.3	27.4	1.0
							0	0	21	10	17	24	4	1	0	2	4	16	32	17	7	3	3	1	28	2	1	0	0	0	0.0	0.0	0.0	0.6	30.4
YR	58.8	0.0	13.2	1.3	0.4	0.3	0	0	263	102	6	16	1	2	5	29	9	4	28	154	58	55	45	53	237	34	62	29	3	0	0.6	5.9	8.6	344.1	5.8
LY							0	5	297	63	6	12	2	1	2	26	16	17	18	150	78	43	53	41	219	67	53	24	2	0	0.0	1.1	1.1	22.6	340.2
YRS			26						24				29									27					27					27			
									24				29									26					26								

**Gujarat State Electricity Corporation Ltd
1x800 MW Supercritical Thermal Power Project**

**EPC Bid Document
K9213R-EPC-SPC-001**

STATION : Baroda (A) 42748 LAT: 22 20 N LONG: 73 16 E HT. ABOVE M.S.L. 38 METERS DATA 1952 TO 1980

MN	SLP	Mean Temperature						Extremes				Cloud		Rainfall					WS
		DB	WB	MAX	MIN	HIGH	LOW	MAX DT	MIN DT	RH	VP	TOT	LOW	TOT RAINY	WET	DRY	HEAVY	DAY	
1	1011.5 1008.1	15.2 27.6	11.3 17.3	29.4	12.2	33.4	7.2	35.8 13 1979	2.8 22 1962	59 10.3 31 11.5	1.2 0.1 1.2 0.1	1.3	0.1	15.8 1953	0.0	14.0	07 1953	7.6	
2	1010.0 1006.3	17.8 30.9	12.4 17.8	32.1	13.9	36.6	8.8	40.6 28 1953	3.9 10 1950	50 10.2 23 9.9	1.0 0.3 1.0 0.3	0.7	0.1	11.0 1961	0.0	6.0	02 1961	7.6	
3	1008.1 1003.9	23.2 35.1	16.5 20.0	36.4	18.2	40.5	13.0	43.9 29 1977	9.3 08 1979	48 13.4 21 11.2	1.1 0.2 1.3 0.2	1.2	0.2	21.4 1967	0.0	11.5	25 1967	7.5	
4	1005.6 1000.9	27.8 38.5	20.8 21.8	39.5	22.8	42.9	18.2	45.9 29 1979	14.4 15 1955	51 19.0 19 12.8	1.2 0.3 1.5 0.3	0.3	0.0	8.2 1978	0.0	8.2	25 1978	8.3	
5	1002.7 997.7	29.9 39.0	24.6 24.5	40.3	26.5	43.7	22.9	46.1 20 1955	19.4 27 1974	64 26.6 29 19.0	1.9 1.6 0.9 0.5	3.7	0.2	50.1 1974	0.0	40.9	29 1956	14.6	
6	999.0 994.9	29.3 34.6	26.1 26.6	36.7	26.8	40.9	23.2	45.6 06 1979	17.1 03 1980	77 31.0 54 28.1	4.9 3.4 3.9 2.5	129.7	5.0	439.0 1976	0.0	187.3	06 1976	18.0	
7	997.7 994.7	27.4 30.2	25.8 26.5	32.4	25.6	36.2	23.5	39.6 02 1968	22.2 28 1952	88 32.0 75 31.6	6.6 4.1 6.5 3.9	290.7	12.6	605.6 1976	60.8	162.0	11 1976	15.2	
8	999.5 996.5	26.5 29.3	25.2 26.0	31.3	24.9	34.4	23.2	39.1 16 1969	21.7 16 1956	90 31.0 76 30.8	6.8 3.9 6.5 3.8	274.4	11.8	657.4 1978	38.5	277.1	05 1956	12.6	
9	1003.2 999.7	26.5 30.9	24.6 25.4	32.7	24.2	36.5	22.2	41.1 29 1951	18.1 25 1972	85 29.4 65 28.1	4.7 2.6 4.5 2.6	147.0	7.2	456.4 1958	0.3	221.6	07 1970	9.1	
10	1007.2 1003.7	26.0 32.9	21.7 23.0	35.4	21.1	37.9	16.5	41.2 15 1980	12.8 27 1960	67 22.6 41 20.2	1.7 0.6 1.8 0.8	21.6	1.3	143.9 1956	0.0	71.1	01 1954	6.2	
11	1010.3 1006.9	21.7 30.2	16.7 20.2	33.4	16.7	36.2	12.4	39.4 01 1980	6.0 26 1968	58 15.0 37 15.6	1.6 0.4 1.5 0.5	16.5	0.7	190.1 1979	0.0	61.4	04 1962	6.7	
12	1011.7 1008.3	17.3 28.0	13.3 18.3	30.7	13.7	33.5	9.5	37.2 06 1968	6.4 30 1977	61 12.1 36 13.3	1.5 0.1 1.6 0.2	3.3	0.2	34.2 1978	0.0	34.2	01 1978	7.0	
YR LY	1005.5 1001.8	24.1 32.3	19.9 22.3	34.2	20.6	44.1	6.8	46.1	2.8	67 21.1 42 19.3	2.9 1.5 2.7 1.3	911.1	39.4	1721.7 1976	314.9	277.1		10.0	
YRS	29 29	29 29	29 29	29	29	29	29	31	31	29 28 29 28	29 16 29 16	30	30	31	31	31		29	

**Gujarat State Electricity Corporation Ltd
1x800 MW Supercritical Thermal Power Project**

**EPC Bid Document
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STATION : Baroda (A) 42748 .. contd

MN	Weather						Wind speed				% Wind Direction							Total Cloud					Low cloud					Visibility							
	PPT	HAIL	THUN	FOG	D.STM	SQUA	62	61	19	0	N	NE	E	SE	S	SW	W	NW	0	0	T-2	3-5	6-7	8	0	T-2	3-5	6-7	8	F8	<1	1-4	4-10	10-20	>20
1	0.2	0.0	0.1	0.2	0.0	0.0	0	1	20	10	34	20	2	4	2	1	1	4	32	19	6	4	2	0	30	1	0	0	0	0	0.3	2.8	14.2	13.1	0.6
							0	2	27	2	26	14	2	0	1	4	11	34	8	19	6	4	2	0	28	2	1	0	0	0	0.0	0.1	2.3	18.9	9.7
2	0.2	0.0	0.1	0.2	0.0	0.0	0	1	18	9	25	18	4	8	5	4	2	5	29	19	4	3	2	0	26	1	1	0	0	0	0.1	2.1	12.1	13.1	0.6
							0	3	24	1	20	13	1	1	1	7	17	36	4	17	6	3	2	0	24	3	1	0	0	0	0.1	0.1	0.9	15.2	11.7
3	0.2	0.0	0.3	0.1	0.1	0.0	0	2	22	7	14	12	4	9	11	12	6	8	24	18	7	4	2	0	28	2	1	0	0	0	0.1	1.3	10.8	18.0	0.8
							0	4	26	1	11	5	2	1	1	11	24	41	4	16	8	5	2	0	26	4	1	0	0	0	0.0	0.1	0.9	17.0	13.0
4	0.1	0.0	0.5	0.0	0.1	0.0	0	2	24	4	12	5	1	2	10	25	14	20	11	19	6	4	1	0	27	2	1	0	0	0	0.0	0.4	9.8	18.9	0.9
							0	3	26	1	7	2	0	0	1	12	32	43	3	17	7	4	2	0	25	4	1	0	0	0	0.1	0.0	1.8	15.5	12.6
5	0.4	0.0	0.9	0.0	0.3	0.2	0	8	22	1	4	1	0	0	8	46	26	10	5	13	7	8	3	0	16	6	7	2	0	0	0.0	0.1	6.1	23.5	1.3
							0	10	20	1	2	1	0	0	4	38	33	19	3	17	9	3	2	0	23	7	1	0	0	0	0.0	0.1	1.7	17.4	11.8
6	7.1	0.0	4.1	0.0	0.2	0.2	0	10	20	0	1	1	0	2	15	51	25	3	2	1	3	10	11	5	4	6	15	5	0	0	0.0	0.7	9.0	19.3	1.0
							0	19	11	0	1	1	1	1	13	59	19	5	0	4	6	7	8	5	7	11	10	2	0	0	0.1	0.7	5.7	14.3	9.2
7	16.7	0.0	3.5	0.0	0.1	0.2	0	6	25	0	0	1	0	2	14	56	22	2	3	0	0	6	13	12	1	6	17	6	1	0	0.0	1.5	14.4	14.5	0.6
							0	16	15	0	0	0	0	2	17	59	17	2	3	0	0	6	14	11	1	7	17	5	1	0	0.1	1.0	8.3	16.1	5.5
8	17.0	0.0	2.7	0.0	0.0	0.0	0	3	27	1	1	0	0	1	9	55	27	4	3	0	1	3	12	15	2	6	16	6	1	0	0.0	1.4	14.2	14.8	0.6
							0	10	20	1	2	1	0	0	11	56	21	5	4	0	1	5	14	11	1	7	16	6	1	0	0.0	0.7	7.2	17.7	5.4
9	9.9	0.0	3.0	0.2	0.0	0.1	0	1	25	4	4	3	1	3	9	32	27	10	11	3	5	7	10	5	9	7	10	4	0	0	0.0	0.9	11.3	15.3	2.5
							0	4	24	2	5	6	1	1	6	28	31	14	8	1	7	9	9	4	3	13	11	3	0	0	0.0	0.3	3.3	13.3	13.1
10	1.7	0.0	1.6	0.3	0.0	0.0	0	1	23	7	11	15	8	14	11	6	5	6	24	13	8	5	4	1	23	4	3	1	0	0	0.1	0.7	8.5	18.3	3.4
							0	1	25	5	17	16	5	2	2	6	14	24	14	10	12	6	3	0	16	11	4	0	0	0	0.0	0.0	1.4	13.9	15.7
11	1.0	0.0	0.3	0.1	0.0	0.0	0	1	21	8	25	26	11	5	2	0	1	2	28	15	7	4	3	1	26	2	2	0	0	0	0.1	1.0	7.8	18.2	2.9
							0	0	25	5	21	19	11	1	1	2	4	26	15	15	7	4	3	1	23	5	2	0	0	0	0.0	0.1	0.9	15.8	13.2
12	0.3	0.0	0.2	0.1	0.0	0.0	0	1	22	8	33	27	5	4	1	0	0	3	27	16	7	5	2	1	29	1	1	0	0	0	0.1	1.2	11.9	15.9	1.9
							0	1	26	4	25	17	6	2	1	2	6	27	14	16	7	5	3	0	28	2	1	0	0	0	0.0	0.0	0.8	17.7	12.5
YR	54.8	0.0	17.3	1.2	0.8	0.7	0	37	269	59	14	11	3	5	8	24	13	6	16	136	61	63	65	40	221	44	74	24	2	0	0.8	14.1	130.1	202.9	17.1
LY							0	73	269	23	11	8	2	1	5	24	19	23	7	132	76	61	64	32	205	76	66	16	2	0	0.4	3.2	35.2	192.8	133.4
YRS				27						24												19												19	
										25												19												19	



TITLE:
**TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM**

1X800 MW WANAKBORI TPS

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

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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, minor civil works as required, trial run, demonstration testing and handing over of Mill Reject Handling System including supply of mandatory spares, erection and commissioning spares and tools & tackles 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:

Scope of supply		
1.	Pyrite Hopper per mill	
a	No of Pyrite Hopper	One (1) no. per mill
b	Pyrite Hopper Accessories	
i.	Temperature Switch	One (1) no. per hopper
ii.	RF type level switch	Two nos. (For High & High - High level)
iii.	Water Spray quenching system with solenoid operated spray nozzle	Minimum One (1) no. per hopper
iv.	Rupture disc	One (1) no. per hopper
v.	Flexible joint/Expansion Joint	One (1) no. per hopper
vi.	Oversize reject chute	One (1) no. per hopper
vii.	Bypass Chute	One (1) no. per hopper
viii.	Sizing Grid	One (1) no. per hopper
2.	Knife Gate Valve	
a	Type & Quantity	
b	Knife gate valve at Mill outlet - (KGV-1)	One (1) no. 200 NB Pneumatic cylinder operated KGV per hopper with open & close limit switches and position indicators
c	Knife gate Valve at Over size discharge chute of Pyrite Hopper (KGV-2).	One (1) no. 200 NB Pneumatic cylinder operated KGV per hopper with open & close limit switches and position indicators
d	Knife gate Valve at By Pass Chute of Pyrite Hopper (KGV-3).	One (1) no. 200 NB Pneumatic cylinder operated KGV per hopper with open & close limit switches and position indicators



TITLE:
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e	Knife gate valve at Pyrite Hopper outlet (KGV-4).	One (1) no. 200 NB Pneumatic cylinder operated KGV per hopper with open & close limit switches and position indicators
3.	Transporter Vessel	
a	No. of transporter vessel envisaged	One (1) no. per Mill
b	Pneumatic Panel	One (1) no. per transporter vessel
c	Outlet bend (ACI with 450 BHN)	One (1) no. per transporter vessel
4.	Reject conveying pipe	
a	Reject conveying pipe size	As per system requirement (to be decided by system supplier)
b	Quantity	As per layout requirement
c	Material of pipe line	MS ERW IS 1239(Heavy grade) (<=150Nb) / 3589 (>150 Nb)
d	Type of joint in pipe line	Flanged
e	Distance over which material is to be conveyed and the lift.	As per layout requirement.
f	Conveying pipe bends	
g	Material of conveying pipe bends	Alloy CI (450 BHN)
h	Quantity	One (1) lot per pipe
5.	Bunker & Its Accessories	
a	Number required	One (1) no. per bay
b	Number of outlet	One (1) no. per bunker with bunker outlet gate and canvas chute
c	Pressure Relief Valve	One (1) no. per bunker
d	RF Type Level Probes for high level in bunker	One (1) no. per bunker
e	Terminal Boxes with Up stand on bunker top for terminating the reject conveying pipes	One (1) set per bunker
f	Handling Facility on bunker	One (1) CPB for each bunker.
g	Structure , staircase, operating & maintenance platform, hand railing,	yes
6	Bag Filter on Bunker top with associated instruments	
a	Type & Number	Reverse pulse jet type / One per bunker
b	Material of filter cloth	Polyester needle felt of antistatic type or material suitable for meeting emission levels.
c	Differential pressure switch (DPS)	One (1) no. Provided.
7.	Compressors with drive motor and all other accessories	
a	No. and type of compressors	2x100% capacity (1 working + 1 Standby) Oil injected screw type air compressors.
b	Location	Housed in Main Plant Air Compressor House.
8.	Air receiver with isolation valves, instruments & accessories	



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a	Quantity	One (1) no. per bay
b	Safety valve and pressure gauge	One (1) no. per air receive
c	Auto drain & Y type Strainer	One (1) no. per air receiver.
10.	Type and no. of sump pumps with local control panel	1 no. per bay, portable sump pumps complete with suction (min. 5 m long) & 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.
11.	Control System	
a	Local Control Panel/pneumatic panels/JBs (1 no. for each pyrite hopper) properly mounted on rack (supplier's scope)	1 lot.
12.	Miscellaneous item	
a	Piping, fittings, valves & instruments for conveying air, instrument air, cooling water for transporter vessel inlet valve top plate (if applicable), cooling water quenching in the pyrite hopper, cooling water for air compressor etc.	Supplier's scope
b	Insulation & cladding, if required, to maintain surface temperature of pyrite hopper within 60° C	Supplier's scope
c	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	Supplier's scope
d	All insert plates, embedment plates, foundation bolts/ anchor bolts etc. required for bidder's equipment.	Supplier's scope
e	Charge of all lubricants and fluids as per GTR	Supplier's scope
f	All counter- flanges with nuts, bolts and gaskets at all the terminal points	Supplier's scope
g	Electrical and C&I scope as per enclosure elsewhere in the specification.	Supplier's scope
h	Relevant scope of supply as per GTR, GCC & SCC	Supplier's scope
i	One (1) set of Mandatory Spares as per the list attached in specification	Supplier's scope
j	One (1) set of erection & commissioning spares as required for the complete system	Supplier's scope
k	All impulse tubing (MOC - Stainless steel).	Supplier's scope
l	Any other instrument, item required for	Supplier's scope



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MILL REJECT HANDLING SYSTEM**

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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

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, supply of EPs/ insert plates anchor fasteners, below conveying vessel if applicable etc.
- c) Supply of grouting material for execution of all grouting work required for various foundations corresponding to mill rejects system shall be in bidder scope.
- d) 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.
- e) Erection & Commissioning of Mill Reject Handling System.
- f) Inspection & testing, trial run, demonstration test & handing over to end client.
- g) Painting of all equipment within the battery limit.
- h) Electrical scope of services as per enclosure elsewhere in the specification.
- i) Preparation of Civil input drawings & documents for foundation details (including load data, GA, foundation pocket details etc.) of storage bunkers, compressors, air receivers, pipe rack and pit / trench details for transporter vessel and reject conveying pipes.
- j) Review of Civil drawings prepared by BHEL based on civil input drawing furnished by the successful bidder.
- k) 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.
- l) Relevant scope of services as per GTR, GCC, ECC & SCC.
- m) 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) 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.



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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 in the specification
- e) Relevant exclusion as per GTR, GCC, SCC & ECC.

2.0 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 mill bay along D row at pressure of 5-7 Kg/Sq cm. (total instrument air provided shall be 1.5 cum/min for plant)
- (B) Service water: Tapping terminated with an isolation valve for service water shall be provided at first column of each mill bay along D – row at pressure of 2.5-3 Kg/Sq cm. (total service water provided shall be 6-8 cum/hr for plant)
- (C) DMCW-SG circuit Cooling Water: Supply and return water tapping terminated with an isolation valve for DMCW circuit. 25 cub.m cooling water shall be provided at 38 deg C (max.) at 5m from compressor at a pressure of 5 Kg/sq cm (approx.). Pressure drop will be of 10 MWC and temperature of hot water shall be limited to 44 deg C.

3.0 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.

4.0 DEMONSTRATION TEST & LIQUIDATED DAMAGES

Demonstration test shall comprise of

Liquidated damages are applicable for following guarantees:



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- i) Guaranteed auxiliary power consumption for conveying air compressor (refer price schedule).

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.

Demonstration criteria:

- i) Continuous effective discharge and conveying at the rated capacity of the mill rejects without spillage or blockage in the system.
- ii) Following shall be demonstrated at site for compressor
- Capacity and discharge pressure of each air compressor
 - Power consumption of each air compressor at its rated duty point with its own motor.
- iii) Guarantees of all equipment as per approved data sheet & quality plan.
- iv) Particulate emission rate from bag filters less than 30 mg/nm³ of air shall be demonstrated at site
- v) Vibration and noise level of each compressor and any other rotating equipment shall be demonstrated at site.
- vi) Parallel operation of air compressors, if applicable, shall be demonstrated at site.
- vii) 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.
- viii) 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. Sound pressure shall be measured all around the equipment at a distance of 1.0 m horizontally from the nearest surface of any equipment/machine and at a height of 1.5m above the floor level in elevation.

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



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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.

5.0 VOID

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 (Refer Painting Specification)

Successful bidder shall furnish detailed Painting Schedule for Mill Reject System (based on painting schedule attached with specification) 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) and general technical requirement

9.0 EQUIPMENT DESIGN CRITERIA (Refer Annexure-II)

9.0.1 The minimum design criteria to be followed for various equipment shall be as per requirements indicated under annexure, standard technical specification & datasheet 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 w.r.t. 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 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 (Reference quality plans attached)

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.



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10.0 DRAWINGS/DOCUMENTS REQUIRED WITH THE BID (Refer Volume III)

The drawings and documents to be submitted with the bid shall strictly be the list. Any document other than those indicated therein will not be reviewed and will not form part of contract.

12.0 DRAWINGS/DOCUMENTS REQUIRED DURING DETAIL ENGINEERING (Refer Annexure - "Main Drawing List with Schedule of Submission")

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

13.0 DRAWING/DOCUMENT DISTRIBUTION SCHEDULE (Refer Annexure-"Drawing/Document submission schedule")

Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System (DMS). Bidder would be provided access to 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 section. For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>

14.0 LIST OF DRAWINGS ENCLOSED WITH THE SPECIFICATION (Refer Annexure-"Input Drawings")

Bidder to note that the flow diagram of Mill Reject System 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.

SUPPLY PRICE PERCENTAGE BREAKUP

S.No.	Details of Works or Equipment/System	Qty (LOT / Nos.)	Percentage (%) Break up proposed for billing purpose during contract
1.2.1	Lumpsum firm price for supply of transporter vessel with dome /butterfly/ vertical swing type valve, insert plates and accessories inclusive of all taxes, duties and other levies as applicable .	8 nos.	15
1.2.2	Lumpsum firm price for supply of Pyrite hopper with level probes, temperature switch, rupture disc, metallic expansion bellow inclusive of all taxes, duties and other levies as applicable .	8 nos.	11
1.2.3	Lumpsum firm price for supply of pneumatic panel/ Air control module/ Solenoid box with accessories inclusive of all taxes, duties and other levies as applicable	8 nos.	4
1.2.4	Lumpsum firm price for supply of storage bunkers, pressure relief valves, bag filters with pressure switch , terminal boxes, level probes, chain pulley blocks, bunker discharge gate with accessories inclusive of all taxes duties and other levies as applicable.	2 nos.	34
1.2.5	Lumpsum firm price for air compressors with drive etc inclusive of all taxes, duties and other levies as applicable	2 nos.	13
1.2.6	Lumpsum firm price for Air receivers with accessories inclusive of all taxes, duties and other levies as applicable	2 nos.	2
1.2.7	Lumpsum firm price of pipes for Mill reject conveying inclusive of all taxes, duties and other levies as applicable	1 lot	6
1.2.8	Lumpsum firm price of pipes for Compressed air (instrument air and conveying air) & cooling water services etc inclusive of all taxes, duties and other levies as applicable	1 lot	1
1.2.9	Lumpsum firm price for Air & Water Line Valves inclusive of all taxes, duties and other levies as applicable	1 lot	1
1.2.10	Lumpsum firm price for pneumatically operated knife gate valves for different application inclusive of all taxes, duties and other levies as applicable .	32 nos.	4
1.2.11	Lumpsum firm price for Alloy C.I bends/ fittings/laterals inclusive of all taxes, duties and other levies as applicable .	1 lot	6
1.2.12	Lumpsum firm price for Field instruments, cable glands & lugs, cable trays/conduits(branch) as per specification requirement inclusive of all taxes, duties and other levies as applicable .	1 lot	2
1.2.13	Lumpsum firm price of fixed sump pump along with all its control, inclusive of all taxes, duties and other levies as applicable.	2 nos.	1
1.2.14	Lumpsum price for tools and tackels and start-up & commissioning spares as required, inclusive of all taxes, duties and other levies as applicable.	1 lot	1
	Total of 1.2.1 to 1.2.14 (Should match with 1.1.1) of schedule II of Main price format. These prices shall be used for billing purpose during contract stage.		



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ANNEXURE – I

DATASHEET – A



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DATASHEET-A (MILL REJECT SYSTEM) – ANNEXURE-I

S. No.	Items	Description
1	Type of mill reject system	Pneumatic Pressure Conveying
2	Material handled	Coal Mill reject
3	No. of mills per unit (working & standby) at 100% BMCR with worst coal firing	8 (7 working & 1 Standby)
4	Mill rejects quantity with worst coal per mill	0.76 TPH/Mill
5	Mill layout	Side Mill Arrangement (Refer Layout)
6	Elevation of Mill Reject Spout (wrt FFL in Mill Area)	2.400 m from EL. 0.0 m, DWG NO. 0-00-620-870-40-RV-02
7	Type of Mills	HP 1103 BOWL MILL WITH PLANETARY GEARBOX
8	MRS bunker location	Refer Layout
9	Effective capacity of bunker	74 T for each bunker (1 bunker per bay)
10	MRS Compressor Location	Main Plant Compressor house (Refer Layout)
11	Type of control	DCS based control system
12	Pneumatic/ local control panel	Yes with DOP of IP 55
13	Reject Temperature (Normal/Design) (deg. C)	Around 180 deg. C / 200 deg. C
14	Max/Normal Size of mill rejects to be handled	Max. size : 50 mm (5% of total reject)
15	Bulk Density for a) Volumetric calculation Load calculation	1600 Kg/m ³ 2400 Kg/m ³
16	Max/Normal Size of mill rejects to be handled	Max. size : 50 mm (5% of total reject) Normal Size : (-)25 mm
17	Avg conveying velocity of material	3.5 to 6 m/sec.



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ANNEXURE – II
EQUIPMENT DESIGN/SELECTION CRITERIA



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EQUIPMENT DESIGN / SELECTION CRITERIA (ANNEXURE-II)

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

Normal size	:	(-) 25 mm
Maximum conveying size	:	(-) 50 mm (about 5% of total reject)
Temperature °C (Normal/Design)	:	180/200 °C (**)
Bulk density	:	1.6 T/m ³ for volumetric calculation
	:	2.4 T/m ³ 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.

S. No.	Equipment	Design/Selection/Sizing Criteria
01	Conveying Air Compressor	Each compressor shall be selected to meet the following requirements: a) 2x100% (1W + 1SB) oil injected screw type air compressors shall be provided to cater air requirement of the unit. Each compressor shall be sized to cater air requirement of the unit. b) A margin of 50 % shall be considered over and above the required/ calculated/ minimum compressor capacity arrived for conveying of total reject generated. c) RH – 95% d) Air Temperature (DBT) – 42 deg C e) Height above MSL- As per project information f) Microprocessor based control; command interfaced with plant DCS. g) Noise level- Shall be limited to 85dBA at a distance of 1.0 m in horizontal direction from the nearest surface of the machine and at a height of 1.5 m from the floor level in elevation. Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with calibrated integrating sound level meter meeting the requirement of IEC 651 or BS: 5969 or IS 9779.
02	Air Receiver	As per IS 2825, class III or ASME Section- VIII equivalent as per any other international standard. Corrosion allowance of 3 mm. Shell/ Body, end plates (dished & flanged): MS: IS 2062, Grade-A; thickness as per design calculation Capacity: The air receiver capacity shall be selected to convey one complete cycle with a minimum margin of 25% provided over and above the arrived air receiver capacity or criteria laid in equipment data whichever is higher.
03	Pyrite Hopper & Accessories	a) Number of outlet – Three (3) b) Capacity – 2-3 times transporter vessel capacity. c) MOC: i) For plates – MS as per IS 2062 Gr. A (min)/equivalent as



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		<p>per any other international standard, min. 10 mm thk with sizing grid.</p> <p>ii) Support, platform: MS as per IS 2062 Gr. A.</p> <p>d) Explosion vent</p> <ol style="list-style-type: none"> 1) Rupture Disc type (One no. per hopper) 2) Rupture Disc Bursting Pressure – 0.5 kg /cm² (g) <p>e) Sizing Grid Details – Shall be made from minimum 10 mm dia./thk IS:2062 MS bars/flats with opening suitable for entrapping reject larger than 50 mm in size.</p> <p>f) Surface Temperature – The surface temperature of the equipment shall be maintained within 60 °C. Insulation, if required, to achieve the same shall be provided by the bidder without any commercial implication.</p> <p>g) Supporting structure and platform – MS IS 2062 , Gr A</p> <p>h) Water Spraying arrangement with Solenoid Valve and fog jet nozzle – Yes</p> <p>i) Valves</p> <ol style="list-style-type: none"> 1) Inlet valve – Pneumatically Operated KGV (200Nb) with expansion joint and deflection cone, limit switches for inter lock purpose. 2) Maintenance valve –Pneumatically Operated KGV (200Nb) with limit switches for inter lock purpose. 3) Over size chute – Pneumatically Operated KGV (200 Nb) with limit switches for inter lock purpose. 4) Emergency chute –Pneumatically operated KGV (200 Nb) with limit switches for inter lock purpose 5) MOC: <ol style="list-style-type: none"> i) Body: Cast Iron (IS 210 Gr. FG 260) ii) Deflection cone at inlet of pyrite hopper: CAST NI-HARD HARDNESS 550 BHN. iii) Knife gate: 10 mm thick SS (ASTM A240 Type 304) (edge hardened to 350-400 BHN). j) Min. instruments required <ol style="list-style-type: none"> 1) Two nos. RF type level switches (High & High-High level) 2) One (1) no. of temperature switch.
04	Transporter vessel & its accessories	<p>a) MOC</p> <ol style="list-style-type: none"> i) Transporter Vessel – Design as per IS 2825, Mild Steel IS – 2062, Gr A/ equivalent as per any other international standard. ii) Inlet Valve – Refer S.No.08 below <p>b) Quantity of material to be conveyed per hour by each transporter vessel – Refer Datasheet-A</p> <p>c) Capacity of transporter vessel - To suit the conveying rate with 85% filling</p> <p>d) Any cooling envisaged for inlet valve – Bidder to decide</p> <p>e) Air supply pressure available – Bidder to decide</p> <p>f) Distance over which material is to be conveyed and the lift – Refer Layout Drawing.</p>
05	Bunker & its Accessories	<ol style="list-style-type: none"> a) Number of outlet - One b) Minimum free board – 300 mm, c) Bunker Plate – 10 mm thk. MS Plate conforming to IS 2062 Gr A . d) Liner – 3 mm SS 304 Liner in conical portion of bunker. e) Minimum Valley Angle - 60 Degrees f) Discharge Gate (Hand lever operated)



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		<ul style="list-style-type: none"> i. Size – 400 mm x 400 mm (clear open) (min) ii. Type – Twin Sector, Manually operated. iii. MOC – 10 mm thick (min.) Cast Iron to IS 210/ MS to IS 2062 (Gr. A /B) with 8 mm thick SAILHARD/TISCRAL LINER on complete inner surface. g) Staircase: Complete staircase to be provided up to bunker top with operating / maintenance platform at all levels having any equipment requiring operation & maintenance. h) Level probe (high) shall be as per C&I specification requirement. i) Pressure relief valve designed for max. Pressure subjected. j) The bunker-supporting column shall be so spaced to have a clear road access of 5.0 m width & clear access /headroom 4.5 m. k) Terminal boxes : IS 2062 Gr. A/B with 8mm thick SAIL HARD/TOSCRAL liner <p>Bag Filter</p> <p>Each Bag filter shall be sized considering simultaneous firing of one normal and one emergency cycle.</p> <ul style="list-style-type: none"> a) Type: Reverse pulse jet type. b) Material of Filter Cloth – Polyester needle felt of antistatic type suitable for prolonged operation up to a temperature of 200°C without losing its collection efficiency & durability. c) Air to Cloth Ratio – 1.5 m/min (Further 10 % additional bags shall be provided) d) Bag Filter casing– MS, IS 1079. 3.0 mm thick. e) Bag Cage – MS, IS 2062, Gr. A (min), 3.0 mm dia (min), galvanized wire. f) Outlet Air Quality – less than 30 mg/nm³. g) Bag Cleaning Mechanism – Automatic and shall comprise of solenoid valves, air nozzles, adjustable solid state timer, pressure switches, piping and fittings etc. h) Test on bag filter casing: In case bag filter is assembled in casing at site, smoke/ bubble test shall be carried out on the bag filter casing to ensure that the casing is free of welding defect. However, if assembly of bag filter & casing is done at shop, relevant NDT shall be carried out as per approved MQP for checking the soundness of weld. i) Chain Pulley Block over bag filter: Shall have 25% margin over weight of bag filter, but in no case the capacity shall be lower than 1.0 T, same shall be as per IS 3832.
06	Lines for Various Services	As per Low Pressure Piping Specification (Refer Index) Pipe above 150NB shall be 5.4mm thick.
07	Knife Gate Valve (pyrite hopper inlet, oversize discharge, emergency discharge, hopper isolation/maintenance)	<ul style="list-style-type: none"> a. Operation: Pneumatic b. Material of Construction: <ul style="list-style-type: none"> 1) Body – CI to IS 210 Gr FG 260 2) Knife Gate – Min 10 mm Thk SS (ASTM A 240 type 304) with wearing parts provided with abrasion resistant material of hardness 350-400 BHN c. Size – 200 NB (min) for all valves d. (All knife gate valve shall be provided with open & close limit switches for interlock and control purpose) e. Deflection cone: Required before the pyrite hopper inlet knife gate



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		valve. (MOC: CAST NI-HARD HARDNESS 550 BHN)
08	Transporter vessel inlet valve	<ul style="list-style-type: none"> a. Pneumatically actuated valve. b. Type: Dome/plate/butterfly/swing type as per supplier's proven practice c. As per IS/BS/International Codes. d. Material of construction e. Body – MS / CI to IS 210 Gr. FG 260, 225 BHN f. Dome – Alloy CI with hardness as 225 BHN with leak proof seat. g. Shaft – SS 304 h. Disk – SS 304/ Alloy CI, hardness of 500 BHN (min)
09	Conveying pipe bend	<ul style="list-style-type: none"> a. MOC & Hardness – Alloy CI, 450 BHN min with min 2% Ni b. End connection- Flanged
10	Fittings, Flanges, Fasteners & Gaskets	As per Low Pressure Piping Specification (Refer Annexure under customer specification)
11	Valves for Air & Water Lines	As per Low Pressure Piping Specification (Refer Annexure under customer specification)
12	Sump Pumps	<ul style="list-style-type: none"> a) Type: Portable type (1 no. per bay) b) Capacity – To meet system requirement but not less than 10 m³/hr c) Head discharge: 10 MWC d) MOC: <ul style="list-style-type: none"> i. Casing & suction bell – 2.5 % Ni-CI to IS 210, FG260 ii. Impeller – 2.5 % Ni-CI to IS 210 , FG260 iii. Shaft/Sleeves – EN-8
13	Hand Operated Chain Pulley Block with Geared Trolley	<ul style="list-style-type: none"> a) Capacity (Kg) – Min 1 T or 25 % margin over and above the max weight to be handled whichever is higher (to suit the heaviest equipment lifting on silo top) b) Service condition - Class II outdoor c) No. of CPB – One (1) no. per bunker. d) Lift (m) - To suit the requirement/16 m (min.) e) Type of suspension- Traveling Trolley. f) Head Room - As per Vendor data. g) Type of gear in CPB - Spur Gear. h) Type of bearing - Ball/Roller. i) Grade of Load Chain - Alloy Steel /Gr. 80. j) Grade of Hand Chain - Steel / Gr. 30 k) Factor of Safety - As per Relevant IS
14	Velocities	Reject conveying velocity : 3.5 - 6 m/sec.



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Air Velocities:

Service	Velocity in m/sec		
	Pipe size below 50 mm	Pipe size of 50 mm to 150 mm	Pipe size of 200 mm & above
Compressed air pressure below 2 Kg/cm ² (g)	15-20	20-30	25-35
Compressed air pressure below 2 Kg/cm ² (g)	20-30	25-40	35-45

Water line velocities:

Service	Velocity in m/sec		
	Pipe size below 50 mm	Pipe size of 50 mm to 150 mm	Pipe size of 200 mm & above
a) Water Pump Suction	0.6-0.9	1.2-1.5	1.2-1.8
b)Water Pump discharge	1.2-1.8	1.8-2.4	2.1-2.5



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SECTION – C2-A
CUSTOMER TECHNICAL SPECIFICATION

- vii) The contractor shall arrange for necessary handling equipments, if required, for the erection of equipments under his scope.
- viii) Supervision of Mill rejects handling system Civil / Foundation work.

5.00.00 **EQUIPMENT SPECIFICATION AND DATA SHEETS**

5.01.00 **Conveying Air Compressor:**

5.01.01 The Compressed Air System shall ensure a reliable supply of adequate quantity and quality of oil free air on continuous and intermittent basis for mill rejects removal from mill outlets.

The normal pressure of conveying Air supply at the outlet of conveying compressor shall be decided by the vendor as per system requirement, allowing for pressure drops in system piping, equipment and all other accessories.

The maximum expected pressure in the system should be computed by considering 10% overpressure over and above the rated discharge pressure of each air compressor as computed above.

There will be no separate compressor house for the MRSH conveying compressors. MRHS compressors will be located in the Main compressor building.

The delivered compressed air at oil filter outlet shall not contain any trace of oil, grease or any other impurities. Size of particles in the delivered air shall not exceed 3 Microns.

Compressed air system equipment requiring cooling water shall be capable of operation at design capacity with cooling water inlet temperature subject to a maximum of 38 °C in Equipment cooling water system. The above equipment shall also be capable to withstand a pressure not less than the shut off head of each pump.

The temperature of air at outlet from after cooler shall not exceed 10°C above the cooling water inlet temperature.

Air Compressors shall be identical and shall be designed for continuous operation with high efficiency to satisfy the performance requirement as specified in the Data Specification Sheet.

The power rating of the driver shall be selected such that a minimum margin of 15% is available over the power required to deliver rated capacity against rated discharge pressure. When the driver is not directly coupled to the compressor, due account should be made for losses in power transmission, in addition to the above margin. However, the power rating of the driver thus selected shall have sufficient margin to run the compressor under relief valve discharge condition considering that the compressor is operating at its rated capacity and discharge pressure corresponding to set pressure of relief valve.

As more than one (1) compressor with drive is specified, satisfactory operation in parallel shall be ensured without any uneven load sharing, undue vibration,

Keeping noise level within permissible limits for a number of compressors working simultaneously.

The Contractor under this specification shall assume full responsibility in the operation of the compressor and the drive as a unit.

Each Air Receiver shall be so sized that even in the event of total stoppage of air inflow to the same, the pressure in the Air Receiver shall not fall below 80% of design pressure kg/cm^2 (g) within two (2) minutes of such stoppage, while maintaining an out flow of air at a rate equal to the rated capacity of a single compressor, during the aforesaid period. In no case, the size of each Air Receiver shall be less than that arrived from IS 7938.

The capacity of each Air Receiver shall be determined in accordance with the following guidelines:

$$V_{AR} = (T \times C \times P_A) / (P_{MAX} - P_{MIN}), \text{ where}$$

$$V_{AR} = \text{Volume of each Air Receiver in } M^3.$$

$$T = \text{Bleed down time in minutes, shall be taken as 2 minutes (minimum)}$$

$$P_A = \text{Atmospheric pressure, (absolute).}$$

$$P_{MAX} = \text{Maximum system pressure in Kg/Sq.cm (absolute).}$$

$$P_{MIN} = \text{Minimum system pressure in Kg/Sq.cm absolute,}$$

$$C = \text{Free air delivery capacity of each Air compressor for IA system or free air delivery capacity of each SA compressor for SA system, } M^3.$$

The water filled volume of each Air Receiver shall be calculated in accordance with the guidelines specified above or $10M^3$, whichever is higher.

5.01.02 Design and Construction

The design shall be such as to ensure trouble free operation with least vibration and noise. Different parts of the compressor and accessories shall be arranged neatly in a compact manner. Due consideration shall be given for easy accessibility and maintenance of the compressors.

Unless inconsistent with this specification equipment from the standard range of manufacture of the bidder shall be preferred.

Compressor components shall be interchangeable as far as possible. Material of construction shall be suitable for the service.

The compressor shall be oil flooded, horizontal, multi-stage, water cooled, electric motor driven screw type, heavy duty, rugged construction. Their speed shall be so selected as to result in low maintenance and trouble-free operation under specified conditions.

Compression chamber wall thickness shall be such that to withstand maximum design pressure.

During maintenance of compressor suitable arrangement for cleaning of the cooling water jackets shall be provided.

Dynamically balanced, one-piece Rotors construction with a symmetric profile to keep leakage loss to a minimum and ensure high efficiency.

Rotor shaft mounted, highly precise timing gears shall be designed to counter the axial forces incurred in compression.

Use of Oil lubricated anti friction type bearings is at least 8000 running hours.

The shaft sealing and retainers shall be free for radial self-adjustment on the rotor shafts.

Minimum design service factor for the integral, oil lubricated type, step up gearbox shall be of 1.5.

AC electric motor will be used for driving the compressor conforming to the relevant Sub Sections of Electrical part (Section-2) of this specification.

The rotor and shaft shall be of single piece construction, made of forged steel with suitable corrosion resistant coated material to minimize leakage and wear (AISI C1141 or equivalent). The stator (casing) shall be of Cast-Iron Construction with corrosion resistant material and with integral jacket cooling.

The seal rings and retainers shall be of stainless steel construction. The seals shall prevent air and oil leakage along the shaft. Air vented from second stage discharge end seals shall provide buffer air to the other seals to prevent migration of oil towards the compression chamber under all operating conditions.

The gaskets shall be of asbestos free material.

For design capacity, outlet pressure and other relevant data, refer Data specification sheet.

Lubrication system

The compressor package shall include a lubricant management system which shall lubricate the bearings and seal.

The lubricant pump shall be shaft driven. An auxiliary motor driven pump shall be provided if required by the manufacturer to supply pre-start and shut down system. All lube oil pumps shall be of rotary positive displacement type, having stainless steel rotors and steel casing. A relief valve will protect the pump discharge system.

All instrumentation and accessories in the lubrication circuit, namely discharge pressure gauge, pressure switch, relief valve etc. shall be included in the scope of supply. Suitable time delay relay or equivalent device to bypass low oil pressure switch during start-up shall be provided.

5.01.03 Gear Box

Speed increasing gears between the motor and compressor stages shall consist of a common helical gear driving the pinion of each stage. Helical timing gears shall be mounted on the rotor shafts to maintain accurate relative rotor position. Gears shall have a rating of AGMA-12 or equivalent.

5.01.04 Coolers

The heat exchangers for compressor intercooler, after cooler, and lube oil cooler shall be water cooled. The heat exchangers shall be located within the enclosed compressor skid.

The fouling factor shall be considered as per the recommendation of TEMA.

The intercoolers and after coolers shall be provided with moisture separators and condensate drain arrangement. Necessary safety valves shall be provided on inter and after coolers.

All heat exchangers shall be designed for a heat duty corresponding to the peak power demand of the compressors.

The coolers shall be designed in accordance with the requirement of IS-2825.

After cooler at each compressor discharge shall be designed to bring the outlet temperature of the compressed air within 10°C of the cooling water inlet temperature.

Inter-cooler, after cooler and moisture separator shall be provided with auto trap stations including strainer, bypass and double isolating valves for the traps. A level gauge glass with isolating cocks shall be provided near the bottom of moisture separator.

The intercooler and after cooler, if any, shall be of shell and tube type with removable tube bundle. The shell, tubes, tube sheets and expansion joints with tube sheets particularly at flare portion etc. of the heat exchangers shall be designed to withstand the maximum working pressures encountered. Necessary allowance for corrosion shall be considered.

Inter coolers / after coolers shall be provided with supports which are designed to avoid undue stress or deflection in support or body of the equipment.

Due consideration for the differential expansion of shell and tube shall be given in the design of the coolers.

- 5.01.05 Installation
- The compressor package shall be suitable for simple installation on concrete floor.
- 5.01.06 Air Receiver
- Air receiver(s) shall be in accordance with IS: 2825 & IS: 7938 or approved equivalent.
- The design pressure, capacity and other parameters shall be as indicated in Data Specification Sheet.
- Receivers shall be of welded construction with minimum number of joints. Longitudinal seams in adjacent sections of shell shall not be in the same line.
- Receivers shall be provided with required number of nozzles, the orientations of which shall be subject to approval by the Purchaser. At least two gasketed inspection holes shall be provided for receivers up to 600 mm diameter. For larger diameter, manhole of minimum 450 mm diameter shall be provided. All openings shall be placed as far as possible from welded seams and in no instance shall pierce the seam.
- Receivers shall be provided with one or more safety relief valves of proper capacity so that the maximum working pressure of the system is not exceeded under any circumstance. Unless otherwise specified, each receiver shall be provided with at least one pressure gauge and one temperature gauge of proper range and required number of pressure switches for compressor control purpose.
- Each air receiver drain connection shall be provided with automatic drain valve for automatic removal of drain consisting of valve, strainer, double isolation and bypass valve. Each air receiver should have air release vents at top to facilitate statutory hydraulic tests.
- The air receiver shall be vertical self supporting cylindrical vessel with dished ends and with supporting stand for resting on Civil Foundation in accordance with Air Receiver data sheet enclosed herewith.
- All welding shall be performed in accordance with relevant code. Filler material, that will deposit weld metal with a composition and structure as near as that of material being welded, shall be used. The electrodes shall be dried immediately before use to ensure freedom from porosity.
- 5.01.07 Intake Air Filter and Silencer
- Filters with multiple elements quick removal type for easy cleaning shall be provided at suction of each air compressor and also be of heavy-duty dry type.
- Cartridge type filters may also be utilized.
- The filters shall be complete with integral silencers. Separate silencers, if specified, shall be provided. The filtering elements shall be easily removable for cleaning.

Maximum pressure drop across filter at design flow rate in new condition shall be 250 mm of water column.

Filtering media shall be of densely packed, replaceable type.

Filter shall be designed to have sound suppressing characteristics.

5.01.08 Interconnecting Piping, Valves and Fittings

Compressed air piping between air compressor and receiver, etc., shall be furnished by the Contractor, complete with valves, fittings, pipe supports as necessary. The piping shall be as per the Codes/Standards mentioned in Data Specification Sheet.

All relief valves shall be provided with hand levers to permit manual operation. Isolation valves shall conform to relevant IS / BS codes. Material of construction shall be suitable for the temperature of fluid & type of fluid it handles. The end connection shall be as mentioned in the datasheets.

Cooling water piping & its fittings shall be as per the data specification sheets.

All lines handling hot air, Reactivating piping / vessel shall be suitably insulated to restrict the exposed surface temperature to 60 °C maximum.

Since a number of compressors will be operating simultaneously in the same room, special attention shall be given for minimising generation and transmission of vibration and noise level during running of the compressors. All piping connections in the compressed air and cooling water lines between the nozzles on the compressors block and the interconnecting piping shall be made by 500 mm of wire reinforced rubber hoses and flexible metallic pressure hoses of suitable size and rating.

Sight flow indicators shall be provided in the cooling water line at the outlet of each piece of equipment and accessories requiring separate cooling water supply. The flow indicators shall be of approved design.

The air discharge piping shall be full size of compressor outlet or larger, short and direct with minimum number of fittings up to air receiver. Only long radius elbows shall be used where bends are unavoidable.

Any pocket in discharge piping shall be provided with drain connection complete with automatic draining arrangement. Long run of vertical piping at compressor discharge shall not be acceptable.

The layout shall be such as to prevent resonance. Provision of thermal expansion of hot pipes shall be made.

All pipe connections with equipment shall be flanged type. All pressure gauges shall be complete with root valves.

All instruments, safety valves etc. as specified and shown in tender drawing shall be furnished on the piping.

Complete piping system shall be provided with adequate supporting arrangement to avoid undue forces and moments at the equipment terminals and vibration.

For water cooled compressors, cooling water shall normally be piped through the intercooler (where applicable) and after cooler in parallel. From the intercooler, the water shall be taken to cylinder jackets. A solenoid valve shall be provided on the water inlet line for interlocked starting of compressors. Where provision for automatic water flow regulation by thermostatic valve has been made, a suitable bypass arrangement to the valve shall be made so that flow is ensured under all circumstances. The velocity in water pipe shall be limited to 2.5 m/sec.

All instruments as specified elsewhere shall be furnished.

All traps shall be of auto drain type to drain out moisture at regular intervals. The body and cover shall be of cast iron/solid steel construction and internals shall be of SS. Isolating valves shall be of stainless steel.

All strainers shall be Y-type with suitable blow-off plugs. The body material shall be cast iron. The screen shall be of stainless steel with 40 mesh openings.

All bolt and nuts shall be of Carbon-steel conforming to IS-1363.

5.01.09 Drive Unit

The compressors shall be driven by A.C electric motor. For determining the output rating of driver general guidelines as indicated in relevant sub-section of the Electrical part (Section-2) of this specification shall be followed.

The driver shall be connected to the compressor either directly or through gear box as per Data Specification Sheet.

For other types of connection between drive unit and compressor, suitable flexible coupling shall be provided.

Necessary guard for all exposed moving parts shall be provided.

Motor speed torque curve shall match with that of the compressor for trouble free start-up.

Motor shall be suitable for eight (8) equally speed starts per hour.

5.01.10 Inspection and Testing

The tenderer shall conduct all tests and inspections required to ensure that the equipment furnished shall conform to the requirements of this specification and in compliance with requirements of applicable Codes and Standards. The particulars of the proposed tests and the procedures for the tests shall be submitted to the Purchaser for approval before conducting the tests. The Purchaser's representative shall be given full access to all tests. The Contractor shall intimate the Purchaser well in advance (at least 15 days notice) so that if desired his representative can witness the test.

Where stage inspection is to be witnessed by Purchaser, in addition to above, the bidder shall submit to the Purchaser at the initiation of the contract, the detailed PERT-Chart showing the manufacturing programme and indicating the period where Purchaser or his authorized inspecting agency is required at the shop.

Shop Tests

Material Test

- i) All materials used for construction shall be of tested quality. Physical and Chemical tests of materials shall be conducted as per the relevant standards and test certificates shall be made available to the Purchaser. If demanded by Purchaser's inspector, proof of use of only tested quality material shall be furnished.
- ii) Where stage inspection is to be witnessed by Purchaser, all material test certificates shall be correlated and verified with the actual material used for construction by Purchaser's inspector who shall stamp the material. In case mill test certificates for the materials are not available, the Contractor shall carry out physical and chemical tests at his own cost from a testing agency, approved by the Purchaser, as per the requirement of specified material standard. The samples for physical and chemical testing shall be drawn up in presence of Purchaser's inspector who shall also witness the testing.
- iii) All castings shall be sound, clean and free from porosity, blow holes, hard spots and other harmful defects.
- iv) If specified in the Data Specification Sheets, the Compressor components shall be subjected to non-destructive testing (NDT). The requirements of NDT shall comply with the relevant standards. The accepted limit shall be as stipulated therein. All components subjected to NDT shall be identified and stamped by Purchaser's inspector on successful completion of testing.

Hydraulic Test

All pressure parts shall be hydraulically tested at shop as per relevant code and at 150% of design pressure or 200% of working pressure (whichever is higher) where not specified, prior to painting and lining, if applicable. The pressure parts shall be kept pressurised for at least one (1) hour at this test pressure, unless contradicted by the relevant test code.

Dynamic Balancing Test

All rotating components and the assembly of the compressors shall be subjected to dynamic balancing test if asked for in the Data Specification Sheet.

Test for capacity, pressure drop and efficiency of intake filter and silencer shall be made as per manufacturer's standard.

Performance Test at shop

Type test/routine test for the compressors shall be done for satisfactory performance in accordance with the relevant IS/BS/ASME or equivalent standard. Test for volumetric and overall efficiency of the machine (and testing of loading & unloading mechanism) shall be included in the routine test if required by the data specification sheet.

Tests shall be conducted with actual driver being furnished.

Reports and test certificates of the above tests shall be submitted to the Purchaser.

All drive motors shall be tested as per procedures detailed in Electrical Sub-sections.

Performance Test at Site

After installation, complete system offered may be subjected to testing at field by Purchaser.

5.01.11 Welding and Radiography

All welding shall be performed generally in accordance with IS-2825 - code for unfired pressure vessels and code for pressure piping B31.1. Filler material that will deposit weld metal with a composition and structure as near as that of the material being welded shall be used. Electrodes conforming to AWS-6010 may be used for welding of Carbon steel vessels. The electrodes shall be oven dried before use to ascertain freedom from weld porosity.

The Tenderer shall have all welding procedure qualified in accordance with the relevant codes prior to commencing any welding on the works. Any procedure for the repair of defects in the weldments and all other materials shall be submitted to the Purchaser for his approval prior to any repairing being done.

If asked for in data specification sheet all butt welded joints used for fabrication of the pressure vessel shall be subjected to spot radiography in accordance with relevant standard. Where radiography cannot be easily employed other non-destructive test like dye-penetration tests may be applied. The result of these tests shall be reported as per IS-2825.

DATA SPECIFICATION FOR AIR COMPRESSOR AND AUXILIARIES

A.	Performance Specification		
	Air Delivery	:	Bidder to compute and indicate as per guidelines in this section.
	Discharge Pressure	:	- do -
	Duty	:	To be designed for continuous load-unload and On-off mode operation.
	Parallel operation of one or more compressors shall be possible without any undue vibration and noise.		
	Noise level	:	Not to exceed 85 dBA at a distance of 1.0 m. from the equipment surface.
	Compressed air outlet temp.	:	Limited to 10°C above of inlet cooling

		water temperature.
	Location	: Indoor
B.	Construction Features	
	Type of Compressor	: Oil flooded rotary Screw compressor with oil separator at discharge to restrict oil in air to 3 ppm (guaranteed).
	Quantity	: As indicated in the single line flow diagram
	Type of drive	: Electric Motor
	Nos. of starts per Hr.	: 8
	Type of Transmission	: Gear
	Anti vibration Arrangement required	: Yes
	Type of Control	: Dual i.e. both load-unload and auto start/stop
	Type of Annunciation	: Audio-visual
	Flange Standard	: ANSI B16.5
C.	Materials of Construction:	
	Gear casing, Compressor	: Cast Iron, GGG 40, DIN 1693
	Compressor Casing / Rotor housing	: Cast Iron, GGG 40, DIN 1693
	Rotors	: Carbon Steel, Teflon coated, St 50-2, DIN 17100
	Bull gear	: Low Alloy Steel, 18 Cr Ni Mo 7-6 , EN 10084
	Pinion Gear	: Low Alloy Steel, 18 Cr Ni Mo 7-6 EN 10084
	Timing Gears	: Low Alloy Steel, 21 Ni Cr Mo 2-2 EN 10084
	Drive shaft	: Low alloyed steel, 42 Cr Mo S4, EN 10083-1
	Oil pump discharge pressure	: 2 – 2.2 bar
	Oil cooler [Plate type]	: Stainless Steel, AISI 316
D.	Supply of Accessories and Service	
	Intake Air Filter with Silencer	: Yes
	Inter Coolers	: Yes
	After Cooler and Moisture Separator	: Yes
	Automatic drain traps	: Yes
	Anti- vibration pads	: Yes.
	All Instruments as specified and as shown in the tender drawing and as required	: Yes
	Coupling guard	: Yes
	Air Receiver	: Yes
	Base Plate	: Yes
	Foundation bolts, nuts, sleeves etc.	: Yes

	Interconnecting pipe work valves & specialties as per scope and as shown in the tender drawing.	:	Yes
	Eye bolts, lifting lugs, tools and tackles	:	Yes
	Jack bolt in each motor base frame for alignment purpose	:	Yes
	Control panel as per specification	:	Yes
	Instrument Gauge Panel	:	Yes
	Shop painting	:	Yes
	Spare parts	:	Yes
	Erection Service	:	Yes
	Shop testing	:	Yes
	Testing at site and commissioning	:	Yes
E.	Testing and Inspection		
	Material Testing and Identification	:	Required
	Radiography Test	:	Yes
	Parts to be Tested	:	All Pressure parts and Vessels
	Dye Penetration Test	:	Yes
	Type of performance test	:	Routine Test
	Volumetric and overall efficiency tests and testing for loading / unloading mechanism included in performance test.	:	Yes
	Hydrostatic test	:	Yes
	Field Performance test	:	Yes
	Performance test and Hydrostatic test at site to be witnessed by the Purchaser	:	Yes
	Non-destructive test of material	:	Yes
	Dynamic balancing test of the rotor	:	Yes
	MPI & UT Tests	:	Yes
G.	Compressor Accessories		
i)	Intake Air Filter and Silencer		
a)	General Information		
	Quantity	:	One (1) no. With each compressor.
	Location	:	Indoor/ at the suction of each compressor
	Type	:	Dry type
	Silencer	:	Yes
b)	Performance Required		
	Air Flow rate, Cu.m/min.	:	To suit compressor rating
	Particle size in micron	:	Maximum 5 micron
	Maximum allowable pressure drop at stated air flow rate in	:	250 mm WC

	new condition of filter		
	Filtering efficiency	:	Minimum 95% for particles 5 microns
c)	Test Requirement	:	
i)	Separate test as per manufacturer's standard practice.		
ii)	Air Receiver		
a)	General Information		
	Quantity	:	As indicated in the single line flow diagram.
	Installation	:	Indoor
	Type	:	Vertical cylindrical with torispherical dished ends
	Design Pressure	:	Bidder to compute and indicate as per guidelines in this section.
	Design temperature	:	50 ⁰ C
	Hydraulic Test Pressure	:	Bidder to indicate
b)	Design code	:	ASME sec. VIII Div. 1 or IS: 2825
c)	Material of Construction		
	Shell, End plates (dished ends) & flanges	:	IS 2062 or Equivalent
d)	Supply of Accessories and Services		
	Companion flanges with nuts, bolts & gaskets etc.	:	Yes
	Pressure Indicator with snubber	:	Yes
	Pressure Switches	:	Yes
	Temperature Indicators	:	Yes
	Relief Valves	:	Yes, set pressure shall be at least 10% above working pressure
	Trap Stations	:	Yes
	Level Gauges	:	Yes
	Vent valve / plug	:	Yes
	Supporting stand with necessary foundation bolts, nuts, sleeves etc.	:	Yes
	Gasketed inspection manhole	:	Yes, minimum 500 mm diameter
	Eyebolts, lifting lugs, tools and tackles.	:	Yes
e)	Painting		
	i) External	:	Adequate number of shop coats of Polyamide Epoxy primer so as to achieve the required dry film thickness (DFT) of 100-150 microns. Then adequate number of finish coats of Aliphatic Polyester Urethane paint of approved quality shall be applied so as to achieve the required dry film thickness (DFT) of 40-50 microns. Thickness of each coat shall be 25-50

			microns.
	ii) Internal	:	Shop painted as per manufacturer's standard
f)	Inspection and Testing		
	Material testing and identification	:	Yes
	Bend test as per BS-5169	:	Yes
	Hydraulic test	:	Yes
	Spot radiography of all circumferential & longitudinal Butt welds	:	Yes
	Field Performance test	:	Yes
	D.P. Test where Radiography can not be done	:	Yes
iii)	Intercooler, After-cooler, moisture separator		
a)	After- Cooler		
	Quantity	:	One (1) no. with each compressor.
	Installation	:	Indoor
	Type	:	Shell & Tube
	Design pressure in air side	:	2 kg/cm ² more than air inlet pressure
	Design pressure in water side	:	Not less than shut off head of ACW Pumps
	Relief Valves	:	Yes
	Internal Baffling	:	Yes
	Moisture Separators	:	Yes
	Trap Stations	:	Yes
	Temperature Indicators	:	Yes
	Level Gauges	:	Yes
b)	Inter-Cooler		
	Quantity	:	One (1) no. With each compressor.
	Installation	:	Indoor
	Type	:	Shell & Tube
	Design pressure in air side	:	2 kg/cm ² more than air inlet pressure
	Design pressure in water side	:	Not less than shut off head of ACW Pumps.
	Relief Valves	:	Yes
	Internal Baffling	:	Yes
	Trap Stations	:	Yes
	Pressure Indicators	:	Yes
	Temperature Indicators	:	Yes
	Temperature Switches	:	Yes
c)	Supply of Accessories and Services		
	Supporting stands with bolts, nuts & gaskets	:	Yes
	Eye-bolt, lifting lugs, tools and tackles	:	Yes
	Counter flanges at terminal points of supply and return of	:	Yes

	cooling water including gaskets, nuts, bolts etc.		
	Shop painting with two (2) coats of red oxide primer	:	Yes
d)	Material		
	Tube	:	Admiralty brass or Aluminium brass or SS-304
	Shell	:	SA 285 Gr. C or equivalent
	Tube Sheet	:	SA 285 Gr. C or equivalent
	Baffle	:	Carbon Steel
	Flange	:	IS-2002 Grade 2A
e)	Testing and Inspection		
	Material Testing and Identification	:	Yes
	Hydraulic test	:	Yes
	Field performance test	:	Yes
iv)	Interconnecting piping, valves		
	Compressed Air Piping	:	IS-1239 (Heavy Grade) Black ERW, for sizes up to 150 mm NB and as per IS-3589 Gr. 410 for sizes above 150 mm NB
	Cooling Water Piping	:	IS-1239 (Heavy Grade), IS-3589 Gr.-410
	Valves (Air Line)	:	All valves shall be non-lubricated type PTFE Ball Valves with flanged end for sizes 65 mm NB and above. Gunmetal body gate, globe, and check valves with screwed ends for sizes 50 mm NB and below.
	Valves (Water Line)	:	Cast CS body gate, globe, and check valve butt-welded ends for sizes 65 mm NB and above. FCS body gate, globe, and check valves with socket welded end for sizes 50 mm NB and below.
	Fittings (Air Line)	:	Screwed up to 50 mm. Long radius elbows to be used. Flanged above 50 mm (Screwed Flanges).
	Fittings (Water Line)	:	Socket welded up to 50 mm and butt-welded above 50 mm.

5.02.00 **Air and Water Piping**

Shall be as per specification enclosed elsewhere in the specification.

5.03.00 **Pyrite Conveying Pipe & Fitting:**

The Tenderer shall include in his proposal all the piping, fittings generally as necessary to make the system complete and full-proof. Necessary steel supports, hangers and fastening materials etc. shall be furnished by the Tenderer.

The piping shall be arranged to provide clearance for the removal of equipment requiring maintenance and for easy access to valves and other piping accessories required for operation and maintenance.

Piping shall generally be routed above ground but where specifically indicated / approved by the Engineer the pipes may be arranged in trenches.

Overhead piping shall have a normal minimum vertical clearance of 3 meters above walk ways and working areas and 8.5 meters above roadways unless otherwise approved by the Engineer.

Data Sheet Piping, Fittings and Accessories

a.	Type of Pipes	As per system requirement, however minimum 115.0 mm OD X 5.4 mm thick ERW steel pipe as per IS: 1239. Heavy class shall be supplied for mill reject conveying piping.
b.	Material of pipe line and thickness	MS ERW as per IS 1239, heavy grade for pipes up to 150 NB, IS 3589 for pipes above 150 NB.
c.	Type of Line joints.	Flanged
d.	Quantity	As required
e.	Fittings (Bends)	Alloy CI with minimum 450 BHN hardness.
f.	Distance over which material is to be conveyed	As per layout requirement, however the bunker should be located adjacent to the mill bay considering nearest approachable space.

TESTING

Hydrostatic, material and hardness test shall be carried out at shop and hydrostatic test shall be carried out after installation.

Pipes shall be hydrostatically tested at shop at Twice the maximum operating pressure.

5.04.00 **Plate Valve:**

The valves shall be of rugged construction designed for the service condition specified in the enclosed data sheet. Liberal wear allowances shall be provided in all components subject to attrition by flowing pyrites.

The valves shall be suitable for trouble-free service with highly erosive pyrites. Design of the valves should be such that there is no possibility of entrapment of solid particles between gate and body seat.

The valves shall be manually / cylinder operated type as required for service condition or as indicated in the data sheet. In case of cylinder operated valves necessary solenoid valves, needle valves etc shall be in the scope of tender

All valves shall be provided with an open / close position indicator.

All parts of the valves coming in contact with pyrite shall be made from appropriate abrasion-resistant material commensurate with the materials specified in the data specification sheet for the principal valves components.

5.05.00 Limit Switch

Wherever needed limit switches shall be provided with the plate valves for interlocking purpose.

Limit switch shall have minimum of one normally open and one normally closed contacts.

5.06.00 **Pyrite Hopper**

No. of Pyrite Hopper	:	One per mill
Temperature Switch	:	One no. / pyrite hopper
RF type level switch	:	Two nos. (For High & High – High level) per pyrite hopper
Level Switch	:	Two nos per pyrite hopper
Spray nozzles	:	Solenoid operated spray nozzle
Rupture disc	:	One no. Per hopper
Plate valve	:	As per Single Line Diagram enclosed

Material of construction

i) Pyrite hopper body	:	} MS-IS: 2062, Gr.A Hopper body 10mm thick
ii) Grid	:	
iii) Supports, Platform	:	

5.07.00 **Conveying Vessel**

No. of conveying vessel envisaged	:	One (1) no. per Mill
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	Material of construction	
	a) conveying vessel	: Mild Steel IS – 2062, Gr. A
	b) Dome Valve / Inlet Valve	: As per equipment sizing criteria
	c) Quantity of material to be conveyed	: As per spec.
	d) Per hour by each transporter vessel	
	e) Design conveying rate selected	: As per spec.
	f) Maximum size of material to be handled	: Up to 40 mm, Normal 25 mm
	g) handled	
5.08.00	Conveying pipe bends	: Alloy Cl, 450 BHN
5.09.00	Bunker & Its Accessories	
	Number of outlet	: One(1) per mill bunker
	Effective Capacity	: As indicated in specification
	Number of outlet	: One
	Minimum free board in mm	: 300 mm approx
	Material Of Construction and Thickness	:
	Bunker Plates	: 10 mm thk. MS plates (min.)
	Liners	: 3 mm SS-304 liner in conical portion
	Discharge gate	: Hand lever operated twin Sector gates Cast Iron IS 210/ FG 260/ MS to IS 2062 with TISCRA/SAIL HARD liner
	Accessories	
	High Level Switch	: One (1)
	Relief Valve	: One (1)
5.10.00	Bag Filter	
	1. Type	: Reverse pulse jet type.
	2. Air to cloth ratio at maximum air flow	: 1.5 With isolation of 10% bags.

3. **Material of construction**

- a) Material of filter cloth : Polyester needle felt. or suitable material meeting emission requirement
- b) Filter bag cage : MS, IS 2062, Gr. A, 3 mm thick, Galvanised.
- c) Filter housing : MS
- d) SMP level of vent air from bag filter : Less than 30 mg/NM³.

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SECTION-VI

**LOW PRESSURE PIPING, VALVES AND
SPECIALITIES**

CONTENT

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2.00.00	CODES AND STANDARDS
3.00.00	SCOPE OF WORK
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5.00.00	DRAWINGS, DATA, INFORMATION & MANUALS
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ANNEXURES

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SECTION-VI

LOW PRESSURE PIPING, VALVES AND SPECIALTIES

1.00.00 GENERAL INFORMATION

This section covers all the low-pressure piping up to 400mm NB size, associated valves and specialties that include but is not limited to the following systems.

- 1.01.00 Service Air System - shall consist of distributions service air to different buildings.
- 1.02.00 Instrument Air System - shall comprise of distribution of instrument quality air to pneumatically operated instruments/ valves/dampers.
- 1.03.00 Demineralised Water Supply system including condensate storage tank.
- 1.04.00 Demineralised Water closed cycle cooling system.
- 1.05.00 Service water system.
- 1.06.00 Drinking water system.
- 1.07.00 Any other low pressure piping as found necessary during detail engineering shall also be included.

2.00.00 CODES AND STANDARDS

2.01.00 In addition to the requirements spelt out in Volume II, the design, manufacture, inspection and testing of the piping, fittings, valves and specialties covered under this specification shall conform, in general, to the standards and codes (latest edition) mentioned below:

- 2.01.01 IS-1239 : Mild steel tubes, tubular and other wrought steel fittings
[Part-I & II]
- 2.01.02 IS-3589 : Electrically welded steel pipes for water, gas and sewage (150 to 2000 mm nominal diameter)
- 2.01.03 IS-554 : Dimensions for pipe threads where pressure tight joints are required on the threads.
- 2.01.04 IS-1363 : Hexagonal head bolts, screws and nuts (size range M5 M36)
[Part-I & II]
- 2.01.05 IS-1364 : Precision and Semi-precision hexagon bolts, screws, nuts and lock nuts (diameter range 6 to 39 mm)

2.01.06	IS-3138	:	Hexagon bolts & nuts (M42 to M150)
2.01.07	IS-5312	:	Swing check type reflux (non-return) valves.
2.01.08	IS-2379	:	Colour code for the identification of pipelines.
2.01.09	IS-2016	:	Plain washers
2.01.10	IS-2712	:	Compressed asbestos fibre jointing
2.01.11	ANSI B-16.5	:	Steel pipe flanges and flanged fittings
2.01.12	ANSI B-16.9	:	Wrought steel Butt welding flanged
2.01.13	ANSI B-16.11 : ANSI B-36.10 :	:	Forged steel fittings, Socket-welding and Threaded. Steel pipes thickness
2.01.14	API-600	:	Steel gate valves
2.01.15	BS-2633	:	Class I Arc welding of ferrite steel pipe work for carrying fluids.
2.01.16	BS-534	:	Specification for steel pipes and specials for water and sewage.
2.01.17	BS-5351	:	Specification for Ball valves.
2.01.18	AWWA-C-504	:	Specification for Butterfly valves.
2.01.19	AWWA-C-208	:	Dimension for fabricated steel water pipe fittings.
2.02.00	Other international codes and standards may also be offered by bidder. However, same may be subject to acceptance by the Purchaser.		

3.00.00 SCOPE OF WORK

3.01.00 The equipment and materials to be supplied shall include but not be limited to the following:

- a) Supply of all low pressure piping including bends, elbows, tees, branches, laterals, crosses, reducing union, couplings, caps, saddles, shoes, flanges, blank flanges, Y-pieces etc. as required for the piping system under the scope of this section.
- b) Matching pipes, matching pieces like reducers/enlargers etc., counter flanges with bolts, nuts, washers, temporary and permanent gaskets, threaded union etc.
- c) Supply and machining work of flanges, pipe spools and matching pipes to connect flow measuring orifices/nozzles with the main pipe work.

- d) All isolating and regulating valves, non-return valves, steam/air traps, relief/safety valves (wherever applicable), strainers, pressure reducing orifices etc. complete with the counter flanges and matching connecting pieces as required within the entire low pressure piping system.
- e) Anchors, hangers and supports, etc. as required. Any platform necessary for maintenance and operation of valve and equipment located 1.5 m above any permanent floor or platform including access ladders, supporting structures etc.
- f) All secondary structural steel members required for pipe supports from building steel structures and from embedded steel wherever provided including pipe supports in trenches. However, trench piping should be avoided to the extent possible.
- g) Funnels, tundishes for drips and drains including all miscellaneous drain piping and drain piping from tundish outlet up to drain points. All drain and vent lines shall be conveniently terminated to floor drain points/permanent drain trenches.
- h) Flanges, counter flanges, blank flanges, bolts, nuts, washers, temporary and permanent gaskets, fasteners caps etc. as required for interconnecting piping, valves & fittings.
- i) Cleaning and Painting of all piping, valves & specialties at manufacturer's shop.

3.02.00 Following general requirements shall however be provided

- a) Instrument Connections including instruments, root valves, sensing lines etc.
- b) Pipe stubs and blanking plates etc. required for chemical cleaning and hydro testing.

For conducting acceptance test, the required pressure, temperature, flow measurement points shall be provided.

3.03.00 All miscellaneous instruments

4.00.00 **GENERAL DESIGN AND CONSTRUCTION**

4.01.00 **General Considerations**

4.01.01 The piping systems included in this section shall be designed to operate continuously without replacement during the plant service life of 30 years.

4.01.02 The piping system shall be complete in every detail and in accordance with the highest standard of workmanship.

- 4.01.03 All design and fabrication shall be in accordance with codes/standards specified.
- 4.01.04 No pipe work shall be run in trenches carrying electrical cables.
- 4.01.05 Pipe size above 50 NB shall be shop fabricated and of size 50 NB and below shall be field run.
- 4.01.06 All piping shall be identified by means of colour strips and by adequate lettering, conveniently spaced and located. Identification colours and lettering shall be as approved.
- 4.01.07 Air release and drain branches shall be provided wherever necessary depending upon the layout and arrangement so that the drains and air release valves are located for easy operation.
- 4.01.08 Unless otherwise specified, all pipe work shall be suitable for a minimum pressure of 10.0 kg/sq. cm(g) at 80 deg. C or as required by the design of the different piping system, if higher.
- 4.01.09 **Drain Pipe Work**
- a) Low pressure drains shall have an isolating valve at the point of take-off from the pipe or vessel to be drained, or as near as possible for conventional operation.
 - b) Unless otherwise stated, all drain piping shall be of 25 mm NB minimum and all vent pipings shall be of 15 mm NB size minimum. For pipes up to 50mm NB, pipe wall thickness shall be as per schedule 80 of ANSI B36.10.
 - c) Unless otherwise stated, wherever a main or branch of any pipeline is terminated with a valve, such terminal valve shall be provided with a blank flange/blanking cap at the free end.
- 4.01.10 Specification of pipes used in different services included in the L.P piping section has been detailed in Annexure-I.
- 4.02.00 **Material Specification**
- 4.02.01 Materials for pipes and fittings shall be as stipulated in Annexure-I. In case bidder wants to offer alternative piping material, same may be accepted by the Purchaser depending on the merits of alternative material.
- 4.02.02 Pipe attachments for supports, anchors and restraints, which are coming in direct contact with pipes, shall have similar materials as the piping concerned. All other materials of supports, anchors and restraints shall be of tested quality and as per manufacturer's standards.

4.03.00 **Fabrication**

Except where otherwise specified all piping shall have butt-welded connections with a minimum of flanged joints necessary for maintenance. Where flanges are adjacent to welded fittings, weld neck flanges shall be used.

Branches shall, in general, be formed by welding. Standard fittings may be used in positions and for sizes where approval has been given in detail drawings. Pipe bends and tees shall be truly cylindrical and of uniform section. all welded branches shall be reinforced where needed as per the applicable codes/regulations.

4.03.01 Piping shall be fabricated in the shop in the largest transportable sections to minimize the number of field weld joints. The choice of field weld joints locations shall be based on the traverse of the pipe through walls, floors, sleeves or other restrictive areas. Support attachments for major piping shall be done at shop.

4.03.02 All pipes bends shall be made true to angle with no negative tolerance and shall have a smooth surface free of flat spots, crease and corrugations. A cross section through any bent portion of the pipe shall be true in diameter, within plus or minus 3% of the pipe diameter. Pipe bends shall be made from straight pipe pieces of sufficiently higher thickness so that after thinning, the minimum thickness of bends shall not be less than the minimum thickness required for the straight pipe. Thinning allowance shall be considered as per the relevant code.

4.03.03 For bends in pipes straight piece of pipes shall be bent by the contractor to required bend radius. However, forged bends (Bend radius = 1.5 x pipe diameter) wherever required shall be provided.

4.03.04 The ends of Pipe and welded fittings shall be bevelled according to details shown in the relevant piping code. All welding shall be made in such a manner that complete fusion and penetration are obtained without an excessive amount of filler metal beyond root area. The reinforcement shall be applied in such a manner that it shall have a smooth contour merging gradually with the surface of adjacent pipe and welded fittings. Backing rings shall not be used on any pipe welds, unless otherwise approved by the Engineer.

4.03.05 **Cutting and Bevelling**

- a) Carbon steel piping - End preparation for butt welding shall be done by machining/flame cutting.
- b) Socket welding - Socket weld and preparation shall be done by saw or machine cutting.

4.04.00 Hangers, Supports, Anchors

Normally pipe supports and anchors shall be selected at those points in the buildings where provision has been made for the loads imposed. The cutting of floor/roof beams or the reinforcement in slabs will not be permitted. Piping attached to a plant item shall be supported in such a way that the weight of the piping is not taken by the plant item.

4.04.01 Support spacing shall be as per good engineering practice. However in no case it shall be less than support spacing stipulated in ANSI B31.1.

4.04.02 Accurate weight balance calculations shall be made to determine the required supporting force at each hanger location and the pipe weight load at each equipment connection.

4.04.03 All large pipes and all long pipes shall have at least two supports each arranged so that any length of pipe or valve may be removed without any additional supports being required.

4.04.04 Support steel shall be of structural quality. Perforated strap, wire or chain shall not be used. Support components shall be connected to support steel by welding, by bolting or by beam clamps. Bolt holes shall be drilled not burned. Support components may be bolted to concrete using approved concrete anchors.

4.05.00 Valves and Accessories

4.05.01 General Requirements

- a) All valves shall be of approved make and type and shall have cast/forged bodies with covers and glands of approved construction and materials as specified in Annexure-II & III. The valves shall be provided with electric motors/solenoids and actuators as required.
- b) Valves and specialties to be supplied under this specification will be used for various air and water services and will be located indoor/outdoor and on horizontal/vertical runs of the pipelines. However, mounting of valves in vertical pipe runs should be avoided as far as possible.
- c) All valves shall, unless otherwise stated, have the internal diameter same/as the internal diameter of the pipes to be joined.
- d) All valves shall receive tests at manufacturer's or contractor's works in accordance with the specific requirements of the approved Codes of Practice. Valves shall be rising stem or otherwise as approved by the Purchaser.
- e) Gate valve and Ball valve have been specified with the intention of achieving isolation and tight shut-off. In full open condition, these valves should offer minimum of resistance to fluid flow.
- f) Globe valves have been specified with the intention of achieving good control of fluid passing. The plug and seat will have therefore suitable profiles for obtaining such controlling action.

- g) Check valves have been specified in order to prevent reverse flow through them.
- h) All valves shall function smoothly without sticking, rubbing or vibration on opening or closing and shall be suitable for most stringent service conditions i.e. flow, temperature and pressure under which they may be required to operate.
- i) Material, design, manufacture, testing etc. for all valves and specialties along with the accessories shall conform to the latest editions of codes.
- j) By pass valves shall be provided for larger size valves as per standards followed and as felt necessary for smooth and easy operation, even though not specifically mentioned in the specification.
- k) All flanged valves and specialties to be supplied under this section shall be provided with two (2) counter flanges, bolts, nuts, washers, gaskets etc.
- l) All valves shall be of approved design and manufacture. Where valves are of similar size and type they shall be interchangeable with one another. Valves shall have welded or flanged connections subject to the Purchaser's approval.
- m) All valves shall have outside screwed spindles and screwed thread of spindle shall not pass through or into the stuffing box. Where valves are exposed to the weather, protective covers shall be provided for the spindles, which shall be subject to approval.
- n) Gate, Globe and Ball valves shall be provided with the following accessories in addition to other standard items:
 - i) Hand wheel with embossed open and shut directions.
 - ii) Local position indicator.
 - iii) Motorised operation as specified by Engineer.
- o) Gate valves, in addition shall be provided with following extra features
 - i) Bypass valve for larger valves
 - ii) Draining arrangement
 - iii) Enclosed Gear operators for valves 300 mm size and above for ease in operation.
 - iv) Motorised operation as specified by Engineer.
- p) All gate and globe valves shall be rising stem type.
- q) All valves shall be provided with hand-wheels, chain, operator, extended spindle and floor stand wherever required so that they can be operated manually by a single operator from the nearest operating floor either at a lower or higher elevation as the case may be. If such a

valve is provided with integral bypass then similar arrangement shall be done for the bypass valve also.

- r) All valves and specialties shall be provided with brass Tag Discs indicating Tag numbers and nomenclature of the valve including duty or service intended and the function of the valves specialties.
- s) Stems shall preferably be arranged vertically with gland at the top, however, in no circumstances must the stem be inclined downward from horizontal or gland be at the bottom. Globe valves shall be installed with the pressure under the disc. Valves shall not be fitted in inverted position.
- t) Where necessary, for accessibility, grease nipples shall be fitted at the end of extension piping and where possible these shall be grouped together and mounted on a common panel situated at a convenient position. A separate nipple shall be provided to lubricate each point. The Bidder shall supply the first fill of oil or grease for these parts. The Bidder shall supply a suitable manually operated grease gun for the standard type of nipple provided.
- u) The spindles for all valves for use outside the building shall have weatherproof protection covers of approved construction.
- v) All valves of nominal size above 50 mm, shall be fitted with indicators so that it may be readily seen whether the valves are open or shut. In the case of those valves fitted with extended spindles, indicators shall be fitted both to the extended spindles and to the valve spindles.

For valves with nominal size upto 50 mm, indicator is not required for rising stem type valves.
- w) Plastic or bakelite valve hand wheels will not be accepted.
- x) All valves shall be closed by rotating the hand wheel in a clockwise direction when looking at the faces of the hand wheel. The face of each hand wheel shall be clearly marked with the words 'Open' and 'Shut' with arrows adjacent to indicate the direction of rotation to which each refers.
- y) Wherever practicable heavy valves of total weight including actuator, drive motor, integral by-pass etc., equal to or greater than 500 kg. shall be provided with suitable lugs to permit direct suspension by hanger rod or direct resting on bottom support, as applicable.
- z) Special attention shall be given to the operating mechanism for large size valves in order that quick and easy operation is obtained and maintenance is kept to a minimum.
- aa) Eyebolts shall be provided where necessary to facilitate handling heavy valves or parts of valves.
- bb) The Bidder shall supply with his bid and in addition during the course of the Contract, comprehensive drawings showing the design of valves, test pressure and working pressure/temperatures. They should

include a parts list referring to the various materials used in the valve construction.

cc) All sampling and root valves shall be of integral body bonnet type.

4.05.02 For Design Requirements for different valves refer Annexure-II & III.

4.06.00 **Safety/Relief Valves**

Safety/Relief valves shall be of direct spring loaded type and shall have a tight, positive and precision closing.

All safety valves shall be provided with manual lifting lever.

Valves used for air and any other compressive fluid shall be of pop type.

Safety/Relief valves shall be constructed and adjusted to permit the fluid to escape without increasing the pressure beyond 10% above the set blow off pressure. Valve shall reset at a pressure not less than 2.5% and more than 5% of the set pressure.

Releasing capacity of the safety/relief valves shall be as per the applicable codes and standards and shall be subject to the approval of the Engineer.

The seat and disk of safety valves shall be of suitable material to resist erosion. The seat of valve shall be fastened to the body of the valve in such a way that there is no possibility of the seat lifting.

4.07.00 **Hosepipe and Accessories**

4.07.01 Hose valves for service water system shall be Gate valves and service air system shall be Globe valves.

4.07.02 Hose pipes with fittings for Service Water System:

- a) The water hose shall be as per IS-444 (Type-3).
- b) Length of each hose shall be 15 metres.
- c) For each hose, one end shall be fitted with M.S. female coupling with swiveling nuts and soft seating ring suitable for connection to male end of hose valve and other end shall be made threaded for joining with the swiveling nut of a second hose whereby two hose lengths may be joined.

4.07.03 Hose pipes with fittings for Compressed air System

- a) The compressed air hose shall be as per IS-911 (Type 2).
- b) The length and type of each end shall be similar to as specified in above clause no. (4.07.02) above.

5.00.00 **DRAWINGS, DATA, INFORMATION & MANUALS**

5.01.00 Drawings, data, Information to be furnished by the Bidder besides those already mentioned in volume : II with the offer.

- 5.01.01 A complete list of all piping and fittings of various sizes with their quantities and details e.g. nominal size, O.D., I.D. (as applicable) thickness, design pressure, design temperature, material of construction/code/standards etc.
- 5.01.02 A complete list of all valves with their type, quantities & ratings.
- 5.01.03 Manufacturer's catalogue indicating complete range of available size and rating of pipes & fittings.
- 5.01.04 Descriptive literature on the manufacturing process and quality control procedures highlighting the manufacturing, fabricating and testing facilities available in the shop.
- 5.02.00 **After Award of Contract**
- Detail drawings including fabrication drawings of all shop fabricated piping system indicating design parameters and complete bill of material (Relevant Standards and grades to be indicated) and information/data pertaining to the hydrostatic and non-destructive test requirements to be submitted progressively.
- 5.02.01 Detail dimensioned drawing of each valve, specialties, indicating tag no., pressure rating, manufacturing standard, the bill of materials and hydrostatic test pressures. The drawing shall include the end preparation details and shall indicate the position of the hand wheel/operator. Technical particulars of motor operators wherever applicable shall also be indicated.
- 5.02.02 General arrangement drawing for each hanger/support/anchor etc. indicating identification number, auxiliary supporting structural details, other details & information as required in the specification.
- 5.02.03 Wiring diagram for all limit switches of motor operated valves.
- 5.02.04 The loading data required for design of structures shall be furnished well in advance to suit Purchaser's time schedule.
- 6.00.00 **BROAD GUIDELINES FOR ERECTION AND INSTALLATION OF LP PIPING**
- 6.01.00 All fittings like "T" pieces, flanges, reducers etc. shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection, after chemical cleaning and during commissioning.
- 6.02.00 Adjustments like removal of oval ties in pipes and opening or closing the fabricated bends of high pressure piping to suit the layout shall be considered part of work and is required to carry out such work as per instruction of Owner, which shall include specified heat-treatment procedures, etc. also wherever required.
- 6.03.00 Certain adjustments in length may be necessary while erecting high pressure pipelines and the contractor should remove the extra lengths to suit the final layout after preparing edges afresh and adopting specified heat treatment procedures.

- 6.04.00 Suspension for piping, pressure parts, etc., will be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.
- 6.05.00 All the valves, lifting equipments, actuators, power cylinders, etc., shall be serviced and lubricated to the satisfaction of Engineer before erecting the same and also during pre-commissioning. Even after commissioning, the equipments, if there are problems in the operation, they have to be attended to by the Bidder during the tenure of the contract. Welding or jointing of extension spindle for valves to suit the site conditions and operational facility shall be part of erection work.
- 6.06.00 All tubes and pipes shall be cleaned and blown with compressed air and shown to the engineer before lifting. Bigger size pipes should be cleaned with flexible wire brush, wherever necessary. After cleaning is over the end caps shall be put back in tube openings till such time they are welded to other tubes.
- 6.07.00 Fine fittings, drain piping, oil systems & other small bore piping have to be routed according to site conditions and hence shall be done only in position. As such, layout of small-bore piping shall be done as per site requirement. There is a possibility of slight change in routing the above pipelines even after completion of erection, which shall be carried out by the Bidder without any extra cost to the Purchaser. Work shall also include fabrication of small bends at site from straight lengths to suit the site conditions.
- 6.08.00 No temporary supports shall be welded on the pressure parts. Welding of temporary supports, cleats, etc., on the building columns shall also be avoided. In case of absolute necessity, Contractor shall take prior approval from Engineer. Further, any cutting or alteration of member of the structure or platform or other equipments shall not be done without specific prior approval of Engineer.
- 6.9.00
- a) All piping shall be grouped wherever practicable and shall be routed to present a neat appearance.
 - b) The piping shall be arranged to provide clearance for the removal of equipment for maintenance and for easy access to valves, instruments and other piping accessories required for operational maintenance.
 - c) Piping shall be routed above ground unless otherwise specifically indicated/ approved by the Engineer. In such special case, the piping may be arranged in trenches, or buried and properly protected as per AWWA Standards.
 - d) Overhead piping shall have a minimum overhead clearance of 4 meters above walkways and working areas and 7 meters above roadways unless otherwise approved by the Engineer.
 - e) Drains shall be provided at all low points and vents at high points as per actual layout regardless of whether some have been shown in respective drawings or not. The pipelines shall be sloped towards the drain points.

- 6.10.00 All drips and drains for piping and equipment whether shown in the drawings or not shall terminate on the ground floor up to station drain unless otherwise specified. Leading such drains up to station drainage is also the responsibility of the Contractor.

ANNEXURE-I

SPECIFICATION OF PIPES FOR DIFFERENT SERVICES

	A		B		C	D
Services	1. Clarified Water piping 2. DMCW piping 3. Service Air		1. Drinking Water Supply, piping (filtered water, chlorinated)		1. Demineralised Water and Instrument Air Piping less than and equal to 50 mm NB	1. Demineralised Water and Instrument air piping for sizes equal to greater than 65 mm NB
1.00.00 Material of Pipe	Carbon Steel IS-1239 Heavy Grade upto 150 mm NB and IS-3589 for sizes above 150 mm with minimum pipe thickness of 6 mm.		Carbon Steel as per IS-1239 Heavy Grade for sizes upto 150 mm NB and IS-3589 for sizes above 150 mm NB with minimum pipe thickness of 6 mm. The pipes shall be galvanized as per IS-4736		Stainless Steel as per ASTM A-312 Gr. 304. Size- as per schedule 40S (Min) ANSI B36.19	Stainless steel as per ASTM A-312 Gr. 304. Size-upto 150 mm NB as per schedule 10S (Min), ANSI B-36.19.
2.00.00 Construction	ERW / Seamless		ERW / Seamless		ERW	ERW
3.00.00 Joints	Slip-on Flange and butt weld for size 65 mm NB and above and Socket weld joint for size 50 mm NB and below.		Screwed flange for sizes 65 mm NB and above and screwed socket for size 50 mm NB and below.		Socket welded for size 50 NB and below	Butt weld joint.
4.00.00 Fittings	Pipe Sizes > = 65 mm NB	Pipe Sizes < = 50 mm NB	Pipe Sizes > = 65 mm NB	Pipe Sizes < = 50 mm NB		
4.01.00 Materials	ASTM-A-234 Gr. WPB	ASTM-A-105	ASTM-A-234 Gr. WPB galvanized as per IS-4736	ASTM-A-105 galvanized as per IS-4736	ASTM-A-182 F304	ASTM-A-351-CF8

	A		B		C	D
Services	1. Clarified Water piping 2. DMCW piping 3. Service Air		1. Drinking Water Supply, piping (filtered water, chlorinated)		1. Demineralised Water and Instrument Air Piping less than and equal to 50 mm NB	1. Demineralised Water and Instrument air piping for sizes equal to greater than 65 mm NB
4.02.00 Construction	Welded/Seamless	Forged	Welded/Seamless	Forged	Forged	Welded/Seamless
4.03.00 Standard	ANSI-B-16.9 for fabricated fitting AWWA-C-208	ANSI-B-16.11	ANSI-B-16.9	ANSI-B-16.11	ANSI-B-16.11	MSS-SP-43
4.04.00 End details	Pipe size ≥ 65 mm NB Butt welded as per ANSI-B-16.25	Pipe size ≤ 50 mm NB Socket welded as per ANSI-B-16.11	Pipe size ≥ 65 mm NB Screwed Flanged	Sizes ≤ 50 mm Screwed socketed as per ANSI-B-16.11 All fittings shall be galvanized.	Socket welded	Butt Welded
5.00.00 Flanges	150 lb class as per ANSI-B-16.5 complete with nuts, bolts and gaskets		As per ANSI-B-16.5 pressure class 150lbs - galvanised-complete with nuts, bolts and gaskets.		As per ANSI-B-16.5 pressure class 150lb complete with nuts, bolts and gaskets. Material as per class 4.01.00.	150 lb class, raised face, as per ANSI-B-16.5 complete with nuts, bolts and gaskets.
Pipes which fall under IS:1239 shall be hydrostatically tested according to the said code, for others refer Section-V, Vol.: II-A.						

ANNEXURE-II

SERVICES OF VARIOUS CATEGORIES OF VALVES

Valve Classification		Service		
A.	Cast iron body Gate/ Globe/Check Valve	i)	Service Water	For sizes 65mm NB and above.
		ii)	Filtered Water	
		iii)	Drinking Water	
		iv)	Inhibited Demineralised Water	
B.	Stainless steel body/ Gate/Globe /Check/Ball Valve	i)	For Demineralised water	For all sizes
		ii)	Drinking Water	For sizes less than and equal to 50 mm NB
		iii)	Instrument Air	For all sizes. Ball valves to be used in air line.
C.	Steel Body valves	i)	Clarified Water	For sizes less than and equal to 50 mm NB
		ii)	Inhibited Demineralised Water for DMCW system	
		iii)	Service Air	
D.	Cast Iron body butterfly valve	i)	For Demineralised Water	For butterfly valve specification refer Annexure II, Sec.V of Vol. II-I. For DM water line rubber lining/ EPDM/ equivalent protection to be provided
		ii)	Raw water	
		iii)	Clarified Water	
		iv)	Filtered Water	
		v)	Inhibited Demineralised Water for DMCW system	

ANNEXURE-III
SPECIFICATION OF VALVES

		A. Cast Iron Body Gate/ Globe/Check Valve	B. Stainless steel Body Gate/Globe/Check/Ball Valve	C. Steel Body Gate/ Globe/Check Valve/ Ball Valve
1.00.00	Valve Classification Code	CIGC	SSGC	STGC
2.00.00	Basic Design Code			
	a) Gate	a) i) IS 780 for 50 mm - 300 mm NB ii) IS2906 for 350 mm NB and above or as per MSS-SP-70	a, b, c) ANSI-B-16.34	i) API 602 for 50mm NB and below. ii) API 600 for sizes above 50mm NB
	b) Globe	b) MSS - SP - 85		b) BS-1873/ANSI-B-16.34
	c) Check	c) IS-5312/MSS - SP -71		c) BS-1868/ANSI B16.34
	d) Ball		d) BS-5351	
3.00.00	Pressure Class	To be suitably chosen considering the pressure requirement. Refer Clause No. 4.01.08 in this regard.		
4.00.00	Construction	Cast body and bonnet / cover	Forged body up to 50mm NB & Cast body above that	Same as Group-B
5.00.00	Material			
5.01.00	Body & Bonnet/ cover	IS 210 Gr. FG 260	ASTM-A-182 F304 for Ball Valves: A351 CF8M for cast body, A 182 F304 for forged body.	ASTM-A-216 Gr. WCB for cast body & ASTM-A-105 for forged body

		A. Cast Iron Body Gate/ Globe/Check Valve	B. Stainless steel Body Gate/Globe/Check/Ball Valve	C. Steel Body Gate/ Globe/Check Valve/ Ball Valve
5.02.00	Trim / Disc.	IS-210 Gr. FG 260	ASTM-A-182 F304 for Gate, Globe, Check valves and 351CF 8M for Ball valves. For DKW system : ASTM-A-182 F6A (min. 250 HB)	13% Cr Steel as per ASTM- A-182 Gr. F6 heat treated and hardened(min 250 NB) for cast body and ASTM-A- 105 Hard faced with Stellite (min 350 HB) for forged body
5.03.00	Seating surface	13% Cr steel as per IS 1570	For Ball valves PTFE seats and seals.	13% Cr. Steel as per ASTM- A-182 Gr. F6
6.00.00	End Preparation	Socket welded for size equal to and below 50mm NB and flanged with counter flanges for 65mm NB and above.		
7.00.00	Testing			
	a) Gate	i) As per IS - 780 for 50 mm - 300 mm NB ii) IS-2906 for sizes equal to and above 350 mm NB	As per ANSI B-16.34	API-598
	b) Globe	Hydrostatic Test as per MSS-SP-85		BS-1873
	c) Check	IS-5312/MSS-SP-71		BS--1868



TITLE:
**TECHNICAL SPECIFICATION FOR
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1X800 MW WANAKBORI TPS

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

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SECTION – C2-B

PROJECT SPECIFIC GENERAL REQUIREMENTS INCLUDING:

- GENERAL TECHNICAL REQUIREMENT
- INSPECTION & TESTING
- PAINTING SPECIFICATION
- PROJECT MANAGEMENT & SERVICES
- ENGINEERING SERVICES
- QUALITY ASSURANCE REQUIREMENT
- REQUIREMENT OF SPARES, TOOLS, TACKLE, LUBRICANTS AND CONSUMABLES



TITLE:
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SECTION – C2-B

GENERAL TECHNICAL REQUIREMENT

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SECTION-IV

GENERAL TECHNICAL REQUIREMENTS

1.00.00 CODES AND STANDARDS

1.01.00 Except where otherwise specified, the Plant shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as listed in the annexure to this Section and mentioned in detailed specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable the Owner to identify all of the Plant in the same detail as would be possible had there been a Standard Specification.

1.02.00 Where the Bidder proposes alternative codes or standards he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification.

1.03.00 The plant will be designed in compliance with applicable National and International Codes and Standards such as ASME, ASTM, DIN, BS, IEC, IEEE, IS, etc. Wherever specified or required the Plant shall conform to various statutory regulations such as Indian Boiler Regulations, Indian Explosives Act, Indian Factories Act, Indian Electricity Act, Environmental Regulations, etc. Wherever required, approval for the plant supplied under the specification from statutory authorities shall be the responsibility of the Contractor.

1.04.00 In the event of any conflict between the codes and standards referred above, and the requirements of this specification, the requirements, which are more stringent, shall govern.

1.05.00 All latest codes & standards shall be considered upto the base date. The base date to be considered for codes and standards is fifteen (15) days prior to opening of price bid.

1.06.00 Successful Bidder to furnish two (2) sets of latest International Codes and Standards which have been used for their plants, equipments and system. IS Codes, ASME codes, ASTM codes need not to be furnished. However, International Performance Test Codes shall be furnished as applicable.

2.00.00 RESPONSIBILITY FOR DESIGN

2.01.00 The Contractor shall assume full responsibility for the design of the whole and every portion of the Plant, whether or not the design work was undertaken specifically in relation to the Contract and whether or not the Contractor was directly involved in the design work.

- 2.02.00 Notwithstanding the Owner's wish to receive the benefits of new, advanced and improved technologies, a prime requirement is that all the systems and components proposed shall have been already adequately developed and shall have demonstrated good reliability under similar, or more arduous conditions elsewhere, at least for continuous 2 years in two different power station.
- 2.03.00 The successful bidder shall have to carry out surge analysis, BFP transient analysis and other transient condition studies as may be necessary and as required by the Owner as per proven engineering practice.
- 2.04.00 Bidder shall comply with the requirements of CPCB and MOEF along with specification requirements whichever is stringent.
- 2.05.00 The Bid shall include a detailed discussion on the development status of, and the reasons for any changes made in proposed systems or components for the Plant, as compared with similar items previously supplied in other installations cited by the bidder as reference plants.
- 2.06.00 The Bidder may also make alternate offers, provided such offers are superior in his opinion in which case adequate technical information, operating feed back, etc. are to be enclosed with the offer, to enable the Owner to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumptions, etc. shall be clearly brought out to the Owner to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications i.e. Base offer shall be as per the technical specifications and the same will be considered for techno-commercial evaluation.
- 3.00.00 **NAME PLATES (RATING PLATES)**
- 3.01.00 Instruction plates, name plates or labels shall be permanently attached to each main and auxiliary item of plant in a conspicuous position. These plates shall be engraved with the identifying name, type and manufacturers serial number, together with the loading conditions under which the item of plant has been designed to operate.
- 3.02.00 Items such as valves, etc. which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Direction of flow is also to be engraved.
- 3.03.00 All trade nameplates and labels shall be in English language. All measurements shall be in M.K.S. Units.
- 3.04.00 The size and location of nameplates shall be subject to Approval of the Engineer.

4.00.00 SAFETY AND SECURITY

4.01.00 The design shall incorporate every reasonable precaution and provision for the safety of all personnel and for the safety and security of all persons and property. The design shall comply with all appropriate statutory regulations relating to safety. All structures and equipment shall be designed and constructed to withstand every foreseeable static and dynamic loading condition, including loading under earthquake conditions, with an adequate margin of safety.

4.02.00 Ready and safe access with clear head room shall be provided to all parts of the plant for operation, inspection, cleaning and maintenance.

4.03.00 Escape routes and clear ways shall be provided to allow speedy evacuation of the plant in the event of fire or explosion, and the plant layout shall allow for ease of access to all parts of the Works by rescue and fire fighting teams. The plant layout shall be designed to localise and minimise the effects of any fire or explosion. The recommendations of NFPA, OSHA, and TAC etc. as necessary shall be followed in all respects.

4.04.00 The use of corrosive, explosive, toxic or otherwise hazardous materials shall be kept to a minimum during construction and the design of the plant shall minimise the requirement for such materials during operation and maintenance. Where such materials must be used, all necessary precautions shall be taken in the design, manufacture and layout of equipment to minimise the resulting hazard, and all equipment necessary for the protection and first-aid treatment of personnel in the event of accidents shall be provided. Particular attention is drawn to avoid the use of materials containing asbestos in any form.

5.00.00 GUARDS

5.01.00 Effective guards and fences must be provided to prevent injury to operators through accident or malpractice.

5.02.00 Mesh guards which allow visual inspection of equipment with the guard in place are generally preferable. The guards shall be constructed of mesh attached to a rigid framework of mild steel rod, tube, or angle and the whole galvanised to prevent loss of strength by rusting or corrosion. The guards shall be designed to facilitate removal and replacement during maintenance.

5.03.00 All drive belts, couplings, gears, sharp metallic edges and chains must be safely guarded. Any lubricating nipple requiring attention during normal running must be positioned where they can be reached without moving the guards.

5.04.00 Guards for couplings and rotating shafts shall be in accordance with BS 5304-1975 or similar approved standard. All rotating shafts and parts of shafts must be covered.

5.05.00 Suitable fencing shall be provided to enclose all openings or doorways used for the hoisting and lowering of machinery etc. This fencing must be securely fixed but quickly detachable when required. A secure hand hold must be provided on each side of the opening or doorway.

6.00.00 LOCATION AND LAYOUT REQUIREMENTS

The majority of plant and equipment (excluding steam generator and some other auxiliaries) shall all be of indoor installation. A broad list of buildings housing such equipment is given elsewhere in this specification. Layout should facilitate access for operation-maintenance and inspection of any one or more equipment/components at a time without disturbing the operation or installation of rest of the plant. Further, Bidder should comply with the criteria given under the various equipment and system specifications as well as those stipulated in Annexure-II attached to this section.

Enclosed General Layout and other tender layout drawings show the location of major installations and auxiliary buildings. The Bidder shall try to retain these locations as far as practicable. The layout of equipment within the power house as shown in the tender drawings is indicative. The Bidder may, subject to Owner's approval alter the same to suit the space requirement of the equipment offered.

Bidder may give as an alternative his own preferred layout clearly indicating the advantages and other implications, if any. Such alternative will not be considered for evaluating the bid, but may be considered with the successful Bidder if Owner/Engineer finds the proposal more attractive in terms of techno-economic consideration.

While developing the layout of buildings the following criteria shall be given effect :

- a) The minimum width of clear access corridors around equipment shall be one (1) meter.
- b) Each building shall have an identified vacant space for equipment unloading and maintenance and preferably a separate bay altogether in buildings housing heavy equipment. Provision for handling equipment by monorail hoist and/or overhead crane shall be made as specified.
- c) The minimum clear height available between two consecutive floor slabs shall not be less than five (5) meters. A clear head room of two (2) meters shall be maintained between the floor and any overhead piping/cables or other obstruction. Adequate provision for natural ventilation and illumination shall be made as per good engineering practices.
- d) There shall be at least two (2) nos. main access doors, one on either side of each building, of which one shall be minimum 3 meters wide with rolling shutters for equipment entry. For multistoried buildings, at least two (2) nos. regular staircases diagonally opposite to each other shall be provided connecting all the floors and roof. These minimum requirements shall be augmented as required depending on the floor area, statutory requirements and TAC recommendations.
- e) All buildings shall have provision for toilet and associated effluent discharge system together with facility for drinking water. The criteria for ventilation, fire protection and illumination of building spaces specified elsewhere in this specification shall be complied with.

- f) All rail/road crossings for pipe/cable racks shall be done with minimum 7 meters clear headroom. Similarly top cover over underground pipes/cables shall be minimum one (1) meter. For other detail refer to Annexure-II.
- g) Cubicle for operating personnel shall be located at safe place near the equipment.
- h) All underground cables in the plant shall be placed in covered reinforced concrete cable trenches. Pipes shall in general be routed above ground and on pedestals, and at road crossings, pipe racks shall be provided. Cable racks / pipe racks shall have hand railings in walkways on both sides at appropriate heights.
- i) Concept of various mechanical and electrical equipment location and building dimensions as shown in Plot Plan/Floor Plan drawing are to be adhered to.

However, size of buildings & facilities as stated above, shall be finalized by EPC Contractor considering the basic design criteria of layout as indicated in the specification.

7.00.00 OPERATION, MAINTENANCE & AVAILABILITY CONSIDERATIONS

7.01.00 Equipment/works offered shall be designed for high availability, high reliability, low maintenance and ease of operation & maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability, availability, operability and ease of maintenance. He shall also furnish details of availability records in plants stated in his experience list.

7.02.00 Ample space for ease of operation and maintenance including equipment removal, tube bundle/cartridge/rotor pulling etc. shall be provided. All valves, gates, dampers and other devices shall be located and oriented in such a way that they are accessible from operating floor levels. Where this cannot be adhered to, platforms and walkways with access ladders shall be provided to facilitate operation and maintenance.

7.03.0 Motorised lifting devices, i.e. hoists, chain pulleys, jacks, etc. shall be provided for handling and carrying out maintenance of any equipment and/or part having weight in excess of 3000 Kg. Suitable beams, hooks etc. for this purpose shall be provided in the buildings.

No lifting arrangement is necessary for part having weight less than 500 Kg. Hoist shall be well protected by environment. Suitable painting and coating covering hoist at outdoor shall be provided.

Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist/crane shall be provided by the Bidder for lifting the equipment, accessories covered under this specification.

7.04.00 All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same material and workmanship as the corresponding parts of the equipment. Where feasible common components shall be employed in different pieces of equipment in order to optimize the spares inventory and utilization.

8.00.00 **MATERIALS**

8.01.00 In selecting materials of construction of equipment, the Contractor shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/fluid handled. Wherever deviations are taken in respect of materials specified, the reasons shall be spelt out clearly in the proposal.

All materials shall be new, and shall be of the quality most suited to the proposed application.

8.02.00 In as far as is possible; materials shall be in accordance with Indian or international standard specifications and shall be used in accordance with Indian or international codes of practice. Where such standards or codes of practice are not available sufficient information shall be provided to allow the Engineer to assess the suitability of the material for the particular application.

All materials used shall have performed lengthy satisfactory service in similar or more arduous conditions to those proposed by the Contractor.

8.03.00 All parts which could deteriorate or corrode under the influence of the atmospheric, meteorological or soil conditions at the Site, or under the influence of the working conditions shall be suitably and effectively protected so that such deterioration or corrosion is a minimum over the life of the plant.

9.00.00 **LUBRICATION**

9.01.00 Provision shall be made for suitable efficient lubrication where necessary to ensure smooth operation free from undue wear.

9.02.00 Non ferrous capillary tubing shall be used throughout.

9.03.00 Gear boxes and oil baths shall be provided with filling and drain plugs, both of adequate size. An approved means of oil indication including level switches and temperature indication shall be provided.

9.04.00 All high speed gears shall be oil bath lubricated. Low speed gears shall be lubricated by means of soft grease. Removable and accessible drip pans shall be provided to collect lubricant which may drop from operating parts.

9.05.00 All lubrication points shall be conveniently situated for maintenance purposes. It must be possible to carry out lubrication from a gangway or landing and without the removal of guarding or having to insert the hand into it. Where accessibility to a bearing for oiling purposes would be difficult a method of remote lubrication shall be fitted.

9.06.00 The Contractor shall supply grease gun equipment suitable to service each type of nipple fitted.

10.00.00 **LUBRICANTS AND CONTROL FLUIDS**

10.01.00 The Contractor shall provide a detailed and comprehensive specification for all lubricating oils, greases and control fluids required for the entire plant. A sufficient supply of these shall be provided by the Contractor for initial commissioning, first fill and till COD of respective units.

10.02.00 The Contractor shall supply a detailed schedule giving the lubricant testing, cleaning and replacement procedures. All equipment and facilities necessary for the testing, cleaning and changing of lubricants and control fluids shall be provided. The Contractor shall endeavor to reduce the varieties and grades of required lubricants and control fluids to a minimum, matching them where possible to those already in use in the generating station in order to simplify procurement and minimise storage requirements. All lubricants and control fluids shall be of internationally recognised standards and shall be easily obtainable from a large number of Indian suppliers. Bidder shall also indicate the equivalent Indian Standard for the above for easy procurement in future.

10.03.00 No lubricant or control fluid shall have toxic or other harmful effects on personnel or on the environment.

11.00.00 **OPERATION AND MAINTENANCE**

11.01.00 The plant shall be designed and constructed so that operation and maintenance manpower requirements are minimised.

The design and layout shall facilitate inspection, cleaning, maintenance and repair. The importance of continuity of operation is second only to that of safety.

11.02.00 Spare parts for equipment shall be interchangeable with the original components and, so far as possible, be of common design and manufacture.

11.03.00 All similar standard components/parts of similar standard equipment provided shall be interchangeable with one another. Further identical equipments shall be provided for similar duties so that the same are interchangeable with one another in totality and component wise.

11.04.00 All heavy parts (500 Kg and above) must be provided with a convenient arrangement for slinging and handling during erection and overhaul. Any item of plant normally stripped or lifted during periods of maintenance and weighing one tonne or above, shall be clearly marked with its weight.

11.05.00 On completion of commissioning, a complete set of tools for the maintenance of the entire plant shall be provided by the Contractor. This shall include all necessary spanners, special wrenches, extraction equipment and any special tools reasonably required by the Engineer. Tools used during erection and commissioning shall not be accepted except with the specific approval of the Engineer.

11.06.00 All equipment and major valves should be provided with adequate maintenance approach and facility.

12.00.00 **PLANT LIFE AND MODE OF OPERATION**

The complete plant including all the equipment and systems individually and collectively shall be designed for continuous operation for an economic service life of thirty (30) years under the prevailing site conditions and for the type of duty intended.

The critical components of the Steam Generator, Turbine-Generator and Auxiliary equipment, the life of which is limited by time and temperature dependent mechanisms such as thermal stress, creep and low cycle fatigue, are to be designed considering expected (hot, warm and cold) start-up, shut-down and cyclic load variations.

The allowable stresses shall be reduced so that life expectancy to minimum 2,00,000 hours of operation can be achieved. The Bidder shall discuss this aspect in his technical proposal.

The unit would be operated on base load with cyclic load variation. The load variation is expected to be as per schedule depending on power demand.

The expected start-ups should be considered as minimum
(Based on HPT metal temperature)

Cold start-up (>50 hrs. shutdown) : 20 per year

Warm start-up (between 10 to 50 hrs. of shutdown) : 40 per year

Hot start-up (less than 10 hrs. shutdown) : 180 per year

13.00.00 **PACKAGING & MARKING**

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials, the limitations from the point of view of availability of railway wagon sizes in India should be taken account of. The details of various wagons normally available with Indian Railways for transportation of heavy equipment shall be considered by the Bidder. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

As per the information available, the dimensions of OD consignment for transportation of the equipment by rail (if any equipment to be handled through rail transportation) are as below :

a) Width of the Package : 3.2 Meters
(from centre-line of rails
- 1.6 metres on both sides)

b) Height of the package from rail top : 4.47 Meters

The above indicates the dimensions which can be normally transported on the wagons without infringement of the "moving gauge". This is however not indicative of the consignment which can be carried out with infringement of "moving gauge" duly authorised and approved by the Indian Railways. There may be difference between the "moving gauge" and the "fixed structure gauge" and consignments infringing the "moving gauge" can be moved after investigation regarding possible infringement with the fixed structures. As the critical fixed structures in each route are different, consignments infringing moving dimensions have to be individually investigated to select a route and also determine the restrictions under which such movement is to be carried out. Such routes selected or other mode of transport envisaged is to be clearly brought out in the proposal wherever transport of over dimensional equipment is involved.

Bidder to consider unloading of material delivered through rail transportation, at near by railway station/site unloading siding. The subsequent transportation up to project work place shall be considered by road only. All unloading and handling equipment both at railway station siding and at project site shall be arranged by the Bidder. Necessary arrangement to be organized with the railway authority for such purpose shall also be under the scope of services if the Bidder. Bidder may consider entire material delivered up to site through rail transportation only.

The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement. Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material.

For imported equipment and material, suitable port facilities may be used in which case material may be transported from the port by tractor-trailer. Bidder may consider this aspect.

14.00.00 **PROTECTION**

Equipment having antifriction or sleeve bearings shall be protected by weather-tight enclosures. Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces that are damaged shall be repainted.

Electrical equipment, controls and insulations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection. All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors.

All piping, tubing and conduit connections on equipment and other equipment openings shall be closed with rough usage covers or plugs. Female threaded openings shall be closed with rough usage covers or forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of piping, tubing and conduit shall be sealed and taped.

Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.

15.00.00 **PAINTING**

15.01.00 **General**

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. Surfaces not easily accessible after shop assembly shall be treated before-hand and protected for life of the equipment. Surfaces to be finish painted after installation shall be shop painted with at least two (2) coats of primer. Steel surfaces, which are not to be painted, shall be coated with suitable rust preventive compound subject to the approval of the Owner.

All paints shall be used in accordance with the manufacturer's instructions. No thinners or other substance shall be added to the coating material without the approval of the Engineer. The quality and vendor of the paints shall require approval of the Owner.

All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.

All primers shall be well marked into the surface, particularly in areas where pitting is evident, and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the equipment. If the drying interval between successive coats, which should not exceed one week, has been so long as to endanger the adhesion of the following coat, the paint already applied shall be lightly rubbed down with fine abrasive paper before putting on the next coat.

Paint spraying on large surfaces shall not normally be done indoors, except with the approval of the Engineer. Spray guns shall not be used outdoors in windy weather or near unprotected surfaces of a contrasting colour and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment.

Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use.

Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel.

The Contractor shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished.

Shop primer for steel and iron surfaces which will have a continuous operating temperature below 35 Deg.C shall be selected by the Contractor, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35 Deg.C.

The colour scheme shall be submitted during execution of contract for approval by the Purchaser/Engineer.

15.02.00 Preparation

Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying.

Surfaces to be shot blasted shall be cleaned to Swedish Standard SA 2.5 or equivalent, and all dust remaining after cleaning shall be removed.

The priming coat shall be applied without delay.

15.03.00 Damaged Paintwork

Any damaged paintwork shall be made good as follows :

- a) The damaged area, together with an area extending 25mm around its boundary, shall be cleaned down to bare metal.
- b) A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50mm around the perimeter of the original damage.
- c) The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming.

15.04.00 Painting Systems

The requirements for the dry film thickness (DFT) of paint and the materials to be used shall be as stated below, unless otherwise specified elsewhere in this specification.

a) Surfaces Subject To Weathering

All surfaces shall have a minimum of four coats of paint made up as follows :

Primer coat	:	35 micron DFT
Tie coat	:	35 micron DFT

Finishing coat (2 Nos.) : 35 micron DFT per coat

The total minimum DFT shall be 140 micron.

b) Surfaces Inside Buildings

All surfaces shall have a minimum of three coats of paint made up as follows:

Primer coat : 35 micron DFT

Tie coat : 35 micron DFT

Finishing coat (2 Nos.) : 25 micron DFT per coat

The total minimum DFT shall be 120 micron.

The type and colour of primer & finish coat shall be selected by the Contractor after approval by the Owner.

For detail painting on building & structural steel elements refer Section-IIG/1 & IIG/2 of this specification.

16.00.00 **COLOUR CO-ORDINATION & FINISH**

16.01.00 Exterior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape.

16.02.00 Interior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and which will be conducive to; the comfort, well-being and high productivity of the operators. Operating plant and services provided shall be colour coded for ease of identification.

16.03.00 All finishes shall be durable and as far as possible maintenance free. Finishes shall be easily cleaned.

16.04.00 Final colours and finishes shall be to the Approval of the Engineer.

17.00.00 **ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT**

17.01.00 **Environment Protection**

The plant shall be designed for installation and operation in harmony with the surrounding environment and all measures of pollution control shall be ensured by the Bidder to restrict pollution from the liquid effluent and stack emission within the limits as given below with due consideration of Environment (Protection) Rules 1986 as amended till date.

In case the Ministry of Environment & Forest stipulate any other conditions not specified hereunder while clearing the project shall be complied with the plant by the contractor.

17.01.01 For Liquid Effluent

- a) Provision laid down in schedule-I for Thermal Power Plants and also in Schedule-VI. General Standards for discharge of Environmental pollutants Part-A : Effects of Environmental (protection) Rules 1986, as amended till date.
- b) Any specific requirement of State Pollution Authorities over and above the above stipulation.

17.01.02 For Air Emission

- a) Suspended Particulate Matter i.e. dust burden at chimney outlet - Maximum 50 mg/Nm³ (with worst coal and one field out).
- b) NO_x - 365 ppm Max. or 750 mg/Nm³ (Equivalent NO₂).
- c) SO₂ - Concentration based standard 2000 mg/Nm³ Load based standard 0.2 metric tonne /MWe/day (for first 500 MW and 0.1 metric tonne/MWe/day for rest of the capacity above 500 MW)

NO_x and SO₂ limitations are based on the World Bank Norms.

In absence of Indian Standard for emission from power plants as on date, for certain gaseous effluents, the internationally accepted World Bank Standard is to be followed. Indian Standard for emission of power plants are under formulation. Should this standard is published before finalisation of the contract, the bidder has to comply the more stringent of the above norm or the new Indian Standard.

The bidder shall include in his scope all necessary equipment and measuring instruments to comply with above requirements. Location and accessibility of the instruments shall be properly coordinated.

17.02.00 **Noise Level Requirement**

The plant will be designed, constructed and provided with suitable acoustic measures to ensure the noise level criteria as per the following stipulations.

- a) Maximum noise level shall not exceed 85 dB (A) when measured at 1.0M away from the noise emission source.
- b) Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, 'Ambient Air Quality Standards' in respect of noise.
- c) Any statutory changes in stipulations regarding noise limitation that may occur in future according to State Pollution Control Board or Central pollution Control Board or Ministry of Environment & Forest regulation during tenure of the contract, the contractor shall comply with the requirement.

An exception will be made for the plant at startup operations and other big pressure reducing devices operating during emergency periods and for the safety valves.

18.00.00 INSPECTION AND TESTING

18.01.00 Inspection and Tests during Manufacture

18.01.01 The method and techniques to be used by the Contractor for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner prior to the Award of Contract.

18.01.02 The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this specification.

18.01.03 Before any item of plant or equipment leaves its place of manufacture the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.

18.01.04 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Contractor may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results.

The Contractor shall forthwith forward to the engineer duly certified copies of the Test Certificates in six copies (one to the Purchaser and five to the Consulting Engineer) for approval. Distribution of six (6) copies of Test Certificates for approval will be two(2) copies to owner and four(4) copies to consultant. These four(4) copies will be further distributed by consultant after approval to owner, site and bidder. One copy will be retained with the consultant for record purpose.

Further, nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere. Distribution of nine (9) copies of Shop Test Certificates for approval will be Two (2) copies to owner, Three (3) copies to site, Two (2) copies to consultant, Two (2) copies to owner's library / record.

18.01.05 Under no circumstances any repair or welding of castings be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer.

18.01.06 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.

Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Contractor shall allow for trial assembly prior to despatch from place of manufacture.

- 18.01.07 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Purchaser as per Owner's approved QAP. The certificates shall include tests for mechanical properties and chemical analysis of representative material.
- 18.01.08 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one hour. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than one hour.
- 18.01.09 All necessary non-destructive examinations shall be performed to meet the applicable code requirements.
- 18.01.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination magniflux and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed.
- 18.01.11 Statutory payments in respect of IBR approvals including inspection for design and manufacturer of equipment shall be made by the Bidder. All payment for erection and testing at site (i.e. under IBR jurisdiction) shall also be made by the Bidder. In such case Contractor's scope shall also be extended to preparation of all necessary documents, co-ordination and follow-up with IBR authorities for above approval.
- 18.02.00 **Performance Tests at Site**
- 18.02.01 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected System shall be tested by the Contractor on site under normal operating conditions. The Contractor shall also ensure the correct performance of the System under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks, etc.
- 18.02.02 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site.
- 18.02.03 The Contractor shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection, pre-commissioning to tests on completion and commissioning of the complete system/equipment.
- 18.03.00 For details of specific tests required on individual equipment refers to respective section of this specification.

19.00.00 **TRAINING OF OWNER'S PERSONNEL**

The Contractor shall extend all possible assistance and co-operation to the Purchaser regarding the transfer of technology and developing expertise in the area of engineering operation and maintenance of the Plant.

Number of man-days of training as mentioned below shall be included in his Tender.

19.01.00 **Training at Contractor's Premises**

The Contractor shall conduct training of sixty (60) engineers of the Owner on engineering, operation and maintenance of the Plant at the Contractor's or Associates or Sub-contractor's premises where adequate training facilities are available during the design and manufacturing stage of the Contractor.

The total man-months for training of engineers shall be maximum sixty (60), having following indicative break-up :

Discipline	No. of Engineers	No. of Man-month
Operation	20 heads	20
Maintenance Boiler, Turbine, Mechanical	20 heads	20
Electrical Maintenance	8 heads	4
Control & Instrumentation	8 heads	4
Maintenance Planning	4 heads	2
	-----	-----
	60 heads	60
	-----	-----

However, the details of the training programme will be discussed and finalised with the successful Bidder.

The training may also be arranged by the Contractor in any Plant where the equipment manufactured by the Contractor or his Associates is under installation, operation or testing to enable the trainees to become familiar with the equipment being furnished by the Contractor. All expenses inherently related to the training shall be borne by the Contractor and shall include but not limited to travel expenses (international and inland fares), lodging and per diem charges as well as medical insurance, instructors fee, programme and miscellaneous cost to be incurred during the training.

The training programme shall be adequate for the trainees to acquire the necessary expertise and competence in the area of engineering, operation and maintenance and as trainers for in-house technology transfer programme of the Purchaser.

The Contractor shall be responsible for the development of the Training Module and Programme Schedule which shall be submitted to the Purchaser for approval.

The components of the training modules shall include but not be limited to the training procedures/methodology, instructional materials such as audio visual materials, CDs and slides and manuals for each trainee.

Three (3) sets of the materials included in the training modules shall be handed over to the Purchaser upon completion of the training. An evaluation shall be jointly undertaken by the Contractor and the Purchaser's representative on the adequacy, appropriateness and relevance of the training and the programme effectiveness after the training. The training material shall be in English language only.

The content of the training programme shall include but not be limited to :

1. Coal fired thermal plant principles in management and practice for operators, technicians and maintenance personnel.
2. Plant operation and systems training for operators including simulator training as applicable.
3. Maintenance training programme covering electrical, mechanical and instrumentation and control.

Said training programme shall be submitted to the Purchaser for approval.

The timing of the training should be such that the participants will be conversant with sufficient know-how to participate in the pre-commissioning and commissioning tests of the Plant.

The Contractor shall provide qualified English speaking instructors and training coordinator(s) during the tenure of the training programme.

19.02.00 Operation and Maintenance Training at Site

The Contractor shall provide a comprehensive training programme related to design application, plant management, operation and maintenance, including trouble shooting, of the Contractor's supplied system and equipment at the Site starting from Start of Commissioning and thereafter up to the Final Acceptance of the first Unit.

The following instructors shall be at the Site continuously during the training :

- a) One (1) for Steam Generator and Auxiliaries ;
- b) One (1) for Turbine Generator and Auxiliaries ;
- c) One (1) for Electrical Works ;
- d) One (1) for Instrumentation and Control (Boiler and Auxiliaries) ;
- e) One (1) for Instrumentation and Control (Turbine and Auxiliaries).

19.03.00 **On-the-Job Training**

During the period of pre-commissioning, commissioning and trial operation, the Purchaser shall provide operation and maintenance personnel to assist the Contractor in the operation and maintenance of his supply and work under the direction of the Contractor for the purpose of on-the-job training.

The Purchaser shall have the right to send to the Site his employees later intended to operate and maintain the equipment supplied under this Contract. The Contractor shall, without additional cost, use his site staff to instruct these employees on the operation and maintenance of the equipment. All instructions shall be in the English language.

20.00.00 **DEVIATIONS**

The Bidder is required to submit with his proposal in the relevant schedules a detail list of any and all deviations taken by him clearly without any ambiguity. In the absence of such a list it will be understood and agreed that the Bidder's proposal is based on strict conformance to this specification and no post-contract negotiations would be allowed in this regard.

Unless otherwise specifically indicated in the deviation list, it will be construed and agreed that details indicated in documents & drawings furnished by the Bidder along with the offer is in-line with the specification requirement.

ANNEXURE-I

LIST OF STANDARDS FOR REFERENCE

- a) International Standards Organisation (ISO).
- b) International Electro-technical Commission (IEC).
- c) American Society of Mechanical Engineers (ASME).
- d) American National Standards Institute (ANSI).
- e) American Society for Testing and Materials (ASTM).
- f) American Institute of Steel Construction (AISC).
- g) American Welding Society (AWS).
- h) Architecture Institute of Japan (AIJ).
- i) National Fire Protection Association (NFPA).
- j) National Electrical Manufacturer's Association (NEMA).
- k) Japanese Electro-technical Committee (JEC).
- l) Institute of Electrical and Electronics Engineers (IEEE).
- m) Federal Occupational Safety and Health Regulations (OSHA).
- n) Instrument Society of America (ISA).
- o) National Electric Code (NEC).
- p) Heat Exchanger Institute (HEI).
- q) Tubular Exchanger Manufacturer's Association (TEMA).
- r) Hydraulic Institute (HIS).
- s) International Electro-Technical Commission (IEC) Publications.
- t) Power Test Code for Steam Turbines (PTC).
- u) Applicable German Standards (DIN).
- v) Applicable British Standards (BS).
- w) Applicable Japanese Standards (JIS).
- x) Electric Power Research Institute (EPRI).

- y) Standards of Manufacturer's Standardization Society (MSS).
- z) Bureau of Indian Standards Institution (BIS).
- aa) Indian Electricity Rules.
- bb) Indian Boiler Regulations (IBR).
- cc) Indian Explosives Act.
- dd) Indian Factories Act.
- ee) Tariff Advisory Committee (TAC) rules.
- ff) Emission regulation of Central Pollution Control Board (CPCB).
- gg) Pollution Control regulations of Dept. of Environment, Govt. of India
- hh) Central Board of Irrigation and Power (CBIP) Publications.
- ii) The Air Prevention and Control of Pollution Act.
- jj) The Environmental Protection Act
- kk) The Public Liability Insurance Act.
- ll) The Forest Conservation Act
- mm) The Wildlife protection Act.
- nn) The EIA Notification, 1994.
- oo) IS: 14665-Specification for Electric Traction Lift
- pp) Any other statutory Codes/Standards/Regulations

ANNEXURE-II

SCHEDULE OF PERMITS & CLEARANCES

Sl. No.	Clearances	Authority	Responsibility
1.0	STATUTORY CLEARANCES		
1.1	Pollution clearance, water and air [Sec.25 of the Water (Prevention & Control of Pollution) Act, 1974 as amended in 1988, and Sec. 21 of the Air (Prevention & Control of Pollution) Act, 1981 as amended in 1987]	Gujarat State Pollution Control Board	Owner-Consent to establish the project. Contractor - Permission for operation
1.2	Environmental clearance	Ministry of Environment & Forest, Government of India	Owner
1.3	Aviation Clearance	Airport Authority of India, New Delhi.	Owner
2.0	NON-STATUTORY CLEARANCES		
2.1	Land availability at Plant area	Govt. of Gujarat / Private land Owner, if any	Owner
2.2	Land for Transportation of Coal	Govt. of Gujarat / Private Land Owner, if any	Owner
2.3	Transportation of Fuel (Secondary Fuel)	Department of Petroleum and Natural Gas, Ministry of Railways, Shipping and Surface Transport	Owner
2.4	Rights & right to access of all public roads from manufacturer's works to site,	Concerned Authorities	Contractor
3.0	OTHER CLEARANCES/ APPROVALS		
3.1	Approval and Registration of steam generator as per Indian Boiler Regulation	Chief Inspectorate of Boilers	Contractor
3.2	Approval as per Indian Electricity Act and Rules for Electrical Installation	Electrical Inspectorate	Contractor
3.3	Approval as per Indian Petroleum Act and Petroleum Rules for storage of petroleum products.	Chief Controller of Explosives	Contractor
3.4	Approval as per gas cylinder rules and handling and transport of compressed gases	Chief Controller of Explosives	Contractor
3.5	a) Collection, storage and disposal of waste during construction till handing over of the project.	Gujarat State Pollution Control Board	Contractor

Sl. No.	Clearances	Authority	Responsibility
	b) Site clearances, safe report and safety audit during construction till handing over of the project.	Gujarat State Pollution Control Board	Contractor
3.6	Approval of Fire Protection Scheme	Authorised Agencies approved by Insurance Regulatory Development Authority, New Delhi (IRDA)	Contractor
3.7	Consent for use of the site for the construction and operation of the Power Station and Fuel Facility	Directorate of Town and Planning of Government of Gujarat	Owner
3.8	Consent for the development of Project Site and the Township site	Directorate of Town and Planning of Government of Gujarat	Owner
3.9	Approval of the proposed design and construction of power station	Chief Inspector of Factories of Government of Gujarat	Contractor
3.10	Allocation / approval of electric supply for bulk construction power	Gujarat State Electricity Dept.	Owner
3.11	Carriage entrance to property	Municipal Corporation: Assistant Engineer, Roads or concerned authorities	Contractor
3.12	Approval of building layout with fire safety concerns and receipt of No Objection Certificate	Municipal Corporation: Chief Fire Officer or concerned authorities	Contractor
3.13	No Objection Certificate regarding air & fugitive emissions	Municipal Corporation: Executive Engineer and Gujarat Pollution Control Board	Contractor
3.14	No objection Certificate for Chimney and Registration	Inspector of Smoke Nuisance	Contractor
3.15	No Objection Certificate for sewage water treatment and associated plumbing	Municipal Corporation: Executive Engineer, Sewerage and Planning or concerned authorities	Contractor
3.16	To review the frequency used for Power Line Carrier Communication (PLCC) system to ensure no interference with other power line users	Postal Tele communication Coordination Committee (PTCC)	Owner-PLCC Contractor- Wireless equipment (postal telecommunication)
3.17	No objection certificate for plant layout with regard to electrical equipment, operational safety	Chief Electrical Engineer of Gujarat	Contractor
3.18	No Objection Certificate for storage of construction Materials and chemicals, etc.	Municipal Corporation: Assistant Engineer, Factory Department	Contractor

Sl. No.	Clearances	Authority	Responsibility
3.19	No Objection Certificate for storage of construction fuel oils and chemicals, etc.	Commissioner of Police	Contractor
3.20	No Objection Certificate for storage of Distillate Oil	Chief Controller of Explosives	Contractor
3.21	No Objection Certificate for road opening and asphaltting Work including traffic Work.	Municipal Corporation: Assistant Engineer, Roads or concerned authorities	Contractor
3.22	Local approval for operating the plant	Municipal Corporation: Ward Office or concerned authorities	Not applicable
3.23	Local approval of Architectural plans for township	Municipal Corporation or concerned authorities	Owner
3.24	Consent under the Factories Act, 1948 relating to fire fighting capacities	Directorate of Town and Planning of Government of Gujarat	Contractor
3.25	Clearance of Lifts	Inspector of Lifts, Govt. of Gujarat	Contractor
3.26	Approvals / clearances for labour / man power like License from labour commissioner for Construction labour, Registration of Workers or exemption to be claimed if group insurance taken for some, etc.	Concerned Authorities	Contractor
3.27	Any other clearances	Appropriate Authorities	Contractor
3.28	Export Authorisation (Export license)	Appropriate Authorities of exporting country	Contractor

ANNEXURE-III

CRITERIA FOR LAYOUT

PLOT PLAN LAYOUT REQUIREMENTS

ITEM	SPECIFICATION REQUIREMENT
A. Site conditions to be considered	
1. Prevalent wind direction	See wind-rose in plot plan. Also refer Metrological Data.
B. Layout Requirements	
1. Maximum permissible slope in	
a) Rail track	1 in 400
b) Road	1 in 30
c) Sides of unpaved embankment	1 in 2
2. Required road width	
a) Main roads Refer Vol. II-G.	
b) Auxiliary interconnections Refer Vol. II-G.	
c) Road to the power house unloading bay :	
• Only for entry to the unloading bay	Yes
• To pass through the unloading bay	No
3. Required minimum horizontal distance between the nearest points of	
a) Plant boundary and the boundary of residential area	(Local municipality/factory rule)
b) Electrical transformer and any other	As per the Tariff Advisory building/facility Committee Rules
c) Fire water supply installation and any building/facility subject to fire risk.	As per the Tariff Advisory Committee Rules
d) Inflammable liquid (fuel oil, etc.) storage & handling installation and their fencing and other buildings/facilities.	Rules of the Indian Explosive (Indian Explosives Act) and Indian Petroleum Code

ITEM	SPECIFICATION REQUIREMENT
4. Required minimum vertical clearance	
a) Under pipes/cable racks at road crossings	7.0 Metres
b) Soil coverage over underground pipes	1.0 Metre (minimum)
c) Pipe/Cable trench	Not Acceptable
5. Railway Wagon clearance	Rules of the Indian Railways
6. Minimum Clearance between any road edge and building/structure/ any fixed installation.	3 Metres
7. Required level, above the local developed grade level, of	
a) top of all roads	150 mm
b) all outdoor paved areas	150 mm
c) Temporary storage areas, workshops, offices, residence etc. required at the time of erection work.	Yes
d) Green belt around power plant area	As per environmental guidelines of MOEF, Govt. of India.

BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS

A. Minimum clear space required at all working and walking areas for operating & maintenance personnel	
1. Horizontal, in all directions	
a) Adjacent to any electrical equipment, electrical cables, running (rotating/reciprocating) equipment, safety valve or vent/drain pipe outlet, pipe/ equipment of surface temperature exceeding 60°C.	1200 mm
b) Adjacent to any other plant facilities (including walls/structures)	1000 mm
2. Vertical (head-room clearance)	
a) Under any pipe/equipment surface of temperature exceeding 60°C and any electrical cables or other electrical items.	2.0 Metre
b) Under any other plant facilities (including structures, pipes etc.)	2.0 Metre

ITEM	SPECIFICATION REQUIREMENT
3. For all areas where any equipment (including trucks, trolleys and other material handling equipment) will move or maneuver.	Minimum 500 mm clear in all direction from the outer edges of the equipment
4. Minimum clear hand space required for	
a) The application of thermal insulation	100 mm
b) Welding work	150 mm
c) Bolt tightening	150 mm
B. Floors, platforms, staircase, ladders, walls, doors & windows	
1. Statutory Requirement	As per the regulations of Tariff Advisory Committee, Indian National Building Code, Indian Factories Act, Local Municipal Rules, etc.
2. Operation & Maintenance Requirement	
a) Adequate floor space shall be kept to permit dismantling, temporary storing and in-situ maintenance of plant & equipment parts, satisfying the clear space requirements stated above. A separate unloading bay for such purpose is required.	Yes
b) Floors or fixed/portable platforms with stairs/ ladders shall be provided for easy approach to any plant item, including valves, instruments, etc. to be operated, observed and/or to be frequently (more than once a month) maintained.	Yes
3. Plinth level of all buildings, above the local developed for power house building.	300 mm, however, 500 mm grade level
4. Minimum access opening required (with rolling shutter) transportation,	3.5M wide x 4M high or, wherever entry of truck, for material more depending upon the is envisaged equipment size to be handled.

ITEM	SPECIFICATION REQUIREMENT
C. Other Maintenance Requirement	
1. Generator stator handling In case the Generator stator cannot be handled by the turbine house crane, all provisions for its overhauling, including the arrangement to slide the stator on the turbine house floor, the foundation work for stator jacking /lowering assembly, dismantling of building end walls/structures etc. shall be kept.	Yes
2. Maintenance of the internals/impellers of all important equipment, like boiler feed pumps, feed water heaters, Surface Condenser, fans of the boiler draft plant, Intake and circulating water pumps, cooling water pumps, coal mills, compressors, blowers, heat exchangers, fuel air oil pumps, filters etc.	Shall be possible without disconnecting or dismantling any piping/ducting.
3. Overhauling and handling of the casings for the above items	Shall be possible without disturbing/dismantling any piping/ducting not directly connected to them.
4. Crane Approach Wherever required the unobstructed approach of the crane hook/other hoisting equipment hook to various plant & equipment shall be possible.	Yes
D. Central Control Room All electronic equipment other than those directly associated with control, operation or presentation of displays shall be mounted external to the control room in air conditioned control equipment room.	Yes
The bidder shall describe in his bid the proposed layout philosophy of the Central Control Room and Control Equipment Room and the arrangement of equipment best suited for the system offered by him and as per good ergonomically consideration.	
However, as a guide line, following features are given :	
a) False ceiling and false flooring shall be provided.	
b) Uniform height, colouring schemes for cabinets etc. shall be available.	

ITEM	SPECIFICATION REQUIREMENT
c) The total area of floor space covered by Control Consoles/Panels in the Control Room shall not exceed 15% of floor area.	
d) No opening shall be provided from Boiler side.	
e) Two double leaf doors, suitably located for entering the Control room shall be provided with opening towards the turbine floor.	
f) Cable entry for the panels/conssoles shall be from bottom and suitable openings shall be provided.	
g) The Control Room lighting shall be designed to provide a glare free uniform illumination. The level of illumination shall be minimum 400 LUX.	
h) Necessary Air Conditioning shall be provided for Central Control room, Control Equipment Room and SWAS room etc.	
i) Basic amenities like toilet, Tiffin rooms, wash basins, rest rooms etc. shall be provided near the Control Room.	
E. Toilet and drinking water facility	Required in all buildings and on all floors wherever operating personnel are to be deployed.



TITLE:
**TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM**

1X800 MW WANAKBORI TPS

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

VOLUME **II-B**

SECTION -C

REV. NO. 00

DATE:

Page

SECTION – C2-B
PAINTING SPECIFICATION



TITLE

DOCUMENT NO. PE-DC-408-100-A999

PAINTING SCHEDULE**1x800 MW WANAKBORI TPS**

REV.NO. 04 DATE 10/02/2016

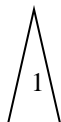
SHEET 1 OF 3

1.0 GENERAL PAINTING REQUIREMENTS

1.1 Painting of equipment shall be carried out as per the specifications indicated below and attached annexures and shall conform to the relevant IS specification/ international standards for the material and workmanship.

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

- IS:5 : Colours for ready mixed paints and enamels
- IS:1303 : Glossary of terms relating to paints
- IS:2379 : Colour code for identification of pipelines
- IS:1477 : Code of practice for painting of ferrous metals in Buildings (Parts I & II)
- IS:2524 : Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
- IS:158 : Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting
- IS:2074 : Ready mixed paint, air drying, red Oxide Zinc Chrome, priming
- IS:104 : Ready mixed paint, brushing, Zinc Chrome, priming
- IS: 2932 : Enamel, synthetic, exterior (a) undercoating (b) Finishing
- IS :2933 : Specification for enamel synthetic exterior type II
- IS:2339 : Specification for Aluminium paints for general purpose

**1.3 Preparation of Surfaces**

All surfaces to be painted shall be thoroughly cleaned of all grease, oil, loose mill scale, dust, rust and any other foreign matter. Mechanical cleaning by power tool and scrapping with steel wire brushes shall be adopted to clear the surfaces. However, in certain locations where power tool cleaning cannot be carried out sand scrapping may be permitted with steel wire brushes and /or abrasive paper. Cleaning with solvents shall be resorted to only in such areas where other methods specified above have not achieved the desired results. Cleaning with solvents shall be adopted only after written approval of the OWNER/OWNER REPRESENTATIVE.



TITLE

DOCUMENT NO. PE-DC-408-100-A999

PAINTING SCHEDULE

1x800 MW WANAKBORI TPS

REV.NO. 04 DATE 10/02/2016

SHEET 2 OF 3

The sheet steel of electrical and instrumentation panels shall be pre-treated through chemical cleaning (7 tank) process of rinsing, degreasing, rinsing, derusting, rinsing, phosphate and rinsing. However, in case mechanical cleaning is also required the Contractor shall carry out the same to get a smooth finish.

1.4 Primer Paint

After the surface is prepared one coat of Zinc Phosphate primer conforming to IS 2074 shall be applied.

1.5 Tie Paint

After the coat is dried up completely, second coat of Zinc Phosphate primer conforming to IS 2074 shall be applied by brushing, spray, roller as per manufacture recommendation to ensure a continuous film. The dry film thickness of each coat shall be as indicated in Ann-I & II enclosed. Insulated surfaces will have only primer coating and no finish painting.

1.6 Finish Paint

Synthetic enamel paint conforming to IS 2932 shall be used for finish coats. The colour /shade shall be as approved by the OWNER. After cleaning the dust on the dried up primer, first coat of synthetic enamel shall be applied. After this first coat dries up hard, the surface is wet scrubbed cutting down to a smooth finish and ensuring that at no place the first coat is completely removed. After allowing the water to get evaporated completely, the second finish coat of synthetic enamel paint shall be applied.



Note For structural painting, customer's specification V II/G2/8 CI 3.03.11 shall be followed however DFT and coating system shall be followed in line with paint manufacturer's recommendation.

1.7 Painting and Corrosion Protection for Pipes & Fittings

1.7.1 All uninsulated piping systems, hangers and supports shall have two coats of Zinc Phosphate Primer (conforming to IS 2074) (One primer coat and one tie coat) and finish paint using synthetic enamel paint to give a finish coat. Shades shall be as per IS 5 or as indicated by PURCHASER/OWNER. Service of the pipeline designations shall be painted on all pipes at visible locations.

1.7.2 Before application of paint, Contractor shall clean the pipes of all mill scale, dirt dust, soot grease, rust etc.

1.7.3 All pipe lines, piping components shall be adequately protected against corrosion during manufacture, fabrication, shipment and storage by appropriate protective paint.



TITLE

PAINTING SCHEDULE**1x800 MW WANAKBORI TPS**

DOCUMENT NO. PE-DC-408-100-A999

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SHEET 3 OF 3

1.7.4 Shop fabricated equipment/items shall be dispatched with final paint. Necessary touch up shall be done at site. Site fabricated equipment/items shall be dispatched with primer painting only and final painting shall be applied at site.

1.8 Painting and Corrosion Protection for Valves & Specialties

Primer of thickness as indicated in Ann-II shall be applied to all steel and cast iron exposed surfaces as required to prevent corrosion before dispatch. The use of grease or oil, other than light grade mineral oil, for corrosion protection is prohibited. Bores of all vales shall be covered immediately after testing, draining and drying with suitable plastic end covers to avoid ingress of foreign materials.

1.9 Suggested Colour Codes for Painting

Suggested colour codes shall be furnished by the successful bidder after award of contract. Colour codes for piping shall be as per IS 2379 with necessary modifications. Where band colour is specified for piping, same shall be provided at 30 metre intervals on long uninterrupted lines and also adjacent to valves and junctions.

2.0 Approved Paint Makes

- | | |
|--------------------------------|------------------------------|
| i) Asian Paints (I) Ltd. | vii) Addison Paints Ltd |
| ii) Berger Paints India Ltd | viii) Grand Polycoat |
| iii) Goodlass Nerolac | ix) Bombay Paints |
| iv) Jenson & Nicholson (I) Ltd | x) Hemple Paints (Singapore) |
| v) CDC carboline (I) Ltd. | xi) Jotun Paints |
| vi) Shalimar Paints Ltd. | xii) Akzonobel coatings |

2.1 PAINTING SCHEDULES

2.1 Painting schedules for various systems/ items are furnished as per enclosed Annexures-I and II. Vendors of different packages/ items will furnish detailed painting schedule for customer approval during detail engineering as per this guide specification.



TITLE

DOCUMENT NO. PE-DC-408-100-A999

PAINTING SCHEDULE


1x800 MW WANAKBORI TPS

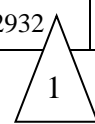
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SHEET 1 OF 2

Annexure-I

Paint Reference Scheme	Surface Preparation Grade / Surface Profile	Primer Coat			Intermediate Coat			Finish Coat			Total DFT in microns
		Premier Paint	No. of Coats	DFT in Microns	Intermediate Paint	No. of Coats	DFT in Microns	Finish Paint (See Note)	No. of Coats	DFT in Microns	
Various type of equipment/v alve, etc. (Temp. upto 90°C)	Degreasing and Mech. Cleaning with wire brushing/hand tool (Sa1/St2/St3 as applicable)	HB Zinc Phosphate (alkyd Medium) as per IS:2074	1	40-45 per coat	HB Zinc Phosphate (alkyd Medium) as per IS:2074	1	40-45 per coat	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	120 – 140*
Structural 	- do -	Epoxy resin based HB Zinc phosphate (alkyd medium)	1	50 – 75 per coat	Epoxy based HB MIO pigmented polyamide cured paint	1	110-125 per coat	Polyamide cured epoxy finish coating + Polyurethane coat	1+1	50 – 60 per coat + 25 – 35 per coat	235 - 295
LP Piping/ Vessels, etc. (Temp. upto 90°)	- do -	HB Zinc Phosphate as per IS:2074 (alkyd medium)	1	40-45 per coat	HB Zinc Phosphate (alkyd Medium) as per IS:2074	1	40-45 per coat	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	110-140*
Equipment with (Temp. upto 250°)	- do -	Heat resistant Al – paint	2	20 per coat	- NA	-	-	NA	Insulated	NA	40
Equipment in corrosive areas like CPU (regeneration) Dosing skid, etc.	Blast clean to Sa 2 ^{1/2}	HB Epoxy resin based zinc phosphate primer	1	50 per coat	Epoxy based MIO pigmented paint	1	50 per coat	Polyamide cured Epoxy finish coat	2	25 – 35 per coat	150 - 170
Elect. / Control Panels, etc.	Seven tank process	HB Zinc phosphate (alkyd Medium) as per IS:2074	2	40-45 per coat	HB Zinc Phosphate (alkyd Medium) as per IS:2074	1	40-45 per coat	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	110 – 140*
Large dia pipes	As per customer specification for Large diameter piping CI. No. 9.00.00 of VII-I/S-5										





TITLE

DOCUMENT NO. PE-DC-408-100-A999

PAINTING SCHEDULE

1x800 MW WANAKBORI TPS

REV.NO. 04

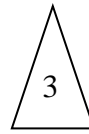
DATE 10/02/2016

SHEET 2

OF 2

Chequered plate / grating
 All Gates & Stop Logs
 All mild steel part used in the water retaining structure.
 Hand railing.
 Ladder pipes.
 Rungs
 Ladder

1. Steel chequered plates and gratings shall be hot double dip galvanized. Thickness of coating will be 610gm/sq.m (minimum).
2. All gates and stop-logs shall be of structural steel, which shall be hot double dip galvanized. Thickness of coating shall be 1000 gm/sq.m (minimum).
3. All mild steel parts used in the water retaining structures shall be hot double dip galvanized. Galvanizing shall be checked and tested in accordance with IS-2629.
4. Hand rails shall be galvanized (as per IS-277). All rungs for ladder shall also be galvanized as per IS-277 (medium class).



Notes:

1. Surface preparation shown above is as per Swedish Standards SIS 05-5900. Degreasing will be as per Standard SSPC-SP1.
2. In case of insulated surfaces, only primer coats shall be applied.
3. GM/SS items with piping and G.I. pipes will not be painted. Further SS/GI piping shall be given necessary colour banding for identification as per colour scheme.
4. All instruments shall be painted as per manufacturer standard practice.
5. All structural steel items shall be painted at site. Piping shall go with primer coating & finish Paint shall be applied at site. Equipment shall be finish painted at shop.
6. Method of painting application shall be as per paint manufacturer's recommendation.
7. **Based on above painting schedule, detailed painting schedule will be prepared by respective Package supplier and approved painting schedule shall be submitted to GSECL/DCPL under information category.**
8. **This painting schedule is applicable for bought out equipment/packages of PEM. Painting specification for various piping/ equipment in scope of various other BHEL units like Power cycle piping, CW piping, LP piping, R.E. joints, Butterfly valves, Power cycle valve etc., shall be furnished by unit separately.**
The total minimum DFT shall be 140 micron for surfaces subject to weathering and 120 micron minimum for surfaces inside buildings.



*



TITLE


PAINTING SCHEDULE
1x800 MW WANAKBORI TPS

DOCUMENT NO. PE-DC-408-100-A999

REV.NO. 04 DATE 10/02/2016

SHEET 1 OF 1

ANNEXURE -II**LDO/HFO Storage Tank**

	Internal	External	Underneath
Surface preparation	Wire bushing	ST2 (Wire Brushing/ Hand tool cleaning)	Blast clean to SA 2.5
Primer	2 coats of double boiled linseed oil	2 coats of red oxide zinc chromate primer (IS 2074) of 30 - 35 microns DFT each	1 coat of high build coal tar epoxy (Bitumastic paint) suitably pigmented, DFT : 80 – 100 microns
Finish 	1 coats of synthetic enamel (IS – 2932) paint of 20 – 25 microns (DFT) each	2 coats of synthetic enamel (IS – 2932) paint of 20 – 25 microns (DFT) each	N.A
Total DFT		100 – 120 microns	80 – 100 microns

4



TITLE

PAINTING SCHEDULE
1x800 MW WANAKBORI TPS

DOCUMENT NO. PE-DC-408-100-A999

REV.NO. 04 DATE 10/02/2016

SHEET 1 OF 2

ANNEXURE-III

SUGGESTED COLOUR CODES FOR PAINTING

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
1.0	Structures, platforms, galleries, ladders and handrails	Dark Admiralty Grey	632	-	-
2.0	Fans, pumps, motors, compressors, Blowers	Light Grey	631	-	-
3.0	Tanks (without insulation and cladding)				
3.1	Outdoor, Stand pipes, vent pipes	Aluminum	-	-	-
3.2	Indoor	Aluminum	-	-	-
4.0	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
5.0	Switchgear	Light grey	631	-	-
6.0	Control & relay panels	Light grey	631/7078 of IS 1650	-	-
7.0	Transformers	Dark Admiralty Grey	632	-	-
8.0	Machinery guards	Signal red	537	-	-
9.0	Piping (without insulation and cladding)				
9.1	Water System				
a)	Boiler feed	Sea green	217	-	-
b)	Condensate	Sea green	217	Light brown	410
c)	D M Water	Sea Green	217	Light orange	557
d)	Soft water	Sea green	217	French blue	166
e)	Bearing cooling water	Sea green	217	French blue	166
f)	Potable & filtered water	Sea green	217	French blue	166
g)	Service & clarified water	Sea green	217	French blue	166
h)	Raw water	Sea green	217	White	-
i)	Cooling water	Sea green	217	French blue	166
9.2	Compressed Air System				
a)	Service air	Sky Blue	101	-	-
b)	Instrument air	blue	101	White	-
9.3	Oil system				
a)	Fuel oil	Light brown	410	French Blue	166
b)	Light oil	Dark Brown	412	Brilliant green	221
c)	Lubricating oil	Light brown	410	Light grey	631



TITLE

PAINTING SCHEDULE
1x800 MW WANAKBORI TPS

DOCUMENT NO. PE-DC-408-100-A999

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SHEET 2 OF 2

SL. NO.	ITEM/SERVICE	COLOUR	IS-5	COLOUR (BAND)	IS-5
d)	Control oil	Light brown	410	Light orange	557
e)	Transformer oil	Light brown	410	Light orange	557
9.4	Gas system				
a)	Carbon dioxide	Canary yellow	309	Light grey	631
9.5	Fire services	Fire red	536	-	-
9.6	Drainage	Black	-	-	-
9.7	Stand pipes and all Vent pipes	Aluminum	-	-	-

Notes:

1. This color code basically refers to IS:2379 for piping with necessary modifications.
2. Where band color is specified, same shall be provided at 10 meter intervals on long uninterrupted lines and also adjacent to valves and junctions.



TITLE:
**TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM**

1X800 MW WANAKBORI TPS

BHEL DOCUMENTS NO.: PE-TS-408-160-A001	
VOLUME II-B	
SECTION -C	
REV. NO. 00	DATE:
Page	

SECTION – C2-B
PROJECT MANAGEMENT & SERVICES

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	PROJECT MANAGEMENT SERVICES
2.00.00	SITE SERVICES

VOLUME : IIA

SECTION-V

PROJECT MANAGEMENT AND SITE SERVICES

1.00.00 **PROJECT MANAGEMENT SERVICES**

1.01.00 **Responsibility**

The Bidder shall identify a separate and independent project management team headed by a Project Manager for the execution of this project. Responsibilities of this project Management team shall cover the areas listed below :

- a) Planning and Monitoring
- b) Engineering Management
- c) Contracts Management
- d) Quality Assurance, Inspection & Expediting
- e) Construction Management
- f) Spares Management
- g) Erection & Commissioning Management

Detailed responsibilities in the above areas are discussed below :

1.02.00 **Organisation**

1.02.01 Headquarters

The headquarters of the project management team shall be headed by a senior level executive designated as the Project Manager who shall be responsible to Owner for the execution of the project. He should have adequate financial power and authority to give decision.

Separately, designated leaders shall be identified for each of the areas mentioned under 1.01.00, who, in turn, will report to the Project Manager for all matters relative to this contract.

1.02.02 Central Co-ordination Cell

The central coordination cell shall have sufficient technical personnel to coordinate technical matters and to quickly resolve day to day queries or references made by Owner and his Consultants without having the need to refer to his headquarters each time.

1.02.03 Site Organisation

The site should have a competent construction manager for all site operations with adequate financial power and sufficient level of authority to take site decisions. The organisation chart for site should indicate the various levels of experts to be posted for supervision in the various fields in civil construction, erection, commissioning etc.

1.02.04 Organisation Chart

The Bidder shall furnish a detailed organisation chart for the project management team, clearly identifying the key personnel in each of the areas mentioned at 1.01.00 above. The expected number of executives at different levels shall also be indicated, separately for headquarters, central coordination cell and site organisation.

1.03.00 **Implementation Schedule**

The schedule for the completion of the Project would be as follows :

Period in Months from Zero date (Taken as the date of issue of Notice to Proceed)

a)	Boiler Hydro-test	By Bidder
b)	Boiler light up	By Bidder
c)	Unit synchronisation	45
d)	Commercial operation	48

To achieve these targets, the Contractor shall furnish to the Owner, various schedules as defined below:

1.03.01 Engineering Schedules

These schedules shall cover various design submissions indicating different engineering activities to be performed. Such schedules shall be furnished by the Bidder for each and every plant/systems/ equipment item covered in the scope of this specification.

1.03.02 Manufacturing Schedule

The Contractor shall submit to the Engineer his manufacturing and delivery schedules for all equipment within thirty (30) days from the date of issue of the Letter of Award (LOA). Such schedules shall be in line with the detailed network for all phases of the work of the Contractor. Such schedules shall be reviewed, updated and submitted to the Engineer, once in every two months thereafter, by the Contractor. Schedules shall also include the materials and equipment purchased from outside suppliers.

1.03.03 Erection Schedules

In order to achieve the overall completion schedule, the Contractor shall provide the Owner all the information covering erection sequence, testing and commissioning activities. These schedules may be based on the recommended erection procedures and will be subject to discussions/agreements with the Owner subsequent to the award of contract.

1.03.04 The successful Bidder shall have to provide all the above schedules (i.e. 1.03.01, 1.03.02 & 1.03.03) in a tabular form in addition to that in the form of L2 & L3 networks and these shall necessarily include information not limited to the earliest and latest dates for various activities/submissions and also any related constraints. However, the Bidder shall include in his proposal a Level-1 (L-1) network showing the major activities and various milestones to achieve the above mentioned completion schedule.

1.03.05 The Contractor shall provide the Owner the original disc/software for all such schedules alongwith requisite no. of copies (as required by the Owner) within an agreed time schedule. This time schedule will be agreed between Owner/Bidder at the time of award. The Contractor's project management software shall be compatible with that of the Owner and the input data shall be furnished to the Owner in a manner compatible with Owner's project management software, Primavera.

1.04.00 **Detailed Responsibilities**

1.04.01 Planning & Monitoring

a) Planning

The Bidder shall prepare a Master Network Schedule in the form of PERT network.

The network shall be prepared on a Work Breakdown Structure for the project which sub-divides the project into a set of manageable systems/sub-systems. The master network will identify milestones of key events for each system/package in the areas of engineering, procurement, manufacture and despatch and erection and commissioning. The master network shall represent the Level-I plan and will form the basis for development of detailed second and third tier execution plans. The master network shall conform to the overall schedule prescribed by Owner.

The master network should be submitted along with the bid which would be mutually discussed and finalised before the Award of Contract. This master network would clearly indicate the responsibility of the Bidder and project management team. This master network would form a part of the contract. The master network shall also identify a complete list of inputs to be furnished by the Owner which may be required for proper interfacing and tie-up. Scheduled dates for providing such inputs shall also be indicated, which will be mutually discussed and finalised.

b) Monitoring & Progress Reporting

The progress reports would be emanated every month, one from the head office of the Contractor and another from the site office. The progress report emanating from the head office should necessarily include the following sections:

- i) Report on key milestones.
- ii) Management summary indicating critical areas with details of actions initiated and effect of any on the project.
- iii) Action needing attention of the Owner/Consultant.
- iv) Detailed packagewise status of engineering submissions, quality plan submissions and approval, procurement manufacture and despatch.

The monthly report generated from the site office should necessarily include:

- i) Report on key milestones.
- ii) Management summary indicating critical areas with details of actions initiated and effect if any on the project.
- iii) Action needing attention of the Owner/Consultant.
- iv) This report would also cover the areas pertaining to the receipt of the equipment at the port, port clearance, transport, receipt at site, erection and commissioning.

In addition to the above, as the project execution progresses, the Contractor shall also be responsible for generating more frequent reports in the form of fax/e-mail information on progress in critical areas so that actions can be expedited. The exact format of the progress report shall be finalised after award of Contract.

1.04.02 Engineering Management

Based on the master network for the project (L-1) the Contractor will prepare an exhaustive list of engineering activities for the equipment/systems covered in his scope and a detailed programme of accomplishing the same within the time frame specified in the master network. This schedule will form the Level-2 (L-2) network for engineering activities.

Based on (L-2) network, the Bidder shall further develop the Level-3 (L-3) network for engineering activities which will indicate schedule for data availability, drawing release date and document submission dates.

Detailed (L-2) and (L-3) networks would be submitted sequentially by the Contractor within two months from the date of issue of Letter of Award and finalised within one (1) month thereafter.

All such networks shall be provided in MS PROJECT software as well as in other format / software suitable to Owner.

The engineering management team should also co-ordinate all interface engineering activity between the Contractor and the equipment sub-vendors so as to ensure the correctness and completeness of related engineering documentation before the same is submitted to the Owner.

1.04.03 Contracts Management

Based on the master network, the Contractor shall submit L-2 programmes of manufacture and despatch. In addition, the master network shall also include periods considered for site activities viz. erection, commissioning etc. These L-2 programmes would be submitted in 2 months time from the date of award of contract and finalised within one (1) month thereafter. The Contractor will also submit site mobilisation plan. This programme would be submitted at the time of finalisation of award of contract and agreed immediately thereafter so that immediate development of the various activities at site could take place.

The Contractor should also submit L-3 programmes for the manufacturing, despatch of the various items. These networks shall also show the customer hold points (CHP) which have to be cleared by Owner or their authorised representative(s) before further manufacture can take place. These L-3 programmes for the manufacture and despatch would clearly identify responsibilities of the Contractor, sub-Contractor and Owner. These networks shall be submitted within one (1) month of the date of finalisation of the various sub-contracts by the Contractor.

In case all the manufacture is being done by the Contractor then the L-2 programmes would be themselves amplified to cover details of the manufacture, inspection, clearance by Owner and despatch.

The Contractor shall also submit the programme for procurement of boughtout items, detailed shipping schedule and cash flow statement for Owner's approval.

1.04.04 Quality Assurance, Inspection and Expediting

The Contractor shall submit the list of manufacturers/sub-vendors from whom the equipment are expected to be procured and the quality assurance plans thereof for the manufacture shall be approved by the QA group of Owner before the manufacture is commenced. The list of major suppliers would be submitted along with the bid and this shall be mutually discussed and approval will be given by the Owner during contract negotiation meeting prior to placement of Letter of Award. This approved list will be binding to the bidder. In the said list, Owner reserves the right to include reputed/reliable vendors of his own choice. Regarding the various other sub-vendors, the list would be submitted within six (6) months of the award of the contract that shall be scrutinized by the Owner to accord approval. In such list Owner

reserves the right to include vendors of his own choice. No further vendor approval will be given after six (6) months. On the quality plans, the customer hold points will also be identified based on which Owner would give clearance for the manufacture to proceed further.

Quality assurance/Inspection group of Owner or its representative would issue a material despatch clearance certificate (MDCC) after the inspection clearance which will enable the Contractor to despatch the equipment and claim the payment. In the despatch programme, the Contractor shall indicate a schedule of estimated programme, tonnages specifically identifying various oversize dimensioned consignments (ODC). Further the Contractor will also be required to ensure at all stages of shipment that packing of all shipments despatched are suitable for ocean freight to India, handling at the port of entry, inland transportation and preservation at site upto erection. All despatch details & item lists shall be made available to both Owner & site immediately after shipping.

The Contractor shall also expedite all despatches from their own works/works of their sub-vendors, so as to match with the various activities mentioned at 1.04.03 above.

1.04.05 Construction Management

Based on the L-1 Master Network Programme, within two (2) months of the issue of Letter of Award, the Contractor shall submit a programme of construction/erection/commissioning, either in continuation with the manufacture and despatch or separately for the implementation. These programmes would be amplified showing when the civil drawings shall be released by him and construction of civil works shall be completed by him to facilitate start of erection and subsequent activities and shall form the basis for site execution and detailed monitoring. The three monthly rolling programme with the first month's programme being tentative based on the site conditions would be prepared based on these L-3 programmes. The Contractor shall also be involved along with the Owner to tie up detailed resource mobilisation plan over the period of time of the contract matching with the performance targets.

The L-3 programme would be jointly finalised by the site in charge of the Contractor with the Owner's project coordinator as well as the site planning representative. The erection programme will also identify the sequential erectable tonnages that are required for various equipment which should be taken care of in the despatch programmes.

Erection and commissioning of the equipment shall also be done under the supervision of experts from the respective equipment/ system supplier.

1.04.06 Spares Management

Alongwith the proposal for the plant and equipment, the Contractor shall also submit proposals/schedule for the following:

- a) Mandatory spares
- b) Recommended spares

While the award for mandatory spares will be finalised at the time of the award of contract, recommended spares will be finalised thereafter.

1.05.00 Project Progress Review Meetings

Keeping in mind the overall responsibility of the Contractor it is intended that periodic progress reviews on the entire activities of execution in respect of Wanakbori Thermal Power Plant (Unit-8) will be held initially atleast once in two (2) months at Vadodara/site or in the country (India) depending on the circumstances and mutual agreement. During peak period it may be held once in a month. These meetings will be attended by reasonably higher officials of the Contractor and their leading sub- contractors and will be used as a forum for discussing all areas where progress needs to be speeded up. Actions will be placed on the concerned agencies and decisions will be taken to expedite/speed up the progress. Minutes of such meetings will be issued reflecting the major discussions and decisions taken and circulated to all concerned for reference and action. The Contractor shall be further responsible for ensuring that suitable steps are taken to meet various targets decided upon such meetings.

In addition to the above, and to streamline the construction and erection at site, a suitable frequency and forum of periodic meetings between the Contractor and the Owner will be decided upon as part of erection coordination procedure. Site co-ordination meeting may be held on weekly basis.

1.06.00 Owner's Consultant

The Owner would appoint a consultant to assist him in some of the areas mentioned at 1.01.00 above. The details of interaction and procedures for coordination between Owner/Owner's Consultant & Contractor/ Contractor's project management team shall be finalised during contract negotiations.

1.07.00 Commissioning Management

1.07.01 For commissioning of the various equipment/system covered under the scope of contract, Owner will form an organisation structure which may consist of the following committees. The Contractor shall nominate his representative on one or more of the committee as decided by the Owner:

- a) Steering Committee
- b) Commissioning Panel.
- c) Working Parties
- d) Testing Teams.

1.07.02 Commissioning documents shall be prepared by the Contractor in the following manner and submitted for Owner's approval :

- a) Field Quality Plan

This document shall be prepared for the various equipment/ systems under commissioning and shall have the following objectives to fulfill and shall be submitted for Owner's approval at least six (6) months before their actual commissioning :

- i) Establish design data against which Plant Performance will be compared.
 - ii) Set-out the testing objectives and proposals.
 - iii) Define the documentation required.
- b) Testing/Commissioning Schedule
- These shall be prepared for the various equipment/systems under consideration and shall contain sections like detailed testing method, programme, safety, individual responsibility and results.
- c) Standard Check Lists
- Standard check lists are intended for use at the completion of erection to ensure correct erection, testing and to a limited extent operation for repetitive items.

1.07.03 Test Reports

After the completion of commissioning activity of equipment/ systems, the Contractor shall prepare the test reports which shall include all the relevant information related to various commissioning checks, tests carried out, any deviations/commissions noticed with respect to the intended design requirements, sequence of various commissioning activities as actually adopted vis-a-vis as recommended in the procedures, programme schedules achieved and any other such information as required. These test reports shall be submitted in requisite number of copies to the Owner and this should be duly signed jointly by the Owner/Consultant and the Contractor/Equipment supplier, who are involved during the commissioning activities.

2.00.00 **SITE SERVICES**

These services shall be rendered by the Bidder as part of the overall project management service. The services shall broadly include but not be limited to the following :

- 2.01.00 Arranging material despatch from the shop by rail/road and/or sea as applicable.
- 2.02.00 Monitoring movement of materials & follow-up as necessary with Railways, road transport, port clearance etc. from the time of despatch F.O.R. works/ F.O.B. port of shipment by Contractor till receipt of the same at site.
- 2.03.00 Unloading of materials at Railway Station/Railway Siding inside project area/ Road Transportation, transportation to site store, assessment of lost/damaged items in transit and arranging insurance claims and replacement of lost/damaged items. The Contractor shall submit to the Engineer a report detailing all the receipts during the week as well as storing, preservation of material at site.

- 2.04.00 Issuing materials from site store/open yard from time to time for erection as per the construction programme. The Contractor shall be the custodian of all the materials issued till the plant is officially taken over by the Owner after complete erection and successful trial run & commissioning.
- 2.05.00 Transportation of materials to their respective places of erection and erection of the complete plant & equipment as supplied under this specification.
- 2.06.00 Trial run and commissioning of individual equipment/sub-systems and the plant as a whole to the satisfaction of the Owner, including supply of temporary equipment & services for chemical cleaning, steam blowing as well as performance guarantee tests.

Apart from Boiler, proper chemical cleaning shall be carried out in following pipe lines/equipment before commissioning

- a) Deaerator
- b) Boiler feed suction, recirculation leak-off lines
- c) Boiler Feed discharge line by passing heaters
- d) Attemperation lines
- e) Condensate suction & discharge piping upto de-aerator by passing the feed water heaters.
- f) Fuel oil lines.

Provision for preservation of individual equipment after trial run and commissioning e.g. Nitrogen blanketing etc. as necessary shall also be in the scope of the Bidder.

Safe disposal of effluent after chemical cleaning shall be done by the contractor.

- 2.07.00 Supply and application of the final paints and first fill lubricants on all the equipment to be erected under this specification. Supply of LDO, chemicals, lub oils upto COD.
- 2.08.00 For the purpose of erection and commissioning the Contractor's scope of work shall include but not be limited to the following :
- 2.08.01 Deployment of all skilled and unskilled manpower required for erection, supervision of erection, watch & ward, commissioning and other services to be rendered under this specification.
- 2.08.02 Deployment of all erection tools & tackle, construction machinery, transportation vehicles and all other implements in adequate number and size, appropriate for the erection work to be handled under the scope of this specification.

- 2.08.03 Supply of all consumables, e.g. welding electrodes, cleaning agents, diesel oil, grease, lubricant etc. as well as materials required for temporary supports, scaffolding etc. as necessary for such erection work except those listed under exclusion elsewhere in this specification.
- 2.08.04 Construction of all civil/structural/architectural works, including construction of foundation for all equipment supplied as required, grouting of equipment on foundation after alignment, and all other incidental civil activities as detailed elsewhere.
- 2.08.05 All structural steel fabrication and erection work as detailed elsewhere in the specification.
- 2.08.06 Providing support services for the Contractor's erection staff e.g. construction of site offices, temporary stores, residential accommodation and transport to work site for erection personnel, insurance cover, watch & ward for security and safety of the materials under the Contractor's custody etc. as required.
- 2.08.07 Maintaining proper documentation of all the site activities undertaken by the Contractor as per the proforma mutually agreed with the Owner; submitting monthly progress reports as also any such document as and when desired by the Owner; taking approval of all statutory authorities e.g. Boiler Inspector, Factory Inspector, Inspector of Explosives etc. for respective portions of work under the jurisdiction of such statutes or laws.
- 2.08.08 The Contractor shall provide 'Industrial Relations' unit and 'Medical' unit to take care of his erection staff and the Owner shall have no obligation in the regard.
- 2.08.09 The successful Bidder shall arrange for Tower crane of adequate capacity for speedy erection activities.

2.09.00 **Site Organisation**

The Contractor shall maintain a site organisation of adequate strength in respect of manpower, construction machinery and other implements at all times for smooth execution of the contract. This organisation shall be reinforced from time to time, as required, to make up for slippages from the schedule without any commercial implication to the Owner. The site organisation shall be headed by a competent construction manager having sufficient authority to take decisions at site.

On award of contract, the Contractor shall submit to the Owner a site organisation chart indicating the various levels of experts to be deployed on the job. The Owner reserves the right to reject or approve the list of personnel proposed by the Contractor. The persons, whose bio-data have been approved by the Owner, will have to be posted at site and deviations in this regard will not generally be permitted.

The Contractor shall also submit to the Owner for approval a list of construction equipment, erection tools, tackle etc. prior to commencement of site activities. These tools & tackle shall not be removed from site without written permission of the Owner.

2.10.00 General Guidelines for Field Activities

- 2.10.01 The Contractor shall execute the works in a professional manner so as to achieve the target schedule without any sacrifice on quality and maintaining highest standards of safety and cleanliness.
- 2.10.02 The Contractor shall co-operate with the Owner and other Contractors working in site and arrange to perform his work in a manner so as to minimise interference with other Contractors' works. The Owner's engineer shall be notified promptly of any defect in other Contractor's works that could affect the Contractor's work. If rescheduling of Contractor's work is requested by the Owner's engineer in the interest of overall site activities, the same shall be complied with by the Contractor. In all cases of controversy, the decision of the Owner shall be final and binding on the Contractor without any commercial implication.
- 2.10.03 The Engineer shall hold weekly meetings of all the Contractors working at Site at a time and a place to be designated by the Engineer. The Contractor shall attend such meetings and take notes of discussions during the meeting and the decisions of the Engineer and shall strictly adhere to those decisions in performing his Work. In addition to the above weekly meeting, Engineer may call for other meetings either with individual contractors or with selected number of contractors and in such a case the Contractor, if called will also attend such meetings.
- 2.10.04 Time is the essence of the Contract and the Contractor shall be responsible for performance of his Work in accordance with the specified construction schedule. If at any time the Contractor is falling behind the schedule, he shall take necessary action to make good of such delays by increasing his work force or by working overtime or otherwise accelerate the progress of the work to comply with the schedule and shall communicate such action in writing to the Engineer, satisfying that his action will compensate for the delay. The Contractor shall not be allowed any extra compensation for such action.
- 2.10.05 The Engineer shall however not be responsible for provision of additional labour and or materials or supply or any other services to the Contractor except for the co-ordination work between various Contractors as set out earlier.
- 2.10.06 The works under execution shall be open to inspection & supervision by the Owner's engineer at all times. The Contractor shall give reasonable notice to the Owner before covering up or otherwise placing beyond the reach of inspection any work in order that same may be verified, if so desired by the Owner.
- 2.10.07 Every effort shall be made to maintain the highest quality of workmanship by stringent supervision and inspection at every stage of execution. Manufacturer's instruction manual and guidelines on sequence of erection and precautions shall be strictly followed. Should any error or ambiguity be discovered in such documents, the same shall be brought to the notice of the Owner's engineer. Manufacturer's interpretation in such cases shall be binding on the Contractor.

- 2.10.08 The Contractor shall comply with all the rules and regulations of the local authorities, all statutory laws including Minimum Wages, Workmen Compensation etc. All registration and statutory inspection fees, if any, in respect of the work executed by the Contractor shall be to his account.
- 2.10.09 All the works such as cleaning, checking, leveling, blue matching, aligning, assembling, temporary erection for alignment, opening, dismantling of certain equipments for checking and cleaning, surface preparation, edge preparation, fabrication of tubes and pipes as per general engineering practice at site, cutting grinding, straightening, chamfering, filling, chipping, drilling, reaming, scrapping, shaping, fitting-up bolting/welding, etc., as may be applicable in such erection and are necessary to complete the work satisfactorily, are to be treated as incidental and the same shall be carried out by the Contractor as part of the work.
- 2.10.10 In case of any class of work for which there is no such specification as laid down in the contract such as, blue matching, welding of stainless steel parts, etc., the work shall be carried out in accordance with the instructions and requirements of the Engineer.
- 2.10.11 It may sometimes be necessary to remove some of the erected structural members to facilitate erection of bigger/pre-assembled equipment. In such cases, the removal and re-erection of such members, which are essential, and if so agreed by the Engineer, will have to be done by the Contractor.
- 2.10.12 Attachment welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., both for regular measurement and performance testing to be provided on equipment, its auxiliaries or pipelines covered within the scope of this tender, will also be the responsibility of the Contractor and the same will be done as per the instructions of Engineer. The erection and welding of all above items will be the Contractor's responsibility, even if :
- a) Product groups under which these items are re-leased are not covered in the scope of this tender.
 - b) Items are supplied by an agency other than the Contractor.
- 2.10.13 Preservation of all materials/equipment under custody of the Contractor during storage, pre-assembly & erection, commissioning etc., shall be the responsibility of the Contractor. All necessary preservatives and consumables like paints, etc., shall be arranged by the Contractor. Necessary touch up painting, periodic application of preservatives/paints on pressure parts/other equipment even after erection until completion of work shall be carried out by the Contractor. The Contractor shall fabricate piping, install lub oil systems and carry out the acid cleaning of fabricated piping. The Contractor shall also service the lub. oil system, carryout the hydraulic test of oil coolers, etc.
- 2.10.14 It is responsibility of the Contractor to do the alignment etc. if necessary, repeatedly to satisfy Engineer, with all the necessary tools & tackles, manpower, etc. The alignment will be complete only when jointly certified so, by the Contractor's Engineer & Owner. Also the Contractor should ensure that the alignment is not disturbed afterwards.

- 2.10.15 Additional platforms for approaching different equipment as per site requirement, which may not be indicated in drawings, shall be fabricated and erected by the Contractor. The materials required for these works shall be supplied by the Contractor and he will have to fabricate them to suit the requirement.
- 2.10.16 Equipment and material which are wrongly installed shall be removed and reinstalled to comply with the design requirement at the Contractor's expense, to the satisfaction of the Owner/ Consultant.
- 2.10.17 Before erection of any equipment on a foundation, the Contractor shall check and undertake if necessary rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc.
- 2.10.18 Assistance for calibrating/testing the power cylinders, valves, gauges, instruments, etc., and setting of actuators coming under various groups shall be provided by Contractor.
- 2.10.19 It shall be the responsibility of the Contractor to provide ladders on columns for initial works till such time stairways are completed. For this, the ladder should not be welded on the column and should be prefabricated clamping type. No temporary welding on any structural member is permitted except under special circumstances with the approval of Owner.
- 2.10.20 Structural materials required for the supporting/operating platforms required for the valves at various levels for the same operation of valves will be arranged by the Contractor.
- 2.10.21 For civil, structural and architectural works, volume IIG/1 & IIG/2 may be referred. For Instrumentation and Electrical works Vol. IIE and Vol. IIF/1 & F/2 may be referred.
- 2.11.00 **Safety**
- Safety and overall cleanliness of work site shall be given top priority.
- 2.11.01 The Contractor shall ensure the safety of all workmen, materials and equipment either belonging to him or to others working at site. He shall observe safety rules & codes applied by the Owner at site without exception.
- 2.11.02 The Contractor shall notify the Owner of his intention to bring to site any equipment or material which may create hazard. The Owner shall have the right to prescribe the conditions under which such equipment or material may be handled and the Contractor shall adhere to such instructions. The Owner may prohibit the use of any construction machinery, which according to him is unsafe. No claim for compensation due to such prohibition will be entertained by the Owner.
- 2.11.03 Storage of petroleum products & explosives for construction work shall be as per rules and regulation laid down in Petroleum Act, Explosive Act and Petroleum and Carbide of Calcium Manual. Approvals as necessary from Chief Inspector of Explosives or other statutory authorities shall be the responsibility of the Contractor.

- 2.11.04 The Contractor shall be responsible for safe storage of his and his sub-contractor's radioactive sources.
- 2.11.05 All requisite tests & inspection of handling equipment, lifting tools & tackle shall be periodically done by the Contractor. Defective equipment shall be removed from service. Any equipment shall not be loaded in excess of its recommended safe working load.
- 2.11.06 All combustible waste and rubbish shall be collected and removed from the worksite at least once each day. Use of undercoated canvas paper, corrugated paper, fabricated carton, plastic or other flammable materials shall be restricted to the minimum and promptly removed.
- 2.11.07 The Contractor shall provide adequate number of fire protection equipment of the required types for his stores, office, temporary structures, labour colony etc. Personnel trained for fire-fighting shall be made available by the Contractor at site during the entire period of the Contract.
- 2.11.08 All electrical appliances used in the work shall be in good working condition and shall be properly earthed. No maintenance work shall be carried out on live equipment. The Contractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installation.
- 2.11.09 All workmen of the Contractor working in construction site shall wear safety helmets, safety boots and safety belts. The Contractor shall take appropriate insurance cover against accidents for his workmen as well as third party.
- 2.11.10 All the worksites shall be provided with adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. by the Contractor for proper working environment during night times.
- 2.11.11 All safety precautions shall be taken for welding and cutting operations as per IS-818.
- 2.11.12 All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.
- 2.12.00 **Taking Delivery & Storage**
- 2.12.01 The Contractor shall arrange issue of all equipment and materials to be erected under the contract from the stores/open yard at site by signing on standard indent forms. After completion of work, detailed auditing of the materials so issued shall be submitted to the Owner.
- 2.12.02 The Contractor shall arrange for proper and safe storage of materials till the same are taken over by the Owner as per terms of the contract. Manufacturer's instructions for preservation shall be strictly followed.
- 2.12.03 All empty containers, packing materials, gunny bags, transport frames and also surplus and unused materials reconciliation prior to completion of contract shall be the property of the Owner and returned to the Owner by the Contractor.

- 2.13.00 Site Welding & Heat Treatment**
- 2.13.01 Welding shall be done in accordance with IS-813, IS-816, IS-9595 & other relevant IS/International standards and as per instructions of Contractor. Only those welders, who are qualified as per IS-817 for ordinary welds and as per IBR/ASME Section-IX for high pressure welds, shall be employed in the job.
- 2.13.02 All welders shall be tested and approved by Engineer before they are actually engaged on the work even though they may possess the requisite certificates. The Owner reserves the right to reject any welder without assigning any reason. The welder identification code as approved by the Engineer shall be stamped by the welder on each joint done by them. The Contractor will be responsible for the periodic renewal, re-testing of the welders as demanded by Owner.
- 2.13.03 The Engineer is entitled to stop Contractor's any welder from his work if his work is unsatisfactory for any technical reason or there is a high percentage of the rejection of joints welded by him, which in the opinion of Engineer will adversely affect the quality of welding even though the welder has earlier passed the tests. The welders having passed the tests do not relieve the Contractor from his contractual obligations, to check the performance of the welders.
- 2.13.04 All charges for testing of welders including destructive and non-destructive tests if conducted by Owner or by the inspection authority at site shall have to be borne by the Contractor. The necessary test materials and consumables will have to be arranged by the Contractor and all testing facility made available, as required.
- 2.13.05 All welded joints shall be subject to acceptance by Engineer. Inspection of welds shall be in accordance with IS-822 or equivalent code.
- 2.13.06 Preheating/post heating and stress relieving after welding are part of fabrication and erection work and shall be performed by the Contractor in accordance with the instruction of Engineer. Contractor shall arrange to supply heating equipment with automatic recording devices. Also the Contractor shall have to arrange for the labour, heating elements, thermocouples, compensating cables, insulation materials like mineral wools, asbestos cloth, ceramic beads, asbestos rope, etc. required for the heat-treatment and stress relieving works. During pre- heat/stress relieving operations, the temperature shall be measured at one or more points as required by attaching thermocouples and recorded on a continuous printing type recorder. All the record graphs for the heat treatment works carried out shall be got signed by the Engineer prior to the commencement of each cycle and handed over to Engineer on completion. The graphs will be the property of Owner. The Contractor has to provide thermo-chalks temperature recorders, thermocouple attachments, units, graph sheets, etc. required for the job and maintain them in good condition.
- 2.13.07 All electrodes shall be baked and dried in the electric/electrode drying oven to the required temperature and for the period specified by the Engineer before they are used in erection work. The electrodes used shall be as per IS-814, IS-815, IS-1442, IS-7280 and other codes as applicable, and shall be of

approved reputed manufacture. The electrodes shall meet the requirement of the pipe material. No electrode manufactured more than 12 months ago and the type covered under certificate issued after conducting tests more than 6 months ago shall be used. All electrodes shall be preserved at works and at site as per manufacturer's recommendations.

- 2.13.08 Oxy-acetylene flame or Exothermic chemical heating for stress relieving is not permitted. Heating shall be by means, of electric induction coil or electric resistance coil.
- 2.13.09 It may become necessary to adopt inter layer radiography/MPT/UT depending upon the site/technical requirement necessitating interruptions in continuation of the work and making necessary arrangement for carrying out the above work.
- 2.13.10 Gas tungsten arc welding process (TIG) shall be adopted for all root pass welds except for structural works until 4.75 mm thickness is deposited. Subsequent welding after root pass can be carried out by manual metal arc welding with coated electrodes. For pipes of thickness less than 6 mm the entire welding has to be carried out by TIG welding.
- Fillet weld shall be made by shielded metal arc process as per applicable codes.
- However, the Engineer will have the option of changing the method of welding as per site requirement. The method adopted for manual arc welding shall be weaving technique and the width of weaving shall not exceed 1.5 times of the dia. of the electrode.
- In case of deviation from welding process and electrodes, the Contractor shall take approval of the Owner prior to adoption of same.
- 2.13.11 The root pass for butt joints shall be such as to achieve full penetration with complete fusion of root edges.
- 2.13.12 Each pass shall be cleared and freed of slag before the next pass is deposited.
- 2.13.13 On completion of each run, craters, weld irregularities, slag etc. shall be removed by grinding or chipping.
- 2.13.14 Each layer of welding shall have an even and smooth appearance.
- 2.13.15 Welding sequence shall be adjusted in such a way that distortion due to welding shrinkage is minimised. Further any movement, shock or vibration during welding shall be avoided to prevent weld cracks.
- 2.13.16 Proper protection of welders and the work shall be taken during periods of rain. No welding shall be carried out when surfaced to be welded are wet from any cause.

- 2.13.17 Following will be stages of inspection during welding :
- a) Two pieces to be joined shall be individually checked for the weld edge preparation and profile dimensionally and to the template. Dye penetrant check shall be carried out on edge prepared surfaces at random. The percentage will depend upon on criticality as specified by Engineer.
 - b) Joint fit up will be a stage of inspection. Misalignment after fit up may vary from 0.3 mm to 1.6 mm depending on outside diameter and thickness.
 - c) All joints shall be offered for visual inspection after root run. Subsequent welding should be made only after the approval of root run.
- 2.13.18 All welded joints shall be painted with anti-corrosive paint immediately on completion of radiography and stress-relieving.
- 2.14.00 For further details on procedures of work at site on civil, architectural, electrical and instrumentation & control services, refer Volume : II-E, II-F & II-G of this specification.



TITLE:
**TECHNICAL SPECIFICATION FOR
MILL REJECT HANDLING SYSTEM**

1X800 MW WANAKBORI TPS

BHEL DOCUMENTS NO.: PE-TS-408-160-A001

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SECTION-VI

ENGINEERING SERVICES

1.00.00 **GENERAL**

1.01.00 As part of the overall project management activity, the Contractor shall be responsible for proper engineering and co-ordination of activities during various phases of execution of the contract. The Contractor shall identify a person, designated as Project Manager, with whom the Owner, the Consulting Engineer or the Review Consultant shall interact on matters related to engineering as well as execution of the contract. The Project Manager shall be the single-point contact person on behalf of the Contractor and shall be responsible for all engineering co-ordination. The Owner/Consultant/Review Consultant shall interact with the Project Manager only on all matters of co-ordination between the Owner and the Contractor or on matters involving the Contractor, his manufacturing units and sub-vendors. For the purpose of expediting the Owner or his representative may sometimes interact with the manufacturing units or sub-vendors of the contractors. However such interaction will not, under any circumstance, dilute the responsibility of the Contractor to provide a fully engineered and co-ordinated package under this contract.

1.02.00 On finalization of the contract, a procedure for exchange of engineering information will be mutually agreed and finalized between the Owner and the Contractor.

2.00.00 **DESIGN COORDINATION MEETING**

The Contractor and his sub-vendors will be called upon to attend design co-ordination meetings with the Engineer, other Contractors and the Consultants of the Owner during the period of execution of contract. The Contractor including his sub-vendors shall attend such meetings at their own cost at Owner's or Consultant's office in Kolkata or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

3.00.00 **CO-OPERATION WITH OTHER CONTRACTORS AND CONSULTING ENGINEERS**

The Contractor shall agree to cooperate with the Owner's other Contractors and Consulting Engineers and freely exchange with them such technical information as is necessary to obtain the most efficient and economical design and to avoid unnecessary duplication of efforts. The Engineer shall be provided with copies of all correspondences addressed by the Contractor to other Sub- contractors and Consulting Engineers in respect of such exchange of technical information.

- 4.00.00 GUIDELINES FOR ENGINEERING SERVICES**
- 4.01.00 Prior to commencement of the engineering work as part of design submissions, all aspects of design viz., criteria for selection and sizing of all equipment and systems, design margins etc. including that for structural steel and civil work shall be outlined and these shall form the basis for the detailed engineering work.
- 4.02.00 Engineering work shall be performed on modern and proven concepts and internationally accepted good engineering practices but fully compatible with the Indian environments. Owner shall have the right to review and approve the engineering work by themselves and/or through consultant and ask for any clarifications and changes/modifications to the work performed by Contractor.
- 4.03.00 At any stage during the performance of assignment, the Contractor may be required to make certain changes/modification/improvements in design/drawing/other documents which are applicable to 800 MW Unit, which in the opinion of the Owner could result in better improved design, layout, operability, plant availability, maintainability, reliability or economy of the plant and its systems/sub-systems in view of revised and more accurate information/data available at a later date(s) or feedback(s) received during execution / operation of similar units. Such changes / modifications/improvements required could be identified by Owner and/or consultant and mutually discussed. Owner requires the Bidder to incorporate such action in the subject assignment appropriately without any additional cost liability and time implication to the Owner and same shall be within the responsibilities and scope of the Contractor.
- 4.04.00 During the course of review of detailed engineering stages, it may be essential in the opinion of Owner to obtain certain classified data for review purposes only. In case Owner so desires, the Bidder shall submit such data to Owner.
- 4.05.00 During the course of review of detailed engineering, it may be essential in Owner's opinion to obtain data and information on similar equipment and plants engineered by the Bidder. In case Owner so desires the Bidder shall submit such data and information to the Owner.
- 4.06.00 It is not the intent to give details of every single task covered in the total engineering work to be carried out by Contractor, however, all engineering work required for the satisfactory completion of the plant/systems as specified shall be carried out by the Contractor. Broadly, the following are the minimum requirements in respect of scope of major items of work:
- 4.06.01 Preparation, updating and finalisation of scheme drawings, control and interlock diagrams, detailed and fully dimensioned layout drawings (plant layout and equipment layout detailed plan, elevation and cross-sectional drawings at different elevations / floor levels) covering all mechanical, electrical, C&I, civil and structural items, equipment, systems and facilities. Drawings and Schedules prepared by the Contractor from time to time, as detailed designs are developed, shall be submitted for Owner's / Consultant's approval before the work is taken up. Revisions, corrections, additions to drawings and schedules shall not be considered to change the scope of work.

- 4.06.02 Preparation of detailed technical specifications including data sheets, tender drawings and bill of material for all bought out items, as also finalisation of corresponding sub-contractors.
- 4.06.03 Review of sub-contractor's data, drawings, design calculations, schedules, bill of materials, instruction manuals etc. for all equipment, before forwarding them to Owner/Consultant for approval.
- 4.06.04 Preparation of civil construction drawings for all equipment showing foundation details and full details regarding equipment loads, floor openings, details of embedments etc. required for preparation of civil construction drawings and also as referred at relevant sections of Scope, Terminal Points & Exclusions. These documents shall be preceded by appropriate design calculations, static and dynamic analysis as necessary.
- 4.06.05 Preparation and finalisation of process piping and instrumentation diagrams and schematics, complete in all respects for all systems/packages of the power plant.
- 4.06.06 Preparation of consolidated schedules and bills of materials, including line numbers, tag numbers, source of supply, service conditions, specifications, materials, types and connections details, quantities for items of the plant including dampers, steam traps, strainers, instrumentations, ducting.
- 4.06.07 Sizing of all piping and equipment as per the stipulated design criteria; carrying out of flexibility analysis/dynamic analysis as necessary; hangers & support engineering.
- 4.06.08 Final revision of all documents including preparation and compilation of Instruction Manuals for installation, commissioning, operation and maintenance for all equipment and systems. Refer clause 5.00.00 for the specific requirement in this regard.
- 4.06.09 Certification and submission of final as-built drawings for all areas.
- 4.06.10 Preparation and compilation of all drawings, schedules and instructions which may be required at site, whether separately mentioned or not.
- 4.06.11 All erection and assembly drawings which may be required at site.
- 4.06.12 For all bought out item packages, the Contractor shall provide complete material / component list along with detail specification, drawings, component part no. etc. during detail engineering stage prior to final approval. Such approved drawing/document shall be made available at site in adequate number prior to commencement of work. Moreover, such document/drawing shall be provided in soft form (CD)
- 4.06.13 Preparation of necessary documentation, design calculations etc. required for submission to statutory authorities like IBR, Chief Electric Inspector etc.

5.00.00 OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS

5.01.00 The Contractor shall provide at least six (6) months before the time of commissioning and before taking over of the plant and equipment, all necessary maintenance manuals and operating instructions. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hard copies.

5.02.00 The information provided, which shall be contained in loose leaf stiff backed covers, shall include :

- a) A complete inventory of all main items of plant, with identification details.
- b) Service manuals for all plant and equipment giving full descriptions of the main items and auxiliary items such as power packs, hydraulic equipment, actuators, lubricating pumps, etc.
- c) A separate electrical manual covering items such as switchgear, cabling, instrumentation, controls, cabling layouts and wiring diagrams.
- d) A schedule of recommendations for routine maintenance of all electrical and mechanical equipment, recommended inspection point, information on detection, cause and rectifications of troubles & faults.
- e) A lubrication schedule with all necessary drawings diagrams to identify the lubrication points.
- f) Manufacturer's literature.

5.03.00 The instruction manual shall be subject to the approval of Owner.

6.00.00 PLANT HANDBOOK

The Contractor shall submit to the Engineer, a preliminary plant handbook preferably in A-4 size sheets which shall contain the design and performance data of various plant, equipment and systems covering the complete project including single line flow diagrams, within twenty four (24) months from the date of his acceptance of the letter of award. The final plant handbook complete in all respects shall be submitted by the Contractor six (6) months before start-up and commissioning activities. The plant handbook shall be submitted in the form of two (2) soft copy in CD (one to Owner and one to Consultant) and twenty five (25) hard copies in decent bound forms.

**7.00.00 CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL
PROCEDURE**

7.01.00 Within fifteen (15) days of issue of Letter of Award (LOA) by the Owner, the Contractor shall furnish a schedule of drawings and design document to be submitted by him to the Owner/Engineer indicating dates against each document.

The documents shall be divided into two categories : a) for approval and b) for information/further engineering and co-ordination by the Owner.

In preparing this schedule, the Contractor shall allow four (4) weeks from date of receipt for review and comments by the Owner/Engineer for each submission of a document.

This document submission schedule shall require approval by the Owner/Engineer.

7.02.00 All contract documents shall be marked, without fail, with the name of the Owner, the Project, the specification title and number and the unit designation.

All dimensions shall be in metric units.

All notes, markings etc. shall be in English.

7.03.00 Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval / information of the Owner/Engineer.

7.04.00 Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Engineer:

- a) List of sub-vendors (from Owner only)
- b) System scheme and instrumentation diagrams
- c) Design basis justifying selection of equipment & process parameters where not specified in the Contract
- d) Equipment data sheets and general arrangement drawings
- e) Materials of construction
- f) Layout drawings.
- g) Operation logic diagrams.
- h) Typical control circuit.
- i) Drawings of Instrumentation and control.

7.05.00 Unless specified otherwise, the following categories of documents/ drawings would be treated for information/further engineering by the Owner/Engineer. The Contractor shall, however, incorporate all additional information and clarifications in these documents / drawings as and when desired by the Owner/Engineer.

- a) Equipment foundation drawings.
- b) Equipment cross-section drawings, product literature etc. which are of proprietary nature.
- c) Predicted performance curves of equipment.
- d) Various bills of quantity, schedules etc.
- e) Piping fabrication drawings, isometrics etc.
- f) Panel wiring diagrams.
- g) Instruction/Operation manuals.
- h) Service manuals and trouble shooting guide for C & I system including field instruments.
- i) Cable schedule and interconnection chart.
- j) Drive/feederwise control scheme showing all external interfaces.

In essence, the Contractor is solely responsible for corrections and adequacy of design & engineering for documents under this category.

7.06.00 Upon review, the Owner/Engineer shall put his remarks and one of the following action stamps on the drawing/document:

- a) Approved.
- b) Approved except as noted, forward final drawing
- c) Approved except as noted, resubmission required.
- d) Disapproved.
- e) For information/reference only.

For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner/Engineer. For action stamp in category (b), further review by Owner/Engineer would not be necessary provided the Contractor agrees & incorporates the comments made on the document.

Except for action stamp under category (c) & (d), the Contractor can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/Engineer.

The Owner/Engineer may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Contractor shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds. Approval of contract documents by the Owner/Engineer shall not relieve the Contractor of his responsibility for any errors and fulfillment of contract requirements.

The Contractor's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Owner/Engineer.

7.07.00 Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.

7.08.00 For review by the Consulting Engineer, the Contractor shall furnish soft copies of drawings & documents and three (3) prints of each drawing/document. Two (2) prints of such submission shall also be sent to the Owner. After review, comment/approval will be sent to the Contractor. Upon action under category (a) or (e), the Contractor shall directly distribute the documents to the various offices of the Owner and other agencies in number of copies as specified in the contract document. Such distribution copies shall be marked with the reference and date of the letter by which the Owner/Engineer has accorded his final approval. Penal action shall be taken against the Contractor for any unauthorised revision in the drawings so distributed from the drawings approved by the Owner/Engineer. The contractor shall furnish three (3) CDs of all as built/final drawings for Owner/Consultant site.

7.09.00 In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.

7.10.00 For details of documentation for Civil, Structural and Architectural works, Vol. II-G may be referred.

8.00.00 **TENDER STAGE DOCUMENT SUBMISSION**

8.01.00 The Bidder shall submit along with his bid all documents/drawings as requested in respective specifications. The documents shall include but not be limited to the following :

- a) All Bid proposal sheets duly filled up.
- b) Detailed experience list and financial resources of the prime bidder his collaborators/associates in this bid as well as the sub-vendors proposed.
- c) Scheme drawings indicating scope of supply and service as offered by the Bidder indicating clearly exclusions, if any.
- d) List of terminal points of the package offered together with quality and quantity of various input (i.e. water, air, electricity etc.) as required from the Owner at such interfaces.

- e) Equipment GA, Layout, Design Calculations, interlock and other write-up, catalogues/literature etc. as required for clear understanding of the bid submitted.
- f) L-1 network indicating target dates for intermediate milestones and final commissioning of equipment supplied; This network shall be supplemented by a detailed write-up on proposal procedure of project implementation, deployment schedule for Key personnel with their bio-data, schedule of construction machinery etc.
- g) List of suppliers for all bought out items.



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SECTION-VII

QUALITY ASSURANCE REQUIREMENTS

1.00.00 **QUALITY ASSURANCE PROGRAMME**

1.01.00 To ensure that the equipment and services under the scope of Contract whether manufactured or performed within the Contractor's works or at his Sub-contractor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Owner/Authorised representative after discussions before the award of contract. A quality assurance programme of the Contractor shall generally cover the following :

- a) His organisation structure for the management and implementation of the proposed quality assurance programme.
- b) Documentation control system.
- c) Qualification data for Bidder's key personnel.
- d) The procedure for purchase of materials, parts, components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
- e) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.
- f) Control of non-conforming items and system for corrective actions.
- g) Inspection and test procedure both for manufacture and all site related works.
- h) Control of calibration and testing of measuring and testing equipments.
- i) System for quality audit.
- j) System for indication and appraisal of inspection status.
- k) System for authorising release of manufactured product to the Owner.
- l) System for handling storage and delivery.
- m) System for maintenance of records.

- n) Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed at Annexure-I to this section.

2.00.00 GENERAL REQUIREMENTS - QUALITY ASSURANCE

2.01.00 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the Contractor for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the Contractor's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder, separately in the format attached at Annexure-I and will be submitted to Owner/Authorised representative for approval. Schedule of finalisation of such quality plans will be finalised before award.

2.02.00 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing.

2.03.00 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control organisation, during various stages of site activities from receipt of materials/equipment at site.

2.04.00 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality plans and reference documents/standards etc. will be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans, Owner/Authorised representative shall identify customer hold points (CHP), test/checks which shall be carried out in presence of the Owners Engineer or his authorised representative and beyond which the work will not proceed without consent of Owner/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorised representative for approval and dispositioning.

2.05.00 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/ Authorised representative, and duly authorised for despatch issuance of Material Despatch Clearance Certificate (MDCC).

- 2.06.00 Materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report as per Owner's approved QAP. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.
- 2.07.00 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record, mechanical property test results shall be furnished.
- 2.08.00 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section-IX/BS-4870 or other International equivalent standard acceptable to the Owner.
- All brazers, welders etc. employed on any part of the contract at Contractor's/ Sub-Contractor's works or at site shall be qualified as per ASME Section-IX or BS-4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorised representative.
- For welding of pressure parts and high pressure piping the requirements of IBR shall also be complied with.
- 2.09.00 All non-destructive examination (NDT) shall be carried out in accordance with approved international standard. The NDT operator shall be qualified as per SNT-TC-1A (of American Society of non-destructive examination). Results of NDT shall be properly recorded and submitted for approval.
- 2.10.00 All the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment list of which shall be drawn up by the Contractor and finalised with the Owner shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalised and approved by the Owner/Authorised representative and form part of the Purchase Order between the Contractor and the Vendor.
- 2.11.00 All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalised with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed.
- Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.
- Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject an equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.
- 2.12.00 Quality requirements for main equipment shall equally apply for spares and replacement items.

2.13.00 Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.

2.14.00 For quality assurance of all civil works refer to the specifications for civil works.

3.00.00 **QUALITY ASSURANCE DOCUMENTS**

3.01.00 The Contractor shall be required to submit two (2) copies and two (2) sets of microfilms of the following Quality Assurance documents within three (3) weeks after despatch of the equipment :

- a) Material mill test reports on components as specified by the specification.
- b) The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.
- c) Non-destructive examination results /reports including radiography interpretation reports.
- d) Factory tests results for testing required as per applicable codes and standards referred in the specification.
- e) Welder identification list listing welder's and welding operator's qualification procedure and welding identification symbols.
- f) Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
- g) Stress relief time temperature charts.
- h) Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following will also be recorded :
 - i) When some important repair work is involved to make the job acceptable.
 - ii) The repair work remains part of the accepted product quality.
- i) Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.

4.00.00 **INSPECTION, TESTING AND INSPECTION CERTIFICATES**

4.01.00 The Engineer, his duly authorised representative and/or an outside inspection agency acting on behalf of the Owner shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

- 4.02.00 The Contractor shall give the Engineer/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Engineer/Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection failing which the Contractor may proceed with test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified copies of test reports in six (6) copies.
- 4.03.00 The Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.
- 4.04.00 When the factory tests have been completed at the Contractor's or sub-contractor's works, the Engineer/Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Engineer/Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Engineer/Inspector. Failure of the Engineer/Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests, or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract.
- 4.05.00 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Engineer/Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Engineer/Inspector or to his authorised representative to accomplish testing.
- 4.06.00 To facilitate advance planning of inspection in addition to giving inspection notice as per Clause 4.02.00, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

ANNEXURE-I

FORMAT OF QUALITY ASSURANCE PROGRAMME

Name of Company/ Contractor	NAME OF CONTRACT PACKAGE			QUALITY PLAN FOR						
	Package No. : _____			QP No. : _____ Date _____						
	Contractor : _____			Rev. No.: _____ Date _____						
Sl. No.	Component & Operation	Characteristics	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norm	Format of Record	Agency	Remarks

Note: All the information for QAP as stipulated above shall be finalized and agreed during contract execution.

ANNEXURE-II


FIELD WELDING SCHEDULE


PROJECT : FWS NO :
 CONTRACTOR : REV NO. :
 PACKAGE : FIELD WELDING CODE :
 SYSTEM : PAGE NO. :


Sl No.	Drawing No. for Weld Locations & Identification mark	Description of parts to be welded	Material specification	Dimensions	Process of Welding	Type of Weld	Electrode Filler Specification	WPS No.	Minimum Pre-heat Temperature	Heat Treatment Temperature [Holding Time in secs]	NDT Method Quantum	NDT Specification Number	Acceptance Norm Ref.	Remarks


The Field Welding Schedule should be submitted for :


- o Pressure Parts
- o Tanks/Vessels
- o Piping
- o Heavy/Important Structural Steel
- o Heat Exchangers
- o Bus Ducts

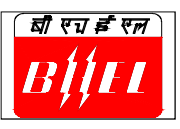
		S/Contactor :			Manufacturing Quality Plan			Project:-					
		Mfrgr:- Works:-			Item :-Local Panels QAP No. LOI Nos:-			Package :- Mill Rejects System Client :-					
					Contractor :- M/s BHEL			Consultant :-					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	Materials CRCA Sheet	Visual Chem. & Physical. Thickness	Major Major Major	Visual Chem.& Physical. Measurement	100% 100% 100%	Appr. Drg / IS: 513 Do App. Drawing	Appr. Drg / IS: 513 Do App. Drawing	IR TC IR/TC	- √ √	P V V	- V V	- - -	
2	Bought outs Verification of type, size & Make of FLV unit, PG, PS, SV	Visual	Major	Visual	100%	Appr. Drawing / Data Sheet	Approved Drawing / Data Sheet	IR/TC	√	V	V	-	
3	Painting Pre Treatment 7 tank process	Physical	Major	DFT / Shade / Finish	100%	Appr. Painting Schedule	Appr. Painting Schedule	IR/TC	√	V	V	-	
4	Final Inspection	Visual	Major	Visual	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	W	-	
		Dimension	Major	Measurement	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	W	-	
		Check for Pneumatic Circuit	Major	Visual	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	W	-	
		Check for Wiring / Mountings / Terminations	Major	Visual / Continuity	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	W	-	
		Functional Check for Solenoid Valve	Major	Functional	100%	Appr. Drawing / Data Sheet	Appr. Drawing / Data Sheet	IR/TC	√	P	W	-	
5	QA Documents	Review	Major	verification	100%	-	-	-					
Manufacturer / Sub Vendor		Contractor		LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N ->CLIENT P->Perform, V-> Verification, W-> Witness			For Client Use:-		Document. No.:				
				SIGNATURES		Name & Signature of Approving Authority with Seal							


		S/Contractor :			Manufacturing Quality Plan			Project:						
		Mfgr:- Works:-			Item :- Transporter vessel QAP No. LOI Nos:-			Package :- Mill Rejects System Client :						
					Contractor :- M/s BHEL			Consultant :-						
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks	
1	2	3	4	5	6	7	8	9		10			11	
								TYPE	D	M	C	N		
1 Raw Materials														
1.1	Dome & dome Valve Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Hardness Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / Standard	App. Drg. / Data Sheet / Standard	- - TC TC	- - √ √	P P P/V P/V	- - V V	- - - -		
1.2	Plates for Vessel	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - TC TC	- - √ √	P P P/V P/V	- - V V	- - - -		
1.3	Insert Seal	Surface Defects Hardness	Major	Visual Measurement	100% 1/Lot	Mfr's Drg. / Std	Mfr's Drg. / Std	- - IR	- - √	P P P/V	- - V	- - -		
1.4	Shaft	Physical Check Chemical Check	Major	TS & Elongation Chemical Comp.	1/Heat 1/Heat	App. Drg./ IS Std.	App. Drg./ IS Std.	TC	√	P/V	V	-		
2 In - Process Insp.														
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V V	- - -	Welders to be approved by BHEL / CLIENT	
2.3	Machining of Dome & dome Valve	Visual & Dimension	Minor	Visual, Measurement	100%	Mfr's Drg / Standard	Mfr's Drg / Standard	-	-	P	-	-		
2.4	Hydotest of Vessel	Soundness / Leakage	Major	Visual, Hydro Pressure Test	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	-		
3 Final Inspection														
3.1	Final Assly	Completeness & Dimension	Major	Visual / Measurement	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	-	At Painted Condition	
3.2	Run Test / Performance	Operation of Dome Valve	Minor	Visual, 5 times Cycle operation	100%	Mfr's Standard	Mfr's Standard	IR	√	P/V	W	-		
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	√	P/V	W	-		
4 QA Documentation														
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	-	P/V	V	-		
Manufacturer / Sub Vendor		Contractor		LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.			Name & Signature of Approving Authority with Seal	
SIGNATURES														


		S/Contractor :			Manufacturing Quality Plan			Project:					
		Mfr:- Works:-			Item :- Pyrite Hopper QAP No. LOI Nos Contractor :- M/s BHEL			Package :- Mill Rejects System Client :-					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	Raw Materials												
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - MTC MTC	- - √ √	P P P/V P/V	- - V V	- - - -	
1.2	Spray Nozzle	Surface Defects Chemical Check Dimensions	Major	Visual Chemical Comp. Measurement	100% 1/Lot 100%	Mfr's Drg. / IS Standard	Mfr's Drg. / IS Standard	- MTC IR	- √ √	P P/V P	- V V	- - -	
2	In - Process Insp.												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V W	- - -	Welders to be approved by BHEL
2.2	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-	
3	Final Inspection												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W*	-	* -> Witness10%
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting shall be Heat Resistance
4	QA Documentation												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		-	P/V	V	-	
Manufacturer / Sub Vendor		Contractor		LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> Client P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-			
SIGNATURES								Name & Signature of Approving Authority with Seal					

		S/Contactor :-			Manufacturing Quality Plan			Project:-					
		Mfgr:-			Item :- Terminal Box QAP No. :- LOI Nos:-			Package :- Mill Rejects System Client :-					
					Contractor :- M/s BHEL			Consultant :- .					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	Raw Materials												
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - MTC MTC	- - √ √	P P P/V P/V	- - V V	- - - -	
2	In - Process Insp.												
2.1	Welders Qualification & Welding	WPS / PQR / WPQ Welding Defects	Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V W	- - -	Welders to be approved by BHEL / Client
2.2	Flange Machining and Drilling	Dimensions	Major	DPT on Final run Measurement	100%	Mfr/Appr. Drg	Mfr/Appr. Drg	IR	-	P	-	-	
2.3	Connection -pipe to flange, pipe to body	Fit up	Major	Joint set up, PCD, Orientation	100%	Mfr/Appr. Drg	Mfr/Appr. Drg	IR	-	P	-	-	If Applicable
2.4	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-	
3	Final Inspection												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	-	
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting before disp.
4	QA Documentation												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	-	P/V	V	-	
Manufacturer / Sub Vendor		Contractor		LEGENDS:-				For Client Use:-		Document No.:-			
				Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness									
SIGNATURES								Name & Signature of Approving Authority with Seal					

		S/Contractor :-			Manufacturing Quality Plan			Project:-						
		Mfgr:- Works:-			Item :- Bunker Discharge Gate QAP No. :- LOI Nos:-			Package :- Mill Rejects System Client :-						
					Contractor :- M/s BHEL			Consultant :-						
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks	
1	2	3	4	5	6	7	8	9		10			11	
								TYPE	D	M	C	N		
1	Raw Materials													
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - TC	- - √	P P P/V	- - V	- - V	- - -	
1.2	Shaft	Physical Check Chemical Check UT If Dia > 50 mm	Major	TS & Elongation Chemical Comp. Internal defect	1/Heat 1/Heat 100%	do	do	TC TC IR	√ √ √	P/V P/V P/V	V V V	- - -		
1.3	Cylinder / Actuator	Visual / Specification	Major	Visual	100%	do	do	Mir's TC	√	V	V	-		
2	In - Process Insp.													
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major Major Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V W	- - -	Welders to be approved by BHEL / CLIENT	
3	Final Inspection													
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	-		
3.2	Operation with job / shop actuator	Opening & Closing of Gate	Major	Visual	100%	Proper Working	Smooth Operation	IR	√	P/V	W	-		
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting before disp.	
4	QA Documentation													
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan		-	P/V	V	-		
Manufacturer / Sub Vendor		Contractor		LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC - Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N-> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
				SIGNATURES						Name & Signature of Approving Authority with Seal				

		S/Contactor :-			Manufacturing Quality Plan			Project:-					
		Mfgr:-			Item :- Pressure Relief Valve			Package :- Mill Rejects System					
		Works:-			QAP No. :			Client :-					
					Contractor :- M/s BHEL			Consultant :-					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	Raw Materials												
1.1	Plates for Body	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp.	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - MTC MTC	- - √ √	P P P/V P/V	- - V V	- - - -	
2	In - Process Insp.												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects	Major	Procedure / Qualification DPT on Root run DPT on Final run	100% 100% 10%	ASME sec - IX ASTM E-165 ASTM E-165	ASME sec - IX ASTM E-165 ASTM E-165	WPS / PQR IR IR	√ √ √	P/V P/V P/V	V V W	- - -	Welders to be approved by BHEL / Client
2.2	Fabrication	Fit up, Marking, Cutting, Grinding	Minor	Visual, Measurement	100%	Mfr's Standard	Mfr's Standard	-	-	P	-	-	
3	Final Inspection												
3.1	Final Assly	Completeness & Dimension	Major	Visual	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	-	
3.2	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR	-	P/V	W	-	Painting before disp.
4	QA Documentation												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	-	P/V	V	-	
Manufacturer / Sub Vendor		Contractor		LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC-Test Certificate , IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-			
SIGNATURES						Name & Signature of Approving Authority with Seal							


		S/Contactor :-			Manufacturing Quality Plan			Project:-					
		Mfgr:-			Item :- Air Receiver			Package :- Mill Rejects System					
		Works:-			QAP No. :-			Client :-					
					Contractor :- M/s BHEL			Consultant :-					
Sl. No.	Components / Operations	Characteristics Checked	Category	Type/Method of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	Raw Materials												
1.1	Plates for Shell, Dished End & Flange	Dimensions Surface Defects Physical Check Chemical Check	Major	Measurement Visual TS & Elongation Chemical Comp	100% 100% 1/Heat 1/Heat	App. Drg. / Data Sheet / IS Standard	App. Drg. / Data Sheet / IS Standard	- - TC TC	- - √ √	P P/V P/V	- - V V	- - - -	
1.2	Formed Dished End	Dimensions Thickness/Thinning DPT of Knuckle	Major	Measurement Measurement DP Test	100% 100% 100%	App. Drg. / Data Sheet ASTM E-165	App. Drg. / Data Sheet ASTM E-165	IR IR TC	√ √ √	P P P/V	- - V	- - -	
2	In - Process Insp.												
2.1	Welders & Welding	WPS / PQR / WPQ Welding Defects do do	Major Major Major Critical	Procedure / Qualification DPT on Root run DPT on Final run Radiography Test on all C/S & L/S including T & X	100% 100% 100%	ASME sec - IX ASTM E-165 ASTM E-165 IS 2825 Class-II / ASME Sec VIII	ASME sec - IX ASTM E-165 ASTM E-165 IS 2825 Class II / ASME Sec VIII	WPS / PQR IR IR RT Film / Report	√ √ √ √	P/V P/V P/V P/V	V V V V	- - - -	Welders to be approved by BHEL / CLIENT
2.2	Fabrication	Marking, Cutting, Rolling, Edge Preparation, Joint & Nozzle set up	Major	Visual, Measurement (Ovality, off set orientation)	100%	Mfr's Standard / Approved Drg.	Mfr's Standard / Approved Drg.	IR	-	P	-	-	
3	Final Inspection												
3.1	Final Assly	Completeness & Dimension	Major	Visual / Measurement	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	-	
3.2	Hydotest of Vessel	Soundness / Leakage	Major	Visual, Hydro Pressure Test	100%	App. Drg. / Data sheet	App. Drg. / Data sheet	IR	√	P/V	W	-	
3.3	Painting	Finish / DFT	Major	Visual, Measurement	100%	App. Painting Schedule	App. Painting Schedule	IR		P/V	W	-	Painting before disp.
4	QA Documentation												
4.1	TC & IR	Completeness	Major	Verification & approval	100%	App. Quality Plan	App. Quality Plan	-	-	P/V	V	-	
Manufacturer / Sub Vendor		Contractor		LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC -> Test Certificate, IR - Inspection Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N-> CLIENT P->Perform, V-> Verification, W-> Witness			For Client Use:-		Document No.:-				
SIGNATURES							Name & Signature of Approving Authority with Seal						

		S/Contactor :-			Manufacturing Quality Plan			Project:-					
		Manufacturer :-			Item :- Rupture Disc QAP No. :- LOI Nos:-			Package :- Mill Rejects System Client :-					
					Contractor :- M/s BHEL			Consultant :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	Materials -> Rupture Disc Material	Physical & Chemical Properties	Major	Chemical Analysis, YTS & UTS	1 per Heat	ASTM A240 Type - 304 / Appved Data Sheet / Drg.	ASTM A240 Type - 304 / Appved Data Sheet	MTC	√	V	V	-	
2	Final Inspection -> Dimension -> Burst Test of Rupture Disc	Measurement Functional	Major Major	Mesurement Burst Test @ 200 Degree Centigrade	100% 1 per lot offered	App. Drawing Approved drawing / Datasheet	App. Drawing Min 0.4 bar (g) @ 200 degree C Max 0.6 bar (g) @ 200 degree C / App. Data Sheet	IR IR / Burst Test Certificate	√ √	P P	W W	- -	
Manufacturer / Sub Vendor		Contractor	LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & K ->Client P->Perform, V-> Verification, W-> Witness				For Client Use:-		Document No.:-				
SIGNATURES							Name & Signature of Approving Authority with Seal						

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

SI. No.		Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking				Remarks
1		2	3	4	5	6	7	8	9		10			11
									TYPE	D	M	C	N	
1		Materials												
->	Load Chain	Mech. Properties Breaking Load Test, Proof Load test	Major	Review of Mfr's Test Certificate	1 per Lot	IS:6216 /Appr. Drg / Appr. Data sheet	IS:6216 /Appr. Drg / Appr. Data sheet	MTC	√	P/V	V	-		
->	Load Sheave	Mech. Properties Chemical Composition	Major	Lab Analysis	1 per Heat	IS:1865 /Appr. Drg / Data sheet	IS:1865 /Appr. Drg / Data sheet	MTC	√	P/V	V	-		
->	Gear & Pinion	Chemical Composition	Major	Lab Analysis	1 per Heat	IS:4432/Appr. Drg / Data sheet	IS:4432/Appr. Drg / Data sheet	MTC	√	P/V	V	-		
->	Hook	Mech. Properties Chemical Composition	Major	Lab Analysis	1 per Heat	IS:8610 / IS:1875 /Appr. Drg / Data sheet	IS:8610 / IS:1875 /Appr. Drg / Data sheet	MTC	√	P/V	V	-		
2		In Process												
->	Hook	Proof Load Test	Major	Load Test	100%	IS:8610 /Appr. Drg / Appr. Data sheet	IS:8610 /Appr. Drg / Appr. Data sheet	MTC / IR	√	P	V	-		
		DPT after Load Test	Major	DPT	100%	ASTM E-165	ASTM E-165 / No Defects	IR	√	P	V	-		
3		Final Inspection												
->	Assembly	Operation Check	Major	Visual	100%	Smooth Operation / IS 3832 Appr. Drg / App. Data Sheet	Smooth Operation / IS 3832 Appr. Drg / App. Data Sheet	IR	√	P	W	-		
		Functional Test	Major	Visual	100%			IR	√	P	W	-		
		Load Test & Over Load Test	Major	Load Test	100%			IR	√	P	W	-		
		Overall Dimensions	Major	Measurement	100%			IR	√	P	W	-		
		Visual (After Load Test)	Major	Visual	100%	IS 3832	IS 3832	IR	√	P	W	-		
Manufacturer / Sub Vendor		Contractor		LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness				For Client Use:-			Document No.:-			
SIGNATURES						Name & Signature of Approving Authority with Seal								

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		S/Contractor :- Manufacturer :-			Manufacturing Quality Plan Item :- Bag Filter (Without Enclosure) QAP No. :- LOI Nos:-			Project:- Package :- Mill Rejects System Client :-				
					Contractor :- M/s BHEL			Consultant :-				
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking	Remarks	
1	2	3	4	5	6	7	8	9		10	11	
								TYPE	D	M	C	N
1	Materials											
1.1	Manifold Body / Casings (MS Plate / Sheet / Pipe)	Chemical & Physical	Major	Chemical & Mechanical	1 per Lot	App. Drawing / Data Sheet / IS:2062 Gr. A / IS:1079 Gr. 0 / IS: 1239 Class Med.	App. Drawing / Data Sheet / IS:2062 Gr. A / IS:1079 Gr. 0 / IS : 1239 Class Med.	MTC	√	V	V	-
1.2	Bag Cages (Inserts)	Chemical & Physical	Major	Chemical & Mechanical	1 per Lot	App. Drawing / data sheet / IS:7887 Gr.8 / IS:1079 Gr. 0	App. Drawing / data sheet / IS:7887 Gr.8 / IS:1079 Gr. 0	MTC	√	V	V	-
1.3	Solenoid Valves	Functional	Major	Operational	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	-
1.4	Sequence Controller	Functional	Major	Operational	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	-
1.5	Filter Bags (Make :- Charminar / Supreme)	Physical	Major	Visual / Measurement	100%	Approved Drawing / Appr. Data Sheet	Approved Drawing / Appr. Data Sheet	MTC	√	P	V	-
2	In Process											
2.1	Manifold	Dimensional & Visual	Minor	Dimensional & Visual	100%	As per Mfr's Drg.	As per Mfr's Drg.	IR	√	P	V	-
2.2		Welding	Major	DPT on Final Weld	100%	ASTM E-165	No Defect	IR	√	P	V**	-
2.3		Hydro Test for 30 Minutes	Major	Leakage	100%	Appr. Data sheet	No Leakage	IR	√	P	V**	-

Document No.:-


3	Final Inspection											
3.1	Assembly	Dimensional	Major	Measurement	100%	Appr. Drawing	Appr. Drawing	IR	√	P	W	-
	\$-> Pneumatic Test at 1.1 times W/Pressure	Pne. test of Manifold in Assly.	Major	Leakage by soap solution	100%	Appr. Data Sheet	No Leakage	IR	√	P	W	-
		Functional Test of Pulsing System	Major	Pulse Sequence	100%	Appr. Data sheet / Testing Procedure	Appr. Data sheet / Testing Procedure	IR	√	P	W	-
4	Painting	Measurement & Visual	Major	DFT / Finish	100%	Appr. Painting Schedule	Appr. Painting Schedule	IR	√	P	-	-

TESTING PROCEDURE TO BAG FILTER

- 1-> Functional test through compressed air , Sequential pulsing through valves and sequential controller on **No - Load Condition** to be conducted.
2-> The Soenoid valve shall be connected to the sequential timer and suitable electric supply shall be provided. Air header to be connected to supply of compressed air. The Timer is set and Sequential operation of Solenoid operated valve is observed.

Manufacturer / Sub Vendor	Contractor	LEGENDS:-	For Client Use:-	Document No.:-
		Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness		
SIGNATURES			Name & Signature of Approving Authority with Seal	


Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		S/Contractor :-			Manufacturing Quality Plan			Project:-					
		Manufacturer :-			Item :- MS ERW/GI Pipes (IS:1239/IS3589) QAP No. :- LOI Nos:-			Package :- Mill Rejects System Client :-					
					Contractor :- M/s BHEL			Consultant :-					
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking		Remarks	
1	2	3	4	5	6	7	8	9		10		11	
								TYPE	D	M	C	N	
1	Final Inspection of Finished Pipes	Physical Dimensional Mechanical Properties Chemical Hydro Test	Major Major Major Major	Visual Measurement Tensile, elongation, Bend or Flattening Chemical Analysis Pressure Testing	100% 100% IS: 4711 1 per heat 100%	IS:1239 / IS:3589 / Approved Data Sheet	IS:1239 / IS:3589 / Approved Data Sheet	IR IR / TC TC IR / TC	- √ √ √	P P / V P / V P	W* V V W *	- - - -	* -> Random 5% of offered lot irrespective of size
2	Galvanising (For GI Pipes)	Uniformity & mass of Zinc Coating, Adhesion test, Free bore test	Major	As per IS:4736	As per IS:4736	As per IS:4736 / Approved Data Sheet	As per IS:4736 / Approved Data Sheet	IR	√	P	W #	-	# one sample for each size
3	Identification	Verification of Batch No. / Mfg stamp / Heat No.	Major	Visual	100%	Mfgr Practise / IS 1239 / IS 3589	Mfgr Practise / IS 1239 / IS 3589	IR	√	P	W	-	
4	Review of QA Documents	-----	-----	-----	-----	As per QAP	As per QAP	-----	√	V	V	-	
NOTES :-													
For SAIL Pipes verification of reports for the tests mentioned in Sl. No. 1 & 2 by BHEL & Client													
For GI Pipes, Galvanising Check as per relevant standard shall be done.													
All material shall be as per approved data sheet in case of ambiguity in QAP, material as data sheet shall be final.													
Manufacturer / Sub Vendor		Contractor		LEGENDS:-				For Client Use:-		Document No.:-			
				Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness									
SIGNATURES								Name & Signature of Approving Authority with Seal					


Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

SI. No.		Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks	
1		2	3	4	5	6	7	8	9		10			11	
									TYPE	D	M	C	N		
1	Raw Material														
1.1	Scrap Receipt	Chemical	Major	Lab Analysis	Random Sample / Lot	Mfg's Std	Mfg's Std	Mfg's Log Sheet	-	P	-	-			
1.2	Ferro Alloys	Chemical	Major	Lab Analysis	Random Sample / Lot	Mfg's Std	Mfg's Std	Mfg's Log Sheet	-	P	-	-			
2	Final Inspection														
2.1	Product Analysis	Chemical Analysis	Major	Chemical	1 / heat	Mfg's Standard	Mfg's Standard	MTC	√	P	V**	-	** Chemical. Analysis to be Witnessed by Vendor		
2.2	Leakage	Hydro Test	Major	Pressure Test	100%	Approved Drg / Data Sheet	No Leakage	IR	√	P	W*	-	* 10% by Vendor / BHEL / CLIENT		
2.3	Dimension	Dimension	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W*	-			
2.4	Hardness	Hardness	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR/TC	√	P	W*	-			
Manufacturer / Sub Vendor			Contractor		LEGENDS:- Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness			For Client Use:-		Document No.:-					
SIGNATURES								Name & Signature of Approving Authority with Seal							


Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		S/Contactor :-			Manufacturing Quality Plan			Project:-					
		Manufacturer :-			Item :- Knife Gate Valve [Manual / Pneumatic] QAP No. : LOI Nos:-			Package :- Mill Rejects System Client :-					
					Contractor :- M/s BHEL			Consultant :-					
SI. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
								9	D	M	C	N	
1	2	3	4	5	6	7	8	9	D	M	C	N	11
1	Raw Material / Bought Out's												
1.1	Body	Chemical & Mechanical	Major	Foundary TC	1 per Heat	Relevant IS / Appr. Drg / Data Sheet	Relevant IS / Appr. Drg / Data Sheet	TC	√	P/V	V	-	
1.2	Gate	do	Major	Lab Analysis	1 per lot	do	do	Mill / Lab TC	√	P/V	V	-	
1.3	Stem (For Manual Valve)	do	Major	Lab Analysis	1 per batch	do	do	do	√	P/V	V	-	
1.4	Pneumatic Cylinder (For Pneu. Valve)	Visual & Functional	Major	Mfr's TC Review	100%	Smooth Operation	Smooth Operation	Mfr's TC	√	P/V	V	-	
2	In - Process Inspection												
2.1	Body, Gate	Dimensional	Major	Measurement	100%	Mfr's Drawing	In-Process Insp. Record	-		P	V	-	# -> Test Pressure as per Data Sheet
2.2	Body Shell Test	Leak Tightness	Major	Hydro Static Test #	100%	Approved Drg / Data Sheet	No Leakage	IR	√	P	V	-	
3	Final Inspection												
3.1	Assembled Valve	Dimension	Major	Measurement	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W	-	BHEL / Vendor/CLIENT to Witness 10 % of Quantity.
3.2	do	Function	Major	Operation	100%	Smooth Operation	Smooth Operation	IR	√	P	W	-	
3.3	do	Seat Leakage	Major	Hydro Static Test #	100%	Approved Drg / Data Sheet	Approved Drg / Data Sheet	IR	√	P	W	-	
Manufacturer / Sub Vendor		Contractor		LEGENDS:-			For Client Use:-			Document No.:-			
				Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness						Name & Signature of Approving Authority with Seal			

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

Sl. No.		Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records	Agency for Checking				Remarks
1		2	3	4	5	6	7	8	9	10				11
									TYPE	D	M	C	N	
														
			S/Contractor :-		Manufacturing Quality Plan			Project:-						
			Manufacturer :-		Item :- Sump Pump			Package :- Mill Rejects System						
					QAP No. :-			Client -						
					LOI Nos:-			Contractor :- M/s BHEL						
								Consultant :-						
1 Raw Material / Bought Out's														
1.1	Casing	Chemical, Mechanical, Hardness, Surface Defect	Major	Chem. Comp. Mechanical Hardness Visual	1 per Heat 1 per Heat 1 Per Heat 100 %	Relevant IS / Appr. Drg / Data Sheet	Relevant IS / Appr. Drg / Data Sheet	TC	✓	P/V	V	-		
1.2	Impeller	do	Major	do	do	do	do	do	✓	P/V	V	-		
1.3	Shaft	Chemical, Mechanical, Surface Defect	Major	Chem. Comp. Mechanical Visual & UT if Dia >50 mm	1 per Heat 1 per Heat 100 %	Relevant IS / Appr. Drg / Data Sheet / ASTM E 388 for UT	Relevant IS / Appr. Drg / Data Sheet / ASTM E 388	do	✓	P/V	V	-		
1.4	Shaft Sleeve	Chemical Hardness	Major	Chem. Comp. Hardness	do	do	do	do	✓	P/V	V	-		
2 In - Process Inspection														
2.1	Casing	Soundness of Casting / Leakage	Major	Hydro Static Test	100%	Appr drg. / Data Sheet / IS 5120	No Leakage	IR	✓	P	V	-		Hyd. Test at 200% of pump rated head or 150% of Shut off head which ever is higher for 30 min.
2.2	Impeller	Residual unbalance	Major	Dyanamic / Static Balancing	100%	Approved Drg / Data Sheet / ISO 1940 Gr. 6.3	ISO 1940 Gr. 6.3	IR	✓	P	V	-		
3 Final Inspection														
3.3	Performance Test with Calibrated Test Lab Motor	Q Vs Head, Power & Efficiency, Noise & Vibration	Major	Measurement & Curves	100%	Approved Drg / Data Sheet / HIS	Approved Drg / Data Sheet / HIS	IR	✓	P	W	-		Noise - 85 db max. & Vibration - 50 microns max.
3.2	Pump strip test in case of doubt due to abnormal sound	Undue Wear	Major	Visual / Strip Test	100%	Mfr's Standard	No Undue Wear	IR	✓	P	W	-		
3.3	Painting	Visual & Measurement	Major	Visual & Measurement	100%	As per approved Painting Schedule	As per approved Painting Schedule	IR	-	P	-	-		
LEGENDS:- Records identified by ✓ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT P->Perform, V-> Verification, W-> Witness														
Manufacturer / Sub Vendor SIGNATURES										For Client Use:- Document No.:-				
Contractor										Name & Signature of Approving Authority with Seal				

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

		S/Contactor :-			Manufacturing Quality Plan			Project:-					
		Manufacturer :-			Item :-EXPANSION BELLOW			Package :- Mill Rejects System					
						QAP No. :-			Client :-				
						LOI Nos:- -							
						Contractor :- M/s BHEL			Consultant :-)				
Sl. No.	Components / Operations	Characteristics	Classification	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Records		Agency for Checking			Remarks
1	2	3	4	5	6	7	8	9		10			11
								TYPE	D	M	C	N	
1	Raw Material												
1.1	Bellows	physical & Chemical	Major	Lab Analysis	1 per Heat	AS204 TP304/ Approved Drg.	AS204 TP304/ Approved Drg.	MTC	√	V	V	-	
1.2	Fianges/ End Pipe	physical & Chemical	Major	Lab Analysis	1 per lot	IS 2062 / Approved Drg.	IS 2062 / Approved Drg.	MTC	√	V	V	-	
2	In - Process Inspection												
2.1	Bellows & Pipe ** For Bellows	Dimension Soundness Of Weld of L-Seam	Major major	Measurement DPT **(Before & After Forming)	100% 100%	Approved Drg. ASTM E- 165	Approved Drg. No Cracks/ Linear Indication	IR IR	√	P P	V V	-	
3	Final Inspection												
3.1	Assembly	DP Test of Fillet Weld of Bellows to Pipe & Pipe to Fiange	Major	visual	100%	ASTM E-165	No Crack / Linear Inication	IR	√	P	W	-	
3.2	Testing	Dimensions pressure	Major Critical	Measurement Hydraulic	100% 100%	Approved Drg EJMA D.3.2.1/ Data sheet	Approved Drg EJMA D.3.2.1/ Approved Drg.	IR IR	√ √	P P	W W	-	
		Spring Rate Test (Axial)	Critical	Stiffness Test	100%	EJMA / Data Sheet	EJMA / Data Sheet	IR	√	P	W	-	
		Deflection	Critical	Deflection Test	100%	EJMA / Data Sheet	EJMA/Data Sheet	IR	√	p	W	-	
3.30	Painting	Visual/ Measurement	Major	DFT	100%	Approved Painting Schedule	Approved Painting Schedule	IR	√	p	-	-	
				LEGENDS:-			For Client Use:-		Document No.:-				
				Records identified by √ shall be essentially included in QA documentation. TC- Test Certificate, IR - Insp. Report									
Manufacturer / Sub Vendor		Contractor		M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT									
SIGNATURES		P->Perform, V-> Verification, W-> Witness			Name & Signature of Approving Authority with Seal								

Note :- In case of any difference in parameters specified in Drawing / Data Sheet & QAP, Value specified in Drg / Data Sheet shall be Final

Manufacturer's Name & Address :		MANUFACTURING QUALITY PLAN					Project :							
		Item : MS Plates & Structures			QP No. :		BHEL Ref. :							
		Sub-System :			Rev. No. : 0		Contract No.:							
					Date :		Contractor : BHEL SUB-CONTRACTOR-							
					Page No.: 11 of 1									
Sl. No.	Components & Operations	Characteristic/Item	Class	Type/method of check	Extent of Check	Reference Document	Acceptance Norm	Format of Record		Agency			Remarks	
										M	C	N		
1	2	3	4	5	6	7	8	9	D	10			11	
RAW MATERIAL														
1	Steel Plates	Chemical composition and Mechanical test	Major	Review of corelated MTC	One/heat	IS:2062	IS:2062	Mfgr. TC	√	P	V	-	Refer Note Below	
2		Visual and dimensional Check	Major	Visual and measurement	100%	Mfgr. TC	Mfgr. TC IS 1852	Mfgr. TC	√	P	W	-		
3		Identification / Marking	Major	Co-relation establish	100%	AS per manufacturing practice	AS per manufacturing practice IS 2062	Mfgr. TC	√	P	V	-		
			LEGEND :											
			M-> Manufacturer/Sub Contractor, C-> Contractor (BHEL) or their nominated agency & N -> CLIENT											
MANUFACTURER/ SUBCONTRACTOR			CONTRACTOR											
SIGNATURE						P->Perform, V-> Verification, W-> Witness			REVIEWED BY		NAME & SIGNATURE OF APPROVING AUTHORITY			

Notes:

- 1 In case material is despatched directly from SAIL/TISCO plant/stockyard or procured from dealer against co-related TC's witnessing by BHEL is waived off and material will be accepted based on MTC of SAIL/TISCO.
- 2 In case material is procured from dealer and co- related TC's are not available, check on 100% quantity of plates will be performed on sample drawn from each plate at NABL certified/ approved laboratory or any govt approved laboratory for chemical & physical properties, However dimensional check shall be witnessed by BHEL.
- 3 There will not be any inspection by CUSTOMER.



TITLE:
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1X800 MW WANAKBORI TPS

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SECTION – C2-B

REQUIREMENT OF SPARES, TOOLS, TACKLE, LUBRICANTS AND CONSUMABLES

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	TOOLS AND TACKLE
2.00.00	SPARES
	ANNEXURES
ANNEXURE-I	MANDATORY SPARE LIST

VOLUME : IIA

SECTION-VIII

**REQUIREMENTS OF SPARES, TOOLS & TACKLE,
LUBRICANTS/OIL/CONSUMABLES**

1.00.00 TOOLS & TACKLE

The Contractor shall supply with the equipment one complete set of special tools and tackles required for the erection, assembly, dis-assembly & maintenance of the equipment. These special tools will also include special material handing equipment, jigs & fixtures for maintenance and calibration/re-adjustment, checking & measurement aids etc. A list of such tools & tackles shall be submitted by the Bidder along with the offer. Detailed description of each tool/tackles, its function along with the equipment/part for which it is meant for and the price of each tool/tackles shall also be indicated in the offer. These tools & tackles shall be separately packed and sent to site before the first unit commissioning. The Bidder shall also ensure that these tools are not used for erection purpose.

2.00.00 SPARES

2.01.00 General

The Bidder shall indicate and include in his scope of supply all the necessary start-up, commissioning and recommended spares in addition to mandatory spares as specified elsewhere in the specification. The Owner reserves the right to buy any or all mandatory and recommended spares. The Contractor shall also state for each item of spares both mandatory and recommended, the normal expected service life.

2.01.01 All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended to replace. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site, e.g. small items shall be packed in sealed transparent plastic bags with dessicator packs as necessary.

2.01.02 Each spare part shall be clearly marked or labelled on the outside of the packing with the description. When more than one spare part is packed in a single case, a general description of the contents shall be shown on the outside and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.

2.01.03 All cases, containers or other packages are liable to be opened for examination as may be considered necessary by the Engineer.

2.01.04 All mandatory spares shall be delivered to site within one to three months prior to the scheduled date of the trial operation of the plant. However, they shall not be despatched before the despatch of the associated main equipment.

- 2.01.05 The Bidder shall also guarantee supply of spare parts, which will be made, based on manufacturer's drawings on special order from the Purchaser for 30 years after commissioning of the plant.
- 2.01.06 Warranty period for all kinds of spares shall be six thousand (6000) hours of operation, except normal wear or eighteen (18) months from the date of receipt at site, whichever is later. In case of failure or non-conformance to specifications, the Contractor shall replace them free of cost.
- 2.02.00 **Recommended Spares**
- 2.02.01 The Contractor shall provide a list of recommended spares giving unit prices and total prices for 2 years of normal operation of the plant for spares of indigenous origin, and for 5 years of normal operation for spares of non-indigenous origin. This list shall take into consideration the mandatory spares specified elsewhere in the specification and should be a separate list.
- 2.02.02 The price of recommended spares will not be used for the evaluation of bids. The price of these spares shall remain valid for a period as specified elsewhere in the specification from the date of Award of the Contract. Where the recommended spares are the same as mandatory spares, the prices shall be the same. The prices of any recommended spares, which are not common with mandatory spares, shall be subject to review by the Owner, and shall be finalised after mutual discussion.
- 2.03.00 **Start-up Commissioning Spares**
- 2.03.01 Start-up commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used until the plant is handed over to the Owner shall come under this category. Said spares, properly marked, shall be supplied together with the main equipment and shall be used by the Contractor, if needed, during erection & commissioning stage. All such spares which remain unused till issuance of Taking Over Certificate by the Owner, along with an equipment-wise quantitative consumption report shall be returned to the Owner during time of handover. The list of commissioning spares to be brought by the Contractor to ensure smooth commissioning of the plant shall be subject to the Engineer's approval.
- 2.03.02 The Contractor shall submit a complete list of all such start-up spares. Costs of the above spares, which are consumed before the handing-over of the plant, shall be deemed to have been included in the lump sum proposal price of the package, and the Contractor shall have no claim on this account to the Owner.
- 2.04.00 **Mandatory Spare Parts**
- 2.04.01 The Owner considers some of the spares are essential for running the equipment irrespective of whether they are included in the list of recommended spares by the Bidder as mentioned above.

Since the components involved can not be foreseen at the bidding stage, only broad requirements of the Owner in this respect are outlined hereinafter. The bidder shall include his proposal, on the basis of this guideline, an item-wise list of all components and the quantity, unit prices & total price thereof, offered as mandatory spares for each and every equipment. This list shall be separate from the list of recommended spares and shall be used for bid evaluation purposes. Any clarification in this respect may be obtained by the Bidder at the pre-bidding stage.

- 2.04.02 Since the components involved can not be foreseen at the bidding stage, only broad requirements of the Owner in this respect are outlined hereinafter. The Bidder shall include in his proposal, on the basis of these guidelines, an item-wise list of all components and the quantity, unit prices & total price thereof, offered as mandatory spares for each and every equipment. This list shall be separate from the list of recommended spares and shall be used for bid evaluation purposes. Any clarification in this respect may be obtained by the Bidder at the pre-bidding stage.
- 2.04.03 The mandatory spares should be supplied to the Owner at least one month before the trial run. The despatch programme is subject to approval of the Owner/Consultant after award of contract.
- 2.02.04 Criteria for selection of Quantity of Mandatory Spares :
- For Mandatory Spares refer Annexure-II
- 2.04.05 Purchaser will have the option to procure any or all of the mandatory spares at his discretion.



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1X800 MW WANAKBORI TPS

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TECHNICAL SPECIFICATION
(ELECTRICAL SPECIFICATION)



TITLE:
**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
MILL REJECT HANDLING SYSTEM

WANAKBORI TPS (1 X 800MW)**

SPECIFICATION NO.
VOLUME NO. : **II-B**
SECTION: **C**
REV NO. : **00** DATE: 10/07/2015
SHEET **1** OF **3**

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D	MOTOR DATASHEET-C	7
D	QUALITY PLAN (FOR MOTORS BELOW 55 KW)	2
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D	ELECTRICAL LOAD DATA FORMAT (ANN-II)	1
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TITLE: ELECTRICAL EQUIPMENT SPECIFICATION FOR MILL REJECT HANDLING SYSTEM WANAKBORI TPS (1 X 800MW)	SPECIFICATION NO.
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1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

The equipment and services to be provided by bidder under this specification shall be as detailed here below but shall not be limited to the following:

- a) Services and Equipment as per "Electrical Scope between BHEL and Vendor".
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for Mill Reject Handling System.
- 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 including GA drg, data sheet as per required format, quality plans, calculations, test reports, test certificates, operation and maintenance manuals, characteristic curves, wiring diagrams/schemes etc. shall be furnished as specified at contract stage. All documents shall be subject to customer / BHEL approval without any commercial implications to BHEL.
- h) The sub-vendor list for various electrical items is subject to BHEL/Customer approval without any commercial implications.
- i) Motors shall meet minimum requirement of Electric motor specification.
- j) Purchaser will furnish data sheets to the vendor after award of contract. Vendor shall furnish filled in data sheets meeting the specification requirements.
- k) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- l) Cable BOQ worked out based on routing of cable listing provided by the vendor for "both end equipment in vendor's scope" shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

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



TITLE: ELECTRICAL EQUIPMENT SPECIFICATION FOR MILL REJECT HANDLING SYSTEM WANAKBORI TPS (1 X 800MW)	SPECIFICATION NO.
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- 3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical / quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following:
- a) A copy of this sheet "Electrical Equipment Specification for Mill Reject Handling System" and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
 - b) Electrical load requirement.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.
- 4.0 **LIST OF ENCLOSURES**
- 4.1 Electrical scope between BHEL & vendor
 - 4.2 Technical specification – Specification for Electric Motors/Actuators
 - 4.3 Datasheets & quality plan for motors.
 - 4.4 Load Data Format. (Annexure –II)
 - 4.5 BHEL Cable listing format (Annexure –III)

PROJECT: 1 x 800 MW WANAKBORI TPS
ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: MILL REJECT HANDLING SYSTEM

REV: 0 DATE: 10.07.2015

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	1. 415 V AC (3 Phase, 3 Wire) supply to motors, 415 V AC (3 Phase, 4 Wire) /240 V AC supply to other equipment etc. shall be provided by BHEL based on load data provided by vendor at contract stage for the equipment supplied by vendor as part of contract. 2. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Refer C & I portion of specification for philosophy of using junction boxes
5	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	a) Cable trays, accessories & cable trays supporting system b) 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, which shall be supplied by vendor.
7	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type Aluminium lugs for Aluminium power cables and heavy duty tinned copper lugs for copper power cables 3. Solder less crimping type heavy duty copper lugs for control cables.
8	Conduit and conduit accessories for cabling between equipments supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding & lightning protection	BHEL	BHEL	
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage. All motors shall be 3 Phase only.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.

PROJECT: 1 x 800 MW WANAKBORI TPS
ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: MILL REJECT HANDLING SYSTEM

REV: 0 DATE: 10.07.2015

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
15	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable (excluding power cables) in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish Electrical equipment layout & cable tray layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts, conduits etc.) shall be decided during contract stage. Electrical equipment layout & cable tray layout drawing shall be subjected to BHEL/ customer approval without any commercial implications to BHEL.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

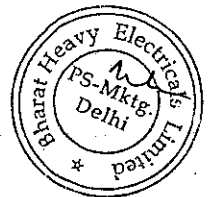
NOTES:

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.

VOLUME : IIF/1

SECTION-II

**TECHNICAL SPECIFICATION
FOR
A.C. & D.C. MOTORS**

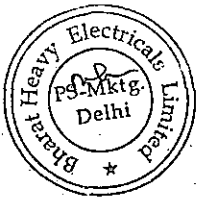


CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	SCOPE
2.00.00	STANDARDS
3.00.00	SERVICE CONDITIONS
4.00.00	TYPE AND RATING
5.00.00	PERFORMANCE
6.00.00	SPECIFIC REQUIREMENTS
7.00.00	ACCESSORIES
8.00.00	TESTS
9.00.00	DRAWINGS, DATA & MANUALS

ATTACHMENT

ANNEXURE-A	DESIGN DATA
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VOLUME : IIF/1

SECTION-II

TECHNICAL SPECIFICATION
FOR
A.C. & D.C. MOTORS

1.00.00 SCOPE

1.01.00 This section covers the general requirements of the drive motors for power station auxiliary equipment.

1.02.00 Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.

1.03.00 In case of any discrepancy, the driven equipment specification shall govern.

2.00.00 STANDARDS

2.01.00 All motors shall conform to the latest applicable IS, IEC and CBIP Standards/ Publications except when otherwise stated herein or in the driven equipment specification.

2.02.00 Major standards, which shall be followed, are listed below other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed :

IS-325

IS-12615

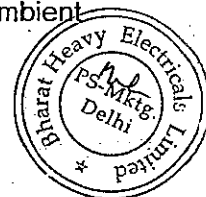
IEC-34

3.00.00 SERVICE CONDITIONS

3.01.00 The motors will be installed in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.

3.02.00 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the annexure to this specification.

3.03.00 For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature.



4.00.00 TYPE AND RATING

4.01.00 A.C. Motors

4.01.01 Motors shall be general purpose, constant speed, squirrel cage, three/single phase, induction type.

4.01.02 All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity.

4.01.03 The motor name-plate rating at 50°C shall have at least 10% margin over the input power requirement of the driven HT equipment and 15% for LT driven equipment at rated duty point unless stated otherwise in driven equipment specification or in general electrical specification.

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

4.01.05 All HT & LT motors shall be energy efficient type as per IS. However for HT motors, if the same is not specified in IS, minimum efficiency of all HT motors shall be considered as 90%.

4.02.00 D.C. Motors

4.02.01 D.C. motor provided for emergency service shall be shunt/compound wound type. All DC motors shall be energy efficient type with minimum efficiency of 80%.

4.02.02 Motor shall be sized for operation with fixed resistance starter for maximum reliability.

Starter panel complete with all accessories shall be included in the scope of supply.

5.00.00 PERFORMANCE

5.01.00 Running Requirements

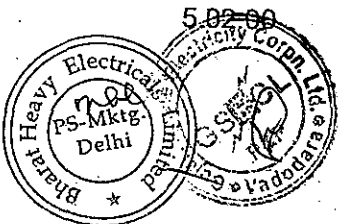
5.01.01 Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given in the annexure

5.01.02 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.

5.01.03 The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.

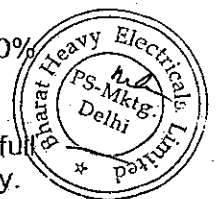
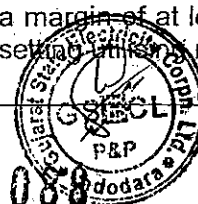
5.02.00 Starting Requirements

Motor shall be designed for direct online starting at full voltage. Starting current shall not exceed 6 times full load current for all HT motors except boiler feed pump motor where the starting current shall be limited to 4.5 times. No further tolerances are applicable on starting current specified above



for HT motors. For LT motors, the applicable starting current shall be limited to 7.2 times of full load current including all tolerance.

- 5.02.01 The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage.
- 5.02.02 Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminal except BFP motor. In case of BFP motor, it shall be 80% rated voltage. Minimum starting requirement for mill motor (double cage) shall be 80% rated voltage at motor terminals. However for mill motors if the minimum starting voltage is more than 80% rated voltage at motor terminal and within 90% rated voltage, bidder shall provide necessary arrangement to keep the motor terminal voltage above that voltage to achieve smooth start of the motor.
- 5.02.03
- a) Motor shall be capable of three equally spread starts per hour, two starts in quick succession from cold condition and one restart from hot condition.
 - b) Cranking motor shall be capable of six equally spread starts per hour, three starts in quick succession from cold condition and one restart from hot condition. The coal conveyor and crusher motors shall be suitable for 3 consecutive hot starts with maximum 20 starts per day.
 - c) Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction.
- 5.02.04 HT pump motors shall be suitable to start with forward rotation.
- 5.02.05 The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage
- 5.03.00 **Stress During Bus Transfer**
- 5.03.01 The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.
- 5.03.02 The motor shall be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.
- 5.04.00 **Locked Rotor Withstand Time**
- 5.04.01 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time.
- 5.04.02 Starting time mentioned above is at minimum permissible voltage of 80% rated voltage.
- 5.04.03 Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting within motor rated capacity.



6.00.00 **SPECIFIC REQUIREMENTS**

6.01.00 **Enclosure**

6.01.01 All motor enclosures for outdoor, semi-outdoor & indoor application shall conform to the degree of protection IP-55 unless otherwise specified. Motor for outdoor or semi-outdoor service shall be of weather-proof construction with canopy.

6.01.02 Motors for circulating water pumps of large output ratings, located indoor and not directly exposed to coal dust or fly ash, could have screen protected drip proof enclosure conforming to IP-23.

6.01.03 For hazardous area approved type of increased safety enclosure shall be furnished.

6.02.00 **Cooling**

6.02.01 The motor shall be self ventilated type, either totally enclosed fan cooled (TEFC) or closed air circuit air-cooled (CACA) or totally enclosed tube ventilated (TETV) type. Totally enclosed tube ventilated (TETV) type motors shall be acceptable for HT motors only.

6.02.02 For large capacity motors, closed air circuit water cooled (CACW) may be considered for acceptance.

6.03.00 **Winding and Insulation**

6.03.01 All insulated winding shall be of copper.

6.03.02 All motors shall have class F insulation but limited to class B temperature rise.

6.03.03 Windings shall be impregnated to make them non-hygroscopic and oil resistant.

6.04.00 **Tropical Protection**

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

6.04.02 All fittings and hardwares shall be corrosion resistant.

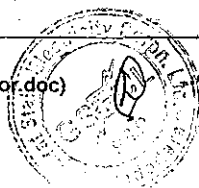
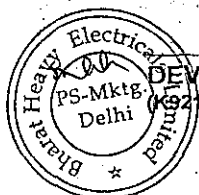
6.05.00 **Bearings**

6.05.01 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application.

6.05.02 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.

6.05.03 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.

6.05.04 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.



- 6.05.05 Grease lubricated bearings shall be prelubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication.
- 6.05.06 Oiled bearing shall have an integral self cooled oil reservoir with oil ring inspection ports, oil sight glass with oil level marked for standstill and running conditions and oil fill and drain plugs.
- 6.05.07 Forced lubricated or water cooled bearing shall not be used without prior approval of Owner.
- 6.05.08 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.
- 6.05.09 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.
- 6.06.00 **Noise & Vibration**
- 6.06.01 The noise level shall not exceed 85db (A) at 1.5 metres from the motor at no load condition.
- 6.06.02 The peak amplitude of the vibration shall be within IS/IEC specified limits.
- 6.07.00 **Motor Terminal Box**
- 6.07.01 HT Motor terminal box (Phase side) shall be Phase Segregated (PSTB) type and LT motor terminal box shall be non-phase segregated type. Both HT & LT motor terminal box shall be located in accordance with Indian Standards clearing the motor base- plate/ foundation.
- 6.07.02 Terminal box shall be capable of being turned 360 Deg. in steps of 180 Deg. for HT motors and 90 Deg. for LT motors unless otherwise approved.
- 6.07.03 The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.
- 6.07.04 The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.
- 6.07.05 Motor main terminal box shall be located right hand side of motor body looking from driving end.
- 6.07.06 Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.
- 6.07.07 The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
- 6.07.08 The terminal box shall be capable of withstanding maximum system fault current for a duration of 0.25 sec.
- 6.07.09 HT motor phase side terminal box shall be phase-segregated type and HT motor neutral leads shall be brought out in a separate terminal box preferably

opposite side of phase terminal box & may not be necessarily phase segregated type with shorting links for star connection.

6.07.10 Motor terminal box shall be furnished with suitable cable lugs and nickel plated double compression brass glands to match with cable used.

6.07.11 The gland plate for single core cable shall be non-magnetic type.

6.08.00 **Grounding**

6.08.01 The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer.

6.08.02 The grounding connection shall be suitable for accommodation of ground conductors as follows :

HT Motor (11kV, 6.6kV & 3.3 kV) : 75 X 10 mm GS Flat

LT Motor above 90 KW : 50 x 6 mm GS Flat

Motor above 30 KW up to 90 KW : 35 x 6 mm GS Flat

Motor above 5 KW up to 30 KW. : 25 x 3 mm GS Flat

Motor up to 5 KW : 8 SWG GI Wire

6.08.03 The cable terminal box shall have a separate grounding pad.

6.09.00 **Rating Plate**

In addition to the minimum information required by IS, the following information shall be shown on motor rating plate :

- a) Temperature rise in Deg.C under rated condition and method of measurement.
- b) Degree of protection.
- c) Bearing identification no. and recommended lubricant.
- d) Location of insulated bearings.

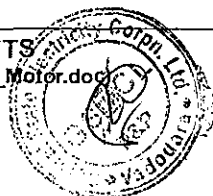
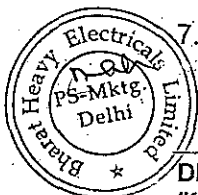
7.00.00 **ACCESSORIES**

7.01.00 **General**

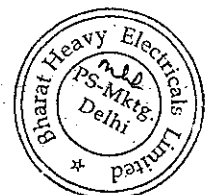
Accessories shall be furnished, as listed below, or if otherwise required by driven equipment specification or application.

7.02.00 **Space Heater**

7.02.01 Motor of rating 30 KW and above shall be provided with space heaters, suitably located for easy removal or replacement.



- 7.02.02 The space heater shall be rated 240 V, 1 phase 50 Hz and sized to maintain the motor internal temperature above dew point when the motor is idle.
- 7.03.00 **Temperature Detectors**
- 7.03.01 All 11000V, 6600V and 3300V motors shall be provided with twelve (12) nos. simplex type winding temperature detectors, four (4) nos. per phase. Six (6) nos. duplex type winding temperature detectors, two (2) nos. per phase shall only be acceptable for special application motors only subject to approval of owner.
- 7.03.02 11000V, 6600V and 3300V motor bearing shall be provided with duplex type temperature detectors.
- 7.03.03 The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0°C.
- 7.03.04 Leads of all simplex type motor winding RTDS and motor bearing RTDS shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDS will be connected to numerical protection relay and another set shall be kept free for DCS connectivity.
- 7.03.05 Five numbers of Temperature detectors / thermisters shall be provided for L.T. motors above 90 KW (3 nos. winding temperatures & 2 nos. bearing temperatures)
- 7.04.00 **Indicator/Switch**
- 7.04.01 Dial type local indicator with alarm contacts shall be provided for the following:
- a) 11000 V, 6600V and 3300V motor bearing temperature.
 - b) Hot and cold air temperature of the closed air circuit for CACA and CACW motor.
- 7.04.02 Flow switches shall be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing, if used.
- 7.04.03 Alarm switch contact rating shall be minimum 0.5 A at 220V D.C. and 5A at 240V A.C.
- 7.05.00 **Current Transformer for Differential Protection**
- 7.05.01 Motor 1000 KW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure. Loose 3 nos. CT for mounting on switchgear side shall be in bidder's scope.
- 7.05.02 The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match Owner's requirements to be intimated later.
- 7.06.00 **Accessory Terminal Box**



7.06.01 All accessory equipment such as space heater, temperature detector, current transformers etc., shall be wired to and terminated in terminal boxes, separate from and independent of motor (power) terminal box.

7.06.02 Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit cable connections.

7.07.00 **Drain Plug**

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

7.08.00 **Lifting Provisions**

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

7.09.00 **Dowel Pins**

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

7.10.00 **Painting**

Motor including fan shall be painted with corrosion proof paints of colour battle ship grey shade 632 of IS-5.

8.00.00 **TESTS**

Routine and Type Tests are to be conducted in presence of customer's representative as per IS:325 and required copies of test certificates are to be furnished for approval. In addition, following tests shall have to be carried out on the motors in presence of OWNER's representative on 3.3kV/6.6kV/11kV motors.

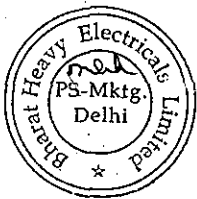
- a. Impulse test by 1.2 / 50 micro sec. On sample coil of Stator winding insulation as type test as per IEC-60034, part -15 test voltages as under :

Voltage rating of motor	Impulse Test Voltage
3.3 kV	18 kV peak
6.6 kV	31 kV peak
11 kV	49 kV peak

- b. Tan delta, charging current and dielectric loss measurements on each phase of motor stator winding as routine test.

- c. Polarization Index Test as per IS:7816 as routine test

- d. Test for suitability of IPW- 55 (Weather proof) as per IS 4691 as type test. Type test certificate for first numeral shall be acceptable in lieu to test, provided the test motor is identical to motor being supplied.



Second numeral test shall be carried out on one motor of each type and rating.

- e. Fault Withstand Test for main terminal box as type test. Type test certificate shall be acceptable, if the test is conducted on exactly identical terminal box.
- f. Test for noise level as routine test.
- g. Test for vibration as routine test.
- h. Tan delta measurement on coils.
- i. Surge withstand test for inter turn insulation.

Tests indicated at (h), (i), shall be carried out during manufacture of the coils and shall be furnished for verification.

Furnished type test certificates of motor shall not be older than five (5) years from the date of Inspection, otherwise type test shall be conducted without any price implication.

9.00.00 **DRAWINGS, DATA & MANUALS**

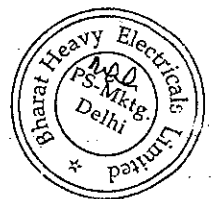
Drawings, data & manuals for the motors shall be submitted as indicated below:

9.01.00 **Along with the bid**

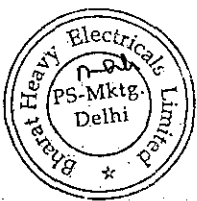
- a) List of the motors
- b) Individual motor data sheet as per format of the proposal data sheets.
- c) Scheme & write up on forced lubrication system, if any
- d) Type test report

9.02.00 **After Award of the Contract**

- a) Dimensional General Arrangement drawing
- b) Foundation Plan & Loading
- c) Cable end box details
- d) Space requirement for rotor removal
- e) Thermal withstand curves hot & cold
- f) Starting and speed torque characteristics at 80% & 100% voltage
- g) Complete motor data
- h) Erection & Maintenance Manual



- i) Test reports
- j) Data sheets to be enclosed



ANNEXURE-A
DESIGN DATA

1.0 AUXILIARY POWER SUPPLY

Supply	Description	Consumer
H.T. Supply	11000 V, 3Ø, 3W, 50 Hz, non-effectively earthed	Motors above 2000 KW & all mill motors
	Fault level 44 KA symm.	
	3300 V, 3Ø, 3W, 50 Hz, non-effectively earthed	Motors above 160 KW upto and including 2000 KW
L.T. Supply	6600 V, 3Ø, 3W, 50 Hz, non-effectively earthed	Motors of CHP system and Water System above 160kW
	Fault level 40 KA symm for 3300V & 6600V	
	415V, 3Ø, 3W, 50 Hz effectively earthed	Motors upto and including 160KW
D.C. Supply	Fault level 50 KA symm.	
	240V, 1Ø, 2W, 50 Hz effectively earthed	Lighting, space hea- ting, A.C. control & protective devices
	220V, 2W, unearthed	D.C. alarm, control & protective devices
	Fault level 25* KA.	

* Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation.

2.0 RANGE OF VARIATION

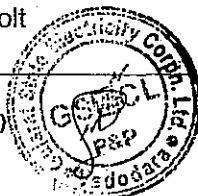
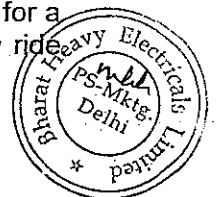
A.C. Supply :

Voltage : ± 10% Frequency : ± 5% Combined Volt : 10% (absolute sum)
+ frequency

During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance.

D.C. Supply :

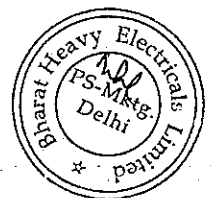
Voltage : 187 to 242 Volt



VOLUME : IIF/1

SECTION-III

**TECHNICAL SPECIFICATION
FOR
ELECTRIC MOTOR ACTUATORS**



CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	SCOPE
2.00.00	STANDARDS
3.00.00	SERVICE CONDITIONS
4.00.00	RATING
5.00.00	PERFORMANCE
6.00.00	SPECIFIC REQUIREMENT
7.00.00	TEST
8.00.00	DRAWINGS, DATA & MANUALS

