TALCHER THERMAL POWER PROJECT STAGE-III
(2 X 660 MW)

TECHNICAL SPECIFICATION
FOR
EFFLUENT TREATMENT PLANT

VOLUME – IIB & III

SPECIFICATION NO.: PE-TS-497-164-W001 REV 00

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

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VOLUME – II B

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PROJECT INFORMATION

TALCHER TPP STAGE-III (2X660 MW)

1.00.00 BACKGROUND

Talcher Thermal Power Project is situated near Talcher town in Angul district of Orissa having capacity of 460 MW (4x60 MW + 2x110 MW). The project was implemented by Orissa State Electricity Board (OSEB). Subsequently TTPS was taken over by NTPC on 03.06.1995. The present proposal is for expansion of TTPS by adding 2 units of 660 MW.

2.00.00 PROJECT HIGHLIGHTS

2.01.00 **Location**

The proposed site is located near Talcher town in Angul district of Orissa having latitude and longitude as 20°55' N and longitude 85°25' E respectively. The site is approachable from Banarpal–Talcher section of National Highway No. 23 at a distance of about 1 km from Anand Bazar. Nearest railway station is at Talcher on Talcher-Cuttack section of North Eastern Railway at about 4 Kms. The nearest commercial airport is Bhubaneswar at about 90 km.

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

3.00.00 BASIC INPUTS

3.01.00 **Land**

The plant facilities for this expansion stage would be accommodated within the land available in the existing power station and ash disposal shall be in mine voids.

3.02.00 **Water**

Make up water requirement for Talcher Thermal power project, Stage-III expansion (2x660 MW) would be about 40 Cusec with ash water recirculation system. Water requirement for the project will be met from upstream of the Samal barrage discharge on the River Brahmani and shall be pumped to the raw water reservoir located about 28 kms from intake well.

3.03.00 **FUEL**

3.03.01 **Coal Requirement, Availability and Linkage**

The Coal Linkage for the project granted by SLC(LT) and CLOA has allocated 5.854 MMTPA coal from MCL.

The primary fuel for the main steam generator shall be coal. The domestic coal quality parameters are indicated in **Annexure-IV-2** and imported coal parameters are indicated in **Annexure-IV-4** are to be considered for steam generator design.

3.03.03 **Coal Transportation**

The envisaged mode of coal transportation from the coal mines to the power plant is through Indian Railways network and will be unloaded in underground RCC Track Hoppers.

3.03.03 **Fuel Oil**

The fuel oil to be used for start-up, coal flame stabilization and low load operation of the steam generator shall be Light Diesel oil (LDO) having the characteristics given at **Annexure-IV-1** and HSD Oil characteristics given at **Annexure-IV-3**.

4.00.00 **STEAM GENERATOR TECHNOLOGY**

The steam generators shall be super critical once through type, water tube, direct pulverized coal fired, top supported, balanced draft furnace, single reheat, radiant, dry bottom type, suitable for outdoor installation. The gas path arrangement shall be single pass (Tower type) or two pass type.

5.00.00 **FLUE GAS DESULPHURIZATION SYSTEM (FGD) & SCR ready system:**

The project is envisaged with Flue Gas Desulfurization (FGD) system and DeNOx ready system meeting Ministry of Environment, Forest & Climate Change notification dated 07.12.2015. Limestone to be used for design of FGD system shall be as per the characteristic given at **Annexure-IV-5.**

6.00.00 **CAPACITY**

Talcher TPP, Stage-III : 2x660 MW - Present proposal

7.00.00 **BENEFICIARY STATES**

The project is being implemented as a regional project for meeting the power demand of Eastern Region Beneficiaries including Orissa – the home-state. The exact allocation of power shall be subject to the approval of Ministry of Power, Govt. of India.

8.00.00 **METEOROLOGICAL DATA**

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

9.00.00 **Plant Water Scheme**

The Plant water scheme is included in Part-E of Technical Specification.

9.01.00 **Condenser Cooling (CW) Water System**

It is proposed to adopt a recirculating type cooling water system with cooling towers for the project. For the re-circulating type CW system it is proposed to supply clarified water as make up. Circulating water from CW pumps to TG area and from TG area to cooling tower will be carried through pipes/ducts. Cooled water from cooling tower will be led to CW pump house through the cold water channel by gravity.

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

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

It is proposed to provide independent primary cooling water circuit for TG & its auxiliaries and Steam Generator & auxiliaries (including station auxiliaries) on Unit basis.

9.03.00 **Other Miscellaneous Water Systems**

CW system blow down water shall be used for the FGD process requirement, ash slurry pumps sealing, sealing of Vacuum pumps (if applicable) of Ash Handling plant, make-up to fire water system. The service water shall be taken from clarified water tank of Pre-treatment plant. The service (wash water) water collected from various areas and coal handling plant shall be treated as per requirement and reused. The drinking water requirement shall be provided from water treatment plant.

The quality of Raw water is given in this sub-section at **Annexure-III**

10.00.00 POWER EVACUATION SYSTEM

In view of above and considering the present capacity of the project (1320 MW), it is proposed to adopt the step-up/power evacuation voltage as 400kV. Accordingly provision for 4 Nos. of 400 kV line bays has been considered in the generation switchyard. Station supply shall be derived directly from 400kV voltage level through 400kV Class station transformers. The issue of power evacuation of the project shall be taken up with appropriate Transmission Utility as per regulatory provision, based on final power allocation received from Ministry of Power.

11.00.00 Criteria for Earthquake Resistant Design of Structures and Equipment

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

12.00.00 Criteria for Wind Resistant Design of Structures and Equipment

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

13.00.00 Vulnerability Atlas of India(VAI), prepared by Building Materials, Training and Promotion Council (BMTPC) under Ministry of Housing and Urban Affairs, is a comprehensive document which provides existing hazard scenario for the entire country and presents the digitized State/UT-wise hazard, maps with respect to earthquakes, winds and floods for district-wise identification of vulnerable areas. It also includes additional digitized maps for thunderstorms, cyclones and landslides. The main purpose of this Atlas is its use for disaster preparedness and mitigation at policy planning and project formulation and construction stage. The VAI provides necessary information for risk analysis and hazard assessment and is available at website www.bmtpc.org.

As per Government's directive, it is mandatory for the bidders to refer VAI for multi-hazard risk assessment and include the relevant hazard proneness specific to project location while planning, designing and execution of the project in terms of following details:

i) Seismic zone (II to V) for earthquakes
ii) Wind velocity
iii) Area liable to floods and Probable max. surge height
iv) Thunderstorms history
v) Number of cyclone storms/sever cyclone storms and max sustained wind specific to coastal region
vi) Landslides incidences with Annual rainfall normal
vii) District wise Probable Max. Precipitation

Accordingly, bidder should refer VAI while planning, designing and execution of the project.

However, for design of structures/facilities and equipment, the criteria for earthquake resistant design of structures and equipment, the criteria for Wind Resistant Design of Structures and Equipment and design parameters for drainage facilities, stipulated in the Technical Specification shall be followed.

For other information like area liable to floods, probable max. surge height, landslide, thunderstorm, cyclone etc. agencies are required to refer the VAI.

ANNEXURE-I

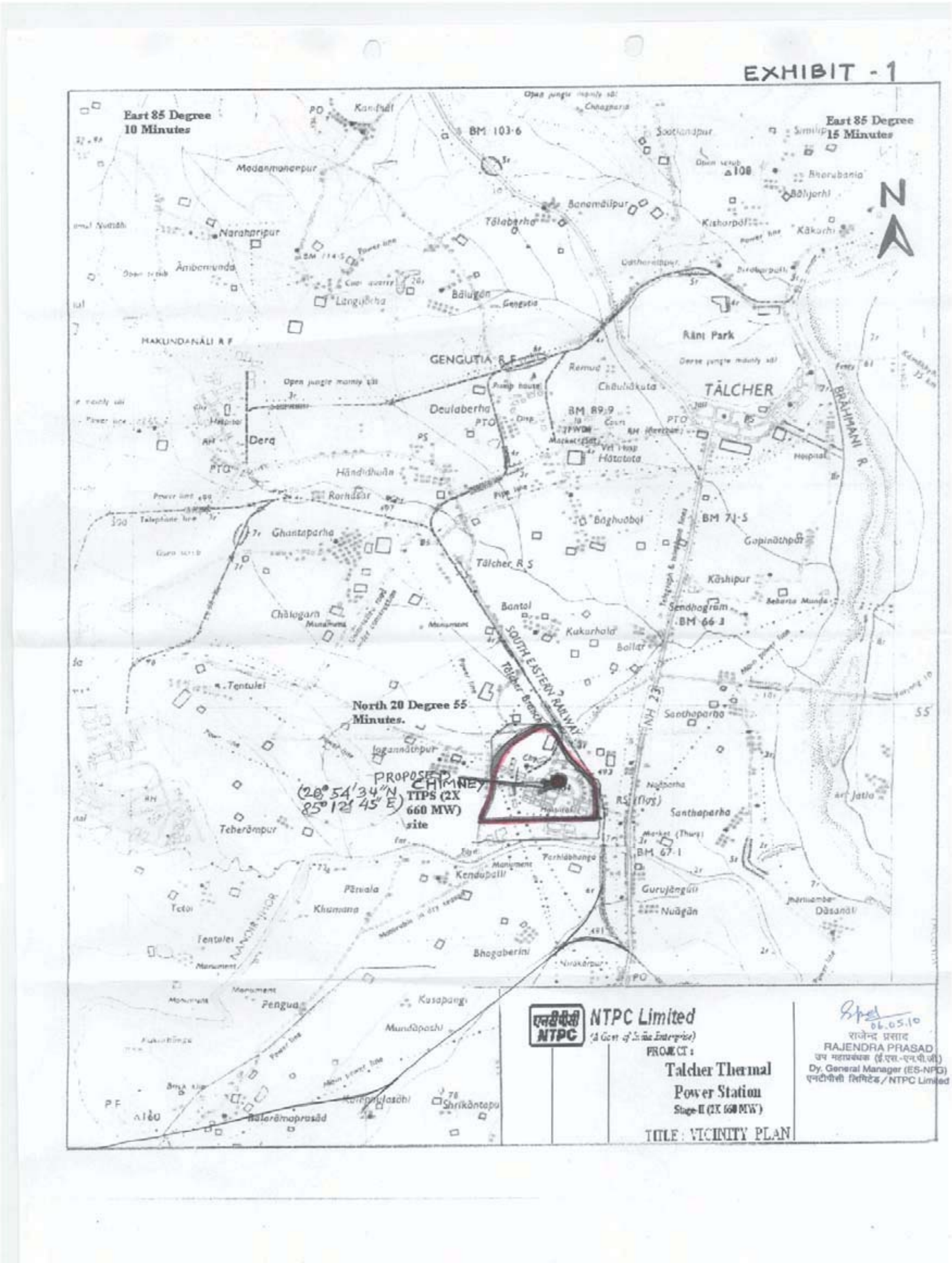
EXHIBIT - 1
East 85 Degree 10 Minutes
East 85 Degree 15 Minutes
North 20 Degree 55 Minutes.
TĀLCHER
BRAHMANI R.
SOUTH EASTERN RAILWAY
NH 23
PROPOSED CHIMNEY
(20°54'34"N 85°12'45"E)
TTPS (2X 660 MW) site
NTPC Limited
PROJECT:
Talcher Thermal Power Station
TITLE: VICINITY PLAN
RAJENDRA PRASAD
Dy. General Manager (ES-NPG)
NTPC Limited

जलवायवी सारणी
CLIMATOLOGICAL TABLE

केन्द्र : अंगुल STATION : Angul — अक्षांश LAT. 20°50' — देशांतर LONG. 85°06' — समुद्री तल से ऊंचाई HEIGHT ABOVE M.S.L. 139 METRES — वर्षों BASED ON OBSERVATIONS 1971-2000

माह MONTH		स्टेशन स्तर पर वायु दाब STATION LEVEL PRESSURE	वायु तापमान AIR TEMPERATURE: माध्य MEAN: सूखा बल्ब DRY BULB	माध्य MEAN: गीला बल्ब WET BULB	माध्य MEAN: दैनिक अधिकतम का माध्य DAILY MAX.	माध्य MEAN: दैनिक न्यूनतम का माध्य DAILY MIN	माध्य MEAN: सर्वाधिक तापमान का माध्य HIGHEST IN THE MONTH	माध्य MEAN: सर्वनिम्न तापमान का माध्य LOWEST IN THE MONTH	चरम EXTREMES: सर्वाधिक तापमान HIGHEST	चरम EXTREMES: दिनांक और वर्ष DATE AND YEAR	चरम EXTREMES: सर्वनिम्न तापमान LOWEST	चरम EXTREMES: दिनांक और वर्ष DATE AND YEAR	आर्द्रता HUMIDITY: प्रेक्षण के समय RELATIVE HUMIDITY	आर्द्रता HUMIDITY: वाष्प दाब VAPOUR PRESSURE	मेघ की मात्रा CLOUD AMOUNTS: औसत मेघाच्छादन ALL CLOUDS	मेघ की मात्रा CLOUD AMOUNTS: निम्न मेघ LOW CLOUDS	वर्षा RAINFALL: औसत वर्षा MONTHLY TOTAL	वर्षा RAINFALL: वर्षा के दिनों की संख्या NO.OF RAINY DAYS	वर्षा RAINFALL: सर्वाधिक वर्षा TOTAL IN WETTEST MONTH WITH YEAR	वर्षा RAINFALL: सर्वाधिक शुष्कतम महीने का योग TOTAL IN DRIEST MONTH WITH YEAR	वर्षा RAINFALL: 24 घंटों में सर्वाधिक वर्षा HEAVIEST RAIN IN 24 HOURS	वर्षा RAINFALL: दिनांक और वर्ष DATE AND YEAR	माध्य वायु वेग MEAN WIND SPEED
		hPa	°C	°C	°C	°C	°C	°C	°C		°C		%	hPa	Oktas	Oktas	mm		mm	mm	mm		किमी/घंटा Kmph
जनवरी JAN	I	1001.2	17.9	15.4	27.9	15.6	31.0	11.3	35.1	29 1994	5.5	2 1971	76	15.8	1.2	0.5	9.0	0.7	61.7 1906	0.0	48.8	22 1906	
	II	997.6	23.7	18.5									47	15.6	1.1	0.5							
फरवरी FEB	I	999.1	21.1	18.0	30.9	18.2	35.3	12.7	38.3	23 1967	8.8	16 1971	72	18.3	2.0	1.1	20.9	1.6	370.1 1961	0.0	118.1	6 1961	
	II	995.4	29.0	19.9									41	16.0	1.6	0.9							
मार्च MAR	I	996.7	25.3	21.0	35.5	21.0	39.2	15.9	40.1	31 1999	10.2	2 1971	67	21.7	1.5	0.8	25.0	1.7	206.0 1990	0.0	115.0	30 1990	
	II	992.6	33.5	22.1									35	17.4	1.8	1.1							
अप्रैल APR	I	993.1	28.7	24.4	38.9	24.4	42.5	20.0	45.6	2 1941	14.4	19 1971	70	27.3	1.7	0.7	35.9	2.3	152.4 1997	0.0	67.2	2 1965	
	II	988.4	35.6	24.4									38	21.5	2.6	1.6							
मई MAY	I	989.4	30.6	25.9	39.8	26.0	44.3	21.6	47.2	24 1921	15.6	24 1964	68	29.7	1.9	0.9	75.6	3.6	333.1 1995	0.0	105.0	30 1990	
	II	985.7	36.6	25.7									42	24.2	3.2	2.0							
जून JUN	I	985.8	29.7	26.0	36.2	25.9	42.5	21.7	47.2	15 1967	17.4	1 1964	74	30.7	4.3	2.8	210.1	8.5	528.2 1990	39.4 1965	161.2	15 1990	
	II	982.5	32.8	26.3									62	29.0	5.1	3.7							
जुलाई JUL	I	986.1	27.9	25.4	32.1	24.4	36.2	22.4	41.1	3 1982	18.3	20 1971	81	30.5	5.4	3.6	350.3	12.1	552.5 1932	102.4 1985	249.8	25 1932	
	II	983.1	29.4	25.9									76	30.7	5.9	4.6							
अगस्त AUG	I	986.5	27.5	25.3	31.4	23.9	34.5	21.3	37.7	22 1983	14.3	28 1974	83	30.6	5.5	4.0	325.3	13.4	826.0 1931	96.5 1937	257.3	21 1931	
	II	983.9	28.8	25.8									78	31.1	5.9	4.6							
सितम्बर SEP	I	990.9	27.5	25.2	32.1	24.1	34.8	20.5	36.1	7 1977	12.8	24 1974	83	30.5	4.5	3.1	205.5	10.2	569.7 1921	56.1 1919	148.8	6 1939	
	II	987.8	28.9	25.6									76	30.3	5.3	4.0							
अक्टूबर OCT	I	991.8	26.2	23.6	32.3	20.7	34.4	18.6	37.7	21 2000	12.0	28 1974	80	27.2	2.9	1.7	100.8	5.1	404.5 1973	0.0	134.2	18 1999	
	II	992.1	29.3	24.3									66	26.5	3.3	2.3							
नवम्बर NOV	I	999.4	22.4	19.4	30.0	18.2	32.5	13.6	35.1	26 1997	5.6	30 1970	75	20.5	1.8	0.9	35.7	1.3	161.5 1930	0.0	101.4	6 1990	
	II	995.8	27.3	20.9									54	19.7	1.9	1.0							
दिसम्बर DEC	I	1001.7	17.8	15.3	27.7	15.1	30.3	11.5	32.1	23 1995	3.5	4 1974	75	15.5	1.0	0.4	3.1	0.3	39.8 1991	0.0	48.8	14 1997	
	II	997.8	24.7	17.9									49	15.3	1.1	0.4							
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I	993.8	25.2	22.0	32.9	21.5	44.1	9.1	47.2	24	3.5	4	75	24.9	2.8	1.7	1200.1	60.9	2693.4	756.1	257.3	21	
	II	990.2	30.1	23.1					5	1921	12	1974	56	23.2	3.3	2.2			1990	1957	8	1931	
वर्षों की संख्या NUMBER OF YEARS	I		26	18	17	17	17	17	89		89		18	18	26	26	30	30	94	94	100		

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ANNEXURE-III

RAW WATER ANALYSIS

SN	Constituent	As	mg/l (except pH & turbidity)
1	Calcium	CaCO3	80
2	Magnesium	CaCO3	35
3	Sodium	CaCO3	20
4	Potassium	CaCO3	5
5	Total Cation	CaCO3	140
6	HCO3	CaCO3	85
7	p Alkalinity	CaCO3	0
8	Chlorides	CaCO3	35
9	Sulphate	CaCO3	20
10	Total Anion	CaCO3	140
11	Reactive Silica	SiO2	25
12	Silica non-Reactive	SiO2	5
13	Total Iron	Fe	0.5
14	pH value	-	6.8-8.0
15	Turbidity	NTU	2000
16	TDS	ppm	190
17	Temp	deg C	20-35
18	KMnO4	ppm	2
19	TOC	ppm	5

ANNEXURE-IV-1

TABLE-1

LIGHT DIESEL OIL CHARACTERISTICS

AS PER IS 15770-2008

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

DOMESTIC COAL CHARACTERISTICS ANNEXURE-IV-2

TABLE-1 – A

S No.	Characteristics (As received basis)	Range of 95% coal supplies			Range of 5% coal supplies	
		Column -1	Column-2	Column-3	Range of Adequacy coal	
1.0	**PROXIMATE ANALYSIS**	**Design**	**Worst**	**Best**	**Worst**	**Best**
1.1	Total Moisture (%)	14	16	12	17	11
1.2	Ash (%)	41	45	38	46	34
1.3	Volatile matter (%)	22	19	24	18	25
1.4	Fixed carbon (%)	23	20	26	19	30
	Total (%)	100	100	100	100	100
2.0	**ULTIMATE ANALYSIS**					
2.1	Carbon (%)	34.04	30.53	37.84	29.33	41.7
2.2	Hydrogen (%)	2.73	2.45	2.8	2.1	3.1
2.3	Sulphur (%)	0.55	0.45	0.65	0.45	0.8
2.4	Nitrogen (%)	0.83	0.63	1.2	0.55	1.3
2.5	Oxygen (%) (By difference)	6.85	4.94	7.51	4.57	8.1
2.6	Total Moisture (%)	14	16	12	17	11
2.7	Ash (%)	41	45	38	46	34
2.8	Total (%)	100	100	100	100	100
2.8	GCV (kcal/kg)	3400	3100	3700	3100	4000
2.9	Hard grove index	50	45	60	45	65
2.10	YGP (mg/kg)	75	80	70	85	65
3.0	**ASH ANALYSIS**					
3.1	Silica (%)	57.61	55.60	59.62	53.10	60.50
3.2	Alumina (%)	29.65	30.20	28.67	32.38	28.10
3.3	Iron Oxide (%)	6.96	7.75	6.03	8.28	5.51
3.4	Titania (%)	1.60	1.50	1.70	1.40	1.80
3.5	Phosphoric Anhydride (%)	0.53	0.58	0.46	0.60	0.40
3.6	Lime (%)	0.89	1.10	1.50	0.80	1.70
3.7	Magnesia (%)	0.35	0.40	0.30	0.50	0.25
3.8	Sulphuric Anhydride (%)	0.05	0.05	0.05	0.05	0.05
3.9	Sodium Oxide (%)	0.30	0.30	0.50	0.25	0.55
3.10	Balance Alkalies(By Difference) (%)	2.06	2.52	1.17	2.64	1.14
4.0	**ASH FUSION RANGE** (Under reducing atmosphere)					
4.1	Initial Deformation Temperature (degree Celsius)	1100	1100	1150	1100	1150
4.2	Hemispherical temperature (degree Celsius)	1300	1250	1350	1250	1350
4.3	Flow temperature (degree Celsius)	1400	1400	1400	1400	1400

TABLE-2 **ANNEXURE-IV-3**

HIGH SPEED DIESEL OIL CHARACTERISTICS

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

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

ANNEXURE-IV-4

TABLE – 4

TYPICAL IMPORTED COAL AND ASH CHARACTERISTICS

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

Annexure – IV-5

LIMESTONE CHARACTERISTICS

Chemical Analysis(% by mass)			
1.	CaO	%	47-51.0*
2.	MgO	%	0.9-3.8
3.	Fe_2O_3	%	0.45-1.0
4.	Al_2O_3	%	1.19-2.1
5.	Si_2O_3	%	2.1-4.5
6.	Mn_2O_3	%	<0.12
7.	P_2O_5,	%	Traces
8.	Cl_2	%	<0.015
9.	Na_2O	%	<0.16
10.	K_2O	%	<0.01
11.	TiO_2	%	<0.02
12.	Total Sulphur	%	<0.1
13.	LOI	%	39.0-41.3
Physical properties			
1	Bond Index	kWh/t	13
2	Granule size		Medium

Notes:

1. *Guaranteed parameters (guarantee on limestone consumption, auxiliary power consumption & gypsum purity) shall be based on available (reactive) CaCO3 content of 89%. The design of Flue Gas Desulphurisation (FGD) system & auxiliaries shall be based on available (reactive) $CaCO_3$ content of 79%.
2. For the purpose of volumetric computations of limestone handling & storage system the bulk density of limestone shall be taken as 1400 kg/m^3. However for torque, drive & structural load requirements the density of lime stone shall be taken as 1700 kg/m^3. For gypsum, the bulk density shall be taken as 900 kg/m^3 for volumetric computation and 1250 kg/m^3 for torque, drive & structural load requirements.
3. For the purpose of sizing of equipments and guarantee, $MgCO_3$ shall be considered as unreactive dolomitic form.

Annexure-IV-6

METHANOL CHARACTERSTICS

SN	Fuel Property	Unit	Methanol
1	Chemical Formula		CH3-OH
2	Fuel Carbon	Wt%	38
3	Fuel Oxygen	Wt%	12
4	Density at 20 deg C	kg/m3	792
5	LHV	Kcal/kg	4800
6	Boiling Temp	^{0}C at 1 bar	65
7	Vapour Pressure	bar at 20^{0}C	0.13
8	Kinematic viscosity	cSt at 20^{0}C	0.74
11	Auto Ignition	^{0}C	470
12	Heat of Vapourization	kcal/kg	260
15	Flammability limit	vol %	6-36
16	Flash Point	^{0}C	12

Annexure-IV-7(A)

S.N.	Technical Data	Unit	Specifications for Torrefied Pellet
1.	Base Material		**Agro residue:** Which means the leftover portion of the agriculture produce such as stubble/straw/stalk/husk of those agro residue which are surplus and not being used as animal fodder such as paddy, soya, arhar, gwar, cotton, gram, jawar, bajara, moong, mustard, seasam, til, maize, sunflower, jute, coffee etc., groundnut shell, coconut shell, castor seed shell etc., pine needle, elephant grass, sarkanda and horticulture waste such as dry leaves and trimmings generated during the maintenance and pruning of trees and plants. Wood obtained from tree cutting shall not be treated as agro residue and shall be not to be used as base material or mixing purpose whatsoever.
2.	Diameter	mm	In case of cylindrical shape: Diameter: Not more than 35 mm Length: Random For other shapes: No dimension should exceed 35 mm.
3.	Fines % (<3 mm) (ARB*)	Wt%	fines ≤ 5%
4.	Gross Calorific Value (GCVARB*)	Kcal/Kg	**Refer below**
5.	Moisture (ARB*)	Wt%	<= 15% (not more than 15%)
6.	Bulk density	Kg^3	600

*ARB – As Received Basis

Annexure-IV-7(B)

The sample was prepared by torrefying rice straw at 300 deg C with a holding time of one hour. Following analysis are carried out at NETRA using the powdered torrefied rice straw samples and the results of various testing for the specific sample is tabulated below:

a. Proximate Analysis (wt %, Air Dried Basis)

M	Ash	VM	FC
6.68	21.66	47.68	23.98

b. Ultimate Analysis (wt %, Air Dried Basis)

C	H	N	S	O
46.65	3.93	1.13	0.14	19.81

c. GCV : 4201 kcal/kg

d. Ash Fusion Temperature under reducing conditions: ^{0}C

IDT	ST	HT	FT
1134	1357	1374	1422

e. Ash Elemental Analysis (Elements expressed as Oxides in %w/w)

Na2O	MgO	Al2O3	SiO2	P2O5	SO3	K2O	CaO	TiO2	MnO	Fe2O3
2.423	7.783	4.623	67.48	1.9	1.9	6.15	4.21	0.39	0.03	2.83

Annexure-IV-7(C)

For the Torrefied Rice Straw Pellets (Prepared by torrefaction of rice straw at 300 deg C with holding time of 1 hr) tested at NETRA, the test results are as follows:

A. For Anion (ISO 16994:2016 E-Solid Biofuels- Determination of total content of sulphur and chlorine)-reported as wt % dry basis

a. Chlorine (Cl): 0.32%

b. Fluorine (F) : 0.09%

B. For Cation (ISO 16967:2015 E-Solid Biofuels- Determination of major elements …)- Reported as wt % dry basis

a. Sodium (Na): 0.31%

b. Potassium (K): 2.04%

Note: The above details as at Annexure-IV-7(A), IV-7(B & IV-7(C) are indicative only and shall vary based on the exact raw material and its subsequent processing.

SECTION – I SPECIFIC TECHNICAL REQUIREMENTS

SECTION – II GENERAL TECHNICAL REQUIREMENTS

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

SECTION – IA - SPECIFIC TECHNICAL REQUIREMENTS – MECHANICAL
SECTION – IB - SPECIFIC TECHNICAL REQUIREMENTS – ELECTRICAL
SECTION – IC - SPECIFIC TECHNICAL REQUIREMENTS – CONTROL & INSTRUMENTATION

SUB-SECTION IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

SUB-SECTION IA

1.0 GENERAL

This specification is intended to cover for SUPPLY PART & SERVICE PART (SUPERVISION OF ERECTION & COMMISSIONING) comprising of design (i.e. Preparation and submission of drawing/ documents including " As Built " drawings and O&M Manuals) , engineering, manufacture, fabrication, assembly, inspection, testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles as applicable, first fill of lubricants & consumables (excluding chemicals), Mandatory Spares, spares for erection, startup and commissioning as required, forwarding, proper packing, shipment and delivery at site, supervision of erection & commissioning, supervision of trial run at site, AMC of Analyzers and Profibus Instruments for 36 months after handing over of plant. Further, It also cover for carrying out performance guarantee /Functional / Demonstration tests at site, training of customer/ client O&M staff & final handing over to end customer in flawless condition the EFFLUENT TRATMENT PLANT complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment and agreements.

2.0 SCOPE OF SUPPLY

2.1 SCOPE OF SUPPLY (MECHANICAL)

Broad scope of supply for this package is detailed below and as indicated in relevant portion of this specification.

2.1.1 Two (2) nos. (1W+1S) TRANSFORMER YARD UNIT-1 OILY WASTE TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.1.2 Two (2) nos. (1W+1S) TRANSFORMER YARD UNIT-2 OILY WASTE TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.1.3 Two (2) nos. (1W+1S) FUEL OIL AREA OILY WASTE TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.1.4 Two (2) nos. (1W+1S) TG UNIT-1A WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.1.5 Two (2) nos. (1W+1S) TG UNIT-1B WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.1.6 Two (2) nos. (1W+1S) TG UNIT-2A WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.1.7 Two (2) nos. (1W+1S) TG UNIT-2B WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.1.8 Two (2) nos. Portable type Belt type Oil Skimmers complete with all instrumentation, valve, piping, fittings etc., along with two (2) nos. MS oil drum of 200 litre capacity.

2.1.9 Two (2) nos. (1W+1S) MRS UNIT-1 WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.1.10 Two (2) nos. (1W+1S) MRS UNIT-2 WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.1.11 Two (2) nos. (1W+1S) ESP UNIT-1 WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling, re-circulation line, etc.

2.1.12 Two (2) nos. (1W+1S) ESP UNIT-2 WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling, re-circulation line etc.

2.1.13 Two (2) nos. (1W+1S) SG UNIT-1 WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling, re-circulation line etc.

2.1.14 Two (2) nos. (1W+1S) SG UNIT-2 WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling, re-circulation line etc.

2.1.15 Two (2) nos. (1W+1S) COT/DOT WASTE WATER TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling, re-circulation line etc.

2.1.16 Two (2) nos. (2W) trolley mounted TROLLEY MOUNTED SCREW PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling, hose pipe, slope oil tank, etc.

2.1.17 One (1) no. WASTE SERVICE WATER SUMP (in twin section, CIVIL WORK by BHEL including RCC) with common inlet and outlet chamber interconnected through gates.

2.1.18 Three (3) nos. (2W+1S) WASTE SERVICE WATER SUMP (WSWS) TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling, re-circulation line for full flow, etc.

2.1.19 Two (2) nos. (2W) Drum type Oil Skimmers each complete with all instrumentation, valve, piping, fittings etc., along with MS oil drum of 200 litre capacity.

2.1.20 Two (2) nos. trolley mounted Centrifuge complete with all accessories as required.

2.1.21 Two (2) nos. (1W+1S) LAMELLA CLARIFIER/TUBE SETTLER (RCC Works by BHEL) each complete with flocculation tank, flash mixer, fittings, media, plate packs and all accessories.

2.1.22 One (1) no. CENTRAL MONITORING BASIN (in twin section, CIVIL WORK by BHEL including RCC) with common inlet and outlet chamber interconnected through gates.

2.1.23 Three (3) nos. (2W+1S) CENTRAL MONITORING BASIN (CMB) TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling, re-circulation line for full flow etc.

2.1.24 Sludge disposal system from Lamella clarifiers with piping, valves, up to sludge sump as indicated in P & ID of Effluent Treatment Plant.

2.1.25 One (1) no. SLUDGE SUMP (in twin section, RCC by BHEL) with common inlet and outlet chamber interconnected through gates.

2.1.26 Two (2) nos (1W+1S) Air blowers of oil free type of required capacity, its drives and associated accessories, air piping from blowers to each section of the SLUDGE SUMP for air scouring.

2.1.27 Two (2) nos. (1W+1S) SLUDGE SUMP TRANSFER PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.1.28 Two (2) nos. RCC LIME dosing tank (CIVIL WORK by BHEL including RCC) for Lamella clarifier / tube settler including basket strainer, slow speed gear operated agitator driven by motor complete with overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.1.29 Two (2) (1W+1S) nos. pumps of Horizontal Screw type suitable for dosing LIME in Lamella Clarifier at design dosage rate specified and head as required. Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, safety relief valves, re-circulation line etc. for lamella clarifier / tube settler.

2.1.30 Two (2) nos. RCC ALUM dosing tank (CIVIL WORK by BHEL including RCC) for Lamella clarifier / tube settler including basket strainer, slow speed gear operated agitator driven by motor complete with overflow seal, integral pipe works, valves, instrumentation and all other accessories required.

2.1.31 Two (2) (1W+1S) nos. pumps of positive displacement type suitable for dosing ALUM in Lamella Clarifier at design dosage rate specified and head as required. Pumps shall be provided with accessories such as Y-type suction strainers, pressure dampeners, safety relief valves etc. for lamella clarifier / tube settler.

2.1.32 Two (2) nos. RCC SERVICE WATER OVERHEAD TANK (CIVIL WORK by BHEL including RCC) complete with integral pipe works, valves, instrumentation and all other accessories required.

2.1.33 Two (2) nos. (1W+1S) FLUSHING PUMPS complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.1.34 Two (2) nos. (1W+1S) PRE-FILTER BACKWASH WATER PUMPS UNIT-1 complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.1.35 Two (2) nos. (1W+1S) PRE-FILTER BACKWASH WATER PUMPS UNIT-2 complete with all instrumentation, valves, piping, fittings, motor, base plate, coupling etc.

2.1.36 Bidder to take care the length of piping as included elsewhere in specification of Effluent Treatment plant. Pipe routing shall be decided during detailed engineering; however, bidder will consider 12m static head + 10% margin, in addition to the losses in straight length and bend in pipes and valves etc. during pump selection for outside ETP area, Central Monitoring Basin transfer pumps, Sludge Sump Transfer pumps.

2.1.37 Pipe racks shall be provided by BHEL wherever available. However, where pipe racks are not available the pipe shall run on pipe pedestals. All auxiliary steel structures (U-clamps, nuts, bolts, channels etc.) for fixing the pipe on the pedestal or trestles shall be in the scope of bidder. If buried piping is required, Wrapping, coating and protection of all the buried pipe is also in bidder's scope & shall be as per IS 10221.

2.1.38 All steel inserts plates with lugs, rungs, ladder, puddle pipes, bolts, edge angle in desired shape, nuts, sleeves, and all other embedding components etc. as required to grout in BHEL civil works and to support/hold the equipment being supplied under this specification shall be in bidder's scope.

2.1.39 Initial charge of all lubricants & grease in bidder's scope.

2.1.40 Instrument hook up material shall be in bidder's scope.

2.1.41 The pipe sizes indicated in the tender specification/ P & I diagram are minimum. Wherever pipe sizes are not indicated, the same shall be selected based on the specification requirement and shall be subject to BHEL /customer approval during detailing engineering. All pipes shall be carbon steel unless exclusively mentioned.

2.1.42 All necessary drains, vents and sampling points with valves as specified and as required are in bidder's scope. All above ground tanks /sumps shall have overflow and drain connections with isolation valves. Manhole covers (Metallic) shall be in bidder's scope.

2.1.43 Monitoring gadgets, instruments and equipment required for maintenance (till demonstration test & plant handover) are in bidder's scope.

2.1.44 Associated piping, instrumentation and valves required for the system are in bidder's scope.

2.1.45 All necessary instruments and controls required for easy and safe operation of the system are in bidder's scope.

2.1.46 Wherever terminal points between BHEL and bidder indicated, bidder shall provide pipes with counter flange.

2.1.47 All pipes, fittings etc. required for hand railing, platforms, and ladders shall be in the scope of bidder. All ladders shall be non-civil work. All insert plates, nuts and bolts, puddle pipes, counter flanges wherever applicable shall be in the scope of bidder. Supply and erection of Hand railing as desired for safety purpose will be in bidder's scope

2.1.48 All the sumps, tanks, reservoirs and other water retaining structures shall be provided by bidder with access ladders/rungs from operating platforms/ground level as the case may be and de-watering pits one for each section (civil work by BHEL).

2.1.49 Two sets of safety equipment each comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall also be provided by the bidder. Near chemical area, the bidder shall provide one nos. personnel drench safety shower and eye fountains.

2.1.50 Instrumentation, valves etc. indicated in P & ID of effluent treatment plant are bare minimum requirement; however, bidder has to provide complete system for trouble free operation meeting technical specification requirement.

2.1.51 Effluent lifting sumps, E1A, E1B, E1C, E2A, E2B, E3, E4, E5, E6, E7, E8, E9, E10, E11, E15 AND E16 shall be located outside ETP area. However, rest facilities indicated in P & ID of ETP shall be located inside ETP area provided in plot plan included in this specification.

2.1.52 All blank flanges/counter flanges, isolations valves, tees etc. to interconnect the pipes at all terminal points.

2.1.53 Mandatory spares as per list attached in ANNEXURE V.

2.1.54 Special tools and tackles as required for the system.

2.1.55 All special tools necessary for proper maintenance or adjustment of the equipment packaged in permanent box. Finish paints for touch-up painting of equipment after erection at site in sealed container.

2.1.56 Supply of any tools/ supporting tools/ items / equipment required for Erection and Commissioning shall be bidder's scope. The shall remain the property of the BHEL/Customer after trial test/demonstration test/ PG test.

2.1.57 Start-up, erection and commissioning spares as required.

2.1.58 All the first fill and one Year's topping requirements of consumable such as greases, oil, lubricants, servo fluids/control fluids, gases and etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be furnished by the bidder. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.

2.1.59 One (1) Electric hoist of capacity of 1 ton to be installed in Chemical shed.

2.1.60 Chain pulley block as per specification requirement.

2.1.61 Paint required for One coat of Finish paints for painting of equipment after erection at site.

2.1.62 One (1) no. Chain Pulley Block of one (1) ton capacity with tripod arrangement of adequate capacity, to meet the erection and maintenance requirements shall be provided by bidder.

2.1.63 The scope of Bidder shall also include to provide tool & tackles required for erection and commissioning of any item/ equipment along with main supply of those of item/ equipment with proper marking.

2.1.64 **PIPING**

a. Complete piping indicated in P & ID of Effluent treatment plant is in bidder's scope of supply and erection. In addition, any additional piping required to make the system complete inside ETP area shall be in bidder's scope. Pipe length inside ETP area has to be considered by bidder in their scope suitably.

b. Pipe distances from sumps outside ETP area up to inside ETP area and inside ETP area to respective location have been listed below. Bidder to note that no commercial settlement / adjustment shall be entertained for variation upto +/- 10% of pipe lengths during detailed engineering.

S. No.	Piping From	Piping To	Distance to be considered in Bidder's

			scope for supply (in Meters)
1.	Transformer Yard Oily Waste Sump Unit-2	Node 1 (As indicated in P&ID)	234
2.	Transformer Yard Oily Waste Sump Unit-1	Node 1 (As indicated in P&ID)	50
3.	Node 1 (As indicated in P&ID)	ETP AREA	869
4.	Fuel Oil Handling Area Oily Waste Sump	ETP AREA	852
5.	TG Unit-2B Floor Wash Water Sump	Node 2 (As indicated in P&ID)	124
6.	Node 2 (As indicated in P&ID)	ETP AREA	1122
7.	TG Unit-2A Floor Wash Water Sump	Node 2 (As indicated in P&ID)	49
8.	TG Unit-1B Floor Wash Water Sump	Node 3 (As indicated in P&ID)	53
9.	TG Unit-1A Floor Wash Water Sump	Node 4 (As indicated in P&ID)	49
10.	MRS Waste Water Sump Unit-2	Node 5 (As indicated in P&ID)	197
11.	MRS Waste Water Sump Unit-1	Node 5 (As indicated in P&ID)	38
12.	Node 5 (As indicated in P&ID)	TP-3 / CHP Area	148
13.	ESP Unit-2 Floor Wash Water Sump	Node 6 (As indicated in P&ID)	93
14.	ESP Unit-1 Floor Wash Water Sump	Node 6 (As indicated in P&ID)	52
15.	Node 6 (As indicated in P&ID)	Ash Slurry Sump	346
16.	SG Unit-2 Floor Wash Water Sump	Node 7 (As indicated in P&ID)	83
17.	SG Unit-1 Floor Wash Water Sump	Ash Slurry Sump	489
18.	Sludge Sump	PT Plant Sludge Sump	390
19.	Central Monitoring Basin (CMB) in ETP Area	Ash Handling Plant	1432
20.	Central Monitoring Basin (CMB) in ETP Area	Future Use	10
21.	Central Monitoring Basin (CMB) in ETP Area	Service Water Pump House	329
22.	Switch Yard Area	Transformer Yard Oily Waste Sump Unit-1	559
23.	CPU backwash Filter Piping from Unit-2	DM Plant N-Pit	375
24.	CPU backwash Filter Piping from Unit-1	CPU backwash Filter Piping from Unit-2 header	40

c. Distances given are from one area to other area only, however inside piping in respective area shall be in bidder's scope which has to be suitably consider by bidder as additional.

2.1.65 Isolation gates as per P & ID enclosed.

2.1.66 Bidder to adhere Format of operation and maintenance manual requirement as per Annexure VIII during detailed engineering.

2.1.67 Bidder to adhere packaging requirements as per Annexure VII during detailed engineering.

2.1.68 Bidder to refer Plot plan as per Annexure IX. Location of effluent sumps is located in plot plan along with tentative routing for bidder's information.

2.1.69 Bidder to refer Annexure III for Functional / performance / demonstration guarantee requirements.

2.1.70 Bidder to refer Annexure VI for water analysis.

2.1.71 Sumps E1A, E1B, E1C, E2A, E2B, E3, E4, E5, E6, E7, E8, E9, E10, E11, E12, E13 E14, E15 AND E16 (RCC work by BHEL) along with piping, valves, fittings, instrumentation and associated accessories.

2.1.72 Bidder to refer datasheet A for technical requirements.

2.2 SCOPE OF SUPPLY (ELECTRICAL)

Complete electrical as per specification / details indicated in Sub Sections IB and IIB.

2.3 SCOPE OF SUPPLY (C&I)

Complete C&I as per specification / details indicated in Sub Sections IC and IIC.

2.4 SCOPE OF SUPPLY (CIVIL)

Total Civil (Design and Construction) is in BHEL Scope of work, however Civil Input drawing shall be provided by bidder.

3.0 SCOPE OF SERVICE

The bidder's scope also includes following services for scope under this specification:

a. Bidder shall ensure to supply all foundation bolts timely so as to facilitate placement of these bolts while casting the foundation. Wrapping, coating and protection of all the buried pipe shall be as per IS 10221.
b. Supervision of Erection and Commissioning of entire Effluent Treatment Plant.
   - The duration of supervision shall be ninety (90) man-days in multiple visits (each visit shall be of minimum of ten (10) working days) with prior intimation by BHEL-Region. The Ninety (90) man-days are to be considered as (90) working days at site excluding the travel time. The supervision charges shall be inclusive of charges of Air-Fair/Rail-Fair, Boarding & Lodging, Local conveyance, medical, insurance, visa (as applicable), etc.
   - Bidder to ensure that the erection and commissioning work meets the technical specification requirement which are necessary to meet the performance guarantee of complete Effluent Treatment Plant.
   - The scope of Bidder shall include to carry out trouble shooting during supervision of erection and commissioning and intimate any minor modification in erection drawings/sequence/ procedure to BHEL.
   - The scope of Bidder shall include to carry out trouble shooting during trial test/ demonstration test/ functional performance guarantee test and to implement the same to meet the performance guarantee of complete Effluent Treatment Plant.
   - Before erection and commissioning, Bidder shall visit site for checking and ensuring Civil Front correctness and readiness for erection and commissioning. In case of any discrepancy find out, Bidder shall intimate to BHEL and propose any minor modification in erection drawings/sequence/ procedure.
c. Conductance of trial test/ demonstration test/ functional performance guarantee test of Effluent Treatment Plant.
d. Arrangement of all lubricants, instruments, reagents for carrying out trial run, commissioning and demonstration test.
e. All personnel (experienced & competent) required during supervision of erection and commissioning, trial run and demonstration Test/ Functional test/ PG test.
f. Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.
g. All other facilities/ services as described in section on site services in specification and related to Effluent Treatment Plant scope of work.
h. Relevant requirements as per GTR, GCC, ECC & SCC.
i. Painting as per enclosed painting schedule ANNEXURE X. However, any variation in the painting schedule as finally approved by customer / BHEL shall be taken care by bidder without any commercial and delivery implication. Color-coding scheme shall be intimated to vendor during detailed engineering.
j. Bidder to attend regular engineering meeting with BHEL and Customer fortnightly in BHEL or Customer office as decided during detail engineering. Vendor will depute his entire concerned engineering representatives along with the project manager for discussion and approval of engineering drawings/ documents during detailed engineering to meet project's various milestones and completion schedule, without any price implication to BHEL and Customer. Meeting can be held at site also.
k. Training of customer/ client O&M staff
   Training requirement of customer/ client O&M staff is also in Bidder's scope. Man-days and schedule of training for customer/client O&M staff listed below. The training charges shall be inclusive of charges of Air-Fair/Rail-Fair, Boarding & Lodging, Local conveyance, medical, insurance, visa (as applicable), etc.

Engineering				
Topics Covered	**Venue/Through On Line VC**	**Batch Size**	**Duration (Days)**	**Man days Covered**
Zero Liquid Discharge (ZLD): System Design - Plant water optimization and Scheme to achieve the ZLD - Basic design features - Latest technological trends for ZLD in Thermal Power Plant	BHEL-PEM/ Respective Vendor's Work/ Talcher Site	2	1	2

Erection & Commissioning				
Topics Covered	**Venue/Through On Line VC**	**Batch Size**	**Duration (Days)**	**Man days Covered**
Plant Visit - Operational feedback	Respective Vendor's Work/ Talcher Site	1	1	1

O&M				
Topics Covered	**Venue/Through On Line VC**	**Batch Size**	**Duration (Days)**	**Man days Covered**
O&M history/problems related to plant	Respective Vendor's Work/ Talcher Site	2	1	2

4.0 TERMINAL POINTS

a. Service water line (50 NB) will be provided by BHEL at 5 m distance from ETP area. Further distribution inside ETP area will be in bidder's scope. Bidder to note that pressure available at terminal point for service water will be 2 kg/cm2 approx. (max.); hence bidder will take care for their pump lubrication / cooling accordingly.
b. Instrument air pipe (25 NB) will be provided by BHEL at 5 m distance from ETP area. Further distribution inside ETP area will be in bidder's scope.
c. Service air pipe (25 NB) will be provided by BHEL at 5 m distance from ETP area. Further distribution inside ETP area will be in bidder's scope.
d. Cooling Tower blow down (300NB) shall be terminated by BHEL at 5 m distance from ETP area. Further piping to Central Monitoring Basin shall be in bidder's scope.
e. Potable Water line (25 NB) will be provided by BHEL at 5 m distance from ETP area. Further distribution inside ETP area will be in bidder's scope.
f. Switchyard Waste transfer line (65 NB) shall be provided by BHEL at 5m distance from Switchyard Oily Waste Transfer Pumps. Further piping to Transformer Yard Oily Waste Sump Unit-1 shall be under bidder's scope.

5.0 EXCLUSIONS

5.1 All civil works including foundation of equipment, excavation & back filling.
5.2 Main pipe trestles.
5.3 Air conditioning, ventilation & firefighting facilities.
5.4 Other exclusions are mentioned in the electrical & C&I parts of this specification.
5.5 Service water, Potable Water, Instrument air, Service air up to terminal points.
5.6 Alum and lime Chemicals.
5.7 Monorail beams for electric hoists.
5.8 Erection & commissioning.

6.0 QP AND SUBVENDOR APPROVAL:

6.1 Minimum QP requirements are specified as Annexure I. However, any additional comments as given by BHEL/Customer shall be adhered by the bidder without any commercial & delivery implication to BHEL.
6.2 The sub vendor list (Annexure- II) enclosed is indicative only and is subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.
6.3 Bidder to propose sub vendor list with back up documents after placement of LOI/LOA. Thereafter no request for additional sub-vendor shall be entertained. The sub vendor list shall subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.
6.4 Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them.

7.0 DESIGN/ CONSTRUCTION REQUIREMENTS

In addition to the requirements of Section I and II the following shall also be complied under scope of this specification. The P&I diagram is enclosed in Annexure IX in this section for bidder's compliance.

The material of construction specified in Data Sheet-A are minimum requirements and material of construction for other components not specified shall be similarly selected by the bidder for intended duty which shall be subject to BHEL / Customer approval during detail engineering without any commercial & delivery implication to BHEL.

7.1 Concrete sewerage pipe/ hume pipe shall not be used for any of the drain disposal system. Cast Iron pipes shall be used for drain disposal system.
7.2 Minimum thickness of 6 mm shall be provided for Atmospheric Tanks and Pressure Vessels.
7.3 For all pumps, while calculating the pump head, 10% margin shall be considered on friction losses.
7.4 The overflow & drains from the various chemical tanks and floor wash drains shall be led to the sludge sump.
7.5 Hydraulics of the Effluent Treatment Plant shall be such as to take an occasional overloading of 20% of the design flow rate.
7.6 Maximum operating speed of all the pumps and blowers shall be limited to 1500 rpm or less unless specified otherwise
7.7 All the tanks shall be provided with vent, overflow, drain and sample connections. Effective capacity for chemical tanks & water retaining structures/ tanks/sumps means the capacity between the bottoms of the overflow nozzle to the top of the outlet nozzle. Outlet nozzle center line shall be kept at least 200 mm from the Invert Level of the Chemical tanks /Water retaining structures /Tanks/Sumps. A minimum free board of 300 mm shall be provided in all the water retaining structures of Effluent treatment plant above the maximum water level at design flow condition/overflow level.
7.8 Depth of ETP sump may vary from 2 to 4 meters.
7.9 Span for Max. support length for MS/CS pipes shall be as per ANSI B31.1.
7.10 Cranes and Hoist should be sized to handle heaviest component to be handled with 25% margin (with minimum capacity if specifically indicated elsewhere for any system/equipment) and should comply to IS:3177/ IS:3938 (as applicable).
7.11 Unless specifically mentioned, design criteria of piping, valves, rubber expansion, should be as per sub section LP Piping.
7.12 Painting requirement shall be as per Painting Specification unless otherwise specified.

7.13 **TUBE SETTLERS/ LAMELLA CLARIFIERS**

a. The tube settler/Lamella Clarifier (counter flow or cross flow type) with flash mixer and Flocculation Chamber at its upstream (all RCC), with minimum 1-minute storage for flash mixer and 10-minute storage for flocculation chamber at the design flow rate. Design of the sludge removal system should be such as to reduce loss of water during sludge blow off within 5% of rated flow. Design flow velocity shall be not more than 5 m3/hr/m2. Minimum side water depth of the unit is 4 M.
b. The cross-sectional area of each tube shall be such that the effective hydraulic diameter is 60 mm (min). The material of tube pack shall be UV inhibited virgin PVC. In case of plate type separator, the plates shall be made of GRP (glass reinforced plastic). The resin for the manufacturing of GRP plates shall be orthophthallic type.
c. The length of the tubes/plates through which the water flow shall not be less than 1.5 m, the tubes/plates shall be inclined by 50-80 deg. angle to the horizontal.
d. Sludge removal system shall be designed to thicken the sludge to minimum 2% consistency before disposing from separator bottom, angle of inclination of sludge hopper shall be minimum 55o to horizontal plane.
e. Walkway (bridge) and platform to approach all the internals shall be provided. Clear width of the bridge shall not be less than 1200 mm. Suitable walkway around periphery of tube settler/clarifier with hand-railing, access ladder with platform, hand railing to be provided. Suitable water jet arrangement shall be provided. All the pipelines carrying the sludge shall be provided with flushing connection. Separate pumps and piping shall be provided.
f. Suitable Sampling connections shall be provided by bidder for performance monitoring.
g. Tube Settler/Lamella Clarifier shall be of double hopper type as indicated in P&ID.

7.14 **ATMOSPHERIC TANKS/ PRESSURE VESSELS**

a. Design of all pressure vessels shall conform to ASME Section VIII or acceptable equivalent standard. Design pressure shall be the maximum expected pressure to which the vessels may be subjected to plus 5% additional margin. Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shutoff head of the pumps plus static head at pumps suction if any. For all other pressure vessels, design pressure shall be at least 8 Kg/cm² (g).
b. Design of all vertical cylindrical atmospheric storage tanks containing water, acid, alkali, and other chemicals shall conform to IS: 803.
c. Design of all horizontal cylindrical atmospheric storage tank containing water, acid, alkali, and other chemicals shall conform to BS: 2594.
d. Design temperature of all pressure vessels and storage tanks shall be 10 deg. C higher than the maximum temperature that any part of the vessel/tank is likely to attain during operation. In case, tank is subjected to vacuum, the same shall be taken care in designing the tank.
e. The design of DM water storage tanks (Vertical type) shall conform to IS: 803. Supporting frame where required shall be in accordance with IS: 800. The tank shall be "Non-pressure" fixed roof type with atmospheric vents.
f. All vessels/tanks without inside rubber lining shall have a corrosion allowance of minimum 2 mm and mill allowance (minimum 0.3 mm) for shell and dished ends. Thinning allowance of 2 mm (minimum) shall be considered for dished end.
g. All the atmospheric tanks shall have sufficient free board above the “Level High”/ “Normal Level” as the case may be. The overflow level shall be kept at least 20 cm or 10% of vessel height above the “Level High”/” Normal Level” for all the tanks except for the DM tanks for which a minimum height of 300 mm shall be provided over the “High Level”. Further, a minimum 100 mm free board shall be provided above the top of overflow level to the bottom of roof of the tank. Wall thickness of atmospheric tanks shall not be less than 6 mm.
h. Vessels coming under preview of IBR shall be designed accordingly.
i. Material of Construction

i) The pressure vessels shall be fabricated from carbon steel plates conforms to SA 515 Gr.70 or SA 516 Gr. 70 if the pressure vessels are designed as per ASME Section VIII.

ii) If the pressure vessels are designed as per IS 2825 following criterion shall be followed: The pressure vessels shall be fabricated of steel as per IS: 2002 Gr. 3 (normalized condition) or SA: 515/516 Gr. 70 (normalized), in case the vessels are designed as per Class 1 or Class 2 of IS: 2825. If the pressure vessels are designed as per Class 3 of IS: 2825, the material of construction shall conform to IS: 2062 or IS: 2002 Gr. 3 (Normalized quality).or SA 515 /516 Gr. 70

iii) All atmospheric tanks shall be fabricated of steel conforming to IS: 2062.

iv) The pipe flanges, manhole/manhole covers reinforcement pads etc. shall be fabricated out of the same material as that one used for the vessel/tank.

j. Fabrication

a) The vessel ends for storage tanks of vertical type shall have flat bottom. However, the ends of horizontal storage tanks, and all the pressure vessels shall be dished design of Torispherial type designed and constructed by forging, pressing or spinning. The dished ends shall have a minimum straight flange length of 60 mm. Conical or flat (with or without reinforcement) ends shall not be accepted.

b) The plates to be used for fabrication shall preferably have a minimum width of 1500 mm. All welding shall be performed by ASME qualified welders under Section-IX of ASME Boiler and Pressure Vessel code and welding electrodes shall be as per relevant Codes/Standards viz. AISC Section 1.17 etc.

c) All pressure vessels and storage tanks except DM water storage tanks, UF, RO Permeate water tanks shall be fabricated complete and tested at manufacturer's works to ensure better workmanship.

k. Appurtances, Connections, Lifting lugs

a) Manholes/Hand Holes: All the pressure vessels and horizontal type storage tanks shall be provided with at least one manhole of 500 mm diameter. The vertical type storage tanks shall be provided with a manhole of 500 mm dia on the top cover, if the diameter of the tank is 1200 mm or more. For the vertical cylindrical atmospheric tanks, manholes shall be provided as per IS: 803.

b) All the vessels and tanks shall be normally provided with a hand hole of 150 mm gasketed located near the bottom of the straight side.

c) All lined vessels connections shall be conformed to required class/rating. Nozzle material shall be ASTM-106 Grade B, Schedule 80.

d) All vessels of internal, diameter of 1200 mm or greater shall be provided with minimum four (4) lifting lugs for safe and effective handling during erection. Smaller vessels shall be provided with at least two (2) lifting lugs. Material of construction for these vessel supports, saddles, lugs shall conform to IS: 2062 of tested quality.

8.0 INFLUENT QUALITY AND OUTLET GUARANTEE PARAMETERS

8.1 **INFLUENT QUALITY PARAMETERS**

a. TSS IN LAMELLA CLARIFIER / TUBE SETTLER: 500 PPM
b. FREE OIL & FLOATING OIL IN WASTE SERVICE WATER SUMP (WSWS): 50 PPM

8.2 OUTLET QUALITY PARAMETERS

a. TSS AT LAMELLA CLARIFIER / TUBE SETTLER OUTLET: AS PER ANNEXURE III
b. OIL QUANTITY AT LAMELLA CLARIFIER / TUBE SETTLER OUTLET: AS PER ANNEXURE III

9.0 PAINTING

Painting schedule shall be prepared in line with the details indicated in Annexure V/ Sub Section IA of technical specification. However, any additional comments as given by BHEL/Customer shall be adhered by the bidder without any commercial & delivery implication to BHEL.

Internal painting of the equipment shall be suitable for withstanding effect of fluid being handled. Outer painting shall be as per technical specifications. Supporting documents shall be furnished in support of suitability of the lining offered for the duty conditions by bidder during detailed engineering.

Bidder to note that painting shall be as per approved painting schedule to be finalized during detailed engineering.

10.0 DRAWING/ DOCUMENTS REQUIREMENT

10.1 For the Drawings/Documents distribution Procedure, please refer attached Annexure-IV/ Sub Section IA. Bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. The numbers of soft copies & hard copies of drawing/documents to be submitted by the bidder shall be as per enclosed Annexure-IV/ Sub Section IA.

10.2 After award of LOI/LOA, drawing/documents to be submitted by the bidder for BHEL/Customer approval has been indicated in Annexure IV/ Sub Section IA. However, any additional drawing/document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial & delivery implication to BHEL.

10.3 Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web-based Document Management System in addition to hard copies to be submitted as per the Annexure IV/ Sub Section IA of this specification. Bidder would be provided access to the DMS for drg./doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end:

- Internet explorer version – minimum Internet Explorer 7.
- Internet speed – 2 mbps (Minimum preferred).
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked.
- Vendor's internal proxy setting should not block DMS application's link. (http://124.124.36.198/wrenchwebaccess/login.aspx)
- DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.
- For quick access bidder may refer the link http://bhelpem.com/DMSManuals/DMSManuals.html

10.4 Bidder shall provide Erection manuals of each equipment/ item, isometric drawings for piping, Interconnecting Equipment erection drawings, Procedure for Sequence of Erection, Preservation guidelines for each equipment/ item, Commissioning procedure, Checklist for Erection and Commissioning,

11.0 SPARES

The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares as indicated in the relevant sections of specifications. The general requirements pertaining to the supply of these spares is given below: -

11.1 MANDATORY SPARES

a. The list of mandatory spares which is to be considered by bidder in their scope are indicated in Annexure V.
b. All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipment.
c. Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.
d. Inspection of mandatory spares shall be in line with the approved quality plans for the respective items/equipment. The inspection categorization of mandatory spares shall also be in line with the approved Categorization plan for the respective items/equipment.
e. All spares supplied under this contract shall be strictly inter changeable with the parts for which they are intended for replacements. 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 with desecrator packs as necessary.
f. All the spares (mandatory) shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.

11.2 START-UP & COMMISSIONING SPARES

a. Start-up and commissioning spares are those spares which are required during the start-up and commissioning of the equipment/system. All spares used till the plant is handed over to the BHEL/Customer shall come under this category. The Bidder shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipment are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up and commissioning spares which remain unused at the time shall remain the property of the BHEL/Customer.
b. The Bidder shall indicate the service expectancy period for the spares under normal operating conditions before replacement is necessary.

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

d. All cases, containers or other packages are to be opened for such examination as may be considered necessary by BHEL / Customer.

e. The Bidder will provide the BHEL/Customer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/components/equipment covered under the contract and will further ensure with his vendors that the BHEL/Customer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.

f. The Bidder shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship.

g. The bidder to provide datasheets/assembly drawings of the manufacturer/ any other relevant document showing Bill of Material(s), Make, Model Number, Part Number etc. through which the mandatory spares to be supplied can be uniquely identified.

Any other documents submitted by bidder except as asked in the bid's specification shall not be evaluated & considered as null & void.

12.0 ADDITIONAL REQUIREMENT

I. Lamella clarifier dosing system shall be located in side industrial shed. Rest all equipment / facilities shall be located outside open to sky. Chemical storage for lime and alum shall be located in side industrial shed adjacent to control room for 15 days regular operation.

II. Control room and MCC room shall be located inside single story RCC building.

III. Analysers shall be kept in EQMS room.

IV. Bidder to submit BBU during detailed engineering after approval of basic documents. BBU shall be equal to BOQ for the package and there shall be no price and delivery implication is applicable to BHEL/ customer for the same. None of the items supplied for the project as non-billable. Incomplete BBU shall not be reviewed by BHEL.

The Break-up (%) of Supply prices of EFFLUENT TREATMENT PLANT in the BBU shall be in line with the details provided below:

Break-up (%) of Supply prices of Effluent Treatment Plant. (To be used during contract execution for payment).	
Lump sum firm price for supply of Valves inclusive of all taxes, duties and other levies as applicable.	8% of Total supply price of Effluent Treatment Plant
Lump sum firm price for supply of Instruments & Analysers inclusive of all taxes, duties and other levies as applicable.	25% of Total supply price of Effluent Treatment Plant
Lump sum firm price for supply of Pumps with motors & blowers with motors, inclusive of all taxes, duties and other levies as applicable.	15% of Total supply price of Effluent Treatment Plant
Lump sum firm price for supply of Agitators, Sluice gates, Centrifuge & Oil skimmer with respective motor and accessories, inclusive of all taxes, duties and other levies as applicable.	10% of Total supply price of Effluent Treatment Plant
Lump sum firm price for supply of Piping & Fittings inclusive of all taxes, duties and other levies as applicable.	30% of Total supply price of Effluent Treatment Plant
Lump sum firm price for supply of Balance items inclusive of all taxes, duties and other levies as applicable.	12% of Total supply price of Effluent Treatment Plant

V. All interconnecting piping, valves, fittings including dosing piping, drain piping from chemical storage dyke to nearby drain through lime pit provided in the dyke area, flushing lines from nearest available water source, valves, fittings and accessories is also in bidder's scope.

VI. All the vertical pumps shall be self-lubricating type.

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

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

IX. KKS numbering if required, as per BHEL/Customer requirement shall be provided by the Bidder during detailed engineering stage without any commercial/delivery implication to BHEL.

X. Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the works 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.

XI. Buried piping shall be protected as under (as per IS-10221).

- Surface cleaning by wire brush, power tool cleaning etc.
- Apply one coat of coaltar/primer/enamel.
- Apply one layer of tape comprising of coaltar. Application of tape shall conform to AWWA C- 203/IS 10221 (Appendix-B) with Minimum thickness of tape as 4MM +10%

XII. All drawings/documents shall be approved by BHEL/Customer during detailed engineering stage. Successful Bidder shall comply with the comment of the customer/BHEL without price & delivery implication.

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

XIV. Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads.

XV. Wherever CIVIL works is excluded from the bidder's scope, successful bidder shall furnish civil assignment / scope drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by bidder, BHEL reserves the right to debit cost of such rework to bidder.

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

XVII. Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t. existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.

XVIII. While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under SECTION -III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of BHEL/ 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 BHEL/ Customer as and when brought to their notice either by the bidder or by BHEL/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication to BHEL / Customer.

XIX. The bidder 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 them of the responsibility of providing such facilities to complete the supply, supervision of erection and commissioning of Effluent Treatment system within quoted price.

XX. 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.

XXI. The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.

XXII. BHEL's/Customer's representative shall be given full access to the shop in which the equipment is being manufactured or tested and all test records shall be made available to him.

XXIII. Wherever local instruments for measurement of Flow, Pressure, Level is indicated in the P&ID, Bidder to provide Diaphragm seal type instrument for Chemical (all type and concentration), corrosive, viscous fluids application.

XXIV. Charging platform for all the chemical tanks along with required handrails, accessories etc. Permanent ladder (not rungs) for approaching the top of tanks, valves for All steel inserts plates with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc as required to grout in civil works and to support/hold the equipment's for opening/maintenance purpose, shall be in bidder's scope.

XXV. Slings & Lifting lugs shall be provided in all equipment.

XXVI. Pump suction valves, re-circulation valves and discharge valves shall be provided with required limit switches for interlock & control.

XXVII. The starting of pumps (wherever applicable) which are provided with forced water lubrication shall be interlocked with the availability of lube water by means of starting of lubrication water pumps, availability of adequate flow, pressure etc. The standby lubrication pump shall be started automatically during inadequate pressure or while tripping of working pump(s).

XXVIII. Bidder to adhere Format of operation and maintenance manual requirement as per Annexure IX/ Sub Section IA during detailed engineering.

XXIX. Bidder to adhere packaging requirement as per Annexure VII/ Sub Section IA during detailed engineering.

XXX. Bidder to adhere site General technical requirement as per Annexure XI/ Sub Section IA during detailed engineering.

XXXI. Bidder to adhere Annexure VIII, XII and XIV of Sub Section IA.

XXXII. Bidder to refer Plot plan attached in Annexure XII/ Sub Section IA. Location of effluent collection sumps located outside respective area have been also located with tentative routing for bidder's information.

XXXIII. Deviations along with cost of withdrawal (positive or negative), if any, should be very clearly brought out clause by clause in the enclosed schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with tender specification & there is no deviation. (Price to be given in sealed envelope only.)

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

XXXV. The equipment covered under this specification shall not dispatch unless the same have been finally inspected, accepted and shipping release issue by BHEL/Customer.

13.0 GENERAL TECHNICAL INSTRUCTIONS

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

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

III. 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.

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

14.0 PLANT OPERATION AND CONTROL

Effluent Treatment Plant, shall be controlled and operated from DDCMIS (BHEL Scope) based control system.

The control philosophy of various systems is described below. However, for all the systems, following basic process related interlocks, alarms/ pre-warning signals shall be implemented in the control system as per system requirement.

a) Among the equipment, it shall be possible to select a specific pump or tank or sump for working/standby/ maintenance etc. through control system.

b) Permissive & Interlocks:

(i) Starting & tripping of pumps with respect to liquid level in the respective sump/ tanks or liquid pressure in the suction lines.

(ii) Starting & tripping of agitators with respect to liquid level in the respective sump/tanks.

(iii) Starting & tripping of pumps (which are provided with forced water lubrication) with respect to lubricating water flow (through low pressure/ low flow signal as the case may be).

(iv) Tripping of pumps when the discharge pressure is very high to avoid operation of the pump under shutoff head.

(v) Stopping/ tripping of equipment due to abnormal parameters related to safety of equipment like high vibration, very high bearing lubrication water (and /or oil) temperature to the drive/pumps, very high bearing temperature of the of pump/drive etc. as applicable based on the recommendations of Equipment Supplier.

(vi) Automatic opening of the re-circulation valve to pre-set percentage, in case of failure of opening of pump(s) discharge valve to ensure minimum flow through the pump, as per the recommendation of manufacturer.

(vii) Automatic starting of standby pumps upon failure of starting of selected pump or tripping of running pump as the case may be.

(viii) Capacity of the metering pump shall be controllable from 10-100% continuously by adjusting the stroke length manually by a micro meter dial calibrated for 0–100% of pump capacity integral with the pump.

(ix) Various annunciations related to low level of the chemical tanks & sumps shall be provided.

(x) Alarms/ signals

(xi) Abnormal parameters such as low & high level in tanks/sumps, high pressure at pump discharge, low header pressure, low lubrication water flow to pumps (provided with forced water lubrication system) etc.

(xii) Failure of starting of equipment such as pumps, blowers etc. upon start command.

(xiii) Tripping of equipment due to protection logic.

In addition, the control system shall facilitate the operator to know the status of various equipment (Whether equipment is running or stopped or tripped etc., whether the equipment is selected for operation/ standby duty /maintenance mode etc. as the case may be).

15.0 PAINTING

(Bidder to also refer “Painting Schedule” in Annexure-X & Section IIA)

a) All the equipment such as pumps, piping etc of this system shall be protected against external corrosion by providing suitable painting as mentioned below.

b) All the metallic parts of equipment of Effluent treatment plant (ETP) which are embedded in concrete or in contact with water shall be painted with three coats of bitumastic heavy duty paint over a coat of primer to prevent corrosion unless otherwise specified and total thickness shall be 400 microns

c) All the other parts of the ETP shall be painted with one coat of primer and three coats of chlorinated rubber paint and total thickness shall be 200 microns. The concrete parts encountering water shall be painted with three (3) coats of bitumastic heavy-duty paint of 400 microns thick.

d) Painting of vessels, tanks & piping shall be as specified elsewhere.

e) The surfaces of stainless steel, Galvanised steel, Gunmetal, Brass, Bronze and non-metallic components shall not be applied with any painting.

f) The steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shot blasting etc. as per the agreed procedure.

ANNEXURE I

QUALITY PLAN

CLAUSE NO — QUALITY ASSURANCE

Items / Components \ Test/Check	Material Test	WPS/PQR/Welder	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic test / Pneumatic test / Vacuum test	Performance Test	Test as per relevant Std / Appd. Data Sheets	Other Tests	Remarks
COMMON ITEMS:											
1. Horizontal Centrifugal Pumps				Y	Y			Y^1	Y		
1.1. Casing	Y^a		Y^b		Y		Y				
1.2. Impeller	Y^a		Y^b		Y					Y^d	
1.3. Shaft	Y^a		Y		Y					Y^c	
2. Vertical Pumps				Y	Y			Y^1	Y		
2.1. Casing	Y^a		Y^b		Y		Y				
2.2. Impeller	Y^a		Y^b		Y					Y^d	
2.3. Shaft	Y^a		Y		Y					Y^c	
2.4. Fabricated Parts	Y^a	Y	Y^b		Y	Y^2	Y				
3. Dosing/ Metering Pumps	Y^a				Y		Y	Y^1	Y		
4. Gate/ Globe/ Check Valves	Y^a		Y^b		Y		Y	Y	Y	Y^3, Y^6	
5. Dual Plate Check Valves	Y^a		Y^b		Y		Y	Y	Y	Y^6, Y^{12}	
6. Diaphragm Valves	Y^a				Y		Y		Y	Y^4, Y^3	
7. Butterfly Valves (Low Pr.)				Y	Y		Y	Y	Y	Y^3	
7.1 Body & Disc (Cast	Y^a		Y^b		Y						
7.2 Body and Disc (Fabricated)	Y^a	Y	Y^b		Y				Y	Y^2	
7.3 Shaft	Y^a		Y^b		Y					Y^c	
8. Plug/ Ball Valves (Low Pr.)	Y^a		Y^b	Y	Y		Y	Y	Y	Y^3	

LEGENDS: Applicable tests are identified by 'Y'.

Y^a : One per Heat / Heat Treatment batch / Lot.

Y^b : On machined surfaces only. Also 100% on Butt Welds & 10% on Fillet Welds.

Y^c : UT shall be done for shafts with Dia 50 mm or above & Plates of Thickness 25 mm or above.

Y^d :Dynamic Balancing per IS: 21940, Grade 6.3 minimum shall be conducted for rotating assy.

Y^1 : As per Pump governing standard. Tolerences as per HIS, USA.

Y^2 : Random 10% RT to be conducted on butt welds for Thk $\geq$10 mm.

Y^3 : Seat Leakage Test for actuator operated valves shall be done by operating the valve with job actuator.

Y^4 : Tests on Rubber Diaphragms shall be conducted per batch of Rubber mix for Tensile, Elongation, Hardness, Thickness, Bleed Resistance. In addition, Type Test for 50,000 cycles for each type of diaphragm shall also be conducted.

Y^6 : Blue Matching, Wear Travel for Gate Valves and reduced pressure test

CLAUSE NO — QUALITY ASSURANCE

Items / Components \ Test/Check	Material Test	WPS/PQR/Welder	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic test / Pneumatic test / Vacuum test	Performance Test	Test as per relevant Std / Appd. Data Sheets	Other Tests	Remarks
9. Blowers/ Compressors	Y[a]		Y[b]	Y	Y			Y	Y	Y[c], Y[d]	
10. Tanks/ Pressure Vessels	Y[a]	Y	Y[b]	Y	Y	Y[8]	Y		Y	Y[7]	
11. Rubber Lining	Y[a]				Y				Y	Y[9]	
12. Strainers	Y[a]	Y	Y[b]	Y	Y		Y		Y		
13. Pipe & Pipe Fittings	Y[a]	Y	Y		Y	Y[8]	Y		Y		
14. Agitators /Flash Mixer/ Flocculator	Y[a]	Y	Y[b]	Y	Y			Y		Y[10]	
15. Ventilation/Exhaust Fan	Y[a]		Y[b]	Y	Y			Y[11]	Y	Y[c], Y[d]	
16. Hoists & Cranes	Y[a]	Y	Y[b]	Y	Y	Y[8]		Y	Y		
17. Wrapping & Coatig Material	Y				Y				Y		
18. Package/ Split AC	Y							Y	Y	Y[14]	
PT & LET PLANT:											
1. Clariflocculator / Reactor Clarifier / Plate or Tube Settler	Y[a]	Y	Y[b]	Y	Y				Y	Y[10]	

for check valves shall be conducted as per relevant standards.

Y[7] : Heat Treatment of the Tank/Vessel shall be done per fabrication code requirement. Welded dished ends shall be stress relieved. Dished ends manufactured by cold working shall also be stress relieved as per the requirement of code.

Y[8] : RT as per fabrication code requirements. However, dished ends welds, if manufactured by using welded plates shall be subjected to 100% RT.

Y[9] : Rubber Lining Mix shall be subjected to Bleed Resistance Test on mould sample. Adhesion Test, Spark Test and Hardness Test for the Rubber lined jobs shall also be conducted.

Y[10] : Gear Boxes shall be checked for smooth No Load Operation at shop to verify noise and vibration levels. Gear Ratio and Kerosene Leak Test shall also be conducted.

Y[11] : One Fan of each type & size shall be routine performance tested as per corresponding code for air flow, static pressure, total pressure, speed, efficiency, power consumption, noise & temperature rise. Also all Fans shall be subjected to run test of 4 hours during which noise, vibration, temperature rise and current drawn shall be measured.

Y[12] : Dry cycle test on valve spring for 1, 00,000 cycles shall be carried out as

CLAUSE NO — QUALITY ASSURANCE

Items / Components \ Test/Check	Material Test	WPS/PQR/Welder	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic test / Pneumatic test / Vacuum test	Performance Test	Test as per relevant Std / Appd. Data Sheets	Other Tests	Remarks
2. Pressure / Vacuum Relief valve / Pressure Regulating Valve	Y[a]			Y	Y		Y	Y	Y		type test, if not carried out earlier, for the similar MOC, size and type of spring. Y[13]: :Test as per approved supplier practice. Y[14] : Electronic leak test for condenser & evaporator unit. Note: 1.The complete Piping system along with valves & fittings shall be hydraulically tested at 1.5 times design pressure or 2 times working pressure whichever is higher after erection at site. 2. In case of items other than those identified above, the quality requirements shall be decided based on system design requirements.
DM PLANT											
1. Resins / Activated Carbon									Y		
2. Filter Membrane					Y				Y		
3. RO Pressure tube	Y[a]				Y		Y		Y		

Items / Components \ Tests/Check		Material Test	DPT/MPI	Ultrasonic test	RT	Balancing	Hydraulic / Water Fill test	Pneumatic Test	Assembly/ fit up	Dimensions	Functional/operational Test	Performance Test	Other Test	All Test as per relevant Std/ Approved Data Sheets	Remarks
A.	~~CW PUMPS~~, VT PUMPS & CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL), SUMP PUMPS, SUBMERSIBLE PUMPS, ~~DRAINAGE PUMP~~								Y[1]	Y		Y[2]			
1	Shaft	Y[a]	Y[b]	Y[c]		Y				Y					
2	Impeller	Y[a]	Y[b]		Y[3]	Y							Y[d]		
3	Suction Bell / Bowl Castings/ Inserts	Y[a]	Y[b]				Y			Y			Y[6]		
4	Discharge Head / Column Pipes / Distance Piece/Base Plate	Y[a]	Y[b]	Y[c]	Y[4]		Y		Y						
5	Companion Flanges	Y[a]	Y[b]	Y[c]	Y[5]				Y						
5	Thrust Bearing (Tilting Pad type)	Y[a]	Y	Y					Y	Y				Y	
B.	BUTTERFLY VALVES						Y[7]		Y	Y	Y		Y[8]	Y	
1	Body & Disc (Cast)	Y[a]	Y[b]												
2	Body & Disc (fabricated)	Y[a]	Y[b]	Y[c]									Y[9]		
3	Shaft	Y[a]	Y[b]	Y[c]											
4	EH Actuators	Y[a]	Y				Y	Y	Y		Y				
C.	RE JOINTS	Y[a]					Y[10]		Y	Y			Y[11]		
D.	R & W PIPES	Y[a]	REFER NOTE 13												
E.	CRANES & HOISTS	REFER RESPECTIVE QA CHAPTERFOR FOR CHECKS ON EOT CRANES AND HOISTS													

F.	**VENTILATION FANS**									Y		Y		Y	
1)	Hub/Blades/Casing /Impeller	Y	Y			Y									
2)	Shaft	Y[a]	Y	Y[c]											
3)	Pre/Fine Filters												Y[14]		
H.	**GATE, GLOBE, CHECK VALVES, PIPINGS, & SPECIALITIES**	Y[a]	Y[b]	Y[c]			Y[15]		Y	Y	Y	Y	Y[15]	Y	

Notes:

a	One per Heat/ Heat Treatment Batch/ Lot.
b	On machined surfaces only for Castings / Forgings and on Welds of Fabricated Components.
c	For Shaft diameter. ≥ 50 mm and for plate thickness ≥ 25 mm
d	Inter Grannular Corrosion (IGC) Test shall be carried out on SS Castings.
1	Trial assembly of all Vertical Turbine Pump components with Column Pipes, Discharge Head, and Motor Stool shall be carried at shop.
2	Performance testing of Pumps shall be carried out at shop, as per HIS standard to determine Head & Flow Characteristics.
3	In case of CW pump impellers, Radiographic Examination shall be conducted as per ASTM E186/446 with Severity Level 2 for Gas porosity, Level 3 for Sand, Slag and Shrinkage. Cracks, Inserts and Mottling are not acceptable. Radiographic Examination should cover Vanes, Vane Junctions, Full Radial depth of Hub & other accessible areas of the rest of the Impeller.
4	Random 10% RT to be conducted on butt welds for Thk ≥ 10 mm & ≤ 25 mm and 100% RT to be conducted on butt welds for Thk > 25 mm (RT may be replaced by Ultrasonic Test due to constraint if any.) Stress relieving shall be carried out as per norms of ASME Section VIII.
5	Segmental Flanges exceeding 37.5 mm thickness shall be stress relieved after welding. All butt weld joints in segmental flange shall be examined by Radiographic Test. (RT may be replaced by Ultrasonic Test due to constraint if any.) Maximum number of segments shall be 4 only.
6	No repair welding is permitted on Cast Iron / Alloy Cast Iron Castings.
7	Hydraulic Test of Body, Seat and Disc strength shall be carried out in accordance with latest edition of AWWA C-504. Actuator operated Valves shall be checked for Seat Leakage by closing the Valve with Job Actuator. Seat Leakage test shall be carried out in both directions.
8	For Proof of Design Test refer respective chapters of engineering portion in the technical specification.
9	For Butterfly Valves of Fabricated construction (Sizes 600mm and above), butt Welds of thickness 20mm & above shall be subjected to 100% Radiography and Components shall undergo stress relieving.

10	During Hydraulic & Vacuum test at 30 mm Hg absolute in 3 different positions, the change in Circumference of the Arch should not be more than 1.5%. Permanent Set, after 24 hours of the test, should not exceed 0.5% of Arch.	
11	Tests on Rubber for Tensile, Elongation, Hardness, Hydraulic Stability as per ASTM D-471, Ozone Resistance test as per IS:3400 Part 20, Aging test, Adhesion strength of Rubber to Fabric and Rubber to Metal shall be carried out.	
12	Smooth operation and Leakage test shall be carried out at site.	
13	Followings are the testing requirements for fabrication of pipes at site	
	Tests	**Quantum of Check**
	WPS, PQR, Welder Qualification Test	100%
	DPT on root run	100% for pipes up to 1200 mm diameter
	DPT after back gauging	100% for pipes above 1200 mm diameter
	RT/ UT by TOFD Technique/PAUT	5%
	DPT on finished butt weld joints	10%
	Hydraulic Test	100%, 1.5 times the design pressure or 2 times the working pressure which ever is higher.
	Note:- After erection, the complete piping system shall be tested at 1.5 times, the design pressure or two times the maximum working pressure whichever greater. No leakage/seepage is acceptable. Butt weld joints which would not be hydro-tested shall be subjected to 100% RT test/ 100% UT by TOFD /PAUT Technique.	
14	Type / Routine tests as per requirements of BS-6540/ ASHRAE-52-76 for Dust arrestance shall be carried out.	
15	a. All pipes and fittings shall be tested as per applicable code. b. All strainers shall be subjected to Hydraulic pressure test for leakage. c. All valves shall be hydraulically tested for body, seat and back-seat (if applicable) as per relevant standard. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure. d. Valves shall be offered for hydro test in unpainted condition. e. Functional checks of the valves for smooth opening and closing shall also be done. f. Anti-corrosive protection shall be tested as per applicable code.	

1) The above-mentioned requirement are bare minimum. However, any additional comments provided by BHEL / Customer shall be adhered by successful bidder without any commercial and delivery implication to BHEL/Customer.

QAP FOR LOW PRESSURE PIPING (LP PIPING)

PIPES, FITTINGS, BENDS, VALVES, COATING-WRAPPING, STRAINERS EXPANSION, JOINTS, TANKS, FASTENERS, LINING ETC.

	Tests/Check / Items / Components	Material Test	DPT/MPI / RT	Ultrasonic Test	WPS/ WQS/PQR	Hydraulic / Water Fill Test	Pneumatic Test	Assembly Fit up	Dimensions	Functional/operational Test	Other Tests	All Tests as per relevant Std	REMARKS
1	Pipes & Pipe Fittings	Y[a]	Y[b]			Y1			Y			Y	
2	Diaphragm Valves	Y[a]				Y[5]			Y		Y[6]		
3A	Cast Butterfly Valves (Low Pressure)					Y		Y	Y	Y	Y[7]		
	Body	Y[a]	Y[b]										
	Disc	Y[a]	Y[b]										
	Shaft	Y[a]	Y	Y[c]									
3B	Fabricated Butterfly Valves	REFER NOTE 14											
4	Gate/ Globe/Swing Check / Ball Valves	Y[a]	Y[b]	Y[c]		Y[5]	Y	Y	Y	Y	Y[8]		
5	Dual Plate Check Valves	Y[a]	Y[b]	Y[c]		Y	Y	Y	Y	Y	Y[4]		
6	Rolled & Welded Pipes and Mitre Bends	Y[a]	Y[3]		Y	Y[3]			Y		Y[3&15]	Y	
7	Coating & Wrapping of Pipes	Y[2]									Y[2]		
8	Tanks & Vessels	Y[a]	Y[b]		Y	Y			Y		Y[16]		
9	Strainers	Y[a]	Y[b]		Y #	Y					Y[11]		#For Fabricated Strainer
10	Rubber Expansion Joints	Y[a]				Y[12]		Y	Y		Y[13]		
11	Internal Lining of Pipes	Y[a]							Y		Y[9]		
12	Site Welding		Y[10]		Y	Y							

NOTES (MEANING OF SUPERSCRIPTS)

a	One per heat/heat treatment batch/lot.
b	On machined surfaces only for castings and on butt welds.
c	For shaft/spindles > or = 40 mm
1	100% Hydraulic test shall be carried out. Weld joints not subjected to hydraulic test due to some unavoidable reasons, shall be subjected to 100% RT/PAUT.
2	Spark Test, Adhesion Test and Material Test for primer and enameled & Coal Tar Tapes as per AWWA-C-203-91/ IS-10221 & IS 15337 as applicable.
3	Followings are the testing requirements for fabrication of pipes at site

TESTS	QUANTUM OF CHECKS
WPS, PQR, Welder Qualification Test	100% Welders and WPS shall be qualified as per ASME- section IX
DPT on root run	100% for pipes up to 1200 mm diameter
DPT after back gauging	100% for pipes above 1200 mm diameter
RT / UT by (TOFD/PAUT) Technique	5% (100% of T Joints)
DPT on finished butt weld joints	10%

	Hydraulic Test	100%, 1.5 times the design pressure or 2 times the working-pressure whichever is higher.
4	Dry Cycle Test on Dual Plate Check valve spring for one lakh Cycles shall be carried out as a type test. If Dry Cycle test carried out earlier for same material & diameter, Test report shall be reviewed.	
5	Seat Leakage Test for Actuator Operated Valves, shall be done with by closing the valves with actuator.	
6	Tests on rubber parts shall be conducted per batch of rubber mix for tensile, Elongation, hardness, adhesion, spark test, bleed resistance test. In addition, type test for 50,000 cycles of each type of diaphragm shall also be conducted.	
7	Hydraulic Test of Body, Seat and disc-strength shall be carried out in accordance with governing design standard in presence of owner / owner's representatives. Actuator operated valves shall be checked for Seat Leakage by closing the valves with actuator. For Proof of Design Test refer respective chapters of engineering portion in the technical specification.	
8	Blue matching, wear travel for gates, valves, pneumatic seat leakage, and reduced pressure test for check valves shall be done as per relevant standard. Maximum allowable vacuum loss is 0.5 mm of Hg abs. for valves to be tested for vacuum operation for internal pressure 25 mm of Hg abs. for a period of 15 minutes. Fire safe test for ball valve shall be done wherever specified. In case of already carried out, the test report shall be submitted for review and acceptance by owner / owner's representatives. Valves shall be offered for hydro test in unpainted condition.	
9	Tensile, Elongation, Hardness, Specific Gravity, Lining Thickness, Humidity Check, Pipe temperature check, Adhesion Test and Holiday Detection Test etc as per applicable standard shall be done for all lining material and application.	
10	10% of welds (Root and finished welds) shall be subjected to DPT. (100% DPT for compressed air line and boiler & deaerator fill line.).	
11	Pressure drop across the strainer for each type and size as a special test shall be carried out. In case of already carried out, the test report shall be submitted for review and acceptance by owner / owner's representatives.	
12	During hydraulic and vacuum tests at 25mm Hg abs in 3 positions, the change in the circumference of arch should not be more than 1.5%. 24 hrs after the test permanent set in dimension should not exceed 0.5%.	
13	Tests on rubber for tensile, elongation, hardness, hydraulic stability check as per ASTM D 471, ozone resistance test as per ASTM D 1149/IS 3400 Part 20 aging test and adhesion strength of rubber to fabric, rubber to metal adhesion shall be carried out.	
14	In addition of all tests as indicated for Cast Butterfly valve being applicable for fabricated butterfly valves, following test shall be done for Fabricated Butterfly Valve: a. UT as per ASTM A-435/IS 11630 & IS 4225 on plate material for body and disc shall be carried out for plate thickness 25mm and above. b. 100% RT and DPT as per ASTM, Section-VIII, Division-I, on butt joins of body and disc. 10% DPT on other welds shall be done. c. Post weld heat treatment as per ASME, Section-VIII, Division-I on butt joints of body and disc. d. Welders and WPS shall be qualified as per ASME- section IX	
15	Maximum number of segments in segmental flanges shall be four (04) only. All butt weld joints in the segmental flanges shall be examined by RT/UT. Segmental flanges exceeding 37.5 mm thickness shall be stress relieved as per norms of ASME Section VIII after welding.	
16	For pressure vessel welds RT shall be done as per design code requirements.	

All Valves shall be offered for inspection in unpainted condition.

No repair welding is permitted on Cast Iron / Alloy Cast Iron Castings.

QAP FOR EOT CRANES AND HOISTS

	Shop Test for T.G.Hall EOT Cranes, Other Cranes & Hoist
1.0	**HOOKS**
1.01	ALL TESTS INCLUDING PROOF LOAD TEST AS PER RELEVANT IS/BS/DIN SHALL BE CARRIED OUT.
1.02	MPI/DPT SHALL BE CARRIED OUT AFTER PROOF LOAD TEST.
2.0	**STEEL CASTING**
2.01	DPT ON MACHINED SURFACE SHALL BE CARRIED OUT.
3.0	**GIRDERS, END CARRIAGE,CRAB, GEAR BOX AND ROPE DRUM**
3.01	THE PLATES OF THICKNESS 25MM AND ABOVE SHALL BE ULTRASONICALLY TESTED.
3.02	NDT REQUIREMENTS ON WELDMENTS SHALL BE AS FOLLOWS: a) BUTT WELDS IN TENSION:- 100% RT AND 100% DPT b) BUTT WELDS IN COMPRESSION:- 10% RT AND 100% DPT c) BUTT WELDS IN ROPE DRUM:- 100% RT AND 100% DPT d) FILLET WELDS:- RANDOM 10% DPT
4.0	**FORGING (WHEEL, GEARS, PINIONS, AXLE, HOOKS & HOOK TRUNION)**
4.01	ALL FORGINGS GREATER THAN OR EQUAL TO 50 MM DIAMETER OR THICKNESS SHALL BE SUBJECTED TO ULTRASONIC TESTING.
4.02	DPT/MPI SHALL BE DONE AFTER HARDFACING AND MACHINING.
5.0	WIRE ROPE SHALL BE TESTED AS PER RELEVANT STANDARD.
6.0	REDUCTION GEARS SHALL BE TESTED FOR REDUCTION RATIO, BACKLASH & CONTACT PATTERN. GEAR BOX SHALL BE SUBJECTED TO NO-LOAD RUN TEST TO CHECK FOR OIL LEAKAGE, TEMPERATURE RISE, NOISE AND VIBRATION.
7.0	THE CRANES SHALL BE COMPLETELY ASSEMBLED AT SHOP FOR FINAL TESTING. ALL TESTS FOR DIMENSION, DEFLECTION, LOAD, OVERLOAD, HOISTING MOTION, CROSS TRAVEL ETC. AS PER IS-3177 SHALL BE CARRIED OUT AT SHOP.
8.0	ALL ELECTRIC HOISTS SHALL BE TESTED AS PER IS-3938 AND CHAIN PULLEY BLOCKS SHALL BE TESTED AS PER IS-3832.
9.0	**LIFTING BEAM**:
9.01	THE PLATES OF THICKNESS 25MM AND ABOVE SHALL BE ULTRASONICALLY TESTED.

9.02	NDT REQUIREMENTS ON WELDMENTS SHALL BE AS FOLLOWS: e) BUTT WELDS IN TENSION:- 100% RT AND 100% DPT f) BUTT WELDS IN COMPRESSION:- 10% RT AND 100% DPT g) FILLET WELDS:- RANDOM 10% DPT
9.03	ALL FORGINGS GREATER THAN OR EQUAL TO 50 MM DIAMETER OR THICKNESS SHALL BE SUBJECTED TO ULTRASONIC TESTING.
9.04	DPT/MPI SHALL BE DONE AFTER MACHINING.
9.05	Lifting Beam will be subjected to overload testing at @1.25 X SWL of Lifting Beam at manufacturer works.

ANNEXURE II

SUB-VENDOR LIST (INDICATIVE)

INDICATIVE VENDOR LIST

Disclaimer for Indicative Vendor List

1.1 Reasonable efforts have been made to collate the sub-vendors proposed by the various main contractors from time to time against different Projects/Packages and accepted by NTPC for various items. However, in case of error/omission, if any, and represented by the successful bidder this will be addressed during the execution of the contract based on the material evidence available with NTPC / Main Contractor.

1.2 The approved sub-vendor list drawn is not based on NTPC driven enlistment process but based on the sub- vendors proposed by various Main Contractors. As such, it is possible that some of the Suppliers/Manufacturers who may be involved in similar work/process may not be appearing in the list as such sub-vendors may not have been proposed by Main Contractors against NTPC Contracts.

1.3 In case the successful bidder chooses to propose additional sub-vendors with relevant experience after the award of the contract such sub-vendors will be considered in terms of Clause no: 19.1 of GCC, provided the proposals are received sufficiently in time: 90 days prior to ordering date of a Bought Out Items/Start of Manufacturing so as not to impede the progress of the contract.

1.4 Sub-vendors have been grouped under different categories of items. It is possible that an item characterized by certain specific features such as range and type required as per Main Contractor's design requirements may not be in the range of the listed sub-vendor's manufacturing process/capability. As such the main contractor to ascertain the vendor's capability to meet his specific requirements before considering a sub-vendor.

1.5 It is to be noted by the bidders that any shortfall in contract performance attributable to the sub-vendor listed will not absolve the contractor from his contractual obligations in any manner.

1.6 The approval was granted based on the evaluation of relevant capabilities and facilities possessed by the sub-vendor at the time of evaluation. Also, some of the sub-vendors may not be active. As such, the successful bidder is to carry out his own due diligence before considering the listed sub-vendor for subletting: the current status of the sub-vendor, the continued availability of productive resources including Human Resources.

1.7 The list of sub-vendors is periodically revised to include new sub-vendors. Such a revision may also see a deletion of certain sub-vendors who may have been disqualified on grounds of inadequate performance or banned in line with NTPC's banning policy. The then current list will be shared with the successful bidder immediately on award.

S. N. क्र.सं.	**Item /** मद	**QP/ Insp. Cat.** क्यूपी/ निरी. श्रेणी.	**QP No. /** क्यूपी . सं.	**QP Sub. Schedule** क्यूपी उप.अनुसूचि	**Proposed sub-supplier/** प्रस्तावित उप आपूर्तिकर्ता	**Place/** स्थान	**Sub-suppliers approval status / category** उप आपूर्तिकर्ता के अनुमोदन की स्थिति /श्रेणी	**Sub-supplier Details submission schedule/** उप आपूर्तिकर्ता के विवरण प्रस्तुतीकरण की सूची	**Remarks/** टिप्पणी	**Provenness Clause (Refer Note-1)**	**Applicable Note**
		I			BROWICK	UK	A				
		I			CARPENTER PATTERSON	UK	A				
		I			CARPENTER PATTERSON INDIA PVT LTD	VELLORE	A		MAXIMUM LOAD: 23877 KG AND MAXIMUM DISPLACEMENT: 220 MM AND UNDER THE SUPERVISION OF M/S CARPENTER PATERSON, UK.		
		I			AAA SUPPORTS PVT LTD	VADODARA	A		MAXIMUM LOAD: 1.5MT AND MAXIMUM DISPLACEMENT: 250MM		
		I			CARPENTER & PATTERSON	RANIPET	A		SUBJECT TO CONDITIONS AND THE INVOLVEMENT OF THEIR PRINCIPALS		
26	CONVENTIONAL VALVES (GATE, GLOBE & CHECK)	I			VELAN INC.	CANADA	A		SINGLE STAGE DRAIN VALVES (FORGED), SIZE UPTO 50MM NB, CLASS UPTO 2680 FOR POWER CYCLE PIPING APPLICATION.		
		I			LEADER VALVES LTD.	JALANDHAR	A		CC NRV UP NB 800, 150# FOR STG PKG.		
		I			BHEL	TRICHY	A				
		I			CRESCENT VALVES	MUMBAI	A		UPTO NB 300 CL 600		

S. N. क्र.सं.	**Item /** मद	**QP/ Insp. Cat.** क्यूपी/ निरी. श्रेणी.	**QP No. /** क्यूपी . सं.	**QP Sub. Schedule** क्यूपी उप.अनुसूचि	**Proposed sub-supplier/** प्रस्तावित उप आपूर्तिकर्ता	**Place/** स्थान	**Sub-suppliers approval status / category** उप आपूर्तिकर्ता के अनुमोदन की स्थिति /श्रेणी	**Sub-supplier Details submission schedule/** उप आपूर्तिकर्ता के विवरण प्रस्तुतीकरण की सूची	**Remarks/** टिप्पणी	**Provenness Clause (Refer Note-1)**	**Applicable Note**
		I			VELAND VALVE CORP.	USA			GATE V/V 2-34" CL 900-4500 CAST STEEL GATE V/V 18-48" CH50-800		
		I			VELAN	UK	A		1) GLOBE V/V 1/4"-2" C14500 (2) BONNETLESS GLOBE V/V 1/2-2.5" Cl 150-500)		
		I			L&T VALVES	COIMBATORE	A		UP TO CLASS 4500 & GRADE 91		
		I			TRILLIUM FLOW	HUBLI	A		UPTO NB 300 & CL-600, FORGED UPTO NB 50 CL 800		
		I			FOURESS ENGG. INDIA LTD.,	THANE	A		(1) 10"X600 # GATE/GLOBE/CHECK VALVES (2) 16"X300# GATE/GLOBE/CHECK VALVES (3) 24"X150# GATE/GLOBE/CHECK VALVE (4) 2"X800 # FS GATE/GLOBE/CHECK (LIST) AS PER BS5352 (B) GATE GLOBE/CHECK VALVES FOR 700# TO 1500#		
		I			NITTON VALVES INDIA PVT. LTD.,	AURANGABAD	A		(1) GATE VALVE: UPTO36" CLASS 600 WCB/WCC (2) GLUBE VALVE: UPTO 16" CLASS 300 WCB/WCC (3) CHECK VALVE : UPTO 12" CLASS 600 WCB/WCC & WC6		

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		I			SAMSHIN LTD.,	SOUTH KOREA	A		(1) GATE - 450 NB 3900 SPL CL SA 217 C12A (GR 91) (2) GLOBE (CAST) - 200 NB 3900 SPL, CL FOR SA 217C12 (G 91) (3) GLOBE (FORGED GR 92) - 50 NB 4500 CL GR SA182 F 92 (4) CHECK (CAST) - 200 NB 3500 SPL CL FOR SA 217C12A (GR91) (5) CHECK (FORGED GR 92) - 50 NB 4500 CL GR SA 182 F 92 (5) ANGLE (FORGED(80 NB		
		I			TOA VALVE ENGGINERING INC.	JAPAN	A		CONVENTIONAL VALVES (1) GATE VALVES UPTO SIZE 16", CLASS 4500 UPTO C12A/F91 (2) GATE VALVES UPTO SIZE 26" CLASS 2500 UPTO C12A (3) CHECK VALVES UPTO SIZE 14" CLASS 2500 UPTO C12A (4) GLOBE VALVES UPTO SIZE 3" CLASS 4500 UPTO C12A (5) GLOBE VALVES UPTO SIZE 10" CLASS 1500 & 4" CLASS 2500 UPTO F91		

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		I			FOURESS ENGG. INDIA LTD.	THANE	A		(1) 10"X600 # GATE/GLOBE/CHECK VALVES (2) 16"X300# GATE/GLOBE/CHECK VALVES (3) 24"X150# GATE/GLOBE/CHECK VALVE (4) 2"X800 # FS GATE/GLOBE/CHECK (LIST) AS PER BS5352 (B) GATE GLOBE/CHECK VALVES FOR 700# TO 1500#		
		I			BABCOCK VALVES	SPAIN	A		(1)CAST GATE VALVE (CS) VALVE CLASS UPTO 2500SPL & SIZE UPTO 10" (2)CAST GLOBE VALVE (CS) CLASS UPTO 2500SPL & SIZE UPTO 3 INCH (3) FORGED GLOBE VALVE (CS) CLASS UPTO 1500 & SIZE UPTO 1" (4) FORGED GLOBE VALVE (CS) CLASS UPTO TO 800 & SIZE UPTO 1.5"		
		I			FORBES MARSHALL PVT LTD	PUNE	A		CONVENTIONAL VALVES :CAST GATE VALVE (CS) CLASS UP TO 2500SPL & SIZE UP TO 10 INCH CAST GLOBE VALVE (CS) CLASS UP TO 2500SPL & SIZE UP TO 3 INCH		

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		I			BABCOCK WILCOX ESPANOLA	SPAIN	A		CONVENTIONAL VALVES -CAST GATE VALVE (CS) CLASS UP TO 2500SPL & SIZE UP TO 10 INCH CAST GLOBE VALVE (CS) CLASS UP TO 2500SPL & SIZE UP TO 3 INCH		
		I			HP VALVES OLDENZAAL B V	NETHERLAND	A		CONVENTIONAL VALVES -CAST GATE VALVE (CS) CLASS UP TO 2500SPL & SIZE UP TO 10 INCH CAST GLOBE VALVE (CS) CLASS UP TO 2500SPL & SIZE UP TO 3 INCH		
27	SAFETY VALVES(SPRING TYPE)	I			DRESSER INDUSTRIES	USA	A				
		I			SAMPELL AG	GERMANY	A				
		I			TYCO (PENTAIR VALVES & CONTROLS	USA	A				
		I			FUKUI SEISAKUSHO CO LTD	JAPAN	A				
		I			RIENEKE GMBH	GERMANY			HYDRAULIC TYPE		
		I			BOPP & REUTHER	GERMANY	A		HYDRAULIC TYPE		
		I			MIEWA CORPORATION	JAPAN	A		(1) SAFETY VALVE SIZE 1/2" TO 6" & 150 TO 4500 CLASS		
		I			BHEL	TRICHY	A				
		I			PENTAIR SANMAR LTD	PUDUKOTTAI	A		AUX STEAM SYSTEM: UP TO 6" SIZE AND CLASS UP TO 600		

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		I			FAINGER LESER VALVES P LTD	AURANGABAD	A		SIZE(INELT/OULET): 200/300 MM APPLICABLE TO MAX DESIGN TEMPERATURE:474 DEG C & PRESSURE:47 KG		
28	ELECTROMATIC RELIEF VALVE (ERV)	I			VALVES TECHNOLOGIES	USA	A		(A) 1.5"X3" CLASS 3100- F91 MATERIAL (B) 2.5"X4", CLASS 1500-F91 MATERIAL		
		I			FUKUI SEISAKUSHO CO LTD	JAPAN	A				
		I			SAMPELL AG	GERMANY	A				
		I			DRESSER INDUSTRIES	USA	A				
		I			MIEWA CORPORATION	JAPAN	A		SIZE UPTO 65MM & UPTO 4500 CLASS		
29	PLUG VALVE	I			FLOW SERVE INDIA CONTROLS	KANCHIPURAM	A		SIZE: 25 TO 300 MM, CLASS 150 & 300		
		I			3Z CORP.	SOUTH KOREA	A				
		I			HAWA VALVES	MUMBAI	A		UP TO 10" SIZE AND 300 CLASS		

एनटीपीसी NTPC	**Project/** परियोजना **: Talcher III** **Package/** पैकेज **: EPC** **Supplier/** आपूर्तिकर्ता**:** **Contract No./** अनुबंध सं**.:**	**LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL** क़्वालिटी प्लान तथा सब – वेंडर के अनुमोदन सहित मदों की सूची **SUB-SYSTEM** उप-प्रणाली**:SG(MECH)**	**DOC. NO./** दस्तावेज सं**.:** **REV. NO.:** **DATE/** तिथि **: 03.02.2022** **PAGE/** पृष्ठ **: PAGE 49 OF 50**

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	NOTE -1 : For final Sub-QR approval , document required to be submitted as per Sub-QR requirements given in the specification. **NOTE-2:** Vendors under 'A' are approved and accepted by NTPC with/without conditions in the past. Similar conditions as the case may be for the vendor shall be applicable for this project and tied up in the quality plan. **NOTE-3:** Predespatch inspection for Alloy/SS Grades needs to be tied up by Main contractor or Third-party inspection agency as required**.** **NOTE-4 : ($)** Review of Mill TC for Raw Material to be done by NTPC and shall be included in the QP of corresponding equipment. **NOTE-5:** Raw Material for 91 and above Grade Material Fittings to be from NTPC approved sources as per Raw Material vendor List. **NOTE-6:**For Motorized/Pneumatic actuated valves the suppliers for actuators shall be from NTPC approved list, Refer NTPC C&I list.										

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LEGENDS/ संकेतिका

SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY /प्रणाली आपूर्तिकर्ता / सब – वेंडर की स्वीकृति की स्थिति की श्रेणी (SHALL BE FILLED BY NTPC एनटीपीसी द्वारा भरा जाए

A – **For these items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list along with the condition of approval, if any./** इन मदों के लिए प्रस्तावित वेंडर एनटी स्वीकार्य है। अनुमोदन की शर्त, , यदि कोई हो, के साथ-साथ पत्र "क" में इंगित किया जाए ।

DR – **For these items "Detailed required" for NTPC review. To be identified with letter "DR" in the list.** एनटीपीसी द्वारा इन मदों की समीक्षा के लिए "विस्तृत ब्यौरे की आवश्यकता" होगी। सूची में " में इंगित किया जाना चाहिए।

QP/INSPN CATEGORY: क्यूपी / निरीक्षण की श्रेणी:

CAT-I / श्रेणी- I: For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC. इन मदों के लिए गुणवत्ता योजनाओं को एनटीप अनुमोदित किया जाता है और एनटीपीसी द्वारा अंतिम स्वीकृति भौतिक निरीक्षण के दौरान उपलब्ध गवाह के आधार पर दी जाएगी।

CAT-II / श्रेणी- II: For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of do as per approved QP. इन मदों के लिए गुणवत्ता योजनाओं को एनटीपीसी द्वारा अनुमोदित किया जाता है। हालाँकि एनटीपीसी द्वारा कोई भौतिक निरीक्षण नहीं किया जाएगा। एनटीपीसी द्वारा अंतिम स्वीकृति अनुमोदि के अनुसार दस्तावेजों की समीक्षा के आधार पर दी जाएगी।

CAT-III/ श्रेणी-III : For these items Quality control to be exercised as per Main contractor Quality Assurance System. The final acceptance by NTPC shall be on the basis of Certificate of Conf (COC) by Main Contractor.

UNITS/WORKS इकाईयां / कार्य: Place of manufacturing/ निर्माण का स्थान Place of Main Supplier of multi units/works/बहु- इकाइयों / कार्यों के मुख्य सप्लाइर का स्थान.

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	Contract No./ अनुबंध सं.:	SUB-SYSTEM उप-प्रणाली: TG-Mech			

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					KSB	Pune	A				
					Hyundai	S Korea	A				
					KBL	Pune	A				
					Flowserve	Coimbatore	A				
51	**Debris Filter/ Self Cleaning Strainer**	I			GEA-BGR	Chennai	A				
					Multitex	Gr.Noida	A				
52	**LP Pipes & Fittings (CS & SS)**	I			Remi	Tarapur,India	A		SS		
					Apex	Alwar	A		SS (up to 150NB)		
					Ratnamani	Ahmedabad	A		SS		
					ISMT	India	A		CS (up to 400 NB)		
					Maharashtra Seamless Ltd.	Maharashtra	A		CS (up to 400 NB)		
					Tube Products Incorporate	Ahmedabad	A				
					TK Corporation	S Korea	A				
					Dee development	Palwal	A				
					Jindal Saw	India	A		CS (up to 400 NB)		
					Tata	India	A		ERW		
					Surya	India	A		ERW		
					JINDAL PIPES LTD	India	A		ERW		
					WELSPUN	India	A		ERW		
					Lalit Pipes & pipes Ltd.,	Thane	A		EFW Pipes		
					Ratnamni Metals and Tubes Ltd.,	Gandhinagar	A		EFW Pipes		
53	**Butterfly Valves (* Also for steam services)**	I			Fouress Engg. *	Bangalore	A		upto 2600 NB		
					IL *	Palakkad	A		upto 2200 NB		
					BHEL *	Bhopal, India	A				
					Kriloskar Bros. Ltd	Pune	A				
					L&T	Chennai	A				
					Trillium Flow	Hubli	A				
					Tyco	Halol	A				
					L&T	Coimbatore	A				

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					Intervalve	Pune	A				
54	**Valves (gate/ globe/check) for LP application**	I			L&T	Chennai/Coimbatore	A				
					Velan	Canada/Coimbatore	A				
					KSB	Germany/Coimabtore	A				
					ToA	Japan	A				
					Fouress Engg	Aurangabad	A				
					Trillium Flow	Hubli	A				
					Crane	USA	A				
					Samshin	S Korea	A				
					KBL	Pune	A				
					Weir	UK	A				
					Leader	Jalandhar	A				
					BHEL	Trichy	A				
					Pentair (Tyco Sempel)	Trichy	A				
					HP Valves(Key Valves Technology)	Netherlands	A				
					IL	Palakkad	A				
					Steel Strong	Mumbai	A				
55	**HP Feedwater Heaters Automatic (String Bypass) Isolation Valves**	I			KSB	Germany	A				
					Tyco Sempell	Germany	A				
					Strack	Germany	A				
					BHEL	Trichy	A				
					Weir Valves & Controls UK Ltd.	UK	A				
56	**Water Steam Cycle HP Valves**	I			KSB	Germany /Coimbatore	A				
					L&T	Chennai	A				
					L&T	Coimbatore	A				
					Velan	Coimbatore	A		up to 2inch, #4500 (up to P92 grade)		
					HP Valves	Netherlands	A		Previous Name:Key Valves Technology		

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					Weir Valves & Controls UK Ltd.	UK	A				
					BHEL	Trichy	A				
					Crane	USA	A				
					Samshin	S Korea	A				
					Pentair(Tyco Sempell)	Germany	A				
					Velan	Canada	A				
					ToA	Japan	A				
					Tyco	USA	A				
57	**Safety Valves**	I			BHEL	Trichy	A				
					Dresser	USA	A				
					Tyco	USA	A				
					Babcock	Spain	A				
					Flainger	Germany	A				
					Bopp & Reuther	Germany	A				
					Flainger	Nasik	A				
					Reineke	Germany	A				
					Valve Technology	USA	A				
58	**Forged Seel Valves up to 2" , Class 800 (FCS/FSS)**	I			KSB	Coimbatore	A				
					Leader	Jallandhar	A				
					L&T	Chennai	A				
					Velan	Canada	A				
					Fouress Engg	Ahmadnagar	A				
					Trillium Flow	Hubli	A				
					Velan	Canada	A				
					Steel Strong	Mumbai	A				
					L&T	Coimbatore	A				
59	**Condenser Tubes**	I			Plymouth	USA	A				
					Ratnamani	Kutchh	A				

एनटीपीसी NTPC		Project/ परियोजना : Talcher - III				LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL क्वालिटी प्लान तथा सब –वेंडर के अनुमोदन सहित मदों की सूची			Doc. No./ दस्तावेज सं.:		
		Package/ पैकेज : EPC PACKAGE							REVISION NO : 00		
		Supplier/ आपूर्तिकर्ता:							DATE/ तिथि : 04.02.2022		
		Contract No./ अनुबंध सं.:				SUB-SYSTEM उप-प्रणाली: TG-Mech					
S. N. क्र.सं	Item / मद	QP/ Insp. Cat. क्यूपी/ निरी. श्रेणी.	QP No. / क्यूपी. सं.	QP Sub. Schedule क्यूपी उप.अनुसूचि	Proposed sub-supplier/ प्रस्तावित उप आपूर्तिकर्ता	Place/ स्थान	Sub-suppliers approval status / category उप आपूर्तिकर्ता के अनुमोदन की स्थिति /श्रेणी	Sub-supplier Details sub sch/ उप आपूर्तिकर्ता के विवरण प्रस्तुती करण की सूची	Remarks/ टिप्पणी	Provenness Clause (Refer Note-1)	Applicable Note
~~65~~	~~Oxygen/NAOH Dosing System~~	~~II~~			~~Main Contractor Approved Sources~~						
NOTE - 1 : For final Sub-QR approval , document required to be submitted as per Sub-QR requirements given in the specification.											
NOTE-2: Vendors under 'A' are approved and accepted by NTPC with/without conditions in the past. Similar conditions as the case may be for the vendor shall be applicable for this project and tied up in the quality plan.											
LEGENDS/ संकेतिका											
* - Inspection category will be decided during vendor evaluation.											
1.0 SYSTEM SUPPLIER / SUB SUPPLIER APPROVAL STATUS CATEGORY प्रणाली आपूर्तिकर्ता / सब –वेंडर की स्वीकृति की स्थिति की श्रेणी											
A – For these items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list along with the condition of approval, if any./ इन मदों के लिए प्रस्तावित वेंडर एनटीपीसी को स्वीकार्य है। अनुमोदन											
2.0 QP INSPECTION CATEGORY : क्यूपी / निरीक्षण की श्रेणी:											
CAT - I : For those items the Quality Plans are approved by Customer and final acceptance will be on physical inspection witness by Customer.इन मदों के लिए गुणवत्ता योजनाओं को एनटीपीसी द्वारा अनुमोदित किया											
CAT - II : For those items the Quality Plans are approved by Customer. However no physical inspection shall be done by Customer. The final acceptance by Customer shall be on the basis of review of											
CAT - III :For these items Quality control to be exercised as per Main contractor Quality Assurance System. The final acceptance by NTPC shall be on the basis of Certificate of Conformance (COC) by Main											
UNITS/WORKS : Place of manufacturing- Place of main supplier of multi units/works.											
FORMAT NO./ प्रारूप सं: QS-01-QAI-P-1B/F1-R0											

एनटीपीसी NTPC	Project/ परियोजना : TALCHER-III Package/ पैकेज : EPC Supplier/ आपूर्तिकर्ता: Contract No./ अनुबंध सं.:	INDICATIVE LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL क्वालिटी प्लान तथा सब -वेंडर के अनुमोदन सहित मदों की सूची SUB-SYSTEM उप-प्रणाली: BOP SYSTEMS (MECHANICAL)	DOC. NO./ दस्तावेज सं.: REV. NO.: DATE/ तिथि : 04-02-2022 PAGE/ पृष्ठ :	

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1	AIR BLOWERS -LOBE TYPE > = 5KW	I			SWAM PNEUMATIC	NOIDA	A			WTP,CPU,AHP
					EVEREST BLOWERS PVT LTD	BAHADURGARH	A		UP TO 40 HP (APPROX 1600 CUM/HR)	
					KAY INTERNATIONAL	SONEPAT	A		UP TO 4800 CUM/HR	
					KULKARNI POWER TOOLS	SHIROL	A		UP TO 2500CUM/HR	
					USHA COMPRESSORS	AHMEDABAD	A		UP TO 60 HP (APPROX 2000CUM/HR)	
2.A	EOT CRANE & ELECTRIC HOIST >5 MT	I (> 10T) / III (>5T UP TO 10T)			REVA INDUSTRIES	FARIDABAD	A		UP TO 60 MT	WTP,CT.AC&VENTILATION,CHP,LHP&GHP,AHP, CW , FDPS
					EDDY CRANE	PUNE	A		UPTO 10 MT	
					CONSOLIDATED HOIST	SATARA /PUNE *	A		SATARA UP TO 20 MT,*PUNE FOR ELECTRIC HOIST UPTO 15 MT	
					ELECTROTHERAPHY	RISHRA	A		UPTO 15 MT FOR ELECTRIC HOIST ONLY	
					HERCULES HOIST	RAIGAD	A		UPTO 15 MT FOR ELECTRIC HOIST ONLY	
					TUBRO FERGUSSON	KOLKATA			UP TO 20MT FOR EOT, UP TO 5 MT FOR FOR ELECTRIC HOIST	
					PRAYAS ENGG (PBL)	V V NAGAR	A		UPTO 10 MT FOR ELECTRIC HOIST ONLY	
					ALPHA SERVICES	ALWAR	A		SINGLE GIRDER EOT CRANE & ELECTRIC HOIST UPTO 15 MT ONLY. GEARBOX FROM	
					CENTURY CRANE ENGINEERS PVT. LTD	BALLABHGARH	A		UP TO 25 MT	
					ARMSEL	BANGALORE	A		UPTO 10 MT EOT & UPTO 15 MT ELECTRIC HOIST	
					TRACTEL TIRFOR	PALWAL	A		UPTO 15 MT FOR ELECTRIC HOIST AND UPTO 10 MT FOR EOT	
					MILLARS INDIA	KARAMSAD	A		UP TO 25 MT	
					AVON CRANES	GURGAON	A		UP TO 25 MT	
					GRIP ENGINEERS	HYDERABAD	A		50 MT (GEARBOX FROM NTPC APPROVED SOURCES FOR EOT CRANE).	
					GRIP ENGINEERS	FARIDABAD	A		UPTO 20 MT ELECTRIC HOIST ONLY	
					CRANEX	GHAZIABAD	A		UP TO 140 MT FOR EOT ONLY	
2.B	GANTRY CRANE >5T	I (> 10T) / III (>5T UP TO 10T)			REVA INDUSTRIES	FARIDABAD	A		UP TO 60 MT	CW
					UNIQUE INDUSTRIAL HANDLERS PVT LTD	NASHIK	A		UP TO 165 MT	
					ANUPAM INDUSTRIES LTD.	ANAND	A		UP TO 60MT	
					SMACO ENGINEERING PVT. LTD	THANE	A		UP TO 60MT	
					MANGLA HOIST	GREATER NOIDA	A		UP TO 10MT	
3	FAN- AXIAL TYPE > = 5KW				CB DOCTOR VENTILLATOR PVT LTD	AHMEDABAD	A		up to 50000 CMH	WTP,CT.AC&VENTILATION,CHP,LHP&GHP,AHP
					HOWDEN SOLYVENT FLAKT INDIA PVT LTD,	CHENNAI	A		up to 125000 CMH	
					C DOCTOR &CO PVT LTD	KOLKATA	A		up to 50000 CMH	
					KRUGER VENTILATION INDUSTRIES (I) PVT LTD	SHAHPUR, THANE	A		Up to 6000 CMH	

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		I			NADI AIRTECHNICS PVT LTD	CHENNAI	A		Up to 15000 CMH	
					ADVANCE VENTILATION PVT LTD	KUNDALI. SONEPAT	A		up to 40000 CMH	
					SK SYSTEMS PVT LTD	KUNDALI PHASE-II, SONEPAT, HARYANA	A		up to 50000 CMH	
					ALMONAROD (P) LIMITED	CHENNAI	A		Up to 14000 CMH	
4	PIPES-MS- (BLACK/ GI) AS PER IS IS:3589 >1000NB	I			STEEL AUTHORITY OF INDIA LIMITED	ROURKELA	A			CW,CT,MUW
					WELSPUN	ANJAR	A		SAW UPTO 2600 NB	
					WELSPUN	BHARUCH	A		SAW UPTO 1300 NB	
					MAN INDUSTRIES	INDORE	A		SAW UPTO 1400 NB	
					SAMSHI	VADODARA	A		SAW 450 TO 2540 NB	
					MUKAT TANKS & VESSELS	TARAPUR	A		SAW 200 TO 1200 NB	
					MUKAT PIPES	RAJPURA	A		SAW UPTO 1800 NB	
					LALIT PIPES AND PIPES LTD	THANE	A		SAW 350 TO 1400 NB	
					RATNAMANI	CHATRAL	A		SAW 600 TO 2600 NB	
					RATNAMANI	KUTCH	A		SAW 400 TO 3600 NB	
					PSL HOLDINGS LIMITED	DAMAN	A		SAW 450 TO 1600 NB	
					PSL INTERNATIONAL LTD.	CHENNAI	A		SAW 450 TO 1600 NB	
					PSL LIMITED	KUTCH	A		SAW 450 TO 1600 NB	
					PSL LIMITED	VISAKHAPATNAM	A		SAW 450 TO 1600 NB	
					JCO PIPES	CHHINDWARA	A		SAW UPTO 1600 NB	
					SURYA GLOBAL STEEL TUBE LTD	ANJAR	A		SAW UP TO 2032 OD	
					CAPACITE STRUCURES PVT LTD	THANE	A		406.4 MM TO 3874 MM OD	
5	PIPES & FITTINGS-GRP	I			EPP COMPOSITES PVT LTD	RAJKOT			UP TO 900MM	WTP,CT
					GRAPHITE INDIA	NASIK			UP TO 1000MM	
					SHRIRAM SEPL COMPOSITES LTD	CHENNAI			UP TO 1100MM	
					BALAJI FIBER REINFORCE PVT LIMITED	VADODARA			UP TO 650MM	
					MEGHA FIBRE GLASS INDUSTRIES PVT LTD	MEDAK			UP TO 900MM	
6	SERVICE VESSEL-CPU & OTHER PR VESSELS >= 10 BAR WORKING PRESSURE	I			DRIPLEX WATER ENGINEERING INTERNATIONAL PVT LIMITED	BHADARBAD	A			WTP,CPU,CAS,CHP, LHP&GHP,AHP
					BGR ENERGY SYSTEMS LTD (ENVIRONMENTAL ENGG. DIV.)	PONNERI	A		UPTO 3000MM DIA & THICKNESS UPTO 28 MM	
					ISHAN EQUIPMENTS PRIVATE LIMITED	VADODARA	A		UPTO 2900 MM DIA & THICKNESS UPTO 28 MM	
					ALMONO FOILS (INDIA) LTD.	DALJE	A		DIA 2800MM, THICNKESS 25MM DESIGN PRESSURE UP TO 47.5 KSC	

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					BELCO POLLUTION CONTROL PVT LTD	GREATER NOIDA	A		UPTO 3200MM DIA & THICKNESS UPTO 30 MM	
7	PUMPS- HORIZONTAL & VERTICAL CENTRIFUGAL -UP TO 300KW	(UP TO 60 KW CAT-II , ABOVE 60 KW CAT-I)			KIRLOSKAR BROTHERS LTD	KIRLOSKARWADI	A			WTP,CW, CPU,FDPS,CHP, LHP &GHP,AC & VENTILATION,MUW, AHP
					WILO MATHER & PLATT	PUNE	A			
					WILO MATHER & PLATT	KOLHAPUR	A			
					SAM TURBO	COIMBATORE	A		FLOW UP TO 1500 CUM/HR AND POWER RATING UP TO 425 KW	
					FLOWMORE LTD	GHAZIABAD	A			
					BEST AND CROMPTON	CHENNAI	A			
					JYOTI LTD	VADODARA	A			
					WPIL	GHAZIABAD	A			
					KISHORE PUMPS	PUNE	A		UPTO 500M3/HR ONLY RUBBERLINED PUMPS ALSO	
					GRUNDFOS PUMPS INDIA PVT LTD	CHENNAI	A		HORIZONTAL UP TO 30 KW ONLY AND VERTICAL UP TO 45 KW ONLY (FOR	
					SINTECH PRECISION	GHAZIABAD	A		HORIZONTAL UP TO 400 KW MOTOR RATING AND VERTICAL UP TO 30 KW MOTOR RATING	
					KSB	PUNE	A			
					KSB	NASHIK	A			
					FLOWSERVE INDIA CONTROLS PVT LTD	COIMBATORE	A		HOIZONTAL CENTRIFUGAL PUMP UP TO 75 KW ONLY	
					SU MOTOR	MUMBAI	A		HORIZONATL UPTO 500M3/HR ONLY RUBBERLINED PUMPS AND VERTICAL CENTRIFUGAL PUMPS UP TO 100CMH ONLY	
					BHARAT PUMPS AND COMPRESSORS	NAINI	A		FLOW UP TO 2200 M3/HR AND HEAD UP TO 60 MWC	
8	PUMPS -VT -UP TO 300KW	I			FLOWMORE LTD	GHAZIABAD	A			WTP, CW
					KIRLOSKAR BROTHERS LIMITED	KIRLOSKARWADI	A			
					WPIL LTD	KOLKATA	A			
					WPIL LTD	GHAZIABAD	A			
					JYOTI LTD	VADODARA	A			
					XYLEM WATER SOLUTIONS INDIA PVT LTD	VADODARA	A			
					FLOWSERVE INDIA CONTROLS PVT LTD	COIMBATORE	A		UP TO 1025 KW	
					SINTECH PRECISION	GHAZIABAD	A			
					WILO MATHER & PLATT	PUNE	A			

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9.A	VALVE-DUAL PLATE CHECK > 600MM OR CLASS > 300 (VALVE- DUAL PLATE CHECK UP TO 600MM & CLASS 300: CAT-II & MAIN CONTRACTOR APPROVED SOURCES)	I			ADVANCE VALVE PVT LTD	GR. NOIDA	A		DUAL PLATE CHECK VALVES CI UPTO 1000 NB CLASS 125, DUPLEX SS UP TO 600NB CLASS 600.	WTP,CW, CPU,FDPS,CAS,LP PIPING
					LEADER VALVES	JALANDHAR	A		UP TO 900MM CLASS 150 , SS 200NB CLASS#300	
					R & D MULTIPLE	VALSAD	A		CI/ CS UP TO 800NB PN 10	
9.B	VALVE-BALL > 100 MM OR CLASS > 800; (VALVE- BALL UP TO 100 MM & CLASS 800:CAT-II & MAIN CONTRACTOR APPROVED SOURCES)	I			TRILLIUM FLOW	HUBLI	A		SS BALL VALVES UP TO 500MM AND CLASS #600, CS BALL VALVES UP TO 250 MM AND CLASS# 900, CS/ SS BALL VALVES UP TO 100 MM AND CLASS # 1500.	WTP, CPU,FDPS,CAS,FOH,CHP, LHP&GHP,AHP
					MICRO FINISH VALVES PVT. LTD.	HUBLI	A		400NB CLASS#600 AND UP TO 600NB CLASS#300	
					FLOW CHEM INDUSTRIES	KALOL	A		100NB CLASS#600,200NB CLASS#300, 50 NB CLASS#800	
					L&T VALVES LIMITED	COIMBATORE	A		UPTO 150NB, CLASS #150/300, AND UPTO 50NB, CLASS #800	
					PRECISSION ENGG CO VALVES PVT LTD	NASIK	A		FCS UP TO 50NB CLASS 800, CCS UP TO 400NB CLASS 150.	
					BELGAUM AQUA VALVE PVT LTD	BELGAON	A		FCS UP TO 50NB CLASS 800, CCS UP TO 200NB CLASS 150.	
					G M ENGINEERING PRIVATE LTD	RAJKOT	A		UP T0 400 NB AND CLASS #600	
9.C	VALVE-BUTTERFLY > 600MM OR CLASS>150 (VALVE-BUTTERFLY UP TO 600MM & CLASS 150::CAT-II & MAIN CONTRACTOR APPROVED SOURCES)	I			INTERVALVE POONAWALA LTD	PUNE	A		SGI / CI / D2 1400MM PN10, SGI / CI 1000MM PN16,CS/SS 500MM PN16, SS 400MM CLASS#300, MS FABRICATED UPTO 2000NB	WTP, CW,CT,CPU,FDPS,CAS, AC& VENTILATION, MUW,CHP, LHP&GHP,LP PIPING,AHP
					TRILLIUM FLOW	HUBLI	A		CI/ DI BUTTERFLY VALVE UP TO 1000MM AND PN16 AND UP TO 1800MM AND PN10,CCS UP TO 1050MM CLASS 150 AND UP TO 1800MM AND PN16 SS - UP TO 400NB PN-16 ,FABRICATED 800MM CLASS#150.	
					PENTAIR VALVES	HALOL	A		FOR SS UP TO 500 NB PN-10, CI- UP TO 900NB PN-10, UP TO 500NB PN-16, 450MM CLASS#300., MS FABRICATED UPTO 2800NB, PN6.	
					FOURES ENGINEERING	BANGALORE	A		CAST SGI/CI/ MS FABRICATED- UP TO 1200 PN-10, UP TO 350 PN-16 ,2400 MM	
					KIRLOSKAR BROTHERS LTD	KONDHAPURI	A		CAST SGI/CI/CS 1400 MM PN16 , SS 300 MM PN16 , 1800MM CLASS 150, MS FABRICATED 900 NB PN40,MS FABRICATED 2800NB, PN6.	
					R & D MULTIPLE	VALSAD	A		CAST SGI/CI/MS FABRICATED- UP TO 1800 MM PN-10/CLASS # 75, ,1100MM PN25,1400MM CLASS#150 MS FABRICATED	
					ADVANCE VALVES PVT LTD	GREATER NOIDA	A		METAL SEATED, TRIPLE ECCENTRIC, SS BFV OF SIZE UPTO 100NB, AND PRESSURE RATING UPTO CLASS #300.	
					BRAY CONTROLS INDIA PVT. LTD	KANCHIPURAM	A		UPTO 450 MM AND CLASS#600	
					INSTRUMENTATION LTD.	PALAKKAD	A		UPTO 2200NB CLASS # 75	
					HAWA ENGINEERS	AHMEDABAD	A		CI/ CS & FABRICATED UPTO 1200MM, CLASS #150, SS UPTO 250MM, CLASS#150	
					CRANE PROCESS FLOW	SATARA	A		UP TO 900MM PN10	

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					L & T VALVES LIMITED	COIMBATORE	A		UP TO 900MM CLASS 150	
					DEMBLA VALVES	THANE	A		UP TO 2200MM CLASS#75	
9.D	VALVE-CONVENTIONAL GATE / GLOBE / CHECK > 600NB OR CLASS > 300	II			LEADER VALVES	JALANDHAR	A		CS GATE 600MM CLASS#600, SS GLOBE 600MM CLASS#600, CS CHECK 600MM AND CLASS#600	WTP, CW,CT,CPU,FDPS,CAS, AC& VENTILATION, MUW,CHP, LHP&GHP,LP PIPING,AHP
					HAWA ENGINEERS	AHMEDABAD	A		FCS / FSS 50 NB CLASS 800.	
					FOURES ENGINEERINGS	THANE	A		400NB CLASS 600 AND 50NB CLASS 800.	
					BHEL IVP	GOINDWAL	A		GATE UP TO 300 NB CLASS 600. GLOBE 250 NB CLASS 400, CHECK 150NB CLASS 600.	
					HITECH ENGG PVT LTD	AHEMDABAD	A		50 NB CLASS 800.	
					KSB PUMPS LTD	COIMBATORE	A		300NB CLASS 2500.	
					NITON VALVES INDIA PVT LTD	NAVI MUMBAI / AURANGABAD	A		CS GATE 900 NB CLASS 600, CHECK 300 NB CLASS 600.	
					L&T VALVES LIMITED	COIMBATORE			650 MM CLASS 600, 50 NB CLASS 800.	
					TRILLIUM FLOW	HUBLI	A		CONVENTIONAL CCS GATE / GLOBE / CHECK VALVES UP TO 600MM AND CLASS # 1500, CSS GATE/ GLOBE/ CHECK VALVES UP TO 200MM AND CLASS # 600, FCS GATE / GLOBE / CHECK VALVES UP TO 50MM AND CLASS # 2500.	
9.E	VALVE- DIAPHGRAGM TYPE	I			CRANE PROCESS FLOW	SATARA	A		UP TO 300NB PN10	WTP,CPU
					WEIR BDK	HUBLI	A		UPTO 250 NB - PN 10, 350MM PN6	
					PROCON ENGINEERS	MUMBAI	A		UPTO 200 NB AND PN 10/CLASS #150	
9.F	VALVE-PLUG > 100 MM OR CLASS > 800(VALVE-PLUG UP TO 100 MM & CLASS 800:CAT-II & MAIN CONTRACTOR APPROVED SOURCES)	I			TRILLIUM FLOW	HUBLI	A		SOFT SEATED 400MM AND CLASS #150, 300NB CLASS#300	WTP,CPU,CHP, LHP&GHP, FOH,AHP
					XOMOX SANMAR	TRICHY	A		UP TO 600MM AND CLASS#300	
					FLOWSERVE INDIA CONTROLS	CHENNAI	A		METALLIC SEATED 400NB CLASS#150, 300NB CLASS #300, 50NB CLASS #800	
10	PUMP -SUBMERSIBLE>= 30KW	I			KSB	NASHIK	A		130 KW	WTP,CT, CPU,CHP, LHP&GHP, FOH,AHP.LP PIPING,FDPS
					KIRLOSKAR BROTHERS LTD	KIRLOSKARWADI	A			
					AQUA MACHINERY	AHMEDABAD	A		UP TO 235 KW	
					WPIL	GHAZIABAD	A			
11	RUBBER EXPANSION JOINT>=1600NB (RUBBER EXPANSION JOINT < 1600NB: CAT-II & MAIN CONTRACTOR APPROVED SOURCES)	I			CORI ENGINEERS PVT LTD	CHENNAI	A		UPTO 2800 MM	ACW, ECW, CW,CT
					SRM EXOFLEX PVT LTD	KOLKATA	A		UPTO 2800 MM	
12	FAN ASSEMBLY -COOLING TOWER				PAHARPUR COOLING TOWERS LTD	SAHIBABAD	A		WITH SOLID FAN BLADES 288" AND 336 " DIA, WITH FOAM CORED FAN BLADES WITH 10METERS AND 10.97 METERS	CT
					PAHARPUR COOLING TOWERS LTD	BHASA	A		60" TO 288" FAN DIA	
					PAHARPUR COOLING TOWERS LTD	KOLKATA	A		60" TO 288" FAN DIA	

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					BLUE STAR (COMPRESSOR FROM HANBEL-TAIWAN)	WADA	A		SCREW CHILLER UP TO 282TR	
35	Mettalic Expansion Bellows	II			MB METTALIC BELLOWS	CHENNAI	A			MRHS
					SUR Industries	KOLKATA	A			
					LONE STAR	CHENNAI	A			
36	Conveying Compressor (Reciprocating)	I			KIRLOSKAR PNEUMATICS	PUNE	A			MRHS
					INGERSOLL RAND	AHEMDABAD	A			
					ATLAS COPCO(CHICAGO PNEUMATIC BRAND)	PUNE	A			
37	ALLOY CAST IRON PIPE, FITTINGS AND LINER	I			CRAWLEY & RAY	KOLKATA	A			MRHS, AHP
					ALLIED FOUNDRIES	BELGAUM	A			
					PARAMOUNT CASTINGS	NAGPUR	A			
					NORTHERN ALLOY	BHAVNAGAR	A			
					MENON METALLIK	KOLHAPUR	A			
					KOLHAPUR STEEL	KOLHAPUR	A			
					AQUA ALLOY	KOLHAPUR	A			
					MARTO PEARL	HYDERABAD	A			
					R.R.L	HOWRAH	A			
					CONCAST ENGINEERING	BURDWAN, WB	A			
					NATRAJ IRON & CASTINGS	DHANBAD	A			
					ABHIPRIYA BUSINESS	PANT NAGAR	A			
38	DRY ASH UNLOADING CHUTE	I			MELCO	FARIDABAD				AHP
					MACAWBER BEEKAY	KESHWANA	A			
					MINING AND MATERIAL HANDLING EQUIPMENT	KOLKATA	A			
					DCL	HYDERABAD	A			
39	BAG FILTER / SILO VENT FILTER				FLAKT	KOLKATA	A			

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		II			ORIENT FANS (ACCO)	KOLKATA	A			AHP,MRHS
					THERMAX	PUNE	A			
					RIECO	PUNE	A			
					MELCO	FARIDABAD	A			
					MCNALLY SAYAJI	ASANSOL/KUMARDHUBI	A			
					MACAWBER BEEKAY	KESHWANA	A			
					TAP ENGINEERING	KANCHEEPURAM	A			
40	REFRIGERANT TYPE DRYER	I			SUMMITS HYGRONICS	COIMBATORE	A		Upto 11893 m3/hr	AHP
					TRIDENT	COIMBATORE	A		Upto 10000 m3/hr	
					MELLCON	GREATER NOIDA	A		Upto 7250 m3/hr	
					DELAIR	GURGAON	A		Upto 7500 m3/hr	
					ATLAS COPCO	BELGIUM	A		Upto model FD 1200. ASSEMBLY AND TESTING AT PUNE	
41	VACUUM PUMP / MECHANICAL EXHAUSTER [WATER SEAL RING TYPE]	I			KAKATI KARSHAK	HYDERABAD	A			AHP
					VACUNAIR	AHEMDABAD	A			
42	BASALT LINE PIPE & FITTING	I			DECCAN MECHANICAL & CHEMICAL	BARAMATI	A			AHP
					ENVIRO ABRASION	PUNE	A		CAST BASALT LINERS FROM SCHOLTEN GmbH-GERMANY	
					TURBO ENGINEERS	COIMBATORE	A		CAST BASALT LINERS FROM KALENBORN - GERMANY/POLAND OR EUTIT - Czech Republic	
					GOENKA CAST ENGINEERING(I) PVT LTD	DURG	A		UP TO 350 NB	
					BMW STEEL	ROORKEE	A		UP TO 550 NB	
43	SLURRY DUTY KNIFE GATE VALVE	I			BRAY CONTROLS INDIA PVT LTD, VAAS KNIFE GATE VALVE DIVISION	CHENNAI	A		UPTO PN 10 RATING	AHP
					FOURESS ENGINEERING	BANGALORE	A		UPTO PN 10 RATING	
					ORBINOX	COIMBATORE	A		UPTO PN 16 RATING	
					WEIR MINERALS	BANGALORE	A		UPTO 12" PN 10 RATING	
44	FLY ASH DUTY KNIFE GATE VALVE	I			BRAY CONTROLS INDIA PVT LTD, VAAS KNIFE GATE VALVE DIVISION	CHENNAI	A			AHP
					FOURESS ENGINEERING	BANGALORE	A			
					ORBINOX	COIMBATORE	A			
					JASH SCHUTTE	INDORE	A			
45	CAST IRON PIPE	II			ELECTROSTEEL	CHENNAI	A		UPTO 450 NB	AHP
					KESORAM	KOLKATA	A		UPTO 350 NB	
					IISCO	KULTI	A			
					KAPILANSH DHATU UDYOG	NAGPUR	A		APPROVED UPTO 300 NB.	
					KUSHA LAVA	VIJAYWADA	A		FOR NON STD. SIZE	
46	ASH SLURRY PUMP	I			KIRLOSKAR BROTHERS LTD.	PUNE	A			AHP

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1	BRANCH PIPE , COUPLING & NOZZLE (SS & GM)	II			BIS APPROVED SOURCES WITH VALID BIS LICENSE					FDPS
2	FIRE EXTINGUISHER	II			BIS APPROVED SOURCES WITH VALID BIS LICENSE					FDPS
3	WATER MONITOR	II			BIS APPROVED SOURCES WITH VALID BIS LICENSE					
4	PIPES-MS- (BLACK/ GI) AS PER IS:1239 & IS:3589 UPTO 1000 NB	II			(BIS MARKED, MANUFACTURERS WITH VALID BIS LICENSE)					WTP,CW,CT,CPU,FDPS,AC&VENTILATION,CHP,LHP&GHP,AHP
5	FIRE HOSE	II			BIS APPROVED SOURCES WITH VALID BIS LICENSE					FDPS
6	HYDRANT VALVE	II			BIS APPROVED SOURCES WITH VALID BIS LICENSE					
7	PIPES FOR IDLERS IS 9295	III			BIS APPROVED SOURCES WITH VALID BIS LICENSE					FDPS
8	BLOWERS -CENTRIFUGAL >=5KW	II			MAIN CONTRACTOR APPROVED SOURCES					WTP
9	ClO2 GENERATOR	II			MAIN CONTRACTOR APPROVED SOURCES					WTP
10	JOINT /FITTING COATING MATERIAL(SLEEVE) FOR 3 LPE PIPES	II			MAIN CONTRACTOR TO PROPOSED VENDOR FOR NTPC APPROVAL					MUW
11	PIPING FABRICATION -HP>300PSI	II			MAIN CONTRACTOR APPROVED SOURCES					WTP,CPU
12	PUMP-METERING/DOSING	II			MAIN CONTRACTOR APPROVED SOURCES					WTP,CPU
13	PUMP - PP- ACID/ ALKALI UNLOADING	II			MAIN CONTRACTOR APPROVED SOURCES					WTP,CPU
14	PUMPS-SCREW TYPE	II			MAIN CONTRACTOR APPROVED SOURCES					WTP,CPU,FOH
15	RUBBER LINING OF TANKS/ VESSELS/ PIPES/ VALVES/FITTINGS	II			MAIN CONTRACTOR APPROVED SOURCES					WTP,CPU
16	RO PRESSURE TUBE	II			MAIN CONTRACTOR APPROVED SOURCES					WTP
17	TUBE SETTLER MEDIA	II			MAIN CONTRACTOR APPROVED SOURCES					WTP
18	WRAPPING & COATING MATERIAL -ANTI CORROSIVE TAPE	II			MAIN CONTRACTOR APPROVED SOURCES					CW,CT,LP PIPING, FDPS
19	DRIFT ELIMINATOR-PVC	II			MAIN CONTRACTOR APPROVED SOURCES					CT
20	FAN CYLINDER SEGMENTS-FRP-COOLING TOWER	II			MAIN CONTRACTOR APPROVED SOURCES					CT
21	COOLING TOWER FILLS	II			MAIN CONTRACTOR APPROVED SOURCES					CT
22	SHAFT-CARDON TYPE-CW PUMP	II			MAIN CONTRACTOR APPROVED SOURCES					CW
23	DUST EXTRACTION SYSTEM	I			MAIN CONTRACTOR's APPROVED SOURCES				BOIs SHALL BE FROM NTPC APPROVED SOURCES	CHP, LHP/GHP
24	DUST SUPPRESSION SYSTEM (PLAIN WATER)	I			MAIN CONTRACTOR's APPROVED SOURCES				BOIs SHALL BE FROM NTPC APPROVED SOURCES	CHP, LHP/GHP
25	DUST SUPPRESSION SYSTEM (DRY FOG)	I			MAIN CONTRACTOR's APPROVED SOURCES				BOIs SHALL BE FROM NTPC APPROVED SOURCES	CHP, LHP/GHP
26	PIPE-SS ASTM A 312	II			MAIN CONTRACTOR's APPROVED SOURCES					
27	PIPE-CS SEAMLESS ASTM A 106	II			MAIN CONTRACTOR's APPROVED SOURCES					

Note-1 Items for which Sub-QR is enviisaged, vendors are accepted subject to Sub-QR clearance from NTPC Engg.

A – For these items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list along with the condition of approval, if any./ इन मदों के लिए प्रस्तावित वेंडर एनटीपीसी को स्वीकार्य है। अनुमोदन की शर्त, , यदि कोई हो, के साथ-साथ पत्र "क" में इंगित किया जाए ।

DR – For these items "Detailed required" for NTPC review. To be identified with letter "DR" in the list. एनटीपीसी द्वारा इन मदों की समीक्षा के लिए "विस्तृत ब्यौरे की आवश्यकता" होगी। सूची में "DR" पत्र में इंगित किया जाना चाहिए।

QP / INSPECTION CATEGORY:

CAT-I / श्रेणी- I: For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC. इन मदों के लिए गुणवत्ता योजनाओं को एनटीपीसी द्वारा अनुमोदित किया जाता है और एनटीपीसी द्वारा अंतिम स्वीकृति भौतिक निरीक्षण के दौरान उपलब्ध गवाह

CAT-II / श्रेणी- II: For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP. इन मदों के लिए गुणवत्ता योजनाओं को एनटीपीसी द्वारा अनुमोदित किया

CAT-III/ श्रेणी-III : For these items Quality control to be exercised as per Main contractor Quality Assurance System. The final acceptance by NTPC shall be on the basis of Certificate of Conformance (COC) by Main Contractor.

UNITS/WORKS इकाईयां / कार्य: Place of manufacturing/ निर्माण का स्थान Place of Main Supplier of multi units/works/बहु- इकाइयों / कार्यों के मुख्य सप्लाइर का स्थान.

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11	1.1 KV LT Power Cables (Type- XLPE Insulated, PVC sheathed (incl FRLS)	CAT I							
					Advance Cable	Bengaluru	A		
					Apar Industries Ltd	Umbergaon	A		
					Cords Cables	Bhiwadi	A		
					CMI	Baddi	A		
					Delton Cable Ltd	Faridabad	A		
					Dynamic Cables	Jaipur	A		
					Gemscabs Industries	Bhiwadi	A		
					Gupta Power Cables	Khurda	A		
					Havells India Ltd.	Alwar	A		
					KEC International	Silvassa , Mysore	A		
					KEI Industries	Bhiwadi	A		
					Paramount Cable	Khushkhera	A		
					Polycab Wires Pvt. Ltd	Daman	A		
					Ravin Cables	Pune	A		
					Special Cables	Rudrapur	A		
					Suyog Cables	Vadodara	A		
					Thermocables	Hyderabad	A		
					Tirupati Plastomatics	Jaipur	A		
					Torrent Cable Ltd	Nadiad	A		
					Universal Cable Ltd.	Satna	A		
12	LT Control Cable 1.1 KV, Type - PVC (incl FRLS)	CAT II							For cable total quantity above 10 km per size/type- Cat-III
					Advance Cable	Bengaluru	A		
					Apar Industries Ltd	Umbergaon	A		
					Cords Cables	Bhiwadi	A		
					CMI	Faridabad	A		
					CMI	Baddi	A		
					Delton Cable Ltd	Faridabad	A		
					Elkay Telelink	Faridabad	A		
					Gemscabs Industries	Bhiwadi	A		
					Goyoline Fibres (I) Ltd	Daman	A		
					Gupta Power Cables	Khurda	A		
					Havells India Ltd.	Alwar	A		
					KEC International	Silvassa , Mysore	A		
					KEI Industries	Bhiwadi	A		
					Paramount Cable	Khushkhera	A		
					Polycab Wires Pvt. Ltd	Daman	A		
					Ravin Cables	Pune	A		
					Special Cables	Rudrapur	A		
					Suyog Cables	Vadodara	A		
					Thermocables	Hyderabad	A		
					Tirupati Plastomatics	Jaipur	A		

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24	CIRCUIT BREAKER	CAT I							
					GE T&D	KANCHIPURAM	A		UP TO 765 KV
					ABB	VADODARA	A		UP TO 400 KV
					SIEMENS	AURANGABAD	A		UP TO 400 KV
					BHEL	Hyderabad	A		UP TO 400 KV
					CGL	NASHIK	A		UP TO 400 KV
25	ISOLATOR	CAT I							
					GR POWER	HYDERABAD	A		UP TO 400KV
					HIVELM	CHENNAI	A		UP TO 400KV
					S&S POWER	PONDICHERRY	A		UP TO 400KV
					SIEMENS	HYDERABAD	A		UP TO 765 KV
					ELEKTROLITES	JAIPUR	A		UP TO 33 KV
					SWITCHGEAR & STRUCTURALS	HYDERABAD	A		UP TO 765 KV
26	'SURGE ARRESTOR	CAT I							
					CGL	NASIK	A		UP TO 400KV
					ELEKTROLITES	JAIPUR	A		UP TO 33 KV
					LAMCO	HYDERABAD	A		UP TO 400KV
					OBLUM	HYDERABAD	A		UP TO 765 KV
27	CLAMPS & CONNECTORS & WELDING SLEEVES	CAT I							
					ELCTROMECH TRANSTECH	KOLKATA	A		
					EXALT	MUMBAI	A		
					KLEMMEN ENGG	CHENNAI	A		
					MEGHA ENGG	CHENNAI	A		
					MILIND	MUMBAI	A		
					EMI	MUMBAI	A		
					NOOTAN ENGG	MUMBAI	A		
					TAG CORPORATION	CHENNAI	A		
					ITPL	MUMBAI	A		
					RASHTRA UDYOG	KOLKATA	A		
					Premier Power Products	Chennai	A		
					PEE VEE ENGG	BANGALORE	A		

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33	132 KV cable termination & straight through jointing kits	CAT I							
					Iljin	South Korea	A		
					ABB Kabeldon	Sweden	A		
					Pfisterer AG	Switzerland	A		
					Tyco Electronics Raychem GmbH	Germany	A		
34	Air Insulated Non Segregated phase type LT busduct	CAT I							
					C&S Electric	G.Noida	A		
					C&S Electric	HARIDWAR	A		
					Unilec	Gurgaon	A		Upto 3200 A
					Stardrive	Chennai	A		
					Spaceage Swgr Ltd	Bawal	A		
					REEP	Chennai	A		
					Enpro	Chennai	A		
					Nitya Electrocontrols	Noida	A		
34.1	Sandwitched type LT Busduct	CAT I							
					Henikwon	Malaysia	A		
					C&S	HARIDWAR	A		
35	SPBD	CAT I							
					BHEL	Rudrapur	A		
					C&S	Greater Noida	A		
					C&S	Haridwar	A		
					GODREJ & BOYCE MANUFACTURING COMPANY LTD	Bangalore	A		
					Powergear	Hindupur	A		
					Powergear	Chennai / Bangalore	A		
					KGS Engg.	Chennai	A		
36	LT MOTOR	CAT I							
		Refer Note 7			ABB	FARIDABAD	A		UPTO 55KW
					ABB	BANGALORE	A		
					JYOTI LTD.	VADODARA	A		
					TIPM	JAPAN	A		UPTO 15 KW (NON FLAME PROOF)
					HYOSUNG	SOUTH KOREA	A		
					WEG	BRAZIL	A		
					HYUNDAI	SOUTH KOREA	A		
					LHP	SOLAPUR	A		
					CGL	AHMEDNAGAR	A		RQP, FOR FLAME PROOF MOTOR
					TMEIC	JAPAN (NAGASAKHI)	A		
					NGEF	BANGALORE	A		UPTO 15 KW
					BHARAT BIJLEE	MUMBAI	A		RQP, FOR FLAME PROOF ALSO
					KEC	BANGALORE/ HUBLI*	A		*UPTO 90KW, RQP, FOR FLAME PROOF ALSO

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					MARATHON	KOLKATA	A		RQP (UPTO 690V & 600 KW) FOR FLAME PROOF ALSO
					ABB	SWEDEN	A		UPTO 55KW
					HAVELL	NEEMRANA	A		UP TO 90KW
					KAWAMATA	JAPAN	A		UP TO 75 KW
					TIPS	JAPAN	A		UP TO 45KW
36.1	**DC Motor**	**CAT I**							
					CGL	MANDIDEEP	A		
37	**LT VFD Control Panel**	**CAT I**							
					Powertech	Sonepat	A		Upto 55 KW with following conditions: i) VFD from Schneider- France, upto 415V, 50KW. ii) Enclosure & bought out items shall be from NTPC acceptable makes & iii) Engineering support for integration will be provided by Schneider/ Authorized integrator of Schneider
					DANFOSS	Oragadam	A		(upto 690V, 1200kW), VFD drives with VFD sourced from Danfoss-Denmark/USA and Panel sourced from Rittal
					YASAKAWA	Japan	A		VFD from Yasakawa- Japan, Upto 415V, 132KW
					ROCKWELL AUTOMATION	SAHIBABAD	A		VFD from Rockwell(Allen Bradley)- USA, (Upto 415 V, 600 KW)
					ABB	BANGALURU	A		VFD from ABB-Finland, Upto 690V, 750 KW
					SIEMENS	NASIK	A		VFD from SIEMENS- Germany, Upto 690V,900KW
					VACON	BANGALORE	A		VFD(NXP model) from VACON Finland, upto 400KW,415V and upto 900KW, 690V

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37.1	**MV VFD Control Panel**	**CAT I**							
					HITACHI HI REL POWER ELECTRONICS PVT. LTD.	SANAND	A		3.3 KV, 1050 KW
					TMEIC INDUSTRIAL SYSTEMS INDIA PRIVATE LIMITED	TUMKUR	A		2200 KVA, 1050 KW, 3.3 KV
38	**Elevator (GEAR TYPE)**	**CAT I**							
					ECE INDUSTRIES,	Ghaziabad	A		
					TECHNO INDUSTRIES LTD.,	AHMEDABAD	A		
					BHARAT ELEVATORS ENGG. PVT. LTD.,	KOLKATA	A		
					OTIS	MUMBAI	A		
					KONE ELEVATORS INDIA PVT. LTD.,	CHENNAI	A		
					OMEGA ELEVATORS	AHMEDABAD	A		
					SAMIL ELTEC CO LTD.	SOUTH KOREA	A		
					ORBIS ELEVATOR CO. LTD.,	AHMEDABAD	A		
39	**HVR Transformer & EC Panel**	**CAT I**							
					ADOR Powertron	Pune	A		
					BHEL	Jhansi	A		
40	**Panel Type Hopper Heater**	**CAT I**							
					HTD	USA	A		
					Hotfoil EHS	USA	A		
					HTD HEAT TRACE(I) Pvt Ltd	Hyderabad	A		
					Thermon	USA	A		
					Thermopads(Unit-II)	Jeedimetla	A		
					Thermon	Pune	A		
41	**Neutral Grounding Transformer**	**CAT II**							
					Pragati Electrical Pvt. Ltd.	Mumbai	A		
					Bharat Bijlee Ltd.	Navi Mumbai	A		
					Prayog Electrical Ltd.	Pune	A		
					Andrew Yule	Chennai	A		
42	**LT Switchgear - Floor mounted Fixed type indoor LT Switchgear Panel (MLDB)**	**CAT I**							
					Switching Circuits	Kolkata	A		
					Hindustan Control & equipment Ltd	Kolkata	A		With fabrication & painting at unit II & MP Electrical Narendrapur
					Maktel	Vadodara	A		Prior Type Testing
					Jakson	Greater Noida	A		
					Vidyut Control	Gaziabad	A		

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11	ON LOAD TAP CHANGER	**CAT III**							
12	OFAF COOLER	**CAT III**							
13	RADIATORS	**CAT II**							
14	REGNENERATIVE MAINTENANCE FREE BREATHER	**CAT III**							
15	CMS System	**CAT I**							
16	CMS PANEL	**CAT II**							
17	TRANSFORMER TESTING & MAINTENANCE EQUIPMENTS	**CAT III**							
	L2 LIST OF BUS DUCTS								
1	Air Pressurisation Equipment	**CAT II**							
2	Hot Air Blower	**CAT II**							
3	LAVT Cubicle / NG Cubicle/ Marshalling Box	**CAT II**							
4	CT for IPBD	**CAT II**							
5	Epoxy Seal off bushing / Insulators	**CAT II**							
NOTE	**L2 LIST OF SWITCH GEAR**								SOURCES FOR THESE ITEMS SHALL BE FINALIZED DURING DETAILED ENGINEERING AND MQP FINALIZATION
1	Numerical Relays	**CAT I**							SUB-QR CLEARED VENDORS ARE ACCEPTABLE FOR NUMERICAL RELAYS
2	Silver Plating	**CAT III**							
3	LV Air Circuit Breaker	**CAT I**							
4	LT CT/PT/CBCT/ Control Transformer	**CAT II**							
5	MV Vacuum Type Circuit Breaker	**CAT I**							
6	MV CT / PT & CBCT	**CAT I**							
7	MCBs	**CAT III**							
8	ENERGY METER	**CAT III**							
9	H.V. Fuse	**CAT III**							
10	Terminal Blocks (Control)	**CAT III**							
11	Surge Capacitors	**CAT II**							

NOTES:

Note - 1 : Vendors to submit project specific documents as per Sub-QR requirements in case the Vendor is approved under collaboration agreement.

Note - 2: Vendors under 'A' are approved and accepted by NTPC with/without conditions in the past. Similar conditions as the case may be for the vendor shall be applicable for this project and tied up in the quality plan.

Note - 3: Main contractor approved sub vendors are acceptable those are evaluated / assesesed as per Main contractor Quality Management System for vendor approval. Main contractor to inform the finaly selected vendor to NTPC as soon as PO is placed for these items. In case of sub-QR Note-1 is also applicable.

Note - 4 : BOI shall be reviewed and finalised during MQP approval for items/systems where ever applicable.

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Note - 5: Category of inspection for LT Cables:									
	For Total Contract Quantity per Size					***Category Of Inspection***			
	For cable total quantity ≤ 2.5 KM					Cat-III - submission of TC & Certificate of Conformance by Main Contractor for the manufacturers having successfully supplied to any NTPC project-site through Corporate contracts for atleast 2 years			
	For cable total quantity above 2.5 km & up to ≤ 10 km per size/type					Cat-II for the manufacturers having successfully supplied to any NTPC project-site through Corporate contracts for atleast 2 years			
	For cable total quantity above 10 km per size/type					Cat-I			
Note - 6: Category of inspection for Cable Trays & Cable Tray Flexible Support System:									
	For Total Contract Quantity per Size					***Category of Inspection***			
	For cable total quantity ≤ 2.5 KM					Cat-III - submission of TC & Certificate of Conformance by Main Contractor for the manufacturers having successfully supplied to any NTPC project-site through Corporate contracts for atleast 2 years			
	For cable total quantity above 2.5 km & up to ≤ 10 km per size/type					Cat-II for the manufacturers having successfully supplied to any NTPC project-site through Corporate contracts for atleast 2 years			
	For cable total quantity above 10 km per size/type					Cat-I			
Note - 7:	**i) For Motors less than 50 KW: CAT-III.** Acceptance of Motor less than 50 KW is based on COC of the Manufacturer and the Main Contractor confirming as follows: "It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate and tested in accordance with approved drawing /data sheets". **ii) For Motors 50 KW and less than 75 KW : CAT- II**. Acceptance of Motor is based on NTPC review of Routine Test inspection report as per **IS: 12615** / applicable standards duly witnessed by main contractor along with COC of the Manufacturer and the Main Contractor confirming as follows: "It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate, space heater and tested in accordance with approved drawing /data sheets". **iii) For Motors 75 KW & above : CAT- I** . AS PER NTPC APPROVED QUALITY PLAN (To be submitted seperately for NTPC review & approval).								
Note - 8:	**NTPC approved Galvanizers:**								
	1. M/s M J Engg,Delhi	7. M/s National Galvanizer, Kolkata				13. M/s Gurpreet Galvanizer, Hyderabad		19. Unitech Fabricators & Galvanizers- Hoogly	
	2. M/s A.V. Engg, Kolkata	8. M/s Unistar Galvanizer, Kolkata				14. M/s Sigma, Mumbai			
	3. M/s Inar Profiles, Vishakapatnam	9. M/s B.P. Project. Kolkata				15. M/s Radhakrishnan Shetty, Chennai			
	4. M/s Anand Udyog, Mumbai	10. M/s Bajaj Pune				16. Karamtara Mumbai			
	5. M/s Techno Engg,Chandigarh	11. M/s Electrocare Industries, Mumbai				17. Poona Galvanizers Pune			
	6. M/S Steelite Engg, Mumbai	12. M/s B.G. Shirke, Pune				18. Neha Galvanizer-Kolkata			

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Note - 9: Relevant certificates shall be submitted for NTPC approval.Approval conditions attached to above identified vendors, as applicable shall be adhered to.

Note - 10 : Indigenous sub-vendors for Annexure-I items are acceptable subject to meeting the MLC (Minimum Local Content} in line with latest MOP order.

LEGENDS / संकेतिका

SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY /प्रणाली आपूर्तिकर्ता / सब –वेंडर की स्वीकृति की स्थिति की श्रेणी (SHALL BE FILLED BY NTPC एनटीपीसी द्वारा भरा जाएगा)

A – For these items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list along with the condition of approval, if any./ इन मदों के लिए प्रस्तावित वेंडर एनटीपीसी को स्वीकार्य है। अनुमोदन की शर्त, , यदि कोई हो, के साथ-साथ पत्र "क" में इंगित किया जाए ।

DR – For these items "Detailed required" for NTPC review. To be identified with letter "DR" in the list. एनटीपीसी द्वारा इन मदों की समीक्षा के लिए "विस्तृत ब्यौरे की आवश्यकता" होगी। सूची में "DR" पत्र में इंगित किया जाना चाहिए।

QP/INSPN CATEGORY: क्यूपी / निरीक्षण की श्रेणी:

CAT-I / श्रेणी- I: For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC. इन मदों के लिए गुणवत्ता योजनाओं को एनटीपीसी द्वारा अनुमोदित किया जाता है और एनटीपीसी द्वारा अंतिम स्वीकृति भौतिक निरीक्षण के दौरान उपलब्ध गवाह के आधार पर दी जाएगी।

CAT-II / श्रेणी- II: For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP. इन मदों के लिए गुणवत्ता योजनाओं को एनटीपीसी द्वारा अनुमोदित किया जाता है। हालांकि एनटीपीसी द्वारा कोई भौतिक निरीक्षण नहीं किया जाएगा। एनटीपीसी द्वारा अंतिम स्वीकृति अनुमोदित क्यूपी के अनुसार दस्तावेजों की समीक्षा के आधार पर दी जाएगी।

CAT-III/ श्रेणी-III : For these items Quality control to be exercised as per Main contractor Quality Assurance System. The final acceptance by NTPC shall be on the basis of Certificate of Conformance (COC) by Main Contractor.

UNITS/WORKS इकाईयां / कार्य: Place of manufacturing/ निर्माण का स्थान Place of Main Supplier of multi units/works/बहु- इकाइयों / कार्यों के मुख्य सप्लाइर का स्थान.

: Control measure of item covered in quality plan of main item.

एनटीपीसी NTPC एक महारत्न कम्पनी	PROJECT : Talcher-III (2X660MW) PACKAGE : EPC PACKAGES CONTRACTOR: CONTRACT NO :	LIST OF C&I ITEMS REQUIRING QUALITY PLAN AND SUB SUPPLIER APPROVAL	REVISION NO : 00 DATE :04.02.2022

Sr No	Item Description	QP Inspection Category	QP No	QP submission SCH	QP approval SCH	Proposed Sub Supplier	Country	SS Approval_Status (Note-1)	SS Detail Sub.SCH	SS Approval SCH	Remark
		II				Nihon Koso Co Ltd	Japan	A			
		II				Dressor Masoneilan	USA	A			only for SH / RH/ up to 2500 class
		II				Dresser Produits industriels Industriels S.A.S	France	A			
		II				SPX Flow Technology	USA	A			only for SH / RH
		II				Leslie Controls Inc	USA	A			only for SH / RH
		II				Sempell AG (Tyco group)	Germany	A			only for SH / RH
		II				CCI	USA/Sweden /S.Korea	A			
		II				Emerson (Fisher)	USA/France /Japan	A			
9-F	Control valve(Other application)										
		I				Mascot Valves Pvt Ltd	Ahmedabad	A			Up to size 12 inches & 900 ANSI class
		I				Control Component India PVT Ltd	Sricity (Andhra Pradesh)	A			Up to 2500 ANSI class
		I				KOSO India Pvt Ltd	Nasik	A			
		I				KSB MIL Controls Ltd	Thrissur (Kerala)	A			Up to 2500 ANSI class
		I				Emerson Process Management Ltd	Chennai	A			Up to 2500 ANSI class
		I				GE Oil & Gas India Pvt Ltd	Coimbatore	A			Up to size 10 inches & 900 ANSI class /Up to size 24 inches & 600 ANSI class
		I				Flow Serve India Controls Pvt Ltd	Bengaluru	A			Up to size 14 inches & 600 ANSI class
		I				Forbes Marshal Arca Pvt. Ltd.	Pune	A			Up to size 16 inches & 900 ANSI class
		I				Instrumentation Limited	Palakkad (Kerala)	A			Up to 2500 ANSI class
		I				Severn Glocon India Pvt Ltd	Chennai	A			Up to size 14 inches & 300 ANSI class
		II				CCI	USA/Sweden /S.Korea	A			
		II				Nihon Koso Co Ltd	Japan	A			
		II				Emerson (Fisher)	USA/France /Japan	A			
		II				Leslie Controls Inc	USA	A			
		II				PARCOL S.P.A	Italy	A			
		II				Dresser Produits industriels Industriels S.A.S	France	A			
		II				HORA	Germany	A			
		II				Wellend & Tuxhorn	Germany	A			
		II				SPX Flow Technology	USA	A			
		II				Sempell AG (Tyco group)	Germany	A			
9-G	Control Valve (Ceramic lined)										
		I				Samson Controls Pvt Ltd	Pune	A			1. For M/S Samson Cera Germany make valve Up to 10 inches size & 150 ANSI class 2. BOI shall be tied up at the time of finalisation of MQP
10	DDCMIS										
		I				ABB	Germany	A			
		I				SIEMENS AG	Germany	A			
		I				Emerson Process Management Asia Pacific Pvt Ltd	Singapore	A			
		I				Hitachi nest control system Pvt Ltd	Bengaluru	A			

Sr No	Item Description	QP Inspection Category	QP No	QP submission SCH	QP approval SCH	Proposed Sub Supplier	Country	SS Approval_Status (Note-1)	SS Detail Sub.SCH	SS Approval SCH	Remark
		I				Honeywell Automation India Ltd	Pune	A			
		I				GE	France	A			
		I				SIEMENS	Gurugram	A			
		I				BHEL	Bengaluru	A			For MAX DNA System
		I				Yokogawa	Bengaluru	A			
		I				GE Power India Ltd	Noida	A			
		I				Toshiba	Japan	A			
		I				ABB	Bengaluru	A			
		I				Emerson Process Management Ltd	Pawane	A			
11	Dust Emision Monitor										
		III				Durag India Instrumentation Pvt Ltd	Bengaluru	A			1. For Durag Germany Make Extractive Type Dust density analyser 2. Other components shall be as per approval letter CQA/NTPC BARH STPP-I / D-263 / Durag India Instrumentation Pvt Ltd Bengaluru Dated 28.08.2019
		III				Sick India Pvt ltd	Mumbai	A			1.For SICK AG Make Extractive Type Dust density analyser 2. Other components shall be as per approval letter CQA/NTPC BARH-I /S-907/M/S SICK India Pvt Ltd dated 28.08.2019
		III				Environment SA India Pvt Ltd	Navi Mumbai	A			1.For ENEVA UK Make Extractive Type Dust density analyser 2. Other components shall be as per approval letter No.: CQA/NTPC BARH-I / E-335 / M/S Environment SA India Pvt Ltd Dated 16.09.2019
		III				Land Instruments International	UK	A			For In Situ type /Optical Transreceiver type
		III				Codel	UK	A			For In Situ type /Optical Transreceiver type
		III				Durag Industrie Elektronik GmbH & Co KG	Germany	A			For In Situ type /Optical Transreceiver type & Extractive Type
		III				Emerson Process Management	Ireland	A			For In Situ type /Optical Transreceiver type
		III				SICK AG	Germany	A			For In Situ type /Optical Transreceiver type & Extractive Type
		III				ENEVA	UK	A			For Extractive Type Dust density analyser
12	Electrical Actuators										
12-A	Electrical Actuator (With gear box if applicable)										
		II				Antrieb Technik Pvt Ltd	Chennai	A			For low torque applications only
		II				Auma	Bengaluru	A			
		II				Limitorque	Faridabad	A			Model no L120,SMB,LY series, Gear Box T, HBC Series
		II				Rotork	Bengaluru	A			For low torque app (Up to 1000 Nm)
		II				Rotork Controls (India) Private Ltd	Chennai	A			For low torque app (Up to 1000 Nm) & High torque 4000 to 7000 Nm With integral starter for non critical applications

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		III				Auma	Germany	A			
		III				Limitorque	USA	A			
		III				Rotork	UK	A			For low torque app (Up to 1000 Nm)
		III				Nippon gear	Japan	A			
		III				Drehmo GMBH	Germany	A			C Matic Series (DMC/DMCR)
12-B	Electrical Actuator- Non-Intrusive (With gear box if applicable)										
		I				Auma India Pvt Ltd	Bengaluru	A			Also acceptable for Field Bus based applicable
		III				Flowserve	USA	A			Also acceptable for Field Bus based applicable
		III				Bernard Controls	France	A			
12-C	Electrical actuator for ID/FD/PA Blade pitch ,IGV &SCOOP										
		III				Harold Beck & Sons Inc	USA	A			
		III				SIPOS Aktrorik GmbH	Germany	A			
13	Electronics Transmitter (Pressure , DP and DP based Flow/Level)										
13-A	Electronics Transmitter (Pressure , DP and DP based Flow/Level)										
		III				ABB Ltd	Bengaluru	A			2600T & critical item from ABB Italy/ Their approved source;
		III				Emerson Process Management Ltd	Pawane	A			
		III				Siemens Ltd	Thane	A			Model:-SITRANS P
		III				Honeywell Automation India Ltd	Pune	A			
		III				Baldota Control and Equipment Pvt Ltd	Navi Mumbai	A			PT & DPT of LD 301 Series (SMAR)
		III				Yokogawa India Limited	Bengaluru	A			EJA-E 110,430,530 SERIES & all raw material and BOI under knocked down condotion (sensor assembly as a single unit) shall be sourced from M/S Yokogawa Japan
		III				M/s Endress + Hauser India Automation Instrument Pvt Ltd	Aurangabad	A			
		III				Emerson (Rosemount)	USA	A			
		III				Yokogawa	Japan	A			
		III				ABB	Germany / Italy	A			2600T & critical item from ABB Italy/ Their approved source;
		III				Siemens	France	A			Sitrans P DSIII Series
		III				Fuji Electric	France	A			FCX -AIII SERIES
		III				Fuji	Japan	A			
13-B	Electronics Transmitter -Field Bus Based (Pressure , DP and DP based Flow/Level)										
		I				ABB India Ltd	Bengaluru	A			One no of Transmitter will be sent at DDCMIS supplier for function testing of field bus communication with DDCMIS during FAT
14	EQMS										

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		I				SWAN	Hyderabad	A			1. Conductivity analyser, pH analyser and Temperature Transmitter will be of M/s ABB, UK make . 2. TSS analyser will be of M/s Daeyoon, South Korea make . 3. Oil in water analyser will be of M/s TriOs, Germany make. 4. Online BOD/COD analyser will be of M/s Shimadzu, Japan make . 5. Flow meter will be of M/s Khrone Marshall, Maharashtra make. 6. Data Aquisition System will be procured from Knowledge Lens, Karnataka.
15	Fiber optic cable										
		Note-3				U M Cables Ltd	Silvassa (Daman)	A			
		Note-3				KEC International Ltd	Mysore	A			
		Note-3				Apar Industries Limited	Valsad (Gujrat)	A			
		Note-3				HFCL	Goa	A			
		Note-3				Aksh Fibre	Bhiwadi (Raj)	A			
		Note-3				Finolex Cable Ltd	Goa	A			
		Note-3				Birla Cable Limited	Rewa	A			
		Note-3				R&M	Switzerland	A			
		Note-3				Molex	UK	A			
		Note-3				Corning	USA	A			
16	Fire alarm Panel										
		II				Toshniwal Industrial Pvt Ltd	Ajmer	A			1.M/S Notifier Make Fire alarm Panel 2.Pl Refer Note-07
		II				Bosch Security system	Bengaluru	A			1.Detector , Hooter, MCP, Modules, Panel shall be M/s Bosch Make
		II				Notifier	USA	A			
		II				Autronica	Norway	A			
		II				Schrack	Austria	A			
		II				Edwards	Mexico	A			
		II				Shield Fire safety and security Ltd	UK	A			
		II				Jhonson Controls	USA	A			Simplex Brand
17	Flame Monitoring System (Scanner)										
		I				Lucent Marcons Pvt Ltd (System Integrator of M/S Forney Corporation USA)	Noida	A			1.Flame detector, amplifier ,light guide fiber optic , smart display programming unit , test kit & simulator will be supplied from M/S Forney Corporation USA 2.Other components like outer carrier ,IDD cable with connector , expander , Y connector with adapter gasket , fastners & signal isolators will be supplied from M/S Forney Corporation USA approved sources . 3.Pl Refer Note-7

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		Note-2				Goyolene Fibers (India) Pvt Ltd	Silvassa	A			F&G Type Cable
		Note-2				Temsens Instruments Ind Pvt Ltd	Udaipur	A			
		Note-2				Havells India	Alwar	A			F Type Cable
		Note-2				Paramount Communication Ltd	Khuskhera	A			
		Note-2				Polycab	Daman	A			
		Note-2				Delton	Faridabad	A			
		Note-2				KEI	Bhiwadi (Raj)	A			
		Note-2				Elkey Telelinks	Faridabad	A			
		Note-2				CORDS	Kaharani	A			
		Note-2				CORDS	Bhiwadi	A			
		Note-2				Nicco	Kolkata	A			
		Note-2				Universal Cable	Satna	A			
		Note-2				Thermocables	Hyderabad /Mahboobnagar	A			
		Note-2				Gupta Power Inftrastructure Ltd.	Khurdha	A			
		Note-2				CMI	Faridabad	A			
		Note-2				Advance Cables Pvt Ltd	Bengaluru	A			F&G Type Cable
		Note-2				Gemscab Industries Ltd	Bhiwadi (Raj)	A			F&G Type Cable
		Note-2				Apar Industries Limited	Valsad	A			F&G Type Cable
		Note-2				Suyog Electricals Ltd	Halol (Gujrat)	A			
		Note-2				Special Cables Pvt Ltd	Rudrapur	A			
		Note-2				T C Communication	Ghaziabad	A			
		Note-2				TEW & C	USA	A			
		Note-2				Habia cables	Sweden	A			
		Note-2				Kerpen cables	Germany	A			
		Note-2				Lapp cables	Germany	A			
		Note-2				Thermo elecrta Bv	Netherland	A			
30	Intelligent Battery charger 24V DC / DCDB/BHMS										
		II				Chabbi Electricals	Jalgaon	A			Rectifier module, Controller module and Battery Health monitoring system shall be of M/s Vertiv make
		II				Eltek SGS Pvt Ltd	Gurugram	A			
31	Large Video Screen (LED Based)										
		I				Pyrotech Electronics Pvt Ltd	Udaipur	A			
		I				Delta India Electronics Pvt Ltd	Gurugram	A			
		I				Barco Electronics system (P) Ltd	Noida	A			
		I				Planner System Inc	USA	A			
32	Level switch- Conductivity type										
		II				Raman Instruments (System integrator of Delta Morbey/ Emerson Mobrey /Solartron -Mobrey)	Delhi	A			1.M/S Emerson (Morbey) UK system 2.Pl refer Note-07
		II				HI Tech System & services Ltd (System Integrator of Levelstate systems Ltd ,UK)	Kolkata	A			1. M/S Levekstate UK System .Vessel from M/s Hi Tech 2.Pl refer Note-07
		II				BHEL	Trichurapalli	A			
		III				Emerson -Mobrey (Solartron mobrey)	UK	A			
		III				Levelstate Systems Ltd	UK	A			

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		III				Yarway	USA	A			
33	Local Instrument Enclosure/Rack										
		I				Pyrotech Electronics Pvt. Ltd	Udaipur	A			BOI from LOA approved sources
		I				Sajas electrical	Trichurapalli (Tamilnadu)	A			BOI from LOA approved sources
		I				Prammen	Puddukottai (Tamilnadu)	A			BOI from LOA approved sources
		I				Chemin C&I Pvt Limited	Puducherry	A			1- BOI from LOA approved sources 2.Fabrication at M/s LUFT tech India 3- Painting at M/s Supreame Coater & Fabricator
34	Master Slave Clock System										
		I				Signals and Systems Pvt. Ltd. (SANDS)	Chennai	A			
		I				Masibus	Gandhinagar	A			
		I				Sertel Electronics Pvt. Ltd.	Chennai	A			
		II				Hopf Electronik GmbH	Germany	A			
		II				Hathway	USA	A			
		II				Mein Berg	Germany	A			
		II				Moser Baer AG	Switzerland	A			
35	Mercury Analyser										
		I				Analyser Instrument Co. Pvt Ltd (AIC)	Kota	A			1. Mercury Analyzer from PS Analytical UK 2.System integration & supply of components like, Enclosure with AC, calibration cylinders, PC will be done by M/s Analyser Instrument Co. Pvt Ltd (AIC) Kota . 3.Pl refer Note-07
		III				Environment SA India Pvt Ltd	Navi Mumbai	A			1-Mercury analyzer with accessories will be from Mercury instruments GmbH Germany . 2- Other components like, sample line between probe to mercury analyzer will be supplied by M/s Environment SA India Pvt Ltd .
		III				Thermo Fisher Scientific India Pvt Ltd	Pune	A			1. Mercury Analyser shall be from Thermofisher USA 2. Other approval conditions are as per approved letter ref no 01/CQA/9578-001/Thermofisher dated 09/12/2016
		III				Durag India Instrumentation Pvt Ltd	Bengaluru	A			Analyser from M/s Verewa Umwelt Germany
		III				Mercury Instruments GmbH	Germany	A			
		III				SICK AG	Germany	A			
		III				Themofisher	USA	A			
36	PA System (IP Based)										
		III				BNA Technology Consulting Ltd.	Bengaluru	A			BOI shall be from LOA approved sources.
		III				Armtel	Russia	A			
		III				Zenitel	Norway	A			1.PA system active component , Proprietary item will be Zenitel Norway make 2.Other components & BOI shall be from LOA approved sources

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		I				Adaptive Engineering Private Limited	Ahmedabad	A			For M/s Schneider make system
		I				Greenwave Solutions Private Limited	Kolkata	A			For M/s Rockwell make system
		I				Dreamz Automation	Ghaziabad	A			For M/s SIEMENS make system
		I				Creative Robotics	Ghaziabad	A			For M/s Honeywell make system
		I				Kruti Techno Engineer Pvt Ltd	Chhapraula (GB Nagar	A			For M/s SIEMENS make system
		I				EDS Instruments & Systems Pvt Ltd	Chennai	A			For M/s Honeywell make system
		I				Delsys Automation Technologies Pvt Ltd	Chennai	A			For M/s Emerson make system
		I				Hindustan Controols and Equipment Ltd	Kolkata	A			For M/s Emerson make system
		I				Vollkraft Engineering And Consultant (P) Ltd	Kolkata	A			For M/s Emerson make system
		I				SSM Infotech Solutions Pvt Ltd	Surat	A			For M/s Schneider make system
		I				Sun Industrial Automation & Solutions	CHENNAI	A			For M/s Schneider make system
38	Pneumatic Actuator Regulating (Power Cylinder HAD,CAD SADC & Burner Tilt)										
		I				Instrumentation Limited	Palakkad (Kerala)	A			
		I				Kelton	Cochin (Alleppy)	A			
		I				SMC Corporation India Private Ltd	Noida	A			Up to Bore size 12 inches
		I				IMI Norgren Herion Pvt ltd	Noida	A			
		II				Dong Woo Valve Control Co. Ltd	S.Korea	A			
		II				Shin Hwa Engineering Co. Ltd	S.Korea	A			
39	Radar type level transmitter										
		III				Limaco	Russia	A			High Frequency Type
		III				Emerson Process Management Ltd	Pawane	A			For M/s Emerson Singapore make
		III				Endress & Houser	Aurangabad	A			
		III				SIEMENS	Canada	A			
		III				B M Technology	Italy	A			For Non Contact type
		III				Magnetrol	Belgium	A			
		III				ABB	USA	A			K-Tech Brand
		III				Endress & Houser	Germany	A			
		III				Saab Rosemeount	Sweden	A			
		III				Emerson Process Management	Singapore	A			Rosemount 3300 series for GW Radar & 5600 Series for Non-Contact type
		III				Endress & Houser	Germany	A			
		III				Vega Grieshaber KG	Germany	A			
40	Short Term Fire Proof cable										
		III				nVent Solutions limited	UK	A			
		III				Wrexham Mineral	UK	A			
		III				KME	Italy	A			

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41	SWAS (Sampling Handling System and Dry Panel)										
		I				Emerson Process Management Ltd	Navi Mumbai	A			Analysers and Other BOI Componets from LOA agreed source
		I				Forbes Marshall	Pune	A			Analysers and Other BOI Componets from LOA agreed source
		I				SEPL	Pune	A			Analysers and Other BOI Componets from LOA agreed source
42	Water Analyser (Chloride, Conductivity, Dissolved Oxygen,pH, Hydrazine, Concentration , Phosphate, Silica, Soldium,Turbidity, Total Iron, Degassed Cation Conductivity)										
		III				Emerson Process Management Pvt Ltd	Pawane	A			For Conductivity,pH, Dissloved Oxygen, Turbidity
		III				Mettlet Toledo India Pvt Ltd	Vasai	A			For pH Analyser (1. PH analyser from M/S Mettler Toledo GmbH Switzerland 2. Other components like, Housing, Panel mounting kit, Tubing's & easy clean mechanism will be supplied by M/s Mettler Toledo India Pvt Ltd)
		III				Endress Hauser India Pvt. Limited	Mumbai	A			For pH Analyser (1. pH sensor with cable , analyser ,retract & cleaning assembly , electrolyte reservoir (As applicable) will be supplied from Principals of M/S Endress Hauser India Pvt. Limited. 2. Other components like, Flow through assembly shall be supplied from M/S Endress Hauser India Pvt. Limited approved sources.)
		III				Thermo Fisher Scientific	USA	A			For Chloride,Dissloved Oxygen,Hydrazine
		III				ABB	UK	A			For Chloride,Dissloved Oxygen,Hydrazine, Phosphate, Silica,Sodium,Turbidity
		III				Hach	USA	A			For Conductivity, pH,Concentration, Phosphate, Silica,Turbidity
		III				ABB	USA	A			For Conductivity, pH
		III				Yokogawa	Japan	A			For Conductivity
		III				Hach	Switzerland	A			For Dissloved oxygen, Hydrazine, Silica,Sodium
		III				Yokogawa	Japan	A			For pH
		III				Eutech Instrument PTE Ltd	Singapore	A			For Silica
		III				Orion	USA	A			For Sodium
43	Temp Transmitter										
43-A	Temp Transmitter										
		III				Endress & Houser	Aurangabad	A			
		III				Emerson Process Management Ltd	Pawane	A			For M/s Emerson Singapore make
		III				Yokogawa	Bengaluru	A			Make Yokogawa japan and caliberation at Yokogawa Banglore

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		III				ABB	Bengaluru	A			For M/s ABB Germany make
		III				WIKA Instruments India Pvt Ltd	Pune	A			For M/s WIKA Germany make Model no T-32
		III				Honeywell Automation India Ltd	Pune	A			
		III				Yokogawa	Japan	A			
		III				Moore	USA	A			
		III				M System co Ltd	Japan	A			Model No-B3HU-0
		III				Emerson	U.S.A/Singapore/ Germany	A			
		III				ABB	Germany	A			
		III				Emerson Process Management	Germany	A			
43-B	Temp Transmitter -Field Bus based Single/Dual Input										
		I				ABB India Ltd	Bengaluru	A			One no of TT will be available at DCS supplier for function testing of field bus communication with DCS during FAT
44	Turbine supervisiory Instruments along with vibration analysis system.										
		I				GE	Pune	A			For GE Bentlly ,USA make system
		I				Meggitt India Pvt ltd	Bengaluru	A			For Meggitt (Vibrometer) Switzerland make system
		I				Forbes Marshall	Pune	A			For Shinkawa ,Japan make system
		II				GE BENTLY	USA	A			
		II				SHINKAWA	JAPAN	A			
		II				MEGGITT	Switzerland	A			
45	Ultrasonic Type Flow Meter (for Stack)										
		III				Sick India Pvt ltd	Mumbai	A			For Sick AG Germany make
		III				Sick AG	Germany	A			
		III				Durag	Germany	A			
		III				Teledyne	USA	A			
46	Ultrasonic type level Transmitter										
		III				EIP Enviro	Noida	A			1-Ultrasonic level Tx shall be BM Technology Italy make 2-Required mounting arrangement , Testing, Calibration shall be carried out at M/s EIP Works.
		III				E & H	Aurangabad	A			
		III				Emerson Process Management Ltd	Pawane	A			Complete Intrument Transmitter & Probe to be procured from Mobrey UK , only intergration & configuration at Pawane works
		III				BM Technology	Italy	A			
		III				Siemens Miltronics	Canada	A			
		III				Nivelco Process Control	Hungary	A			
		III				E & H	Germany	A			
		III				HAWK Measurement PTY Ltd	Australia	A			
47	UPS With ACDB										
		Note-5				Vertive Energy Pvt Ltd	Pune	A			Upto 125 KVA for 1 phase and 300 KVA for 3 Phase
		Note-5				Vertive Energy Pvt Ltd	Mumbai	A			Upto 160 KVA
		Note-5				Hitachi Hirel Power Electronics Pvt Ltd	Gandhinagar	A			Upto 160 KVA,

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50	Field Bus Cable/ Profibus Cable- PA & DP type										
		I				LAPP India Pvt Ltd	Bangalore	A			
51	Field bus components (Field bus modules ,segment protector ,surge protector & SS JB)										
		III				Phoenix Contact Inc	USA	A			Materiall will be allowed to dispatch from the vendor works as CAT-III item ,however all material except SS junction box will be available at DDCMIS supplier works for functional testing .
		III				Pepperl + Fuchs Pte Ltd	Singapore	A			Materiall will be allowed to dispatch from the vendor works as CAT-III item ,however all material will be available at DDCMIS supplier works for functional testing .
52	Stockyard Management System(Including 3D profiling scanner ,Thermal Imaging Camera, RTK GPS)										
		III				TSA	Brazil	A			For 3D profiling / Tripple-IN Germany make
		I				EIP Enviro	Noida	A			For 3D profiling / 1-Tripple-IN Germany make Laser Scanner and RPU along with software from TSA Brazil inline with the M/s TSA Letter. 2- Other item like ethernet cable, Ethernet Switch, Junction Box required for execution of 3D stockpile managemment system can be supplied by EIP Enviro
53	Perimeter Intrusion Detection System										
		III				Senstar	Canada	A			
54	Radar based Perimeter Surveillance System										
		III				Magos System Ltd	Israel	A			Third Party "Cyber Penetration report " shall be provided along with material TC/COC
55	Thermal Camera (PTZ)										
		III				FLIR Commercial Systems INC	USA	A			
Main Contractor approved sources (Note-12)											
MC-1	Amonia Analyser	III				Main Contractor Approved Sources					
MC-2	Amonia leak detector	III				Main Contractor Approved Sources					
MC-3	Air Filter Regulator	III				Main Contractor Approved Sources					
MC-4	Anemometer	III				Main Contractor Approved Sources					
MC-5	Annunciator	III				Main Contractor Approved Sources					
MC-6	Battery Health Monitoring System	III				Main Contractor Approved Sources					
MC-7	Biofouling/ Deposit Monitor	III				Main Contractor Approved Sources					
MC-8	Coal bunker Level monitor	III				Main Contractor Approved Sources					
MC-9	Compression Fittings(SS)	III				Main Contractor Approved Sources					
MC-10	Condensing Pots	III				Main Contractor Approved Sources					
MC-11	Conduits /Pipe (GI)	III				Main Contractor Approved Sources					
MC-12	Conduits lead coated (Flexible)	III				Main Contractor Approved Sources					

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MC-13	Copper tubing/Brass connectors	III				Main Contractor Approved Sources					
MC-14	Coriolios Type Mass Flow meter	III				Main Contractor Approved Sources					
MC-15	Coupling /Interposing Relays	III				Main Contractor Approved Sources					
MC-16	Density Indicator	III				Main Contractor Approved Sources					
MC-17	Desk for OWS/EWS/Printer/Server	III				Main Contractor Approved Sources					
MC-18	Digital Indicators	III				Main Contractor Approved Sources					
MC-19	Dust Sensor	III				Main Contractor Approved Sources					
MC-20	Dew point sensor/meter (H2)	III				Main Contractor Approved Sources					
MC-21	Flow Gauge	III				Main Contractor Approved Sources					
MC-22	Flow Indicator cum Totaliser	III				Main Contractor Approved Sources					
MC-23	Flow Switch	III				Main Contractor Approved Sources					
MC-24	FRP Junction Box	III				Main Contractor Approved Sources					
MC-25	Furniture for control Room(Chair, Almira, Lock)	III				Main Contractor Approved Sources					
MC-26	Furnace exit gas temp probe	III				Main Contractor Approved Sources					
MC-27	Graphic Interface Unit	III				Main Contractor Approved Sources					
MC-28	Hand Held Calibrator	III				Main Contractor Approved Sources					
MC-29	Hart Management System	III				Main Contractor Approved Sources					
MC-30	Humidistat / Thermostat / Gyserstat / Airstat	III				Main Contractor Approved Sources					
MC-31	Instant Corrosion Rate Monitor & Portable Corrosion Meter	III				Main Contractor Approved Sources					
MC-32	Impact head type flow element	III				Main Contractor Approved Sources					
MC-33	Instrument Tube Fittings (Air)	III				Main Contractor Approved Sources					
MC-34	Instrument Valve	III				Main Contractor Approved Sources					
MC-35	IR Detector	III				Main Contractor Approved Sources					
MC-36	KVM Switch/Matrix KVM Switch	III				Main Contractor Approved Sources					
MC-37	Level gauge (Transperent & Reflex, Tubular type)	III				Main Contractor Approved Sources					
MC-38	Level Indicator (Float & Board type)	III				Main Contractor Approved Sources					
MC-39	Level switch - Float/Displacer Type	III				Main Contractor Approved Sources					
MC-40	Level Switch (RF Type)	III				Main Contractor Approved Sources					
MC-41	Level switch capacitance type	III				Main Contractor Approved Sources					
MC-42	Limit Switch	III				Main Contractor Approved Sources					
MC-43	Maintenance and Calibration Equpiment	III				Main Contractor Approved Sources					
MC-44	Mini UPS-Type C configuration	III				Main Contractor Approved Sources					
MC-45	Orifice plate assembly	III				Main Contractor Approved Sources					
MC-46	On line carbon in Ash analyser	III				Main Contractor Approved Sources					
MC-47	Pitot Tube	III				Main Contractor Approved Sources					
MC-48	Pr./Vaccum./DP Gauges	III				Main Contractor Approved Sources					
MC-49	Press, DP, Vaccum Switch	III				Main Contractor Approved Sources					
MC-50	Printer (Dot Matrix/Inkjet / Laser)	III				Main Contractor Approved Sources					
MC-51	Psycrometer	III				Main Contractor Approved Sources					
MC-52	Pulse jet Controller	III				Main Contractor Approved Sources					
MC-53	Pulse Valve	III				Main Contractor Approved Sources					
MC-54	Residual Chlorine Analyser	III				Main Contractor Approved Sources					
MC-55	Rotameter	III				Main Contractor Approved Sources					
MC-56	Reverse Rotation Indicator	III				Main Contractor Approved Sources					
MC-57	Synchronising Relay	III				Main Contractor Approved Sources					
MC-58	Synchroscope	III				Main Contractor Approved Sources					
MC-59	Semaphore Indicators	III				Main Contractor Approved Sources					
MC-60	Sight Flow Indicator	III				Main Contractor Approved Sources					
MC-61	Smart Positioner	III				Main Contractor Approved Sources					
MC-62	Socket Weld Fittings	III				Main Contractor Approved Sources					
MC-63	Solenoid Valve	III				Main Contractor Approved Sources					

एनटीपीसी NTPC एक महारत्न कम्पनी	PROJECT : Talcher-III (2X660MW) PACKAGE : EPC PACKAGES CONTRACTOR: CONTRACT NO :	LIST OF C&I ITEMS REQUIRING QUALITY PLAN AND SUB SUPPLIER APPROVAL	REVISION NO : 00 DATE :04.02.2022

Sr No	Item Description	QP Inspection Category	QP No	QP submission SCH	QP approval SCH	Proposed Sub Supplier	Country	SS Approval_Status (Note-1)	SS Detail Sub.SCH	SS Approval SCH	Remark
MC-64	Solid Mass Flow Meter	III				Main Contractor Approved Sources					
MC-65	Terminal Block (Cage and Clamp type)	III				Main Contractor Approved Sources					
MC-66	Temperature cum Humidity Indicator	III				Main Contractor Approved Sources					
MC-67	Temperature Element(Thermocouple , RTD & Thermowell)	III				Main Contractor Approved Sources					
MC-68	Temperature Gauge(With Thermowell)	III				Main Contractor Approved Sources					
MC-69	Temperature Switch	III				Main Contractor Approved Sources					
MC-70	Transducer	III				Main Contractor Approved Sources					
MC-71	Tube thicknes Meter	III				Main Contractor Approved Sources					
MC-72	Voltmeter/ Watterhour Meter	III				Main Contractor Approved Sources					
MC-73	Valve manifolds	III				Main Contractor Approved Sources					
MC-74	Electric to Pneumatic Converter	III				Main Contractor Approved Sources					
MC-75	Network components	III				Main Contractor Approved Sources					
MC-76	Isolator	III				Main Contractor Approved Sources					
MC-77	ORP Monitor /Analyser	III				Main Contractor Approved Sources					
MC-78	Ultrasonic Type Flow Transmitter	III				Main Contractor Approved Sources					
MC-79	Chlorine Leak detector	III				Main Contractor Approved Sources					
MC-80	Density Meter	III				Main Contractor Approved Sources					
MC-81	Electro Magenetic Flow meter	III				Main Contractor Approved Sources					
MC-82	Postive dispalcement Type Flow Meter	III				Main Contractor Approved Sources					
MC-83	Level Scanner (3 D)for Solid Application	III				Main Contractor Approved Sources					
MC-84	Mosaic tiles /Console items	III				Main Contractor Approved Sources					
MC-85	Electrical Control Panel (UCP/Backup)	III				Main Contractor Approved Sources					
MC-86	Electrical Indicating Instruments (Mosaic Compatible)	III				Main Contractor Approved Sources					
MC-87	OWS/EWS/Server	III				Main Contractor Approved Sources					
MC-88	Bio Matrix Reader	III				Main Contractor Approved Sources					
MC-89	ANPR	III				Main Contractor Approved Sources					
MC-90	UVSS	III				Main Contractor Approved Sources					
MC-91	Comd & Control System	III				Main Contractor Approved Sources					
MC-92	Access & Controller Software	III				Main Contractor Approved Sources					
MC-93	IR LED based Illuminator	III				Main Contractor Approved Sources					
MC-94	ATB Bolloard	III				Main Contractor Approved Sources					
MC-95	Boom Barrier	III				Main Contractor Approved Sources					
MC-96	Touchless biomatric recorder	III				Main Contractor Approved Sources					
MC-97	GPS Sensor based Vehicle Monitoring system	III				Main Contractor Approved Sources					
MC-98	10mp digital camera with tripod for photo capture	III				Main Contractor Approved Sources					
MC-99	2D GIS map application	III				Main Contractor Approved Sources					
MC-100	Audible alarm device	III				Main Contractor Approved Sources					
MC-101	CameraPoles	III				Main Contractor Approved Sources					
MC-102	Card Reader	III				Main Contractor Approved Sources					
MC-103	Door Frame Metal Detector -DFMD	III				Main Contractor Approved Sources					
MC-104	Door sensor	III				Main Contractor Approved Sources					
MC-105	Egress Switch	III				Main Contractor Approved Sources					
MC-106	EM LOCK	III				Main Contractor Approved Sources					
MC-107	Emergency exit / door override switch	III				Main Contractor Approved Sources					
MC-108	Emergency Siren /Hooter	III				Main Contractor Approved Sources					
MC-109	Flap barrier	III				Main Contractor Approved Sources					
MC-110	Flash Lights for covering perimeter area for clear view from PTZ in night time	III				Main Contractor Approved Sources					
MC-111	Geo fencing	III				Main Contractor Approved Sources					
MC-112	Glass Break switch at Emergency Exit	III				Main Contractor Approved Sources					
MC-113	Guard tour	III				Main Contractor Approved Sources					

एनटीपीसी NTPC एक महारत्न कम्पनी	PROJECT : Talcher-III (2X660MW) PACKAGE : EPC PACKAGES CONTRACTOR: CONTRACT NO :	LIST OF C&I ITEMS REQUIRING QUALITY PLAN AND SUB SUPPLIER APPROVAL	REVISION NO : 00 DATE :04.02.2022

Sr No	Item Description	QP Inspection Category	QP No	QP submission SCH	QP approval SCH	Proposed Sub Supplier	Country	SS Approval_Status (Note-1)	SS Detail Sub.SCH	SS Approval SCH	Remark
MC-114	Half Height Turnstile	III				Main Contractor Approved Sources					
MC-115	Handheld Walkie - Talkie	III				Main Contractor Approved Sources					
MC-116	HHMD	III				Main Contractor Approved Sources					
MC-117	Long Range RFID Reader	III				Main Contractor Approved Sources					
MC-118	Monitors 24 Inch Full HD	III				Main Contractor Approved Sources					
MC-119	Network Panel	III				Main Contractor Approved Sources					
MC-120	Optical Time Domain Reflector-meter (OTDR) with all accessories	III				Main Contractor Approved Sources					
MC-121	Panic Button with Audible Alarm	III				Main Contractor Approved Sources					
MC-122	Panic button/SOS button supportin SIP protocol	III				Main Contractor Approved Sources					
MC-123	RFID based Stickers	III				Main Contractor Approved Sources					
MC-124	Sliding Gate	III				Main Contractor Approved Sources					
MC-125	SMS gateway	III				Main Contractor Approved Sources					
MC-126	Storage Device (SAN/NAS/DAS) of 100 TB each	III				Main Contractor Approved Sources					
MC-127	Traffic Light	III				Main Contractor Approved Sources					
MC-128	Turnstile - half height	III				Main Contractor Approved Sources					
MC-129	SPIKE BARRIER	III				Main Contractor Approved Sources					
MC-130	CHAIN LINK FENCE	III				Main Contractor Approved Sources					
MC-131	X-ray Baggage Scanner	III				Main Contractor Approved Sources					
MC-132	Static Radio Set	III				Main Contractor Approved Sources					

LEGENDS :

1.0 SYSTEM SUPPLIER / SUB SUPPLIER APPROVAL STATUS CATEGORY

A - For those items proposed vendor is acceptable to Customer. To be indicated with letter "A" in the list alognwith the condition of approval, if any.

2.0 QP INSPECTION CATEGORY :

CAT - I : For those items the Quality Plans are approved by Customer and final acceptance will be on physical inspection witness by Customer

CAT - II : For those items the Quality Plans are approved by Customer. However no physical inspection shall be done by Customer. The final acceptance by Customer shall be on the basis of review of documents.

CAT - III :For these items Quality control to be exercised as per Main contractor Quality Assurance System. The final acceptance by NTPC shall be on the basis of Certificate of Conformance (COC) by Main Contractor.

UNITS/WORKS : Place of manufacturing- Place of main supplier of multi units/works.

NOTE - 1 : A: Vendors to submit project specific documents as per Sub-QR requirements in case the Vendor is approved under collaboration agreement.
B: In case approved sub vendor is offering product with latest model/series apart from earlier approved, vendors to submit project specific documents as per Sub-QR requirements.

NOTE - 2 : For Insrument cable <= 1 KM inspection category CAT - III, For > 1 KM to <= 10 KM Inspecton category CAT - II COC & FOR> 10 KM Inspection category CAT-I

NOTE -3 : For Fiber Optic cable <=10KM inspection category CAT - III & for > 10KM Inspection category CAT-II

NOTE-4 : Batteries for UPS <= 10 KVA and batteries for intelligent battery charger 24 V DC <= 40 Amp inspection category CAT-III & for Batteries for UPS> 10KVA and batteries for intelligent battery charger 24 V DC > 40 Amp rating

NOTE-5 UPS <= 10 KVA rating inspection category CAT-III & for > 10KVA rating inspection category CAT-I

NOTE - 7 - EMPTY CABINETS, COMPUTERS, SIGNAL ISOLATOR/ MULTIPLIER and TB SHALL ALSO BE ACCEPTABLE FROM OWNER ACCPETED IN QP. IF THE TOTAL INTEGRATED PANEL AND FAT IS CONDUCTED INDEGENEOUSLY

NOTE-8 : For the C & I instrumnts mounted on the skid of the main item or supplied as a integral part of the main item, instrument to be supplied as per proven practice of the manufacturer meeting the Customer technical specification

NOTE-9- This item is a bought out componenet of main equipments like DDCMIS ,PLC,TSI,CCTV ,PA system etc

NOTE-10- For these controlled items, vendor shall be proposed for owner accpetance with-in the agreed contract schedule of the package

NOTE-11 - Major Bought-Out-Items are to be procured from LOA approved sources & the same shall be finalized during the finalization of Manufacturing Quality Plan . MQP shall be duly vetted by OEM with their project specific authorisation letter .

NOTE-12 : Main contractor apporved sub vendors are acceptable those are evaluated / assesesed as per Main contractor Quality Management System for vendor approval. Main contractor to inform the finaly selected vendor to NTPC as soon as PO is placed for these items. In case of sub-QR Note-1 is also applicable.

SUB-VENDOR LIST FOR LT MOTORS

SL NO.	VENDOR NAME	
1	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003
2	BHARAT BIJLEE LTD.	BHARAT BIJLEE LIMITED, 1ST FLOOR, 7-B, RAJINDRA PARK, PUSA ROAD, NEW DELHI - 110 060.
3	CROMPTON GREAVES	3RD FLOOR, EXPRESS BUILDING,9-10, BAHADUR SHAH ZAFAR MARG, NEAR ITO CROSSING,NEW DELHI-110002, INDIA
4	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032
5	KIRLOSKAR ELECTRIC CO LTD.	P.O. BOX 5555 , MALLESWARAM WEST ,BANGALORE 560055
6	LAXMI HYDRAULICS PVT. LTD	129/130, INDUSTRIAL ESTATE PATIL NAGAR, HOTGI ROAD SOLAPUR-413003, MAHARASHTRA
7	MARATHON	MARATHON ELECTRIC INDIA PRIVATE LTD.SECTOR - 11, MODEL TOWN, FARIDABAD - 121006
8	NGEF	POCKET NO.10, FLAT NO. 37 & 38, EXPANDABLE DDA FLATS, NASIRPUR DWARKA, PHASE-I NEW DELHI-110 045
9	RAJINDRA ELECT INDUSTRIES	14 SHAH IND.ESTATE VEERA DESAI RD,ANDHERI(W) MUMBAI-400053
10	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA

SUB-VENDOR LIST FOR GLANDS

1	ALLIED TRADERS & EXPORTERS	C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA
2	ARUP ENGG & FOUNDARY WORKS	391/119,PRINCE ANWAR SHAH ROAD, CALCUTTA-700068
3	BALIGA LIGHTING EQPT.PVT.LTD.	63A,CP RAMASWAMY ROAD, ALWARPET,P.B.No 6910, CHENNAI-600018
4	COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063
5	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.
6	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059
7	INCAB	HARE STREET,KOLKATA,WEST BENGAL-700001

SUB-VENDOR LIST FOR LUGS

1	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.

2	UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001

SUB-VENDOR LIST FOR DC LEAD ACID BATTERY

1	EXIDE INDUSTRIES LTD	NEW DELHI
2	HBL POWER SYSTEMS LTD (FOR TUBULAR TYPE)	HYDERABAD-TELANGANA
3	HOPPECKE BATTERIEN GMBH & CO.KG,	HOPPECKE, GERMANY

SUB-VENDOR LIST FOR DC NI-CD BATTERY

1	AMCO SAFT INDIA LTD	BANGALORE-KARNATAKA
2	HBL POWER SYSTEMS LTD	HYDERABAD-TELANGANA

SUB-VENDOR LIST FOR DC BATTERY CHARGER

1	AMARA RAJA POWER SYSTEMS LIMITED	TAMIL NADU
2	CHHABI ELECTRICALS PVT.LTD.	MAHARASHTRA
3	CHLORIDE POWER SYSTEMS & SOLUTIONS LIMITED	KOLKATA
4	DUBAS ENGG PVT LTD	BANGALORE
5	EMERSON NETWORK POWER (INDIA) PVT. LTD.	MAHARASHTRA
6	HBL POWER SYSTEMS LTD	HYDERABAD
7	JEMA ENERGY (For Static SCR Type Full Wave fully Control type)	Lasarte-Oria--SPAIN
8	MASS-TECH CONTROLS PVT.LTD.	MUMBAI-MAHARASHTRA
9	STATCON POWER CONTROLS LTD	NOIDA-UTTAR PRADESH

SUB-VENDOR LIST FOR FRP CABLE TRAYS & ACCESSORIES

1	EPP COMPOSITES PRIVATE LIMITED	Rajkot-Gujarat
2	SUMIP COMPOSITES PVT.LTD.	Ahmedabad-Gujarat

NOTE:

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

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BIDDER TO PROPOSE SUB VENDOR LIST WITH BACKUP DOCUMENTS/ CREDENTIALS WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.

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2. DEALERS ARE NOT ACCEPTABLE FOR ANY ITEM (MECH., ELECTRICAL AND C&I) OF THE PACKAGE. BIDDER SHALL PROCURE ALL ITEMS INCLUDING PLATES, STRUCTURAL, FLANGES; COUNTER FLANGES ETC. FROM APPROVED SUB VENDOR ONLY.

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

PACKAGE WISE REGISTERED SUPPLIER LIST (PERMANENT CATEGORY) AS ON 4/16/2021 PM

Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
CONTROL VALVE	R.K.CONTROL INSTRUMENTS PVT. LTD.	PLOT NO.A-250, OPP.POLICE STATION, WAGLE INDUSTRIAL ESTATE, THANE Phone- 25820943/2331 Pincode : 400604 Email : rkcipl@vsnl.com ; rkcinpvt@bol.net.in	Works-1->SAVITH KUMAR PLOT NO. A-250, OPP.POLICE STATION,WAGLE INDUSTRIAL ESTATE, THANE -THANE-MAHARASHTRA INDIA Phone- 022-'66060942 FAX : 022-25820801 Pincode : 400 604 Email : rkadmin@rkcipl.co.in
CONTROL VALVE	Mascot Valves Pvt. Ltd.	166-167 GIDC Naroda Ahmedabad Phone- 0792282 1619 Pincode : 382330 Email : dom.sales@mascotvalves.com	Works-1->Varun Patel Dir 166-167 ,GIDC Naroda -Ahmedabad-GUJARAT India Phone- 0792282 1619 / 3369 FAX : Pincode : 382330 Email : dom.sales@mascotvalves.com
CONTROL VALVE	Severn Glocon India Pvt. Ltd.	F96 & F97, Sipcot Industrial Park, Irungattukottai, Chennai, Phone- 044-47104200, Pincode : 602117, Email : info@severnglocon.co.in,	Works-1->Mr. K.Kaushik, F96 & F97, Sipcot Industrial Park,Irungattukottai, -Chennai-TAMIL NADU India Phone- 044-47104200, FAX : 044-47100073, Pincode : 602117, Email : info@severnglocon.co.in
CONTROL VALVE	BOMAFA SPECIAL VALVE SOLUTIONS PVT LTD	Mr. K.M. Anklesaria/ R. M. Anklesaria Plot No: 285/2, Panchratna Estate, Near Ramol Bridge, Vatva Ahmedabad Phone- 079-40083825 Pincode : 382445 Email : info@bomafa-india.com	Works-1->Mr. K.M. Anklesaria/ Mr. R.M. Anklesaria Dir Plot No: 285/2, Panchratna Estate, Near Ramol Bridge, Vatva, -Ahmedabad-GUJARAT INDIA Phone- 079-40083825 FAX : Pincode : 382445 Email : info@bomafa-india.com
CONTROL VALVE	SAMSON CONTROLS PVT. LTD.	Mr. Atul raje-MD D 281, MIDC Ranjangaon Ta Shirur Pune Phone- 02067246600 Pincode : 412220 Email : sales@samsoncontrols.net	Works-1-> Others D 281, MIDC Ranjangaon -Pune-MAHARASHTRA India Phone- 02067246600,8554997963 FAX : Pincode : 412220 Email : sales@samsoncontrols.net
CONTROL VALVE	FORBES MARSHALL ARCA PVT.LTD.	A-34/35 , MIDC ESTATE, H-BLOCK, PIMPRI, PUNE, Phone- 020-27442020, Pincode : 411018 Email : mnadgaundi@forbesmarshall.com	Works-1->Mr. Sanjeev Shinde A-34/35 MIDC Estate,H Block, Pimpri, -Pune-MAHARASHTRA India Phone- 9323176406 FAX : 020-27442040 Pincode : 411018 Email : sshinde@forbesmarshall.com
CONTROL VALVE	INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com	Works-1->D.SASIDHARAN, AGM(Works&PPC) KANJIKODE WEST, -PALAKKAD-KERALA INDIA Phone- 0491-2566536 FAX : 0491-2566135 Pincode : 678623 Email : sasidharan@ilpgt.com;mraj@ilpgt.com;gireesh@ilpgt.com, commercial@ilpgt.com;fa2@ilpgt.com;nazeera@ilpgt.com;pkv@ilpgt.com;remith@ilpgt.com
CONTROL VALVE	Koso India Private Limited,	H 33 & 34, MIDC, Ambad, Nashik, Phone- 09650233433 Pincode : 422010, Email : jetmal.gour@koso.co.in	Works-1->P.J.ASHOK KUMAR/SEEMA ANAND Control Valve Division, H-33&34, MIDC, Ambad, -Nashik-MAHARASHTRA India Phone- 91 944 744 3198 FAX : 0491 - 5269914 Pincode : 422010 Email : pja@koso.co.in;enquiry@koso.co.in Works-2->+P.J.ASHOK KUMAR/SEEMA ANAND J-1,MIDC,Ambad -Nashik-MAHARASHTRA India Phone- 91 944 744 3198 FAX : 0491 - 5269914 Pincode : 422010 Email : pja@koso.co.in;enquiry@koso.co.in
CONTROL VALVE	CIRCOR FLOW TECHNOLOGIES INDIA PVT. LTD.	Mr. Vinodh Gopinath, Senior Director SF No. 337/2, No.15 Naranapuram Village,Ponnandampalayam Coimbatore Phone- 9500928448 Pincode : 641659 Email : santhosh.ponnusamy@circor.com	Works-1->Mr. Santhosh Ponnusamy Others SF No. 337/2, No.15, Naranapuram Village,Ponnandampalayam -Coimbatore-TAMILNADU INDIA Phone- 9500928448 FAX : 04212321600 Pincode : Coimbatore Email : santhosh.ponnusamy@circor.com
CONTROL VALVE	KSB MIL CONTROLS LTD.	Mr.Jacob Cherian/Mr.Geo Jolly Meladoor, Annamanada P.O. MALA, Thrissur Phone- 0480-2695700 Pincode : 680741 Email : biju.simon@ksb.com	Works-1->Mr.Biju Simon/Mr.Jose Paul Meladoor, Annamanada, -Thrissur-KERALA INDIA Phone- 9447555500 FAX : 91 480 2890952 Pincode : 680741 Email : jose.paul@ksb.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Kaustubha Udyog,	S.No. 36/1/1, Sinhgad Road, Vadgaon Khurd, Near Lokmat Press, Pune, Phone- 020-24393577, Pincode : Email : pressure@vsnl.com,	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : sales@switzerprocess.co.in	Works-1->C S Shankar 127, Sidco North Phase, Ambattur Estates, -CHENNAI-TAMIL NADU INDIA Phone- 8754491904 FAX : 044-26248849 Pincode : 600050 Email : cservice@switzerinstrument.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Barksdale GmbH, Germany	Michael Weileder Dorn Assenheimer, Strasse 27 Reichelsheim Phone- +91-9999107840 Pincode : D-61203 Email : msingh@barksdale.de	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS INDUSTRIES LIMITED	B-20-21, INDUSTRIAL AREA, MEERUT ROAD, GHAZIABAD Phone- 0120-2712016 Pincode : Email : mktg@indfos.com	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com	
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com	Works-1->MR G.SRINIVASAN/MR ANUJ MALPANI PLOT NO:A-19/2 & T-4/2,I.DA. NACHARAM , -HYDERABAD-TELANGANA INDIA Phone-09866550762 FAX : 040 27152193 Pincode : 560076 Email : gshrinivasan@forbesmarshall.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 À GIDC À Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com	Works-1->Shikha Hazra/ Shyamal Hazra 32, Industrial Suburb,Yeshwanthpur -BANGALORE-KARNATAKA INDIA Phone- 080-23370300 FAX : 080-23379890 Pincode : 560022 Email : shikhahazra@hgurusouth.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net	Works-1->NA NA -- Phone- FAX : Pincode : Email :
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, -Kalamboli Taluka Panvel-MAHARASHTRA India Phone- 022-27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-gauges.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, Kolkata Phone- +91 33 2548 7220 Pincode : 700074 Email : parthabosebpi@gmail.com; bosepanda@vsnl.net	Works-1->Mr. Partha Bose 44, Saheed Hemanta Kumar Bose,Sarani, -Kolkata-WEST BENGAL India Phone- +91 33 2548 7220 FAX : +91 33 2548 0429, Pincode : 700074 Email : parthabosebpi@gmail.com bosepanda@vsnl.net
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in	Works-1->Mr. Gautam Mukherjee Kusumba,Sonarpur Station Road,P.O. -Narendrapur, -Kolkata-WEST BENGAL INDIA Phone- 9836878855 FAX : 033-24342748 Pincode : 700103 Email : gkm_ani@hotmail.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in	Works-1-> Others 26/2, G Type, Global Ind. Park Near Nahuli Railway Crossing, -Vapi-GUJARAT INDIA Phone- 9920576002 FAX : Pincode : 396105 Email : sales@nesstech.co.in, bkapadia@nesstech.co.in
TEMPERATURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com

Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
TEMPERATURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode :	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 À GIDC À Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
TEMPERATURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com	Works-1->Shikha Hazra/ Shyamal Hazra 32, Industrial Suburb,Yeshwanthpur -BANGALORE-KARNATAKA INDIA Phone- 080-23370300 FAX : 080-23379890 Pincode : 560022 Email : shikhahazra@hgurusouth.com
TEMPERATURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, -Kalamboli Taluka Panvel-MAHARASHTRA India Phone- 022-27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-gauges.com
TEMPERATURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net	Works-1->NA NA -- Phone- FAX : Pincode : Email :
TEMPERATURE GAUGE	GOA THERMOSTATIC INSTRUMENTS PVT.LTD.	FLAT -B , GF, HILL CROWN APTS., COLLEGE ROAD, MAPUSA Phone- Pincode : 403525 Email : gtilworks@pyro-electric.in	Works-1->Mrs Saanvi Naik BICHOLIM, -BICHOLIM-GOA INDIA Phone- 9595855152 FAX : Pincode : 403 529 Email : saanvi.naik@thermostatic.in
TEMPERATURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in	Works-1->Mr. Gautam Mukherjee Kusumba,Sonarpur Station Road,P.O. -Narendrapur, -Kolkata-WEST BENGAL INDIA Phone- 9836878855 FAX : 033-24342748 Pincode : 700103 Email : gkm_ani@hotmail.com
TEMPERATURE GAUGE	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com,	Works-1->Mr. S.G. Dixit D2/5, Mapusa Industrial Estate, -Mapusa-GOA INDIA Phone- 09326054551 FAX : 0832-2262331 Pincode : 403 507 Email : sumukh@goainstruments.com
TEMPERATURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com	Works-1->MR G.SRINIVASAN/MR ANUJ MALPANI PLOT NO:A-19/2 & T-4/2,I.DA. NACHARAM , -HYDERABAD-TELANGANA INDIA Phone- 09866550762 FAX : 040 27152193 Pincode : 560076 Email : gshrinivasan@forbesmarshall.com
LEVEL GAUGE	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com	
LEVEL GAUGE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sasi Kumar Plot No. 92B & 93B,Sec-V, IMTManesar -GURGAON-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 122002 Email : bharat@blissanand .com
LEVEL GAUGE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
FLOW ELEMENT	TM TECNOMATIC SPA	MR. ANTONIO NOVIELLO/Mrs. Enrica Bazzocc VIA DELLE INDUSTRIE, 36 CREMONA Phone- 39037221574 Pincode : 26100 Email : info@tmtecnomatic.com	Works-1->Mrs. Enrica Bazzocchi VIA DELLE INDUSTRIE, 36, -CREMONA-Italy Phone- 39037221574 FAX : 39037228318 Pincode : 26100 Email : sales@tmtecnomatic.com
FLOW ELEMENT	STAR-MECH CONTROLS (I) PVT.LTD.	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net	Works-1->VIVEK GOTE/ MAHúNDRA BANSODE Sr no.54, Plot No.Il0,Swami ViVekanand Industrial Est.HADAPS -PUNE-MAHARASHTRA INDIA Phone- 02026970450 FAX : 02026970470 Pincode : 411028 Email : marketing@starmech.net
FLOW ELEMENT	INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com	
FLOW ELEMENT	MICRO PRECISION PRODUCTS PVT. LTD.	Mr. Anil Bhati, H.B. No.-40, Revenue Estate, Village-Dudhola,Tehsil & Distt. Palwal FARIDABAD Phone- 9560742713;095607427 Pincode : 121002 Email : anil.bhati@wika.com	
TEMP. ELEMENT	DETRIVE INSTRUMENTATION & ELECTRONICS LTD.	320, TV INDUSTIAL ESTATE, OFF.DR.A.BESANT ROAD, BEHIND GLAXO, WORLI, MUMBAI Phone- 24934125,24938403 Pincode : 400025 Email : trivtech@vsnl.com	Works-1->Mr. A.D.Solomon J-14, MIDC, TARAPORE, BOISER STN., -THANE-MAHARASHTRA India Phone- FAX : Pincode : Email : trivtech@vsnl.com
TEMP. ELEMENT	Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in	Works-1-> Others 26/2, G Type, Global Ind. Park Near Nahuli Railway Crossing, -Vapi-GUJARAT INDIA Phone- 9920576002 FAX : Pincode : 396105 Email : sales@nesstech.co.in, bkapadia@nesstech.co.in
TEMP. ELEMENT	Thermal Instrument India Pvt. Ltd.	Mr. Raghavendra M. Kulkarni 194/195, Gopi Tank Road Behind Citylight Cinema,Mahim Mumbai Phone- 09322664709 Pincode : 400016 Email : ramk@giconindia.com	Works-1->Mr. Raghavendra M. Kulkarni Survey No. 250A/B, Post-Mangaon,Tal.- Kudal, Dist.- Sindhudurg, --MAHARASHTRA India Phone- 09322664709 FAX : 022-24455026 Pincode : 416519 Email : ramk@giconindia.com
TEMP. ELEMENT	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 À GIDC À Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
TEMP. ELEMENT	PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD.	M. D. BICHU/R. M. BICHU G.B, HILL CROWN APARTMENTS, COLLEGE ROAD, MAPUSA Phone- 9326114601 Pincode : 403507 Email : priyanka.marketing@pyro-electric.in	Works-1->A A KULKARNI/ VINOD C G PLOT NO. 71,BICHOLIM INDUSTRIAL ESTATE -BICHOLIM-GOA INDIA Phone- 9326114409 FAX : 91 832 2363381 Pincode : 403529 Email : pyroworks@pyro-electric.in
TEMP. ELEMENT	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, -Kalamboli Taluka Panvel-MAHARASHTRA India Phone- 022-27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-gauges.com
TEMP. ELEMENT	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com,	Works-1->Mr. S.G. Dixit D2/5, Mapusa Industrial Estate, -Mapusa-GOA INDIA Phone- 09326054551 FAX : 0832-2262331 Pincode : 403 507 Email : sumukh@goainstruments.com
TEMP. ELEMENT	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	Works-1-> Khasra No.: 218-230& 235, Industrial Estate,Makhupura, -Ajmer-RAJASTHAN India Phone- 9887865856, FAX : 0145-2695174, Pincode : 305002, Email : rajeev.gupta@tipl.com
TEMP. ELEMENT	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
TEMP. ELEMENT	Tempsens Instrument (I) Pvt Ltd	MR. V.P.RATHI/MR. HEMANT RATHI B-188A ROAD NO.5 , M.I.A UDAIPUR Phone- 09352420069 Pincode : 313003 Email : info@tempsens.com	Works-1->Mr. S.D Deval B-188A ROAD NO.5 ,M.I.A -UDAIPUR-RAJASTHAN INDIA Phone- 9352501530 FAX : 0294-3057750 Pincode : 313003 Email : deval@tempsens.com
TRANSMITTERS	ABB INDIA LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com	
TRANSMITTERS	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
TRANSMITTERS	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com	
TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,	Works-1-> PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, -BANGALORE-KARNATAKA INDIA Phone- 080-41586000, FAX : 080-28521442, Pincode : Email : uday.shankar@in.yokogawa.com
TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	Works-1-> Khasra No.: 218-230& 235, Industrial Estate,Makhupura, -Ajmer-RAJASTHAN India Phone- 9887865856, FAX : 0145-2695174, Pincode : 305002, Email : rajeev.gupta@tipl.com

Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
TRANSMITTERS	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in	Works-1->MR. MOHAN PADWAL 691/A/2,BIBWEWADI INDL ESTATE -PUNE-MAHARASHTRA INDIA Phone- 918600042374 FAX : 912024215670 Pincode : 411037 Email : wm@sbem.co.in
TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,	Works-1-> M-171 to 173, MIDC, Waluj, -Aurangabad-MAHARASHTRA India Phone- 9881000474, FAX : 0240-2555179, Pincode : 431136, Email : Narendra.Kulkarni@wetzer.endress.com
TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	Works-1->Mr. Santosh Shukla Others R-628,TTC Industrial Area, MIDC Rabale, -Navi Mumbai-MAHARASHTRA India Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com
TRANSMITTERS	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com	Works-1->Matt Moren/Gina Cruz 16650 Schoenborn St., North Hills -CALIFORNIA- USA Phone- +1 818 894 7111, ext FAX : +1 818 830 5588 Pincode : 91343 Email : gcruz@miinet.com
TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com	Works-1->Mr. S L Sadani Others 104 - 115,Electronic Complex -Indore-MADHYA PRADESH INDIA Phone- 0731-4081307 FAX : Pincode : 452010 Email : sales@nivocontrols.com;sadanis@nivocontrols.com
TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com	Works-1->Kalpesh Chandan/Hrishikesh Aghor Plot No. A 145/4 TTC IND AREA,MIDC, PAWANE, -NAVI MUMBAI-MAHARASHTRA INDIA Phone- 9619688001 FAX : 022-66736000 Pincode : 400 705 Email : Kalpesh.chandan@emerson.com
TRANSMITTERS	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com	Works-1->Ankit Varshney Kalwa Works, Thane-Belapur Road, Thane, -MUMBAI-MAHARASHTRA INDIA Phone- FAX : Pincode : 400708 Email :
TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delbby.rpgms.ems.vsnl.net.in	
TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com	Works-1->Mr.Kedar Tillu 53, 54, 56 & 57,Hadapsar Industrial Estate -PUNE-MAHARASHTRA INDIA Phone- 9665034625 FAX : 020 66039905 Pincode : 411013 Email : kedar.tillu@honeywell.com
TEMPERATURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com	
TEMPERATURE SWITCH	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com	
TEMPERATURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com	
TEMPERATURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : sales@switzerprocess.co.in	Works-1->C S Shankar 127, Sidco North Phase, Ambattur Estates, -CHENNAI-TAMIL NADU INDIA Phone- 8754491904 FAX : 044-26248849 Pincode : 600050 Email : cservice@switzerinstrument.com
TEMPERATURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
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SIGHT FLOW INDICATORS	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sasi Kumar Plot No. 240, Sector-3, HSIIDC, Bawal -Rewari-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 123501 Email : bharat@blissanand .com
SIGHT FLOW INDICATORS	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	
SIGHT FLOW INDICATORS	B.K.EQUIPMENTS PVT.LTD.	T. BALAKRISHNAN/S.VENKATESH 217 , ARCOT ROAD PORUR , CHENNAI Phone- 9444057761 Pincode : 600116 Email : bkequip@gmail.com	Works-1->V.KARUNANIDHI/P.BABU 217 , ARCOT ROAD,PORUR , -CHENNAI-TAMIL NADU INDIA Phone- 9444131187 FAX : 044-24766852 Pincode : 600116 Email : bkequip@gmail.com
SIGHT FLOW INDICATORS	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@ieflowmeters.com	Works-1->MR. A.V.MURTHY/MR. K.T. RAVISANKER PLOTS 1,2,3, PHASE-III,IDA, JEEDIMETLA -HYDERABAD-TELANGANA INDIA Phone- 9885107312 FAX : 040-23096401 Pincode : 500055 Email : sales@ieflowmeters.com
SIGHT FLOW INDICATORS	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
DIFFERENTIAL PRESSURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	
JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net	
JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com	Works-1->B. Srinivas Suchitra Industries, Opp No 53, Muneshwara Black Devinagar, Lottagal hal -BANGALORE-KARNATAKA INDIA Phone- 080-23511247 FAX : Pincode : 560094 Email : suchitra_industries@yahoo.com
JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com	Works-1->Mr. Dineshbhai Zaveri CEO C-1/ 27&37, GIDC, Kabilpore, -Navsari-GUJARAT INDIA Phone- 02637-265140,265003 FAX : 02637-265308 Pincode : 396424 Email : flexpro@flexproltd.com
JUNCTION BOX	Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com	Works-1->Mr.Pulin Shah/ Mr. Kaloesh Parmar 39 A/3 ,Panchratna Industrial Est,Sarkhej-Bavla Road, Changodhar -Ahmedabad-GUJARAT INDIA Phone- 98250 80339 1 FAX : 079-26932424 Pincode : 382213 Email : sales@sumip.com
JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	JIGNESH MAHENDRA AJMERA DENA BANK BLDG.,SHREE NAGESH INDL. ESTATE,STATION ROAD, MUMBAI Phone- 022 67973578 Pincode : 400 088 Email : ajmera@ajmera.net, jmajmera@yahoo.com	Works-1->JIGNESH MAHENDRA AJMERA DENA BANK BLDG., SHREE NAGESHINDL. ESTATE,STATION ROAD, -MUMBAI-MAHARASHTRA INDIA Phone- 022 67973578 FAX : Pincode : 400 088 Email : ajmera@ajmera.net
INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone-+91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com

Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	
INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd,Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
VENTURI METER	TM TECNOMATIC SPA	MR. ANTONIO NOVIELLO/Mrs. Enrica Bazzocc VIA DELLE INDUSTRIE, 36 CREMONA Phone- 39037221574 Pincode : 26100 Email : info@tmtecnomatic.com	Works-1->Mrs. Enrica Bazzocchi VIA DELLE INDUSTRIE, 36, -CREMONA-Italy Phone- 39037221574 FAX : 39037228318 Pincode : 26100 Email : sales@tmtecnomatic.com
VENTURI METER	MICRO PRECISION PRODUCTS PVT. LTD.	Mr. Anil Bhati, H.B. No.-40, Revenue Estate, Village-Dudhola,Tehsil & Distt. Palwal FARIDABAD Phone- 9560742713;095607427 Pincode : 121002 Email : anil.bhati@wika.com	
VENTURI METER	STAR-MECH CONTROLS (I) PVT.LTD.	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net	Works-1->VIVEK GOTE/ MAHúNDRA BANSODE Sr no.54, Plot No.ll0,Swami ViVekanand Industrial Est.HADAPS -PUNE-MAHARASHTRA INDIA Phone- 02026970450 FAX : 02026970470 Pincode : 411028 Email : marketing@starmech.net
ROTAMETER	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@ieflowmeters.com	Works-1->MR. A.V.MURTHY/MR. K.T. RAVISANKER PLOTS 1,2,3, PHASE-III,IDA, JEEDIMETLA -HYDERABAD-TELANGANA INDIA Phone- 9885107312 FAX : 040-23096401 Pincode : 500055 Email : sales@ieflowmeters.com
ROTAMETER	TANSA EQUIPMENTS PVT. LTD.	Mr. Vardhan Tamhankar, Unit No35/36/41,Om Anand Industrial Est. Mohanjee Sundarjee Road,Raghunath Nagar, Thane Phone- 022-25832323 Pincode : 400604 Email : tansaindia@gmail.com	Works-1-> Others Mohanjee Sundarjee Road, Raghunath Nagar, Thane - Mumbai-MAHARASHTRA INDIA Phone- FAX : Pincode : 400604 Email :
ROTAMETER	EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.	Mr V. K. Pandit/Mr Ashish Shaha 17-20, Royal chambers, Paud Road Pune Phone- 9370469466 Pincode : 411038 Email : sales@eurekaflow.com	Works-1->Mr S. M. Alawani/Mr V. V. Deshpande J-501, M.I.D.C. Pimpri, -PUNE-MAHARASHTRA INDIA Phone- 9325751732 FAX : 020-30681731 Pincode : 411018 Email : works@eurekaflow.com
ROTAMETER	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Centre, S.No. 65, Hissa No. 7,By-Pass Juction, Kausa, -Mumbai-MAHARASHTRA INDIA Phone- 9892230623, FAX : 022-25491408/9 Pincode : 400 612, Email : sales@scientificdevices.com
LEVEL SWITCH-CAPACITANCE TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
LEVEL SWITCH-CAPACITANCE TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
LEVEL SWITCH-CAPACITANCE TYPE	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com	
LEVEL SWITCH-CAPACITANCE TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	
LEVEL SWITCH-CAPACITANCE TYPE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 À GIDC À Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
LEVEL SWITCH-CAPACITANCE TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
LEVEL SWITCH-CONDUTIVITY TYPE	Sapcon Instrument Pvt Ltd.	131, PALSHIKAR COLONY Contact Person- Mr. Ashwin (9826080207) INDORE Phone- +91-731-4085751, Pincode : 452004 Email : sales@sapconinstruments.com	Works-1->Mr. Ashwin R Palshikar/Mr. Navin Bodse 131 PALSHIKAR COLONY, -INDORE-MADHYA PRADESH INDIA Phone- 9754261005 FAX : 0731-2475475 Pincode : 452004 Email : sales@sapcon.in
LEVEL SWITCH-CONDUTIVITY TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	Works-1-> 38G, PICNIC GARDEN ROAD, -KOLKATA-WEST BENGAL INDIA Phone- FAX : Pincode : Email :
LEVEL SWITCH-CONDUTIVITY TYPE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sasi Kumar Plot No. 92B & 93B,Sec-V, IMTManesar -GURGAON-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 122002 Email : bharat@blissanand .com
LEVEL SWITCH-CONDUTIVITY TYPE	HI-TECH SYSTEMS & SERVICES LTD.	Mr. Vikash Agrawal/Mr. Tarun Debnath 119, PARK STREET , KOLKATA Phone- 033-22290045 Pincode : 700016 Email : sandeep@hitech.in	Works-1->Mr. Jitendra Kumar/Mr. Debasis Dey 82/1, Sarsuna Main Road, -KOLKATA-WEST BENGAL INDIA Phone- 9883994030 FAX : Pincode : 700061 Email : jitendra@hitech.in
LEVEL SWITCH-CONDUTIVITY TYPE	RAMAN INSTRUMENTS PVT.LTD.	Mr. N R Shenoy/Mr G B Vijh 8, First Floor.Plot : 160A Bait-Ush-Sharaf, 29th Road,Bandra(W) MUMBAI Phone- 09892331381 Pincode : 400050 Email : ramanbpl@vsnl.com	Works-1->NA -- Phone- FAX : Pincode : Email :
LEVEL SWITCH-CONDUTIVITY TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
LEVEL SWITCH-CONDUTIVITY TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
LEVEL SWITCH-CONDUTIVITY TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
LEVEL SWITCH-FLOAT TYPE	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com	
LEVEL SWITCH-FLOAT TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
LEVEL SWITCH-FLOAT TYPE	D.K. INSTRUMENTS PVT.LTD.	N.SIKDAR/ SUMIT SIKDAR 76/2,SELIMPUR RD DHAKURIA Kolkata Phone- 033-2415-1310. Pincode : 700031 Email : dkinst@vsnl.net	
LEVEL SWITCH-FLOAT TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
LEVEL SWITCH-FLOAT TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	
LEVEL SWITCH-FLOAT TYPE	GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com	

Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
LEVEL SWITCH-FLOAT TYPE	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in	Works-1->MR. MOHAN PADWAL 691/A/2,BIBWEWADI INDL ESTATE -PUNE-MAHARASHTRA INDIA Phone- 918600042374 FAX : 912024215670 Pincode : 411037 Email : wm@sbem.co.in
LEVEL SWITCH-FLOAT TYPE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 À GIDC À Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
LEVEL SWITCH-FLOAT TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI-MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
LEVEL SWITCH-FLOAT TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	
INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd,Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
ULTRASONIC FLOW METERS	Electronet Equipments Pvt Ltd.	Mr. Rajendra Nagaonkar/MD, Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune Phone- 9822015256 Pincode : 411048 Email : ho@eeplindia.com	Works-1-> Others Plot No. 84, 85 & 86, Tiny Industrial Estate, Kondhwa Budruk -Pune-MAHARASHTRA INDIA Phone- 20-26932039 FAX : 20-26934122 Pincode : 411048 Email : ho@eeplindia.com
ULTRASONIC FLOW METERS	Adept Fluidyne Pvt. Ltd.	Vinayak Gadre Plot No 4,S.No.17/1-B Kothrud Industrial Estate Pune Phone- 020 25464551 Pincode : 411038 Email : info@adeptfluidyne.com	Works-1-> Plot No 4,S.No.17/1-B Kothrud Industrial Estate -Pune-MAHARASHTRA india Phone- 020 25464551 FAX : Pincode : 411038 Email : info@adeptfluidyne.com
ULTRASONIC FLOW METERS	FLEXIM Flexible Industriemesstechnik GmbH	Boxberger Str., 4, Berlin Berlin Phone- 0049 30 93 66 76 60 Pincode : 12681 Email : info@flexim.de	Works-1-> Others Boxberger Str. 4, -Berlin- GERMANY Phone- 0049 30 93 66 76 60 FAX : Pincode : 12681 Email : info@flexim.de
ULTRASONIC FLOW METERS	Rockwin Flowmeter India Pvt. Ltd.	B-24, Site-IV, Sahibabad Industrial Area Ghaziabad, Phone- 9810129687 Pincode : 201010, Email : amiya@rockwin.com	Works-1->MR Rajiv PRAKASH B-24, Site-IV, Sahibabad Industrial Area, -Ghaziabad-UTTAR PRADESH India Phone- 9810129687 FAX : 01202895450 Pincode : 201010, Email : rajiv@rockwin.com
ULTRASONIC FLOW METERS	FLASH FORGE PVT LTD	Mr. Gautam Makker, 503, 'A'-wing, Delphi, Orchard Avenue Road, Powai Mumbai Phone- 022-42784300 Pincode : 400076 Email : hemendrapatil@f-f.co.in	Works-1-> Others M/s Endress & Hauser, Aurangabad, Maharastra -Aurangabad-MAHARASHTRA INDIA Phone- FAX : Pincode : Email : Works-2->+ Others M/s Endress & Hauser, Bhiwandi,Thane -Thane-MAHARASHTRA INDIA Phone- FAX : Pincode : Email :
ULTRASONIC FLOW METERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	Works-1->RAJEEV TOSHNIWAL, MD Others INDUSTRIAL ESTATE, MAKHUPURA -AJMER-RAJASTHAN INDIA Phone- FAX : 1456601111 Pincode : 305002 Email : info@tipl.com
ULTRASONIC FLOW METERS	NIVUS GMBH	Mr. Marcus Fischer Im Taele 2, D - 75031 Eppingen Phone- 00491712233770 Pincode : Email : carolin.schuster@nivus.com	Works-1->Mr. Marcus Fischer CEO Im Taele 2, Eppingen, -Baden Wuerttemberg,-Foreign Country GERMANY Phone- 0049-726291910 FAX : Pincode : 75031 Email : carolin.schuster@nivus.com
FLOW ELEMENT - ORIFICE	TANSA EQUIPMENTS PVT. LTD.	Mr. Vardhan Tamhankar, Unit No35/36/41,Om Anand Industrial Est. Mohanjee Sundarjee Road,Raghunath Nagar, Thane Phone- 022-25832323 Pincode : 400604 Email : tansaindia@gmail.com	Works-1-> Others Mohanjee Sundarjee Road, Raghunath Nagar, Thane -Mumbai-MAHARASHTRA INDIA Phone- FAX : Pincode : 400604 Email :
FLOW ELEMENT - ORIFICE	MINCO (INDIA) PRIVATE LIMITED	Mr. Rajeev Vasudeva, D/35, TIVIM INDUSTRIAL ESTATE, KARASWADA, MAPUSA, Goa, Phone- 9313637073 Pincode : 403526, Email : gicdelhi@general-gauges.com	Works-1-> D/35,TIVIM INDUSTRIAL ESTATE, KARASWADA,MAPUSA, -Goa-Goa India Phone- 9320197825, FAX : 0832-2257262, Pincode : 403526, Email : santoshkumar@general-gauges.com
FLOW ELEMENT - ORIFICE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
FLOW ELEMENT - ORIFICE	Electronet Equipments Pvt Ltd.	Mr. Rajendra Nagaonkar/MD, Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune Phone- 9822015256 Pincode : 411048 Email : ho@eeplindia.com	Works-1-> Others Plot No. 84, 85 & 86, Tiny Industrial Estate, Kondhwa Budruk -Pune-MAHARASHTRA INDIA Phone- 20-26932039 FAX : 20-26934122 Pincode : 411048 Email : ho@eeplindia.com
FLOW ELEMENT - ORIFICE	INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com	Works-1->D.SASIDHARAN, AGM(Works&PPC) KANJIKODE WEST, -PALAKKAD-KERALA INDIA Phone- 0491-2566536 FAX : 0491-2566135 Pincode : 678623 Email : sasidharan@ilpgt.com;mraj@ilpgt.com;gireesh@ilpgt.com, commercial@ilpgt.com;fa2@ilpgt.com;nazeera@ilpgt.com;pkv@ilpgt.com;remith@ilpgt.com
FLOW ELEMENT - ORIFICE	MICRO PRECISION PRODUCTS PVT. LTD.	Mr. Anil Bhati, H.B. No.-40, Revenue Estate, Village-Dudhola,Tehsil & Distt. Palwal FARIDABAD Phone- 9560742713;095607427 Pincode : 121002 Email : anil.bhati@wika.com	Works-1->Mr. SANJEEV CHAUHAN ,H.B. No.-40 Others Revenue Estate, Village-Dudhola, Tehsil & Distt.-Palwal -Faridabad-Haryana India Phone- 9560742713 FAX : Pincode : 121002 Email : anil.bhati@wika.com
FLOW ELEMENT - ORIFICE	MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	Mr. Raghavendra M. Kulkarni D2-49/50, Tivim Industrial Estate, Karaswada Mapusa Phone- 0832-2257059 Pincode : 403526 Email : gicflowelement@giconindia.com	Works-1->Mr. Raghavendra M. Kulkarni Dir D2-49/50, Tivim Industrial Estate,Karaswada -Mapusa-GOA INDIA Phone- 0832-2257059 FAX : 022-24455026 Pincode : 403526 Email : gicflowelement@giconindia.com
FLOW ELEMENT - ORIFICE	STAR-MECH CONTROLS (I) PVT.LTD.	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net	Works-1->VIVEK GOTE/ MAHúNDRA BANSODE Sr no.54, Plot No.ll0,Swami ViVekanand Industrial Est.HADAPS -PUNE-MAHARASHTRA INDIA Phone- 02026970450 FAX : 02026970470 Pincode : 411028 Email : marketing@starmech.net
FLOW ELEMENT - ORIFICE	CHEMTROLS INDUSTRIES PVT. LTD.	Mr. K. NANDAKUMAR AMAR HILL, SAKI VIHAR ROAD, POWAI, MUMBAI Phone- 022-67151261 Pincode : 400072 Email : manikandan@chemtrols.com	Works-2->+Works -II :M/s Chemtrols Samil (I) Pvt. Ltd.,Plot No.F-43,44 Others Additional Ambernath Industrial ,M.I.D.C., Ambernath -Thane-MAHARASHTRA INDIA Phone- 22-67151261,9821014902 FAX : 91-22-28571913 Pincode : 421503 Email : manikandan@chemtrols.com
FLOW ELEMENT - ORIFICE	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@ieflowmeters.com	Works-1->MR. A.V.MURTHY/MR. K.T. RAVISANKER PLOTS 1,2,3, PHASE-III,IDA, JEEDIMETLA -HYDERABAD-TELANGANA INDIA Phone- 9885107312 FAX : 040-23096401 Pincode : 500055 Email : sales@ieflowmeters.com

Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
FLOW ELEMENT - ORIFICE	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	Mr. Yogish M. Kulkarni Plot # 23, Udyambag, Belgaum Phone- 0831-4210386 Pincode : 590008 Email : yogish@dyna-fluid.com	Works-1->Mr. Yogish M. Kulkarni Dir Plot # 23, Udyambag, -Belgaum-KARNATAKA INDIA Phone- 0831-4210386 FAX : 0831-4210386 Pincode : 590008 Email : yogish@dyna-fluid.com
INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone- +91-250-2392246 Pincode : 401210 Email : arya@aryaengg.com	
INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com	Works-1->Shahanawaz Khan Vishweshwar Ind. Premises Co-op Soc. Ltd,F-18/19, Pradhikaran,Bhosadi MIDC -PUNE-MAHARASHTRA INDIA Phone- 020-30694134 FAX : 022-23013010 Pincode : 411026 Email : shahanawaz.khan@perfectinstrumentation.com
INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com	Works-1->Mr. Abbas Bhola Unit No. 16, Supreme Industrial Estate,Kaman Bhiwandi Road,Devdal, -Vasai East-MAHARASHTRA India Phone- 9920044113 FAX : 07303178243 Pincode : 401208 Email : ab@fluidfitengg.com
INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd,Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
INSTRUMENT FITTINGS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	Works-1->Mr. Santosh Shukla Others R-628,TTC Industrial Area, MIDC Rabale, -Navi Mumbai-MAHARASHTRA India Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com
INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
INSTRUMENT FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	
INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasan Phone- 02764-267036/37 Pincode : 382705 Email : marketing@com-fit.com	Works-1->Miss Sonal Pithadia/Miss Pavan Chavda Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway, Laxmipura -Nandasan-GUJARAT INDIA Phone- 8460848087 FAX : 2764-267036/37 Pincode : 382705 Email : domestic@com-fit.com
INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com	Works-1->S. Harichandran/ P.S. Pandi B-11, Mugappair Industrial Estate, -CHENNAI-TAMIL NADU INDIA Phone- 044-25252537 FAX : 044-26252538 Pincode : 600037 Email : sales@hpvalvesindia.com
ELECTROMAGNETIC FLOW METER	Adept Fluidyne Pvt. Ltd.	Vinayak Gadre Plot No 4,S.No.17/1-B Kothrud Industrial Estate Pune Phone- 020 25464551 Pincode : 411038 Email : info@adeptfluidyne.com	Works-1-> Plot No 4,S.No.17/1-B Kothrud Industrial Estate -Pune-MAHARASHTRA india Phone- 020 25464551 FAX : Pincode : 411038 Email : info@adeptfluidyne.com
ELECTROMAGNETIC FLOW METER	Electronet Equipments Pvt Ltd.	Mr. Rajendra Nagaonkar/MD, Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune Phone- 9822015256 Pincode : 411048 Email : ho@eeplindia.com	Works-1-> Others Plot No. 84, 85 & 86, Tiny Industrial Estate, Kondhwa Budruk -Pune-MAHARASHTRA INDIA Phone- 20-26932039 FAX : 20-26934122 Pincode : 411048 Email : ho@eeplindia.com
ELECTROMAGNETIC FLOW METER	V.A Valves	Mr.Vishal Jain, Udyog Nagar, Gadaipur, Jalandhar Phone- 9872626376 Pincode : 144004 Email : support@fedrelflowmeters.com	Works-1->Mr.Vishal Jain Dir Udyog Nagar, Gadaipur, -Jalandhar-PUNJAB INDIA Phone- 01812601741,9872626376 FAX : Pincode : 144004 Email : support@fedrelflowmeters.com
ELECTROMAGNETIC FLOW METER	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
ELECTROMAGNETIC FLOW METER	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com	Works-1->Mr. S L Sadani Others 104 - 115,Electronic Complex -Indore-MADHYA PRADESH INDIA Phone- 0731-4081307 FAX : Pincode : 452010 Email : sales@nivocontrols.com;sadanis@nivocontrols.com

NOTE:

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

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BIDDER TO PROPOSE SUB VENDOR LIST WITH BACKUP DOCUMENTS/ CREDENTIALS WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.

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2. DEALERS ARE NOT ACCEPTABLE FOR ANY ITEM (MECH., ELECTRICAL AND C&I) OF THE PACKAGE. BIDDER SHALL PROCURE ALL ITEMS INCLUDING PLATES, STRUCTURAL, FLANGES; COUNTER FLANGES ETC. FROM APPROVED SUB VENDOR ONLY.

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

SUB-VENDOR LIST (CONT.)

LIST OF MAKES OF SUB-VENDOR ITEMS

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	AIR BLOWERS (TWIN LOBE TYPE)	SWAN PNEUMATIC	NOIDA	
		EVEREST TRANSMISSION	NEW DELHI	
		KAY INTERNATIONAL	NEW DELHI / SONEPAT	
		EVEREST BLOWER	BAHADURGARH	
		KULKARNI POWER TOOLS	KOLHAPUR/ PUNE	
2.	METERING PUMPS	VK PUMPS	NASIK	
		MILTON ROY INDIA	CHENNAI	
		SWELLORE	AHMEDABAD	
		POSITIVE METERING PUMPS	NASIK	
		METACHEM	MUMBAI	
3.	AGITATOR / FLUCCOLATOR	REMI PEOCESS PLANT & M/C	MUMBAI	
		FIBRE & FIBRE	MUMBAI / SILVASA	
		CEECONS	CHENNAI	
		STANDARD ENGINEERS	MUMBAI	
4.	HORIZONTAL CENTRIFUGAL PUMPS	BEST AND CROMPTON ENGG LTD.	CHENNAI	
		BHARAT PUMPS & COMPRESSORS LTD	ALLAHABAD	
		FLOWMORE LTD.	GURGAON	
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATORE	
		JYOTI LTD.	VADODARA	
		KIRLOSKAR BROTHERS LTD	PUNE	
		WILO MATHER & PLATT PUMPS PVT. LTD.	PUNE	
		V-FLO PUMPS & SYSTEMS CO. LTD.,	BEIJING-CHINA	
		WPIL LIMITED	KOLKATA	
		VARAT PUMP AND MACHINERY PVT. LTD.	HOWRAH	
		SINTECH PRECISION PRODUCT LTD.	GHAZIABAD	
		MAXFLOW PUMPS INDIA PVT. LTD.	GURUGRAM	
5.	VERTICAL CENTRIFUGAL PUMPS	BHARAT PUMPS & COMPRESSORS LTD	ALLAHABAD	
		FLOWMORE LTD.	GURGAON	
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATORE	
		JYOTI LTD.	VADODARA	
		WILO MATHER & PLATT PUMPS PVT. LTD.	PUNE	
		SULZER PUMPS INDIA LTD.	THANE	
		WPIL LIMITED	KOLKATA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
6.	SCREW PUMP	UT PUMP		
		ROTO PUMPS		
		TUSHACO		
7.	HORIZONTAL CENTRIFUGAL PUMPS (RUBBER LINED)	KISHORE PUMPS	PUNE	
		SU MOTORS	MUMBAI	
8.	NON METALLIC (PP/FRP) HORIZONTAL CENTRIFUGAL PUMPS	ENGINEERS COMBINE	THANE	
		ANTICORROSIVE	VALSAD	
		LEAK PROOF PUMPS PVT. LTD. (RAJEDIA)	-	
9.	MISC. PUMP VERTICAL TURBINE TYPE	KBL	PUNE	
		M&P	PUNE	
		WPIL	GHAZIABAD	
		KISHORE PUMPS	PUNE	
		FLOWMORE	SAHIBABAD	
10.	COATING & WRAPPING MATERIAL TAPE	IWL LTD.	CHENNAI	
		MP TAR PRODUCT	BHILAI	
		PORWAL INDUSTRIES	RAIPUR	
		RUSTECH	KOLKATA	
		STP	JAMSHEDPUR	
11.	CAST IRON/SS GATE/GLV/NRV/SRV	A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		G.M. DALUI AND SONS PVT.LTD.	HOWRAH	
		H.SARKER AND COMPANY	HOWRAH	
		LEADER VALVES LTD.	JALANDHAR	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
12.	BALL VALVE (MANUAL /PNEUMATIC/ ELECTRIC) CLASS 150	A.V. VALVES LTD	AGRA	
		AKAY INDUSTRIES PVT.LTD.	DHARWAD	
		BELGAUM AQUA VALVES PVT. LTD.	BELGAUN	
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS.	CHENNAI	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		DEMBLA VALVES LTD.	THANE	
		M/S GM ENGINEERING	RAJKOT	
		HAWA VALVES (INDIA) PVT. LTD.	NAVI MUMBAI	
		INTERVALVE (INDIA) LTD.	PUNE	
		LEADER VALVES LTD.	JALANDHAR	
		MICROFINISH VALVES PVT LTD.	HUBLI	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		NILON VALVES PRIVATE LIMITED	AHMEDABAD	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		UNIFLOW	CHENNAI	
		VALTECH INDUSTRIES	MUMBAI	
		VAAS AUTOMATION PVT. LTD.	NEW DELHI	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
13.	ELECTRIC MOTOR	CROMPTON GREAVES	AHMEDNAGAR	
		LAXMI HYDRAULICS PVT. LTD	BANGALORE / HUBLI*	
		RAJINDRA ELECT INDUSTRIES	FARIDABAD* / BANGALORE	
		GE-POWER		
		BHARAT BIJLEE	MUMBAI	
		SIEMENS	MUMBAI	
		NGEF	BANGALORE	
		KIRLOSKAR ELECTRIC CO LTD.		
		ASEA BROWN BOVERI		
		MARATHON	KOLKATA	
14.	BUTTER-FLY VALVE	ADVANCE VALVES PVT. LTD.	NOIDA	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		INSTRUMENTATION LTD.	PALAKKAD	
		INTERVALVE (INDIA) LTD.	PUNE	
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		PENTAIR VALVES AND CONTROLS INDIA PRIVATE LIMITED	NAVI MUMBAI	
		UPADHAYA VALVES MANUFACTURERS PRIVATE LIMITED,	KOLKATA	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
15.	DIAPHRAGM VALVE (MANUAL / PNEUMATIC) CLASS 150	WEIR BDK	HUBLI	
		CRANE FLOW PROCESS	SATARA	
		PROCON	MUMBAI	
		MAJESTIC VALVES (LABLINE)	-	
		HAWA ENGINEERS	AHMEDABAD	
16.	DUAL PLATE CHECK	ADVANCE VALVES PVT. LTD.	NOIDA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
	VALVES	FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	1. DUAL PLATE CHECK VALVE CI - CLASS 150 & UP TO 600NB, 2. DUAL PLATE CHECK VALVE CCS - CLASS 150 & UP TO 500NB
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CI ,CCS & STAINLESS STEEL SPRING ASSISTED DUAL PLATE CHECK VALVES UPTO 700 NB AND 150 CLASS RATING.
17.	**Y-TYPE STRAINER**	OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		GRAND PRIX	NEW DELHI	
		JAYPEE	NEW DELHI	
		GREAVES COTTON	MUMBAI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI / NOIDA	
		FILTERATION ENGINEERS (I) PVT. LTD	MUMBAI	
		FLUIDNYE	-	
		SUNGOV ENGINEERING PVT. LTD.	DELHI	
		GRAND PRIX	FARIDABAD	
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
		BHATIA ENGINEERING CO.	DELHI	
18.	**RUBBER FLAP TYPE CHECK VALVES**	ASHVIK VALVES	-	
		FLOW WAY VALVES	-	
		BDK	-	
		MAJESTIC VALVES (LABLINE INST)	-	
		ADVANCE VALVES	-	
19.	**SOLENOID VALVES**	ROTEX	-	
		AVCON	-	
20.	**PRESSURE GAUGE/ DIFFERENTIAL PRESSURE GAUGE**	A.N. INSTRUMENTS PVT. LTD.	KOLKATA	
		ASHCROFT INDIA PVT LTD.	GUJARAT	
		BOSE PANDA INSTRUMENTS PVT.LTD.	KOLKATA	
		FORBES MARSHALL (HYD) LTD.	HYDERABAD	
		GAUGE BOURDON INDIA PVT.	MUMBAI	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		LTD.		
		H.GURU INDUSTRIES	KOLKATA	
		H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	BANGALORE	
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI	
21.	CHAIN PULLEY BLOCK	ARMSEL MHE PVT. LTD	BANGALORE	
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 10 TONNE.
		TRACTEL TIRFOR INDIA PVT. LTD.	FARIDABAD	
		TECHNO INDUSTRIES	AHMEDABAD	
		ARMSEL MHE PVT. LTD	BANGALORE	
		ALPHA SERVICES	BHIWADI	
		CONSOLIDATED HOISTS PVT LTD	PUNE	UPTO 20 TONNES
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		EDDY CRANES PVT. LTD.	MUMBAI	CAPACITY UPTO 10 TONS. BOIS BHEL APP.SUB-VENDORS.
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD,	
		GLOBAL TECHNOLOGIES	HYDERABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		MANGLA HOISTS PVT LTD	NEW DELHI	
		MEEKA MACHINERY PVT. LTD.	AHMEDABAD	
		REVA INDUSTRIES LTD.	FARIDABAD	UPTO 25.0 T CAPACITY.
		ROCKWELL HOISTO CRANES PVT. LTD.	BAHADURGARH	
		SAFEX ENERGY PVT. LTD.	AHMEDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 15 TONNES.
		TECHNO INDUSTRIES	AHMEDABAD	
22.	ELECTRIC HOIST	ARMSEL MHE PVT. LTD	BANGALORE	
		ALPHA SERVICES	BHIWADI	
		CONSOLIDATED HOISTS PVT LTD	PUNE	UPTO 20 TONNES
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		EDDY CRANES PVT. LTD.	MUMBAI	CAPACITY UPTO 10 TONS. BOIS BHEL APP.SUB-VENDORS.
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD,	
		GLOBAL TECHNOLOGIES	HYDERABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		MANGLA HOISTS PVT LTD	NEW DELHI	
		MEEKA MACHINERY PVT. LTD.	AHMEDABAD	
		REVA INDUSTRIES LTD.	FARIDABAD	UPTO 25.0 T CAPACITY.
		ROCKWELL HOISTO CRANES PVT. LTD.	BAHADURGARH	
		SAFEX ENERGY PVT. LTD.	AHMEDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 15 TONNES.
		TECHNO INDUSTRIES	AHMEDABAD	
23.	CONTROL VALVE	SPX CORPORATION, USA	AHMEDABAD	
		CONTROL COMPONENT INC.	CALIFORNIA	
		DRESSER VALVE INDIA PVT. LTD	COIMBATORE	
		DAUME REGELARMATUREN GMBH,	GERMANY	
		EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	CHENNAI	
		WEIR VALVES & CONTROLS UK LTD.	U.K	
		HOLTER REGELARMATUREN GMBH & CO.KG	GERMANY	
		INSTRUMENTATION LTD.	KERALA	
		KOSO INDIA PRIVATE LIMITED,	NASHIK	
		LESLIE CONTROLS, INC	USA	
		MIL CONTROLS LTD.	KERALA	
		METSO SINGAPORE PTE. LTD.,	SINGAPORE	
		PARCOL S.P.A	ITALY	
		R.K.CONTROL INSTRUMENTS PVT. LTD.	THANE	
		RINGO VALVULAS S.L,	SPAIN	
		SHENJIANG VALVE CO. LTD.	CHINA	
		VALVITALIA S.P.A. ,	ITALY	
		WALDEMAR PRUSS ARMATURENFABRIK GMBH	GERMANY	
24.	PRESSURE/DP/VACUUM SWITCH	INDFOSS	GHAZIABAD	
		SOR	USA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		DRESSOR	USA	
		DELTA CONTROL	UK	
		TRAFAG	RANIPET	
		GIC(GAUGES BOURDON)	PANVEL	
		ASHCROFT INDIA PVT LTD.	USA/GERMANY	
		SWITZER	CHENNAI	
25.	TEMPERATURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	KOLKATA	
		ASHCROFT INDIA PVT LTD.	GUJARAT	
		BUDENBERG GUAGE CO.LTD.	UK	
		FORBES MARSHALL (HYD) LTD.	HYDERABAD	
		GOA INSTRUMENTS INDUSTRIES PVT.LTD.	GOA	
		GOA THERMOSTATIC INSTRUMENTS PVT.LTD.		
		GAUGE BOURDON INDIA PVT. LTD.	MUMBAI	
		H.GURU INDUSTRIES	KOLKATA	
		H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	BANGALORE	
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI	
26.	LEVEL GAUGE (F&B, TUBULAR, REFLEX)	SBEM		
		CHEMTROL		
		PUNE TECHTROL		
		SIGMA		
		V AUTOMAT		
		GENERAL INSTRUMENTS		
27.	ROTAMETER	EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.	PUNE	
		FLOW STAR ENGINEERING PVT. LTD.,	FARIDABAD	
		FLOWTECH INSTRUMENTS SERVICRS	VADODARA	
		INSTRUMENTATION ENGINEERS PVT LTD	TELANGANA	
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	NAVI MUMBAI	
		TANSA EQUIPMENTS PVT.LTD	MUMBAI	
28.	LEVEL SWITCH-CONDUCTIVITY TYPE	BLISS ANAND PVT. LTD.	GURGAON	
		FLOWTECH INSTRUMENTS SERVICRS	VADODARA	
		HI-TECH SYSTEMS & SERVICES LTD.	KOLKATA-	VENDOR SHALL SOURCE IMPORT CONTENTS OF LEVEL SWITCH (CONDUCTIVITY TYPE) FROM

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
				LEVELSTATE SYSTEMS LTD., UNITED KINGDOM.
		LEVCON INSTRUMENTS PVT. LTD.	KOLKATA	
		RAMAN INSTRUMENTS PVT.LTD.	MUMBAI	VENDOR SHALL SOURCE IMPORT CONTENTS OF LEVEL SWITCH (CONDUCTIVITY TYPE) FROM MOBREY MEASUREMENT, AN OPERATING UNIT OF MORBEY LTD., SLOUGH, BERKSHIRE, UNITED KINGDOM.
		SIGMA INSTRUMENTS CO.	MUMBAI	
		SOR INC.	USA	
		SAPCON INSTRUMENT PVT LTD.	INDORE	
		V. AUTOMAT & INTRUMENTS (P) LTD.	NEW DELHI	
29.	LEVEL SWITCH (ALL TYPES)	LEVCON		
		CHEMTROLS SAMIL (INDIA) PVT LTD.		
		SWITZER		
		WAAREE (BAUMER INSTRUMENTS)		
		V AUTOMAT		
		PUNE TECHTROL		
30.	MAGNETIC FLOW METER	ABB	-	
		WAAREE (BAUMER INSTRUMENTS)	-	
		EUREKA	-	
		EMERSON	-	
		YOKOGAWA	-	
		HACH (POTENSE)	-	
		KROHNE MARSHALL	-	
31.	FLOW ELEMENT - NOZZLE	HYDROPNEUMATICS PVT. LTD.	GOA	
		INSTRUMENTATION LTD.	PALAKKAD	
		MICRO PRECISION PRODUCTS PVT. LTD.	FARIDABAD	
		MINCO (INDIA) FLOW	GOA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		ELEMENTS PVT. LTD.		
		STAR-MECH CONTROLS (I) PVT.LTD.	PUNE	
		SEIKO FLOW CONTROL GMBH	AUSTRIA	
32.	FLOW ELEMENT - ORIFICE	FLOW STAR ENGINEERING PVT. LTD.,	FARIDABAD	
		HYDROPNEUMATICS PVT. LTD.	GOA	
		INSTRUMENTATION LTD.	PALAKKAD	
		INSTRUMENTATION ENGINEERS PVT LTD	HYDERABAD	
		MICRO PRECISION PRODUCTS PVT. LTD.	FARIDABAD	
		MINCO (INDIA) PRIVATE LIMITED	GOA	
		STAR-MECH CONTROLS (I) PVT.LTD.	PUNE	
		CHEMTROLS INDUSTRIES PVT.LTD	THANE	
		DYNAFLUID VALVES AND FLOW CONTROLS(P) LTD.	BELGAUM	
		ELECTRONET EQUIPMENTS PVT. LTD	PUNE	
		MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	MAPUSA	
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	NAVI MUMBAI	
		TANSA EQUIPMENTS PVT.LTD	MUMBAI	
33.	FLOW TRANSMITTERS (ALL TYPES)	E & H	-	
		KHRONE MARSHALL	-	
		EMERSON	-	
		ABB	-	
		HONEYWELL	-	
		YOKOGAWA	-	
34.	LEVEL TRANSMITTERS (ALL TYPES)	EMERSON	-	
		E & H	-	
		ABB	-	
		HONEYWELL	-	
		V AUTOMAT	-	
		YOKOGAWA	-	
		SIEMENS	-	
		KROHNE MARSHALL	-	
35.	PRESSURE TRANSMITTERS (ALL TYPES)	EMERSON	USA/PAWANE	
		LAXONS AUTOMATION	DAMAN	
		YIL	BANGALORE	
		SIEMENS	THANE	
		FUJI	CHINA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		YOKOGAWA	JAPAN	
		HONEYWELL	USA/PUNE	
36.	TEMPERATURE TRANSMITTERS	EMERSON	-	
		E & H	-	
		ABB	-	
		HONEYWELL	-	
		V AUTOMAT	-	
		YOKOGAWA	-	
		SIEMENS	-	
		FORBES MARSHALL	-	
37.	PH TRANSMITTERS	EMERSON	-	
		YOKOGAWA	-	
		HONEYWELL	-	
		ABB	-	
		HACH	-	
		FORBES MARSHALL	-	
38.	ANALYSERS (ALL TYPES)	ABB	-	
		EMERSON	-	
		YOKOGAWA	-	
		HONEYWELL	-	
		HACH POLYMETRON	-	
		SIEMENS	-	
		FORBES MARSHALL	-	
39.	INSTRUMENT FITTINGS	AURA INCORPORATED	NEW DELHI	
		ASTEC VALVES & FITTINGS PVT. LTD.,	MUMBAI	
		ARYA CRAFTS & ENGINEERING PVT. LTD.	MUMBAI	
		COMFIT & VALVE PVT. LTD.	GUJARAT	
		FLUIDFIT ENGINEERS PVT. LTD.	MUMBAI	
		FLUID CONTROLS PVT. LTD.	MUMBAI	
		HP VALVES & FITTINGS INDIA PVT. LTD.	CHENNAI	
		PRECISION ENGINEERING INDUSTRIES	MUMBAI	
		PANAM ENGINEERS,	MUMBAI	
		PERFECT INSTRUMENTATION CONTROL (INDIA) PVT. LTD.	MUMBAI	
		VIKAS INDUSTRIAL PRODUCTS	NOIDA	
40.	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	MUMBAI	
		FLEXPRO ELECTRICALS PVT. LTD.	GUJARAT	METAL TYPE JUNCTION BOX ONLY

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		K.S.INSTRUMENTS PVT.LTD.	BANGALORE	
		SUCHITRA INDUSTRIES	BANGALORE	
		SHRENIK & COMPANY,	AHMEDABAD	
41.	CABLE GLAND	COMET	-	
		DOWELL	-	
		CHETNA	-	
42.	CABLE LUGS	ELECTRO BILLETS	-	
		COMET	-	
		DOWELL	-	
		CHETNA	-	
43.	MS PLATES	SAIL		
		ESSAR STEEL		
		TISCO		
		RINL		
		JINDAL		
		LLOYD		
		ISPAT		
		INDIAN IRON & STEEL CO. LTD		
44.	CS PIPE (ASTM A 106 GR. B)	INDIAN SEAMLESS METAL TUBES	AHMEDABAD	UPTO 150 NB
		MAHARASHTRA SEAMLESS	RAIGAD	UPTO 350 NB
45.	MS PIPES	SAIL	ROURKELA	
		JINDAL	GHAZIBAD/HISSAR	
		SURYA ROSHNI	BAHADUR GARH	
		TATA TUBE	JAMSHEDPUR	
		PSL	CHENNAI/VIZAG/KUTCH/DAMAN	
		LALIT PROFILE	THANE	
		SAMSHI PIPES INDUSTRIES	VADODARA	
		MUKUT PIPES	RAJPURA	
		INDUS TUBES	G B NAGAR	
		MANN IND	INDORE	
		SURENDRA ENGG	RAJPURA	
		PRATIBHA PIPES & STRUCTURE PVT LTD	THANE	
		JCO GAS PIPE	CHINDWARA	
		NUKAT TANKS AND VESSELS	TARAPUR	
		DADU PIPES	SIKRANDRABAD	
		GOOD LUCK TUBES	SIKANDRABAD	
		ADVANCE STEEL TUBES	SAHIBABAD	
		BIHAR TUBES	SIKANDRABAD	
		HI TECH PIPES	SIKANDRABAD	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		RATNAMANI	KUTCH/AHMEDABAD/CHHATRAL	
		MAHARASHTRA SEAMLESS	RAIGAD	
		WELSPUN	ANJAR/BHARUCH	
46.	SS PIPES/ TUBES	APEX TUBES	BEHROR (ALWAR)	
		RATNAMANI	CHATTRAL	
		REMI	TARAPUR	
		PRAKASH STEELAGE	-	
47.	POWER/CONTROL/INSTRUMENT CABLE	CORDS CABLE	BHIWADI	
		RADIANT CABLES	HYDERABAD	
		POLYCAB	DAMAN	
		KEI	BHIWADI	
		NICCO	KOLKATA	
		RAVIN CABLES	PUNE	
		INCAB	PUNE	
		HVPL	FARIDABAD	
		TORRENT CABLE	NADIAD	
		HAVELLS	ALWAR	
		PARAMOUNT	KHUSHKHERA	
		SRI RAM CABLES	BHIWADI	
		THERMOCABLES	HYDERABAD	
		TORRENT CABLE	NADIAD	
		UNIVERSAL CABLES	SATNA	
		GEMSCAB	BHIWADI	
		DELTON	FARIDABAD	
48.	SAFETY SHOWER	UNICARE	-	
		MOHAN INDUSTRIES	-	
		SUPER SAFETY SERVICES	-	
49.	EJECTOR	ESSEM TECHNOLOGIES	-	
		RATNA PRASAD	-	
50.	LOCAL CONTROL PANEL	INDUSTRIAL SWITCHGEAR & CONTROL	-	
		POSITRONICS	-	
		DELTA CONTROL	-	
		L & T	-	
		GE POWER	-	
		PYROTECH	-	
		C& S	-	
		MODERN EQUIPMENTS	CHENNAI	
		EAGLE PLAST	PUNE	
		OMEGA PLAST	MUMBAI	
51.	STROKE CONTROLLER	V K PUMPS	NASIK	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		METACHEM	MUMBAI	
		SWELORE	AHMEDABAD	
		MILTON ROY INDIA	CHENNAI	
52.	SAFETY VALVES/RELIEF VALVES	METACHEM	MUMBAI	
		KEYSTONE	BARODA	
		V K PUMPS	NASIK	
		MILTON ROY	CHENNAI	
53.	ORIFICE PLATE	MICRO PRECISION	FARIDABAD	
		INSTRUMENTAION LTD	PALGHAT	
		CARLO DYNAMICS	HYDERABAD	
54.	STEEL GATE/GLOBE/NR VALVES	A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	JALANDHAR	(1) CARBON STEEL GATE VALVES & NON RETURN VALVES: 15 NB TO 50 NB (#800) & 65 NB TO 300 NB (#150) (2) CARBON STEEL GLOBE VALVES: 15 NB TO 50 NB (#800) & 65 NB TO 200 NB (#150)
		FLUIDLINE VALVES COMPANY PVT.LTD.	KAUSHAMBI	
		M/S GM ENGINEERING	RAJKOT	
		INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C)SUPPLIER NOT REGISTERED FOR NR VALVES
		LEADER VALVES LTD.	JALANDHAR	
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
		NSSL LIMITED.	NAGPUR	
		STEEL STRONG VALVES (I) PVT.LTD.	NAVI MUMBAI	LIMITED TO RANGES & CLASSES AS AVAILABE IN VD FILE.
		VENUS PUMPS AND ENGG.	KOLKATA	CC/CSS-GATE-

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		WORKS		BBT-UPTO600NB CL UPTO300,GATE-PSBT UPTO250NB CL 1500,GLV-BBT-UPTO300NB CL UPTO600,SCNRV-BBT-UPTO600NB CL UPTO150,SCNRV-BBT-UPTO300NB CL 300,SCNRV-PSBT-UPTO150NB CL UPTO900
		VALTECH INDUSTRIES	MUMBAI	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE-GV/150/900,GV/300/400, GV/600/300 , GV/GLV/NRV/900/250 , GLV/300/300,GLV/150/350/ , SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.
		V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
55.	SLUICE GATE	H SARKAR	KOLKATA	
		JASH ENGINEERING	-	
		YASHWANT INDUSTRIES	-	
56.	3 WAY VALVE	HI TECH	AHMEDABAD	
		ADVANCE VALVES PVT.LTD	NOIDA	
		BDK	HUBLI	
		FOURESS ENGG.INDIA LTD.	MUMBAI	
		FLUIDLINEVALVES COMPANY PRIVATE LTD.,	MUMBAI	
		INSTRUMENTATION LTD.	PALAKAD	
		KIRLOSKAR BROTHERS LTD.	PUNE	
		VENUS PUMP & ENGG. WORKS	KOLKATA	
		SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY	CHENNAI	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		STAFFORD CONTROLS LIMITED	PUNE	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
57.	PLUG VALVE(MANUAL)	BDK	HUBLI	
		HAWA ENGINEERS / MARCK & CARE	-	
		MICON VALVES	-	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
58.	FITTINGS (CS/SS)	M.S. FITTINGS	KOLKATA	
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
		TUBE PRODUCTS	BARODA	
		NL HAZRA	KOLKATA	
		GUJRAT INFRA PIPES	BARODA	
		EDWARDS	USA	
		PIPEFIT ENGINEERS	BARODA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
59.	FLANGES (SS/CS)	PRADEEP METALS LTD	MUMBAI	
		TUBE PRODUCT INCOROPORATION	BARODA	
		MS FITTINGS	KOLKATA	
		HAWA ENGINEERING	-	
		ALIANCE PIPE & PLANGES	KOLKATA	
		JAI AMBE	MUMBAI	
60.	PIPE & FILLTING (PP,HDPE,PVC & CPVC)	GEROGE FISHCHER	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
		JAIN IRRIGATION	-	
		ORIPLAST	-	
61.	VALVES (GATE/GLOBE/NRV/BALL)- (PP,HDPE,PVC & CPVC)	GEROGE FISHCHER IPING SYSTEMS PVT LTD	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
		JAIN IRRIGATION	-	
		ORIPLAST	-	
62.	AIR FILTER REGULATOR	SHAVO NORGEN	-	
		PLACKA INSTRUMENTS	-	
63.	TUBE SETTLER/ LAMERLLA CLARIFIER FILTER MEDIA	BHEL APPROVED SOURCES		
64.	OIL SKIMMER (BELT TYPE / DRUM TYPE)	BHEL APPROVED SOURCES		
65.	VENTURI MIXER	BHEL APPROVED SOURCES		

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
66.	HOSE PIPE	BHEL APPROVED SOURCES		
67.	DISSOLVING BASKET	BHEL APPROVED SOURCES		
68.	FLOAT VALVE	BHEL APPROVED SOURCES		
69.	OIL CENTRIFUGE	BHEL APPROVED SOURCES		
70.	DC LEAD ACID / NI-CD BATTERIES	AMCO SAFT INDIA LTD	BANGALORE	NI-CD BATTERIES ONLY
		EXIDE INDUSTRIES LTD	NEW DELHI	LEAD ACID BATTERIES ONLY.
		HBL POWER SYSTEMS LTD	HYDERABAD	NI/CD AND TUBULAR TYPE FOR LEAD ACID
		HOPPECKE BATTERIEN GMBH & CO.KG,	GERMANY	
71.	PAINT	ASIAN PAINTS (I) LTD.		
		BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		JOTUN PAINTS		
72.	PNEUMATIC ACTUATOR	PROCON ENGINEERS	-	
		TYCO	-	
		CRANE PROCESS	-	
		BDK	-	
		INTERVALVE	-	
		BRAY CONTROL	-	
73.	MOTORISED ACTUATOR	ROTARK	-	
		AUMA	-	
		LIMITORK	-	

NOTE:

1. The sub vendor list above is indicative only and is subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.

   Bidder to propose sub vendor list with following back up documents within 4 weeks of placement of LOI. Thereafter no request for additional sub-vendor shall be entertained. The sub vendor list shall subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.

a) Documentation to show that the equipment /system has been supplied for a plant of similar or higher capacity.

b) End user performance certificate that the equipment/system has been operating satisfactorily for minimum two years as on the scheduled date of bid opening.
Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them.

2. The inspection category will be intimated after award of contract by BHEL/customer. However, the same will be adhered by the bidder without any commercial and delivery implication to BHEL/ customer.

ANNEXURE-III

FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES

In case during performance guarantee tests it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the performance guarantee test(s) with Employer's consent. However, if the specified performance guarantee(s) are still not met even after the above modifications/replacements within ninety (90) days or a reasonable period allowed by the Employer, after the tests have been completed Employer will have the right to the following:

1.01.00 **GUARANTEE UNDER CATEGORY –II**

In case the performance guarantee(s) are not met by the Contractor during demonstration test, the Contractor shall carry out all necessary modifications and/or replacements to comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the performance guarantee test(s) with Employer's consent. If, however, the demonstrated guarantee(s) are not met even after the above modifications / replacements within ninety (90) days, it will be concluded that, the equipment has failed to meet the guarantee(s).
In such a case, Employer shall Reject the equipment/plant/system and recover from the Contractor the payments already made. The performance guarantees under this category shall be called 'Category - II ' Guarantees. Conformance to the performance requirements under Category -II is mandatory.

Following parameters/equipment of ETP comes under Category -II guarantee.

Noise

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 specified in General Technical Requirement, Section-II of the technical specifications.
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 61672-1 & 2 (latest edition) 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 1.5 m 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.

1.02.00 **GUARANTEE UNDER CATEGORY –III**

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

A. EFFLUENT TREATMENT PLANT
The Bidder shall guarantee that the equipment offered shall meet the rating and performance requirements stipulated for various equipment covered in this specification.
The guaranteed performance parameters furnished by the bidder in his offer, shall be without any tolerance values and all margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures.
The bidder shall demonstrate all the guarantees covered herein during demonstration test / PG test.
The various tests which are to be carried out during demonstration tests are listed in the specification. The guarantee tests shall be conducted by the bidder at site in presence of BHEL/ CUSTOMER. All costs associated with the tests shall be included in the bid price.

In case during demonstration test /PG test, it is found that the equipment/system has failed to meet the guarantees, the bidder 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 BHEL/ CUSTOMER and re-conduct the demonstration test(s) / PG test with BHEL/ CUSTOMER's consent.
Bidder to demonstrate following parameters at site during demonstration test:

1. TUBE SETTLER / LAMELLA CLARIFIER

a. Lamella Clarifier shall be guaranteed for design effluent capacity meeting the effluent quality as mentioned below.
b. Effluent quality at the outlet of Tube settler/ Lamella Clarifier shall be guaranteed for the following:
Effluent Turbidity: 10 NTU at design flow
Effluent Oil & grease: 5 ppm (maximum)

B. CRANE, MONORAIL, HOIST ETC

The parameters/capabilities to be demonstrated for following systems/ equipment shall be:

1. EOT Cranes: Over load tests, travel and hoist speed checks as per relevant India Standards (Latest edition).
2. HOT cranes, monorails etc.: Over load test, travel and speed checks, functional and performance tests as per relevant India Standards (Latest edition).

C. PUMPS

a) Capacity, head, and power consumption of all the pumps at the rated duty point (to be demonstrated and proved at shop with the respective job motors) and to operate in accordance with the approved pump characteristic curves. During the shop test no negative tolerance in the guaranteed capacity, head and efficiency of the pump shall be allowed.
b) Current, Voltage, Motor input Power, Frequency, Speed, Bearing/ Motor winding Temperature, Vibration and noise level of pumps and drives and parallel operation (as applicable) without hunting & abnormal noise and with load sharing within 10% of each other at the rated duty point of pumps shall be demonstrated at site as a part of Performance & Guarantee test.

D. BUTTERFLY VALVES

a) The functioning of various Butterfly valves, opening and closing operation as per control logic, accumulator capacity of hydraulic operated valves etc. shall be demonstrated as per the approved design document.

Standard PG Test Procedure:

Effluent Treatment Plant

Scope: PG Test shall be conducted after successful trial run to establish the various guarantee parameters as defined in the technical specifications.

(a) Guaranteed effluent quality and capacity for each of ~~Clarifier, Gravity Filter~~, Tube Settler and ~~Coal Slurry Settling Pond~~.

(b) Sample collection and analysis:

Table1:

S.N.	Sample_ID	Chemical parameters	Frequency of sampling
1	~~Raw Water~~	All parameters given in feed analysis	Once/day
2	Clarifier Outlet	~~Flow~~, Organic matter, Iron content, Turbidity	Two-hourly
3	Gravity Filter Outlet	Flow, Turbidity	Two-hourly
4	Tube Settler Inlet & Outlet	Flow, Turbidity, Oil & Grease	Two-hourly
5	CSSP outlet	~~TSS, Particle size~~	Two-hourly
Note: Joint sampling to be done during PGT.			

(c) Noise and vibration levels of all rotary equipments.

(d) Current, voltage, motor input power, frequency, speed, bearing/motor winding temperature, vibration and noise level of pumps, blowers and their drives and parallel operation of pumps and blowers, if applicable are to be demonstrated.

(e) Capacity, head and power consumption of specified pumps.

General Requirements:

(a) Responsibility of conducting the test: ETP Bidder

(b) Standard analytical procedures to be followed for chemical parameter determination.

(c) All necessary tools & tackles, equipment, any additional equipments viz. piping, valves strainers etc required for PGT shall be arranged by vendor. Laboratory facilities at site shall be made available for analysis purpose. In absence of proper lab facility, same shall be arranged by the vendor/sample to be got tested at external NABL labs.

Test Methodology:

(a) After inffleunt supply is established in tube settler/lamella clarifier, flow to be adjusted as desired, amount of treatment chemicals is to be assessed by jar test at site.

(b) PGT shall be carried out separately for each tube settler/lamella clarifier of rated flow for a time period as defined in technical specifications.

(c) The guaranteed parameters of respective systems shall be demonstrated during performance guarantee test as per approved test procedure, test procedure is to be submitted by agency.

PT-CW Clarifier , PT-DM Clarifier & Tube Settlers

Test Objective	Test Procedure	Remarks
Effluent Capacity	Flow is to be adjusted so that the effluent quantity from clarifiers/Tube Settler is as defined in technical specifications.	i.Duration of each test shall be 8 hours and one run in one day shall be conducted. ii.Three tests shall be run for each clarifier/Tube settler and average value of three test runs shall be considered for approval.
Effluent Quality	Chemicals shall be dosed based on laboratory Jar Test results for the water available at the time of PGT.	
	20% overloading test of each clarifier is to be done exactly in line with 100% flow test procedure for 8 hours.	

PT-Potable Gravity Filter & PT-DM Gravity Filter

Test Objective	Test Procedure	Remarks
Effluent Capacity	Flow is to be adjusted so that the effluent quantity from clarifier is as defined in technical specifications.	i.Duration of each test of filter shall be 24 hours. ii.Three tests shall be run for each gravity filter and average value of three test runs shall be considered for approval.
Effluent Quality	Effluent from filter is to be sampled and analysed.	
	Backwash water requirement not to exceed 2% of water treated between two successive backwashes.	

Coal Slurry Settling Pond (CSSP)

Test Objective	Test Procedure	Remarks
Effluent Quality	Flow is to be adjusted so that the effluent quantity from CSSP is as defined in technical specifications.	i.Duration of each test shall be 8 hours for each pond. ii.Three tests shall be run for each pond and one test in one day shall be conducted. iii. Average value of three test runs shall be considered for approval. iv. Rated flow shall be provided by NTPC during PGT. If rated inlet flow is not available, PGT shall be conducted as per prevailing conditions and recording of reason for non-availability be done jointly.

Test Summary (Table 2):

S.N.	Unit	Test Objective	Parameters	Remarks
1	PT-CW clarifier, PT-DM Clarifier	Effluent Capacity	Flow	By Flow Transmitter
		Effluent Quality	Turbidity & Iron	By Offline testing
			Organic matter	KMnO4 Method
2	PT-Potable Gravity Filter, PT-DM Gravity Filter	Effluent Capacity	Flow	By Flow Transmitter
		Effluent Quality	Turbidity	By Offline testing
3	Tube Settler	Effluent Capacity	Flow	By Flow Transmitter
		Effluent Quality	Turbidity, Oil & Grease	By Offline testing
4	CSSP	Effluent Quality	Effluent TSS at the outlet of each CSSP during storm water flow condition as defined in technical specifications.	By Flow transmitter and offline testing of TSS

Note:

i. List of instruments is to be provided by vendor.
ii. Chemical consumption: As per design calculations submitted by agency.
iii. Agency should submit the detailed PG test procedure based on the above details for approval of NTPC.

PREREQUISITES TO GUARANTEE TESTS TO BE ENSURED BY CONTRACTOR

1. Deputation of team to site to associate with the Guarantee tests,
2. Calibration of belt weigher scales and accuracy of same to be demonstrated to NTPC.
3. Arrangement of wattmeters / energymeters calibrated and sealed from approved Govt. test house or NTPC site laboratory. Arrangement of any other instrument/ accessory for the test.
4. Proper adjustment of skirt boards and belt cleaners prior to the start of tests.
5. Arrangement of calibrated equipments for measurement of vibration & noise levels.
6. Protection Relays of LT/HT switchgears and all motor feeders shall be checked.
7. Belt protection switches, local push buttons, hooters, brakes/rail clamps to be in working order.
8. Free rotation of idlers and pulleys.
9. Protection relays of LT/HT switchgears and all motors/transformer feeders to be checked.
10. Sufficient illumination.

FORMAT FOR SUBMISSION OF GUARANTEE TEST PROCEDURE

Clause No. as per LOA/ Tech. Specs.	Provision of LOA / Tech. Specs.	Name and Methodology of Test proposed by Vendor	NTPC comments on the tests proposed by vendor

GUARANTEE TEST PROFORMA

POWER MEASUREMENT

Project :

Package :

Date :

1. Equipment/Stream Composition :
2. Motor Description :
3. Sr. No. of meters used :
4. Date of Calibration of instrument and name of test house :
5. Multiplying factor (M.F.) of the wattmeter :
6. Wattmeter Readings (to be taken at 1 minute intervals) :

Sl. No.	Measurement Terminal Location	Time	Voltage (Volts)	Current (amps)	kw Reading M.F.		Total (W1+W2) MF kw	Remarks
					W1	W2		

GUARANTEE TEST PROFORMA

NOISE LEVEL MEASUREMENT

Project :

Package :

Date :

Details of Sound Level Meter

1. Make
2. Model
3. Date of calibration with name of Test House

Sl.No	Equipment with location	Equipment load/capacity	Measurement* point no.	Sound level dBA.	Remarks

NTPC **Contractor**

* For each equipment location, a Projected Plan Diagram shall be made and the location of measurement points shall be identified.

ANNEXURE-IV

DRAWING/DOCUMENTS REQUIRMENT & DISTRIBUTION SCHEDULE

After award of LOI, the drawing documents listed in MDL are minimum drawing/ documents, which shall be submitted by the bidder for BHEL and Customer approval. However, any additional drawing/ document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial & delivery implication to BHEL.

The bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. Bidder to comply with the observations of the BHEL and CUSTOMER without price & delivery implication.

Every revised submission incorporating BHEL/Customer comments shall be resubmitted within 7 days by bidder.

Bidder to further note that the submitted drawings/ revised drawing, should be complete in all respects. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL's / Customer's office for across the table discussions/ finalizations/ submissions of drawings.

- List and schedule of drawings/documents to be submitted after award of contract shall be as per MDL.

- Bidder to note that drawings/documents submission shall be through web-based Document Management System. Bidder would be provided access to the DMS for drawings/documents approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.
  - Internet explorer version – Minimum Internet Explorer 7
  - Internet speed – 2 mbps (Minimum preferred)
  - Pop ups from our external DMS IP (124.124.36.198) should not be blocked
  - Vendor's internal proxy setting should not block DMS application's link (http://124.124.36.198/wrenchwebaccess/login.aspx)
  - DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking
  - documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor
  - session.
  - For quick access bidder may refer the link http://bhelpem.com/DMSManuals/DMSManuals.html

- Bidder shall submit soft copy/hard copy/CD ROMs of all the finally approved drawings and O&M Manuals as required by Customer/Customer consultant/BHEL-site/BHEL-PEM. The exact number of hard copies/CD ROMs of these documents to be submitted shall be notified to the bidder at the time of detailed engineering and bidder shall submit the same without any commercial/delivery implications to BHEL/Customer.

- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.

- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.

  For the execution of the contract regular meeting (generally, once in 15 days or as per project requirement) is required.

- Vendor to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.

- Bidder to submit instrument schedule, cable schedule and valve schedule in MS- Excel format during detailed engineering.

- Bidder to also furnish the auto cad copy/MS-Excel/MS-word (as applicable) of the following documents after award of contract. However, any other auto cad copy/MS-Excel/MS-word of any other document as per the insistence of BHEL and customer will also be submitted by the bidder without any delivery and commercial implication to BHEL and customer.

- P&IDs.
- Equipment lay out.
- Equipment Cable tray layout.
- Civil assignment drawings.
- Piping layout drawing.
- Valve Schedule
- Instrument Schedule
- Any other drg/docs as required.

e-Learning Package/ Module:

E-learning packages shall be supplied for the equipment / system for the complete system along with associated electrical and C&I system. Bidder to refer Section-II for detail.

- Data/Reports other than listed drawings/documents will also be made available to BHEL as and when required for import into BHEL model.

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

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

- In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion. However, in case changes are necessitated due to any constraints at customer end, delay in review/ approval of such revised drawing beyond one month will be to customer's account.

MASTER DRAWING LIST OF EFFLUENT TREATMENT PLANT

Sr.No	DOCUMENT / DRAWING No.	DRAWING / DOCUMENT TITLE	SCHEDULE OF SUBMISSION FROM LOI	SIZE
1.	PE-V0-497-164-W001	DATASHEET AND GA DRAWING FOR PLUG VALVES FOR ETP	8	A4
2.	PE-V0-497-164-W003	G.A & DATASHEET OF AGITATOR FOR LET PLANT	8	A4
3.	PE-V0-497-164-W005	DATASHEET AND GA DRAWING FOR GATE VALVES FOR ETP	8	A4
4.	PE-V0-497-164-W007	DATASHEET AND GA DRAWING FOR DIAPHRAGM VALVES FOR ETP	8	A4

5.	PE-V0-497-164-W009	DATASHEET AND GA DRAWING FOR BALL VALVES FOR ETP	10	A4
6.	PE-V0-497-164-W011	DATASHEET AND GA DRAWING FOR HORIZONTAL CENTRIFUGAL PUMPS FOR ETP	10	A4
7.	PE-V0-497-164-W012	P & ID FOR ETP	4	A2
8.	PE-V0-497-164-W013	YARD PIPING LAYOUT FOR ETP	16	A0
9.	PE-V0-497-164-W014	MECH GA FOR LAMELLA CLARIFIER/ TUBE SETTLER FOR ETP	12	A1
10.	PE-V0-497-164-W015	PIPING LAYOUT INSIDE ETP AREA	16	A0
11.	PE-V0-497-164-W016	ELECTRICAL LOAD LIST FOR ETP	14	A4
12.	PE-V0-497-164-W017	DATASHEET AND GA DRAWING FOR SCREW PUMPS FOR ETP	10	A4
13.	PE-V0-497-164-W018	SUB VENDOR LIST AND INSPECTION CRITERIA	4	A4
14.	PE-V0-497-164-W019	DATASHEET AND GA DRAWING AIR BLOWERS FOR ETP	8	A4
15.	PE-V0-497-164-W020	EQUIPMENT LAYOUT FOR ETP	4	A1
16.	PE-V0-497-164-W021	G.A & DATASHEET OF NON-RETURN VALVE FOR LET PLANT	8	A4
17.	PE-V0-497-164-W022	DATASHEET AND GA DRG FOR ELECTRIC HOIST/ MANUAL HOIST/ CHAIN PULLEY BLOCK FOR ETP	10	A4
18.	PE-V0-497-164-W023	PG TEST PROCEDURE OF ETP PLANT	20	A4
19.	PE-V0-497-164-W024	CIVIL INPUT DRAWING INSIDE ETP AREA	10	A1
20.	PE-V0-497-164-W025	Datasheet for OIL SKIMMER - ETP	14	A4
21.	PE-V0-497-164-W026	MECHANICAL GA DRG OF RCC SUMPS OUTSIDE ETP AREA	10	A2
22.	PE-V0-497-164-W027	CABLE TRAY/TRENCH & CONDUIT ROUTING DIAGRAM INCLUDING JB LOCATION OF INSIDE AND OUTSIDE ETP	16	A2
23.	PE-V0-497-164-W028	GA & DATASHEETS OF MOTORS FOR ETP	12	A4
24.	PE-V0-497-164-W031	GA DRAWING FOR ATMOSPHERIC TANKS FOR ETP	10	A2
25.	PE-V0-497-164-W034	VALVE SCHEDULE FOR LET	6	A3

26.	PE-V0-497-164-W035	PIPE SCHEDULE FOR LET	6	A4
27.	PE-V0-497-164-W037	PROCESS SIZING, PRESSURE DROP AND HYDRAULIC FLOW CALCULATION FOR ETP	4	A4
28.	PE-V0-497-164-W039	SYSTEM DESCRIPTION & CONTROL WRITE UP FOR LET	4	A4
29.	PE-V0-497-164-W040	OPERATION & MAINTENENACE MANUAL FOR LET	20	A4
30.	PE-V0-497-164-W041	LIST OF DRIVES, JB GROUPING AND I/O LIST	8	A4
31.	PE-V0-497-164-W042	DATASHEET AND GA DRAWING FOR VERTICAL CENTRIFUGAL PUMPS FOR ETP	10	A4
32.	PE-V0-497-164-W044	PAINTING SCHEDULE FOR LET	8	A4
33.	PE-V0-497-164-W045	DATASHEET AND GA DRAWING FOR ISOLATION GATE FOR ETP	8	A4
34.	PE-V0-497-164-W046	INSTRUMENT SCHEDULE OF ETP	8	A4
35.	PE-V0-497-164-W047	DATA SHEET OF ANALYSERS - ETP	12	A4
36.	PE-V0-497-164-W048	DATA SHEET OF TRANSMITTERS -ETP	12	A4
37.	PE-V0-497-164-W049	DATASHEET OF LOCAL INSTRUMENTS -ETP	12	A4
38.	PE-V0-497-164-W050	CABLE SCHEDULE & CABLE INTERCONNECTION DIAGRAM FOR ETP	12	A4
39.	PE-V0-497-164-W051	DATASHEET OF DATASHEET AND GA FOR JUNCTION BOXES - ETP	12	A4
40.	PE-V0-497-164-W052	LIST OF ALARM & SIGNALS FOR ETP AREA	6	A4
41.	PE-V0-497-164-W054	UPS Load List & ACDB distribution.	10	A4
42.	PE-V0-497-164-W071	QAP FOR VERTICAL CENTRIFUGAL / TURBINE PUMP	10	A4
43.	PE-V0-497-164-W072	QAP FOR HORIZONTAL CENTRIFUGAL PUMP	10	A4
44.	PE-V0-497-164-W073	QAP FOR VERTICAL SCREW PUMP	10	A4
45.	PE-V0-497-164-W074	QAP FOR METERING PUMP	10	A4
46.	PE-V0-497-164-W075	QAP of Air Blower (Lobe Type) less than 5KW	10	A4
47.	PE-V0-497-164-W076	QAP FOR BUTTERFLY VALVE UP TO 600MM & CLASS 150 - ETP	10	A4

48.	PE-V0-497-164-W077	QAP FOR MS PIPES UP TO 1000NB - ETP	10	A4
49.	PE-V0-497-164-W078	QAP FOR SLUICE GATE/ISOLATION GATE - ETP	10	A4
50.	PE-V0-497-164-W079	QAP FOR DIAPHRAGM VALVES (ETP)	10	A4
51.	PE-V0-497-164-W080	QAP FOR PLUG VALVES (ETP)	10	A4
52.	PE-V0-497-164-W081	QAP FOR DUAL PLATE CHECK VALVES (ETP)	10	A4
53.	PE-V0-497-164-W082	QAP FOR BALL VALVES (ETP)	10	A4
54.	PE-V0-497-164-W083	GA & DATA SHEET OF PORTABLE CENTRIFUGE FOR WASTE SERVICE WATER TREATMENT PLANT	10	A4
55.	PE-V0-497-164-W084	DATASHEET AND GA DRG FOR BUTTERFLY VALVE FOR ETP	10	A4
56.	PE-V0-497-164-W085	DATASHEET AND GA DRAWING FOR METERING PUMPS FOR ETP	10	A4
57.	PE-V0-497-164-W086	DATASHEET AND GA DRAWING FOR ELECTRIC HOIST & CHAIN PULLEY BLOCK FOR ETP	12	A4
58.	PE-V0-497-164-W087	INSTRUMENTATION INSTALLTION DIAGRAM	12	A4
59.	PE-V0-497-164-W088	ERECTION MANUAL, SEQUENCE OF ERECTION & ERECTION DRAWINGS	20	A4
60.	PE-V0-497-164-W089	PIPING ISOMETRIC DRAWINGS	20	A4
61.	PE-V0-497-164-W090	ENGINEERING BOQ FOR EFFLUENT TREATMENT PLANT	20	A4
62.	PE-V0-497-164-W091	COMMISSIONING SEQUENCE AND PROCEDURE	20	A4
63.	PE-V0-497-164-W092	PRESERVATION GUIDELINES FOR EQUIPMENT	20	A4

DRAWING/DOCUMENTS DISTRIBUTION SCHEDULE

S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk
1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents		
	First submission and submission with major changes		
	▪ Layout (A0&A1 sizes)	4	-
	▪ Other Drawings/Documents (A0&A1 sizes)	2	-
	▪ P&ID (All sizes)	4	-
	a) Final drawings/documents (Directly to site)	6	2
	b) "As Built" Drawing/Documents (Directly to site)	6	2
	c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications.	2	2
2	Erection Manual (Directly to site)	4 sets	2
3	Operation & Maintenance manual i) First Submission	1 set	--
	ii) Final Submission (Directly to site)	4 sets	2
4	Plant Hand Book i) First Submission	1	1
5	Commissioning and Performance Test Procedure manual i) First Submission	1 set	--
	ii) Final Submission (Directly to site)	4 sets	2

S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk
6	Performance and Functional Guarantee Test Report i) First Submission	2 sets	--
	ii) Approved Copies (Direct to Site)	4 sets	2
7	Project Completion Report (Directly to site)	6 sets	2
8	QA programme including Organisation for implementation and QA system manual(with revisions)	1	--
9	Vendor details in respect of proposed vendors including contractor's evaluation report.	2	--
10	Manufacturing QPs, Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc i) For review/comment	1	--
	ii) Approved final copies of Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc (Direct to Site)	4	2
11	Welding Manual, Heat Treatment Manuals, Storage & preservation manuals i) For review/comment	1 set	--
	ii) Approved copies (Direct to Site)	4 sets	2
12	QA Documentation Package for items / equipment manufactured and despatched to site	2 sets	2
13	QA Documentation Package for field activities on equipment/systems at site	2 sets	2

Notes:

- Quantity of prints may change during detailed engineering stage based on BHEL / Customer requirement. However, the same will be adhered by the bidder without any delivery/commercial implication to BHEL.

- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in
  addition to hard copies.

- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.

- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copes whichever is later.
- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software.
  Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.

- Bidder has to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.

- Bidder to submit instrument schedule, cable schedule and valve schedule in MS- Excel format during detailed engineering.

- Bidder to also furnish the auto cad copy / MS-word (as applicable)/MS-Excel (as applicable) of the following documents after
  award of contract. However, any other auto cad copy/MS-Excel/MS-word of any other document as per the insistence of
  BHEL / customer will also be submitted by the bidder without any delivery/commercial implication to BHEL.

  - P&IDs.
  - Equipment lay out
  - Equipment Cable tray layout
  - Equipment earthing layout
  - Civil scope drawings.
  - Piping lay out drawing
  - Valve schedule.
  - Instrument schedule.
  - Any Other Dwg/Docs as required.

ANNEXURE-V

MANDATORY SPARES

MANDATORY SPARES FOR EFFLUENT TREATMENT PLANT

1. Metering / Dosing Pumps

Sl. No.	Name of Items	Unit	QUANTITY
i.	Alum Dosing Pump Unit	Nos.	1
ii.	Lime Dosing Pump Unit	Nos.	1

Note: One set consists of quantity required for complete replacement for one pump.

2. Air Blowers for Sludge pit

Sl. No.	Name of Items	Unit	QUANTITY
i.	Impeller with shaft	Set	1
ii.	All Bearings (Blower & Motor)	Set	1
iii.	Gears	Set	1
iv.	Filters	Nos.	1

Note: One set consists of quantity required for complete replacement for one blower.

3. Agitators

Sl. No.	Name of Items	Unit	QUANTITY
i.	Agitator Assembly with Motor & Gear Box – Lime Dosing tank	Set	1
ii.	Agitator Assembly with Motor & Gear Box – Alum Dosing tank	Set	1
iii.	Agitator Assembly with Motor & Gear Box – Flash Mixer	Set	1
iv.	Agitator Assembly with Motor & Gear Box – Flocculation Tank	Set	1

Note: One set consists of quantity required for complete replacement for one agitator.

4. Electric Hoist

Sl. No.	Name of Items	Unit	QUANTITY
i.	Bearing	Set	1
ii.	Rope Guide	Set	1
iii.	Brake lining	Set	1
iv.	Wire rope	Set	1

Note: 1 Set consists of quantity required for complete replacement of 1 hoist of each type and capacity

5. ETP System

Sl. No.	Name of Items	Unit	QUANTITY
i.	Pack of Lamella Clarifier/ Tube Settler	Set	1
ii.	Oil Skimmer (Waste Water Collection Sump)	Set	1

Note: One set of Pack of Lamella Clarifier consists of quantity required for complete replacement for one Lamella Clarifier/ Tube Settler.

One set of Pack of Oil Skimmer consists of quantity required for complete replacement for Oil skimmer in WSWS.

6. MOTOR

Sl. No.	Name of Items	Unit	QUANTITY
i.	Alum Dosing Pump motor for tube settlers System	Nos.	1
ii.	Lime Dosing Pump motor for tube settlers System	Nos.	1
iii.	Waste Service water transfer pump motor	Nos.	1
iv.	Central Monitoring Basin Transfer Pump motor	Nos.	1

Note: One set consists of quantity required for complete replacement for one motor.

7. Instruments (As applicable)

Sl. No.	Name of Items	QUANTITY
1.	Electronic Transmitters	
i.	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	2 Nos. of each type and model.
2.	Temperature elements	
i.	Temperature Transmitter	2 Nos. of each type and model.
ii.	RTD's*	1 no. of each type
iii.	Thermo well	1 no. of each type
	* (With head assembly, terminal block and nipple)	** (to be divided into various insertion lengths in proportion to main population)
3.	Local Indicators (Non-Electrical type) -As applicable for the package as per the following items	
i.	Temperature gauges	1 no. of each range and type
ii.	Pressure gauges	1 no. of each range and type
iii.	Differential Pressure Gauges,	1 no. of each range and type
iv.	Level gauges	1 no. of each range and type
v.	Flow gauges excluding Rota meters	1 no. of each range and type
vi.	All types of Rota meters	1 no. of each range
1.	Process Actuated Switch Devices -As	

	applicable for this package, as per the following items	
i.	Temperature switches	1 no. of each range and type
ii.	Pressure switches	1 no. of each range and type
iii.	Differential Pressure switches	1 no. of each range and type
iv.	level switches	1 no. of each range and type
v.	Flow switches	1 no. of each range and type
5.	Solenoid Valves	2 nos. of each type, model and rating.
6.	Limit Switches (for Pneumatic Valves and Manual valves)	2 no. of each type

8. Pre-Filter Backwash Water Pumps

Sl. No.	Name of Items	Unit	QUANTITY
i.	Impeller for each type	Set	1
ii.	Wearing rings – Impeller for each type (if applicable)	Set	1
iii.	Wearing rings – Casing for each type (if applicable)	Set	1
iv.	Shaft for each type	Set	1
v.	Shaft Sleeves for each type	Set	1
vi.	Stuffing box for each type	Set	1
vii.	Pump bearings for each type	Set	1
viii.	Gland , Packing & Gland Assembly/Mechanical seal assy. for each type (as applicable)	Set	1

9. Valves (applicable for valves installed in Pre Filter Backwash Water Pumps discharge line to N-pit)

Sl. No.	Name of Items	Unit	QUANTITY
i.	NRV (Flap type and Dual Plate Type)	Nos.	Minimum 1 no. each type, size & rating
ii.	Butterfly Valves of all types	Nos.	Minimum 1 no. each type, size & rating

Note:

1. Refer Section IIA (Mandatory Spares) for general requirements and interpretation of various terms and conditions.
2. In case the main population of any item is only one no., then the spare quantity shall also be one no.
3. Wherever the quantity is given only in percentage, the spare quantity shall be distributed into various ranges/size/rating/type (as the case may be) in the same proportion of the main population. For the quantities coming less than 1, shall be treated as 1 only.
4. Identification: Each spare shall be clearly marked and labelled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

ANNEXURE-VI

WATER ANALYSIS

WATER ANALYSIS

Sr.No.	Constituents	As	Raw Water Analysis	Expected Clarified Water Analysis (Design with Alum/PAC Dosing)	AFTER 5 COC (Expected) BLOWDOWN ANALYSIS
1	Calcium	CaCO3	80	120.5	602.5
2	Magnesium	CaCO3	35	35	175
3	Sodium	CaCO3	20	20	100
4	Potassium	CaCO3	5	5	25
5	Total Cations	CaCO3	140	180.5	902.5
6	HCO3	CaCO3	85	85.2 - 91.2	426 - 456
7	P-Alkalinity	CaCO3	0	0	0
8	Chlorides	CaCO3	35	36.8 - 37.8	184 - 189
9	Sulphate	CaCO3	20	20 - 51.5	100 - 257.5
10	Total Anions	CaCO3	140	142.0 - 180.5	710 - 902.5
11	Silica (Reactive)	SiO2	25	20.8	104
12	Silica (Non-Reactive)	SiO2	5	5	25
13	Iron (Total)	Fe	0.5	1.3	6.5
14	pH Value	-	6.8-8.0	6.0 - 8.0	6.0 - 8.0
15	Turbidity	NTU	2000	<10	<50
16	Total Dissolved Solids	PPM	190	246.8-283.5	1234 – 1417.5
17	Temp	Degree C	20-35	20-35	20-35
18	KMnO4	PPM	2	2	10
19	TOC	PPM	5	5	25

Note;

1. Clarified Water is being used for washing in all power plant areas.
2. Clarified Water is being used for preparation of chemicals in ETP area.

ANNEXURE-VII
PACKAGING REQUIREMENTS

DOMESTIC PACKING

COMMON GUIDELINES

1 GENERAL:

This standard lays down packing instructions for domestic packing of Components/ Assemblies/ Equipment to be despatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments. For Seaworthy Packing refer standard AA0490004 wherever applicable.

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit & storage. For specific applications the concerned engineering department shall issue a product standard. Reference of this product standard, must appear in the Shipping list/Packing List.

2 SCOPE:

This procedure gives minimum guidelines to be complied with for domestic packing of Components /Assemblies/ Equipment. This domestic packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage of materials.

3 WOOD SPECIFICATION

Based on availability, the wood shall conform to specification AA51401 or AA51402.

4 TYPES OF PACKING:

The following 5 types of packing have been standardized for packing of General Components/ Assemblies.

1) **'OP'** - Open Type.
2) **'PP'** - Partially Packed.
3) **'CP'** – Crate/Box Packing - Components/Equipment requiring physical protection.
4) '**CQ**' - Case Packing – Machined components-Small & Medium Components/ Assemblies/ Equipment which require corrosion & physical protection.
5) '**CR**' - Case Packing – Electrical/Electronic Components/ Assemblies, which require special packing viz. Water Proof, Shock Proof etc...

5 DESCRIPTION OF TYPES OF PACKING:

The various types of packing, as standardized above, are described below.

5.1 'OP' - Open Type

In case, of components which are not affected by water & dust and do not require special protection, are generally not machined, shall be sent as open packages. However, these components may be sent in crates, wherever necessary.

5.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene

Film to Specification No. AA51420. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film

5.3 'CP' - Crate Packing

Assemblies/Components which need only physical protection from the point of view of handling shall be despatched duly packed in crates.

5.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of silica gel to AA55619 or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall be entirely covered with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420, wherever required. This may be prescribed for electronic parts/critical machined components/surfaces.

For mechanical product like valves where motors are separately securely wrapped in polyethylene, the requirement of individual component wrapping shall be exempted.

5.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons. Adequate quantity of Silica gel to AA55619 packed in cotton bags of 100grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420 before being packed in the cases. VCI Powder/Tablets can be used as an alternative to Silica Gel to AA55619.

Empty space in the cartons shall be filled with rubberized coir to get proper cushioning effect. The cartons shall be manufactured from corrugated Fiber Board, meeting requirements of AA51414.

6 PREPARATION OF PACKING CASES

6.1 DIMENSIONS:

a) Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25/20mm +2/-3 mm as per applicable drawings of the respective units.

b) Width of all planks including the tongue shall be more than 125mm and after plaining it shall be minimum 100mm.

c) Minimum number of planks shall be used for a shook.

d) Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel.

e) Width of binding planks shall be minimum 100mm.

f) Distance between any 2 binding planks shall be less than 750mm.

g) diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm

h) Distance of the outer edges of these planks from the edge of case shall be less than 250mm.

i) Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

6.2 JOINTING OF PLANKS

Single length planks shall be used for cubicles whose overall length is less than 2400mm. For cubicles of length more than 2400mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag manner. From the joint along height side, it shall be of lap joint with overlap of at least the width of plank.

6.3 TONGUE AND GROOVE JOINTS

Two consecutive planks shall be joined by tongue and groove joint. Depth of tongue shall be 12+1 mm, thickness of tongue shall be 8 +1 mm. The groove dimensions shall be such that the tongue fits tightly into the groove to make a good joint. This type of joint can be done based on the product requirement wherever required.

6.4 PERMISSIBLE DEFECTS

Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.

End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60mm per meter run of shook's. Wood pins shall be used to prevent further development of split.

Surface cracks: Surface cracks with a maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.

6.5 OTHER MATERIALS

6.5.1 NAILS

The dia. of the nails shall be 3.15mm. The length of the nails shall be 65mm wherever two planks of 25mm thickness are joined and 75mm wherever a 25mm planks is joined to a 50mm plank.

6.5.2 BLUE NAILS

These are used for nailing bituminized Kraft paper/hessian cloth to the planks. The length of the nails shall be 16mm.

6.5.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6+0.01mm. The material shall be free from rust.If sufficient nailing is done for bigger boxes, strapping need not be done.

6.5.4 CLIPS

These shall be used for strapping the hoop iron strips on the boxes.

6.5.5 BRACKETS

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness min 2mm and width 25+1mm. The brackets shall be of "L" shape, the length of each side being 100+2mm. Two holes shall be provided towards the end of each side for screwing /nailing.

6.5.6 FASTENERS

Bolts, double nuts, spring washers will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box. The bolts, nuts, washers will be provided by the vendor. Drilling of holes will have to be done using contractor's tools.

6.5.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

100GSM (Colourless) Multi Layered Cross Laminated Polythelene Film Specification No: AA51420 are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

6.5.8 RUBBERISED COIR:

The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

6.5.9 FOAM RUBBER / 'U' FOAM:

This is used for covering the delicate items. This material is provided by the vendor.

6.5.10 MARKING PLATE:

This shall be of anodized aluminium sheet. Size of the marking plate shall be maintained minimum of size as per the details specified in the Figure 4.

6.5.11 PACKING SLIP HOLDER:

This shall be of galvanized iron tinned sheet /Aluminium sheet

6.5.12 SILICA GEL:

This shall be of indicating type to conform to IS: 3401/AA55619.Silical gel shall be used for such products only where moisture needs to be avoided.

6.5.13 COTTON BAGS:

These are used for holding silica gel. The bags shall have the following matter indicated on them:

BHEL-UNIT NAME	PLACE-PINCODE
SILICA GEL	INDICATING TYPE
BLUE :	ACTIVE
ROSE :	REDUCED ACTIVITY
WHITE :	NO ACTIVITY. TO BE REPLACED WITH FRESH SILICA GEL

6.5.14 COTTON/ PLASTIC TAPE:

This is used for tying small items. And also to prevent vibrations of moving parts within the cubicles.

6.5.15 MARKING INK:

The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water.

6.5.16 POLYETHYLENE BAGS:

These are to be used for keeping the Packing slips. The bag shall be of size 70mm X 100mm (minimum).

6.5.17 Hessian cloth, twine thread, paint will have to be used in packing certain items.

6.5.18 Mechanical Latching clamps:

For CLW Railway panels and similar Panels self-locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement. For reusable boxes, these clamps provide easy locking and unlocking arrangement. These clamps will be made available from BHEL in some cases.

6.5.19 STICKERS

The following stickers to be put by the vendor on cubicles/Boxes after packing.

1) Case No sticker: 2 nos. Size 25.Cm x 0.45Cm
2) BHEL Monogram sticker: 1 no. Size 1.75Cm x 2.3Cm
3) Address sticker: 2 nos. Size 3.8Cm x 3.0Cm
4) Direction sticker “Front” & “Back” - 4 nos. Size 2.0Cm x 0.75Cm
5) Chain Mark Sticker: 4 Nos. Size – 3.0Cm x 0.75Cm
6) "Fragile” sticker: 2 Nos. Size. 2.1Cm x 1.5Cm
7) "DO NOT STACK” sticker - 2 Nos. Size 3.0Cm x 2.2Cm

In place of stickers, writing all the details legibly with paint shall be allowed & respective units may take decision accordingly.

7 PACKING OF CUBICLES:

7.1 The packing is to be done as per clause 5 in all respects.

7.2 The cubicles are already fixed on wooden pallets. Hence the contractor need not arrange the bottom pallets normally.

7.3 The cubicles will be of different sizes both width wise and lengthwise. The cubicles may be made up of single suite, 2 Suite, 3 Suite, 4 Suite, etc., The width of the cubicles generally varies from 400 mm to 1650mm.The length of the cubicle, generally varies from 1500 mm to 4800 mm. The height is normally 2430 mm. In some cases, the height may be less/more.

7.4 MULTI LAYER CROSS LAMINATED POLY FILM

The inner surface of 4 sides of shook's shall be nailed with Multi-layer cross laminated poly film (as per 6.5.7) using blue nails (as per 6.5.2) wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film (as per 6.5.7). This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film (as per 6.5.7).

7.5 SILICA GEL:

Silica gel (as per 6.5.12) packed in cotton bags shall be kept at different places inside the cubicle as per BHEL-Unit directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 6.5.13).

7.6 LOOSE PARTS:

Any loose parts in the cubicles shall be tied using cotton/ plastic tape. Wooden battens shall be provided wherever necessary.

7.7 WOODEN BATTENS:

In case of cubicle which are not rectangular in shape like control desks, sufficient number of wooden rafters/battens of proper size shall be provided to give strength to the package.

7.8 RUBBERISED COIR:

Gap between the cubicle and the case shall be filled with rubberized coir (as per 6.5.8) with distance between consecutive layers less than 500mm.

7.9 CLAMPING:

Packing shall be bound at edges by nailing M.S. Clamps / Brackets (as per 6.5.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

7.10 PACKING SLIP:

Packing slip kept in the polyethylene bag (As per 6.5.16) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 6.5.11) shall be nailed to front / rear of case.

7.11 MARKING PLATE:

One no. (As per 6.5.10) shall be nailed to the front side of the case.

7.12 CASE MOUNTING:

After complete packing, stencil marking of various details and marking of symbols shall be done as per BHEL instructions using indelible / non washable marking ink.

7.13 Different types (Typical) of Cubicles with sizes for Packing

1. Single suite cubicle - 900 x 950 x2500
2. Two suite cubicle - 1650 x 950 x 2500
3. Three suite cubicle - 2400 x 950 x2500
4. Four suite cubicle - 3150 x 950 x 2500
5. Regulation cub - 1300 x 1350 x 2500
6. Thy cub - 2870 x 1350 x 2500
7. VFD Cub - 3800 x 1550 x 2500

7.14 PACKING OF CUBICLES FOR EXPORT

Refer Corporate Standard AA0490009.

8 PACKING OF LOOSE ITEMS/SPARES

1) Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.
2) Wood shall conform to specification AA51401 or AA51402 with Tongue and Groove joint as per clause 6.3.
3) Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.
4) External surface of planks on front and rear shall be plane 100% (except bottom plank).
5) Inner surfaces of all 6 sides shall be lined with Multi Layered Cross Laminated Polythelene Film (as per clause 6.5.7) using blue nails.
6) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.
7) Internal packing: Items that go into the box shall be packed using 100GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No: AA51420. Any space left between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect.
8) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.
9) Silica gel as per clause 6.5.12 held in cotton bags as per clause 6.5.13 shall be kept at proper places in the box.
10) Packing slip kept in polyethylene bag (clause 6.5.16) shall be placed in the box.
11) Marking plate as per clause 6.5.10 shall be nailed to side of the box.
12) Two numbers of hoop iron strips as per clause 6.5.3 shall be strapped tightly on the case using clips.
13) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
14) Loose items to be kept inside the cubicle

- The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually, kept in wooden box and tied firmly in bottom of Cubicle.

- Other items which are given loose in addition to cubicle shall be packed in separate boxes.

9 BOX SIZES

9.1 BOX SIZES

Table 1 – SPARES WOODEN BOX DETAILS

SNO	BOX TYPE	BOX SIZE (in mm)	BOX Wt (in KG)	Carrying Capacity
1	A	800 X 200 X 200	15	
2	B	1500 X 200 X 200	22	
3	C	2000 X 200 X 200	27	
4	D	1100 X 200 X 200	15	
5	E	200 X 200 X 200	5	
6	F	320 X 250 X 260	13	
7	G	320 X 250 X 430	16	
8	H	430 X 370 X 430	23	
9	I	1100 X 400 X 400	45	
10	J	1500 X 500 X 400	65	
11	K	2000 X 500 X 400	93	
12	L	2500 X 500 X 400	88	
13	M	900 X 600 X 600	100	
14	N	3000 X 400 X 400	60	
15	P	600 X 500 X 400	35	
16	Q	710 X 630 X 600	90	
17	R	850 X 630 X 670	102	
18	S	1000 X 770 X 670	140	
19	T	2500 X 850 X 800	180	
20	U	1500 X 700 X 700	120	
21	W	1200X900X600	120	
22	Y	450 X 200 X 200	10	

Table 2 – WOODEN BOX DETAILS

BOX TYPE	BOX SIZE (in MM)	BOX Wt (in KG)	Carrying Capacity
1	320X250X260	10	
2	320X250X430	15	
3	430X370X430	25	
4	670X670X470	65	
5	720X630X600	75	
6	1000X770X660	100	
7	1100X430X670	80	
8	1200X1200X900	80	
9	1300X770X1050	155	
10	2500X850X800	225	
11	2000X1500X1200	305	
12	1850X1050X1250	260	
13	2000X800X800	180	
14	2600X1500X1600	470	
15	250X250X600	20	
16	250X250X880	30	
17	300X300X700	25	
18	380X380X880	45	
19	510X510X1400	60	
20	570X570X1400	80	
21	575X575X1875	105	
22	3600X1100X1100	390	
23	900X500X800	110	
24	2000X950X740	225	
25	1600X1120X700	220	
26	2500X2000X1200	490	
27	2900X1900X1400	525	
28	3000X1000X900	370	
29	3200X2200X950	450	
30	2150X1100X750	325	
31	2000X2000X700	130	
32	700X1200X1325	130	

Table 3 – STEEL BOXES

SL NO	TYPE	DIMENSION IN MM			WEIGHT	CARRYING CAPACITY (KGS)
		LENGTH	BREADTH	HEIGHT		
1	I	2480	1680	1500	339	4500
2	II	1200	900	600	061	2000
3	IIB	1800	850	950	115	2500
4	III	900	600	600	029	1000
5	IV	600	450	500	019	750
6	V	400	350	300	011	500

TYPICAL PATTERN OF WOODEN BOX

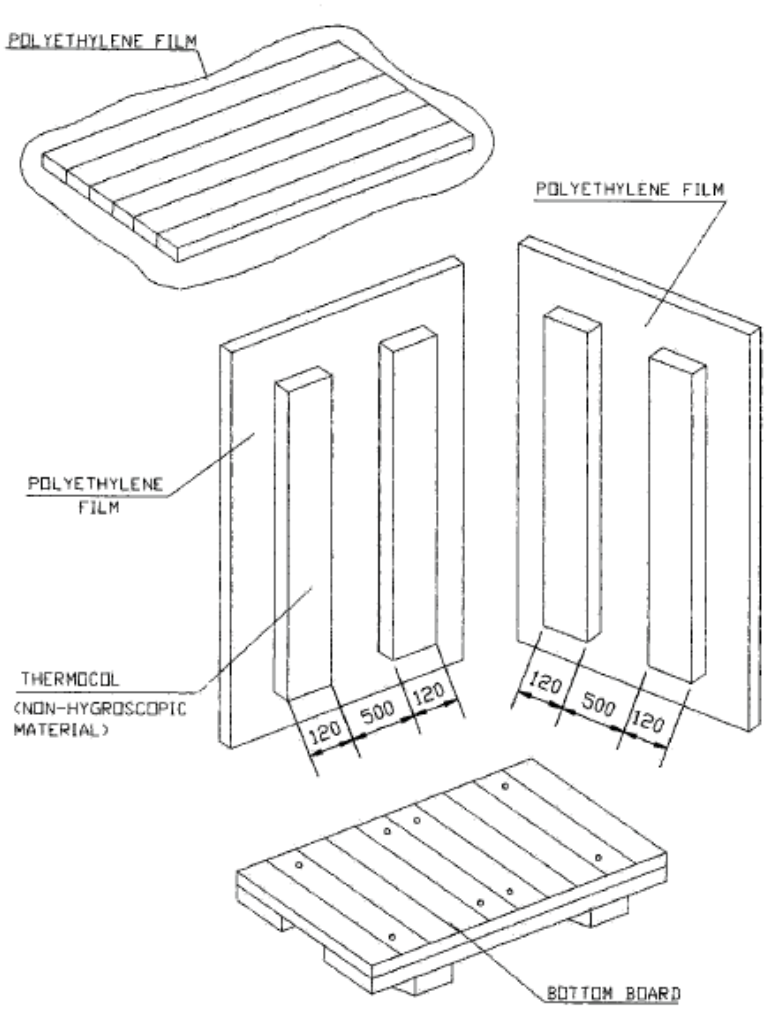


Figure 1

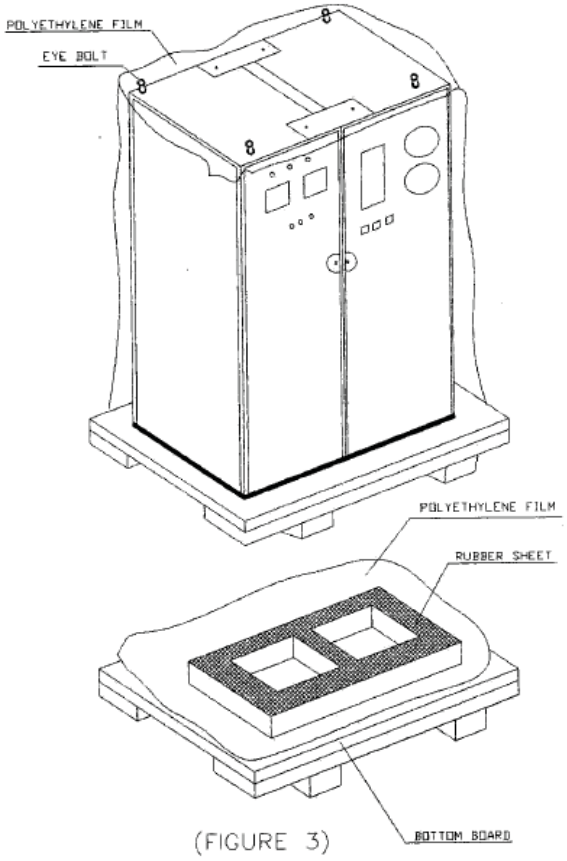


Figure 2

9.2 STEEL CONTAINERS:

Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies. The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections. Depends on the availability of resources & requirements units may be allowed to use standard cargo containers also instead of fabricated steel boxes.

a) Following precautions are to be taken during packing: -

b) Put the machine in the steel container properly,

c) Cover the machine with polythene.

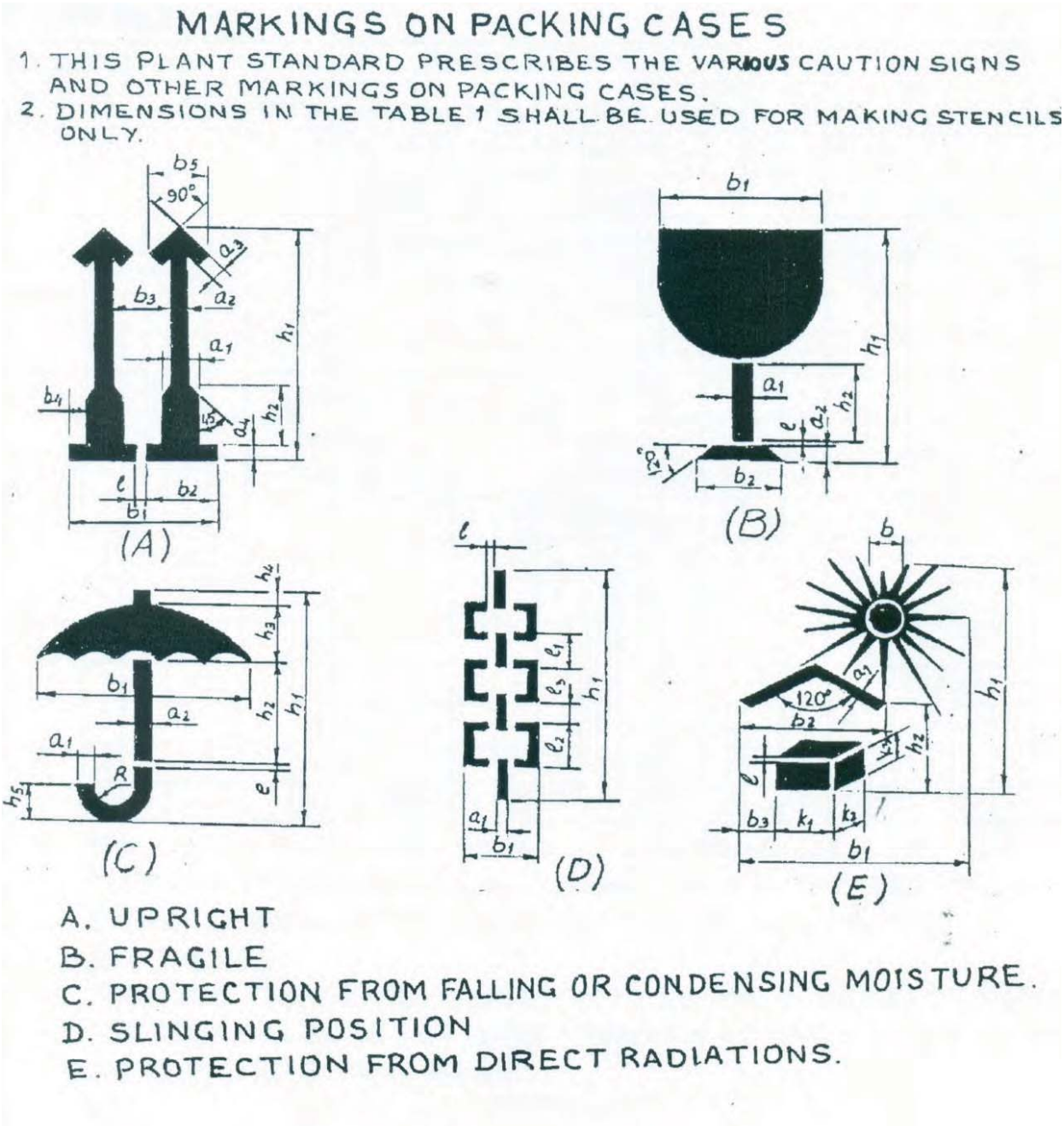
d) To arrest the movement in the steel container necessary wooden Blocks/Battons may be put.

e) Put cover on steel, container and Bolt Properly

9.3 SEALED PACKING:

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture. The components sub-assemblies and assemblies are completely covered with 2 layers of polyethylene sheet. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

10 MARKINGS/STENCILINGS



Center of Gravity

Figure 3

DESIGN-ATION		DIMENSION IN MM																						
		a1	a2	a3	a4	b1	b2	b3	b4	b5	b	l	h1	h2	h3	h4	h5	k1	k2	k3	l1	l2	l3	R
A	1	12	5	5	4	52	25	19	8	21		2	84	23										
	2	17	7	7	6	75	36	29	11	30		3	119	33										
	3	24	10	10	8	104	50	38	16	42		4	168	46										
	4	34	14	14	11	147	71	59	23	60		5	239	65										
B	1	5	5			50	33					2	84	25										
	2	7	7			71	47					3	119	36										
	3	10	10			100	66					4	168	50										
	4	14	14			142	94					5	239	71										
C	1	4	3			66						2	80	39	19	5	11							6
	2	6	4			85						3	114	55	27	7	16							9
	3	8	6			120						4	160	78	38	10	22							12
	4	11	9			170						5	227	110	54	14	31							17
D	1	6				30						4	148								30	30	10	
	2	9				42						5	209								42	42	14	
E	1	3				69	47	10			16	2	91	26				17	8	11				
	2	4				98	67	15			23	3	128	33				24	11	16				
	3	6				138	94	20			32	4	182	62				34	16	22				

Table 4

Black and Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height.

In case of consignment consists of more than one package, each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in high quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel(AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks.

Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: Incase the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

	BHEL – <unit> - <location> - <pin>				
CONSIGNEE					
MATERIAL					
CUSTOMER REF.				MO. NO.	
DESPATCH ADVICE NOTE NO				CASE NO	
DIMENSIONS(MM) L x B x H				NET WT –KGS	GROSS WT –KGS
SPECIAL INSTRUCTIONS	HANDLE WITH CARE - KEEP DRY DO NOT DROP - DO NOT TILT				

Figure 4 – TYPICAL MARKING PLATE (225 X 170)

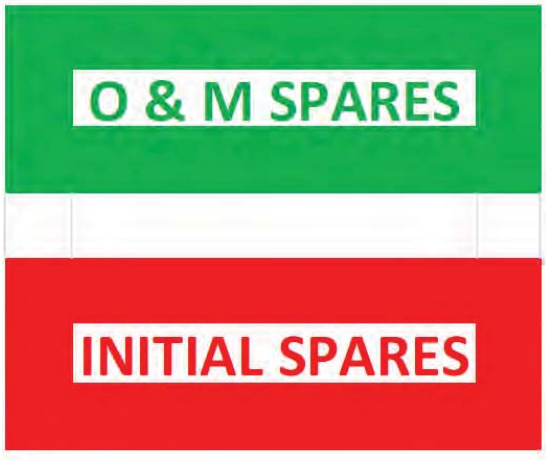


Figure 5

Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

11 RECYCLING OF INCOMING WOODEN PACKING CASES

OBJECTIVES

– To utilize useable wood of incoming packing cases, for manufacturing of new packing boxes.
– To recycle incoming wooden packing cases, as such, wherever possible.

1) All incoming wooden packing cases received from suppliers /customers will be opened carefully, with the intention of reusing them, by Shop.
2) After carefully taking out the contents, the empty wooden packing cases will be shifted by Shop to the specified locations i.e. bin / nearly spaces, already earmarked in stores.
3) Material shifting contractor engaged by store, will collect all such wooden packing cases and scrap wood from specified points, on a regular basis.
4) After collecting / loading the empty packing cases/ scrap wood, contractor will take the carrier first to Weighment Bridge for weighment, thereafter; he will go to Carpentry, where Carpentry representative will identify the packing cases which can be used by Carpentry for manufacturing of New Packing Boxes. All such identified packing boxes will be unloaded and handed over to Carpentry by contractor.
5) These packing boxes will be made re-useable after necessary rectification and additional work.
6) Contractor will again take the carrier for weighment and this second reading will also be recorded on the same “Weighment Slip”.
7) Weight of empty packing cases / scrap wood taken will be calculated on the basis of 1st and 2nd weighment readings recorded on the “Weighment Slip”. A copy of“Weighment Slip” (where both the weighment readings are recorded) will be given by the contractor to the carpentry representative. Based on this “Weighment Slip”, carpentry will maintain a register in which details of quantity received will be recorded.
8) All “Weighment Slips” will invariably be signed by carpentry representative (even when no boxes have been unloaded by carpentry). Store will accept the scrap wood only if “Weighment Slips” are signed by carpentry representative.
9) Balance empty packing cases / scrap wood will be handed over by contractor to Store, for storing in scrap yard.
10) A separate area in Scrap yard will be provided, for executing the work of denailing of wooden packing cases, under supervision of carpentry.
11) Carpentry contractor will identify packing cases / scrap wood for denailing, which will behanded over to him by Store, at Scrap yard, for denailing and further operation.
12) Quality and Carpentry will jointly inspect the wood generated by de-nailing process and will prepare “INSPECTION CUM RECEIPT REPORT OF USEABLE WOOD RECEIVED FROM TPS – STORE BY CARPENTRY”.
13) After acceptance of the wood by Quality and Carpentry, the same will be shifted to carpentry for receipt and its record will be maintained by carpentry.
14) This will be a Permanent Productivity Project executed by carpentry. “Productivity Savings “duly verified at the current Purchase Order rate of wood, will be sent every month to Resource Management Department, for highlighting it in their monthly progress report.

12 STANDARD METHOD OF PACKING

Table 5 - Standard Method of Packing

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
PRESSUE VESSELS								
TOWERS					O			
TANKS					O			
VESSELS					O			
GASKETS	O							
FASTENERS	O							
COVERS		O						
EXCHANGERS								

CORPORATE STANDARD

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
HEAT EXCHANGERS					O			
TUBE BUNDLE	O							
SHELL					O			
AIR FIN COOLERS					O			
COLOUMNS, MOTOR SUSPENSIONS, PLENUM CHAMBERS, SCREEN GUARDS, ETC					O			
BEARING BLOCKS	O							
FANS	O	O						
MOTORS	O							
GASKETS	O							
FASTENERS	O							
TEST FLANGES			O					
TEST RINGS			O					
COVERS			O					
CRYOGENIC VESSELS								
COLD CONVERTERS					O			
HORIZONTAL STORAGE TANKS					O			
TRANSPORTATION TANK					O			
COLD BOX					O			
DRYING UNIT					O			
DRYING BOTTLES					O			
MOISTURE SEPARATORS					O			
SILENCERS					O			
ONGC SKIDS					O			
VAPORISER		O						
SPECIAL PRODUCTS								
SI/VI PIPING		O						
CRO BIO CONTAINERS	O							
AIR BOTTLES	O							
TITANIUM BOTTLE	O							
WAR HEAD CONTAINER	O							
MISSILE CONTAINER	O							
FUEL CONTAINER	O							
AIR LOCK ASSEMBLY	O							
BOILER DRUMS					O			
BOILER ITEMS								
COILS			O					
PANELS					O			
HEADERS			O		O			
FEEDERS								
MACHINED ITEMS								
SHELL SEGMENTS					O			

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
SHELL SEGMENTS IN STACKS					O			
SPHERE PETALS								
COLOUMNS, BASE PLATES, TIERCOS, PIPES, NOZZLE E1, F1, INTERNAL PIPES, PADS ETC.					O			
ROLLERS	O							
VALVE TRAYS								
VALVE TRAY COMPONENTS	O							
LATTICE GIRDERS		O						
FASTENERS	O							
GASKETS	O							
SUB CONTRACTS								
FAB STRUCTURALS					O			
SUPPORTING STRUCTURALS					O			
STRUCTURE SUB ASSEMBLY					O			
FAB PIPES					O			
GRATINGS					O			
STAIR CASES					O			
HANDRAILS/ PLATFORMS					O			
BOUGHT OUT COMPONENTS								
IRON & STEEL (LIKE PLATES, BEAMS, ANGLES, CHANNELS ETC.)					O			
PIPE FITTINGS								
CS PIPES, TUBES					O			
SS PIPES, TUBES					O			
FIN TUBES	O							
ELBOWS		O			O			
FLANGES	O	O						
VALVES	O							
GAUGES	O							
DEMISTERS		O						
ABSCRBANTS (LIKE MOLECULAR SIEVES, ACTIVATED ALUMINA, MOBILE SORBID)						O		
PAINT TINS		O						
PAINT DRUMS						O		
IGNITORS	O							
SPRAY NOZZLES	O							
ELECTRICAL INSTRUMENTATION								
MOTORS, PUMPS, COMPRESSORS, TURBINES	O							
SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES		O						
INDICATORS, VIBRATOR SWITCHES	O							

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
CABLE BUNDLES, CABLE DRUMS					O			
CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL		O						
OPERATIONAL SPARES	O							

13 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

13.1 Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.

13.2 Appropriate material handling equipment like fork lifters, cranes etc. shall be used where needed.

13.3 Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. shall be done carefully.

13.4 For critical items, where specified, special handling fixtures shall be used for lifting.

13.5 Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.

13.6 Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.

13.7 Precision machined components like blades, catches, rollers etc. shall be lifted using suitable wooden pallets.

13.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

Before loading/unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

a) The markings showing the upright position.

b) The markings showing the sling position

c) Markings showing the fragile contents.

d) Other required markings as per clause no.10

13.8.1 Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15º.

13.8.2 Handling and lifting should be done without jerks or impacts.

13.8.3 Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.

13.8.4 On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.

13.8.5 Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.

13.8.6 Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

14 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

Based on the Dimensions/Weight indicated in the Transportation Sketch, the type of Trailer is decided and indicated in the Tender Enquiry.

14.1 TRANSPORTATION:

1. LOW BED TRAILERS (LB 8):
   - Well Bed Length : 10000mm
   - Over Gooseneck : 13000mm
   - Width : 3000mm
   - Carrying Capacity : 40MT

2. LOW BED TRAILERS (LB 16):
   - Well Bed Length : 12000mm
   - Over Gooseneck : 16000mm
   - Width : 3000mm
   - Carrying Capacity : 75MT

3. TOW TYPE TRAILERS (WITH FRONT DOLLEY 16 TYRES): 12000MM length
   (for Exceptional equipment length: 30000mm and above)

   Bigger Dia equipment are loaded in the Well with overhanging.

   Smaller Dia equipment with excess length are loaded over Gooseneck with rear hanging.
   The Vehicle Dimensions are defined above are only guidelines for selection based on actual Dimensions/ Weight of the Consignment

14.2 PACKING:

For all ODCs, Wooden Saddles are cut to the diameter of equipment as per the Transportation Sketch.

Wooden Saddles	For Diameter up to 4000mm	For Diameter above 4000mm
Length:	1836/2743mm (6'0"/9'0")	3353mm (11'0")
Width:	300mm (1'0")	300mm (1'0")
Height:	Saddle + one/two wedges a top	Saddle + three/four wedges a top

Number of Saddles:	
Minimum	3 in case of Loading inside Well +1 when loaded on Gooseneck
Maximum:	4 in case of Loading inside Well +2 when loaded on Gooseneck

For Securing the equipment firmly on the Trailer, 19mm (3/4"), wire rope with 25mm (1") Heavy Duty Turn Buckles / BD Clamps are used as Lashing for the equipment.

14.3 NUMBER OF LASHINGS:

	CONSIGNMENT LOADED INSIDE WELL BED	CONSIGNMENT LOADED OVER GOOSENECK
a) up to 40MT	4 (2 Single Line lashing 2 Double Line Lashing)	5 (3 Single Line Lashing 2 Double Line Lashing)
b) 40MT to 60MT	5 (3 Single Line Lashing 2 Double Line Lashing)	5 (Single Line Lashing 3Double Line Lashing)
c) 60MT and above	5 (2 Single Line Lashing 3 Double Line Lashing)	6 (3 Single Line Lashing 3 Double Line Lashing)

15 GUIDELINES FOR HANDLING/LOADING/LASHING

15.1 HANDLING

Figure 6

Before unloading the jobs Completely painted and neatly stencilled will be checked.

Pipes with split type end cover will be checked

Figure 7

All Coil Tubes to be provided with End Caps.

Figure 8

Neatly stacked Coil Assemblies.

Figure 9

Columns to be lifted with Nylon belts. This protect painting, edges and attachments.

Figure 10

15.2 LOADING

All the components to be transported by putting inside the properly fabricated Crating

Figure 11

Small components may fall down while transporting without closed crating and there are chances of missing of small parts. Hence, it is always better to transport small components in closed containers/crating. Loose to be being shipped in a closed crating.

Figure 12

No component loaded over the crating.

Figure 13

Headers supported with wooden V blocks at 3 meters interval.

Figure 14

Spacers in between each coil assembly.

Figure 15

Goose pipe to be provided with rubber pad protects removal of painting and damage to the job.

Figure 16

15.3 LASHING

Use Nylon belts only for lashing of all components. It prevents removal off painting and cut in the materials.

Figure 17

Nylon Belts used for lashing the beams.

Figure 18

16 PRODUCT WISE SPECIAL INSTRUCTION

Additional instructions of packing not included in this standard shall be covered by individual product standard.

17 REFERRED STANDARDS (Latest publications including amendments):

1) AA51420	2) AA55619	3) AA51414	4) IS:3401	5) AA10108
6) AA56126	7) AA51402	8) AA51401	9) IS:1234	

VACUUM PACKING FOR ELECTRONIC COMPONENTS

1 GENERAL

This standard lays down the packing instructions for packing of components / Electronic module / Assemblies to be dispatched against Customer contracts.

2 SCOPE

This procedure covers method of packing electronic components using vacuum packing in a wooden packing boxes.

3 OBJECTIVE

To establish a rust proof safe packing procedure and where the components required to protect against temperature and humidity. In general minimum temperature +5 deg C and maximum temperature 45 deg C, and relative humidity between 10% to 40%.

4 PACKING BOX

Wooden Box shall be made as per BHEL Standard AA0490010 for Domestic/ AA0490009 for Export/ AA0490004 for Seaworthy packing. Size of the box as per the contract requirement which has to be checked by QC.

5 PACKING PROCEDURE

a) Cleaning parts shall be thoroughly cleaned just before VCI (Volatile Corrosion Inhibitor) Vacuum packing. Finger prints on cleaned items are to be avoided as the same are very corrosive.

b) VCI Rust preventive oil (Ferrous grade oil base) shall be applied to all the components to withstand any corrosion.

6 VCI VACUUM PACKING

a) Bubble wrapping the items VCI vacuum packing.

b) Appropriate vapour corrosive packets one pouch (1 gm. /pouch) of VCI Anticorrosive Powder and one pouch (10gm./ pouch) of VCI Desiccant per 1000 cub. meter packing space shall be placed inside the VCI vacuum packing.

c) All the components shall be separately packed using VCI laminated Aluminium foils from which air/moisture are removed by the air vacuum device and sealed thoroughly using heat sealing machine. At the time of the evacuation the vacuum inside the pack should be less than 0.5 ata.

d) One identification slip containing component information such as description of item, Material No. Customer PO, Item No. Quantity etc. shall be put inside the VCI vacuum packing.

e) Top cover of the wooden box shall be sealed only after final clearance from QC for confirmation of above.

f) All boxes should be covered by water proof tarpaulin over top and on all sides.

g) The packing boxes shall be covered with GI sheets (0.25 -0.4mm thick) on all the sides for Export / Seaworthy packing.

h) Vacuum packing room temperature and Relative Humidity should be maintained as mentioned below:

Min. +5 deg. C and Max. 45 deg. C, Relative humidity between 10% to 40%.

7 COMPONENTS REQUIRED

7.1 VCI laminated Aluminium foil

Volatile Corrosion Inhibitor (VCI) safe foil shall be with aluminium barrier laminated which is flexible, heat sealable, water vapour and anticorrosion resistant barrier laminate of polyester, Aluminium foil and VCI Polyethylene. It is used as a primary packaging material for packing metal components and sealed with the help of a heat sealer after vacuuming with vacuum machine maintaining the humidity level below 40 RH inside the package.

7.2 Composition construction of VCI laminated Aluminium foil

a) PET Film : 12 Microns
b) Bonding layer : 2 Microns
c) Aluminium Foil : 9 Microns
d) Bonding layer : 2 Microns
e) VCI Poly film : 100 Microns
f) Total thickness : 125 Microns + or – 5%

7.3 Properties of VC Laminated Aluminium foil

a) Basic Weight : 138 gsm +/- 8%
b) Sealing condition : 180 C/ 2 sec
c) Tensile strength
   MD: 20 kgf
   CD: 18 kgf
d) Tear Strength
   MD 4.8 kg
   CD:3.4 kg
e) Heat Seal Strength : 30.380 N/cm
f) WVTR Value : 0.05gms/m /24 hrs.
g) OTR Value : 0.1 cc/m/24 hrs

8 MARKING OF PACKING BOX

Mark the following information on the two adjacent sides of the each package

a) Material No.
b) Customer PO
c) Item No.
d) Quantity
e) Storage Requirement : Indoor
f) Content Description : Electronic Module
g) Net weight (in kg)
h) Dimension (L x W x H in centimetres)
i) Project Name
j) Consignee
k) Water proofing (Umbrella Stencilling)
l) Upside direction

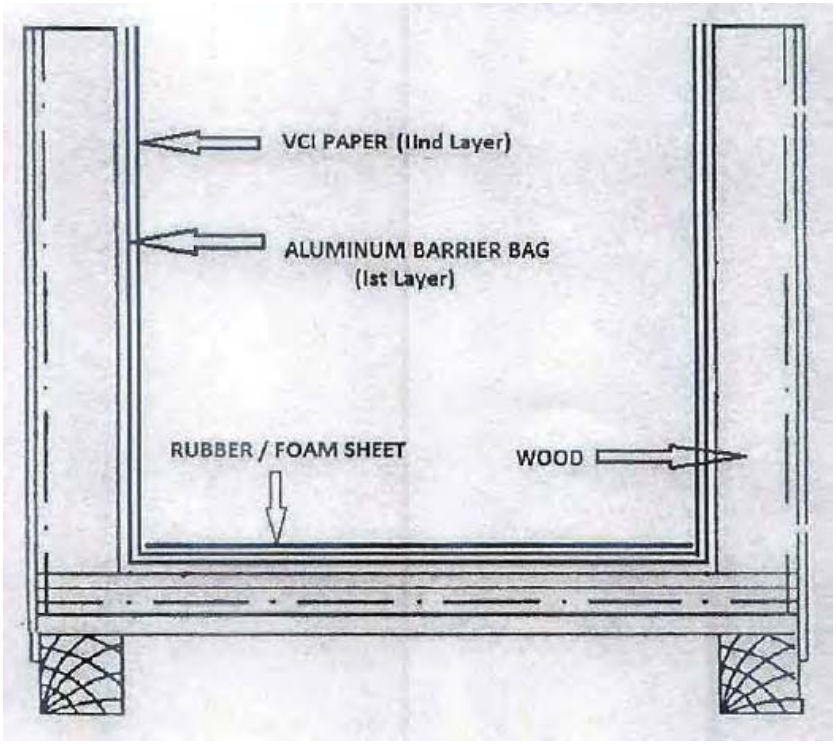

VCI PAPER (IInd Layer)
ALUMINUM BARRIER BAG
(Ist Layer)
RUBBER / FOAM SHEET
WOOD

Figure 1

VACUUM PACKING FOR ELECTRICAL COMPONENT

1 GENERAL

This standard lays down the packing instructions for packing of components / Electrical components Stator/ Rim punching, Wound Pole/ Field Coils and Stator coils / bars to be dispatched against Customer contracts.

2 SCOPE

This procedure covers method of packing component in a wooden packing boxes.

3 OBJECTIVE

To establish a rust proof safe packing procedure and where the components required to protect against temperature and humidity. In general minimum temperature +5 deg C and maximum temperature 45 deg C, and relative humidity between 10% to 40%.

4 PACKING BOX

Wooden Box shall be made as per BHEL Standard AA0490010 for Domestic/AA0490009 for Export/ AA0490004 for Seaworthy packing. Size of the box as per the contract requirement, which has to be checked by QC.

5 PACKING PROCEDURE

a) All items packed are to be marked by QC with “OK” stickers. Varnished stator punchings are to be brought down to room temperature before labelling them “OK” for packing. Do not pack hot/warm stator punchings that have is just received from the varnishing.

b) Packing of stator punchings, wound pole/ field coils and stator coils / bars should be done in a covered shed.

c) Packed materials are to be stacked in proper alignment and to be kept in wooden packing.

6 Additional Packing Methodology for Stator / Rim Punchings (Double stacking) only

In order to eliminate the use of studs avoid double stack packaging per box. Where double stacked packing boxes are unavoidable, the stator /rim punchings are to be securely tightened using GI studs, nuts and soft material washers (rubber/plastic). GI studs, nuts and soft material only to be used in case of double stacking of rim / stator punchings (with holes). Use soft rubber washers to seal the punctured opening at the bottom from where the studs pass in each layer of VCI (Volatile Corrosion Inhibitor) paper, polythene and tarpaulin sheet in case of rim /stator punchings (with holes).

a) GI studs with rubber washer to be placed initially inside the wooden packing box.

b) Over the wooden base, place water proof tarpaulin sheet.

c) Rubber washer shall be placed after the layer of tarpaulin sheet.

d) Then place a layer of porous plastic sheet with total thickness of at least 5mm (for cushioning and reduces the chances of damage to punchings).

e) Place the Aluminium Barrier laminated Bags over this porous sheet, place the rubber washer over it.

f) Place VCI papers on the Aluminium barrier bag and fix with rubber washer.

g) PVC Pipes shall be inserted over the GI studs. These pipes are to be used to cover each stud, to protect its direct contact and hence rubbing with punchings.

h) Now place the stack of punchings over the VCI paper and securely tighten the punchings using nuts and soft material, washers.

i) Each layer should be secured in position. Wrap the punchings with VCI paper and properly sealed separately using an adhesive tape.

j) Silica Gel packets are to be placed over the VCI paper and uniformly distributed inside the boxes on the VCI paper to remove/prevent moisture.

k) Aluminium barrier laminated bag has secured in position and properly sealed by using heat sealing machine and air to be drained out by using vacuum pump. At the time of the evacuation the vacuum inside the pack should be less than 0.5ata.

Use two separate VCI papers for doubled stacked boxes independently covering each stack. Similarly two Aluminium barrier laminated bag are to be used to wrap the two stacks independently, as explained above.

7 Additional Packing Methodology for Wound Pole/ Field Coils and Stator Coils/Bars only

a) Over the wooden base, place the waterproof tarpaulin sheet.

b) Then place a layer of porous plastic sheet with total thickness of at least 5mm (for cushioning and reduces the chances of damage to Wound pole/field coils and stator coils/ bars.

c) Place the Aluminium barrier laminated bag over this porous sheet.

d) Place the VCI paper (Volatile Corrosion Inhibitor as per BHEL Standard AA51406) on the Aluminium barrier laminated bag along with rubber washer.

e) Bare copper portion of field coils and stator coils / bars to be covered by VCI paper pouch and fasten with VCI tape.

f) Now place the wound pole, stack of field coil and stator coil / bars over the VCI paper.

g) Each layer should be secured in position. Wrap wound pole / field coils and stator coils / bars with VCI paper and properly sealed separately using an adhesive tape.

h) Silica Gel packets are to be placed and uniformly distributed inside the boxes on the VCI paper to remove/prevent moisture.

i) Then Aluminium barrier laminated bag has secured in position and properly sealed by using heat sealing machine and air to be drained out by using vacuum pump. At the time of evacuation the vacuum inside the pack should be less than 0.5ata.

j) The VCI paper must contact the stator / rim punchings, wound pole / field coils and stator coils/bars. It has to ensure that the VCI paper, Aluminium barrier bag should not get damage / puncture during the packing process.

k) Top cover of the wooden box shall be sealed only after final clearance from QC for confirmation of above.

l) All boxes should be covered by water proof tarpaulin over top and on all sides.

m) The packing boxes shall be covered with GI sheets (0.25 -0.4mm thick) on all the sides for Export / Seaworthy packing.

n) Vacuum packing room temperature and Relative Humidity should be maintained as mentioned below:

Min. +5 deg. C and Max. 45 deg. C, Relative humidity between 10% to 40%.

8 COMPONENT REQUIRED

8.1 VCI laminated Aluminium foil

Volatile Corrosion Inhibitor (VCI) safe foil shall be with aluminium barrier laminated which is flexible, heat sealable, water vapour and anticorrosion resistant barrier laminate of polyester, Aluminium foil & VCI Polyethylene. It is used as a primary packaging material for packing metal components and sealed with the help of a heat sealer after vacuuming with vacuum machine maintaining the humidity level below 40 RH inside the package.

8.2 Composition construction of VCI laminated Aluminium foil

a) PET Film : 12 Microns

b) Bonding layer : 2 Microns

c) Aluminium Foil : 9 Microns

d) Bonding layer : 2 Microns

e) VCI Poly film : 100 Microns

f) Total thickness : 125 Microns + or – 5%

8.3 Properties of Aluminium Barrier laminated Bag

a) Basic Weight : Unit: g/sq. m 150 +/- 5

b) Tensile strength : Unit: N/sq. mm MD: 40 (min.)

Unit: N/sq. mm TD: 41 (min.)

c) Water Vapour Transmission : Unit: g/m^2 0.01 in 24 hrs. at 38 deg C & 90% RH(max)

d) Oxygen Transmission : Unit: cm^3/m^2 0.02 in 24 hrs. at 38 deg C & 90% RH (max)

e) Sealing Temp. : Unit : Degree C 180-220 deg C

9 MARKING ON PACKING BOX

Mark the following information on the two adjacent sides of the each package.

a) Box No.

b) Customer PO

c) Product Name.

d) Project Name

e) Quantity

f) Storage Requirement : Indoor

g) Net weight (in kg)

h) Dimension (L x W x H in centimetres)

i) Consignee

j) Water proofing (Umbrella Stencilling)

k) Upside direction

l) Sling position indicator

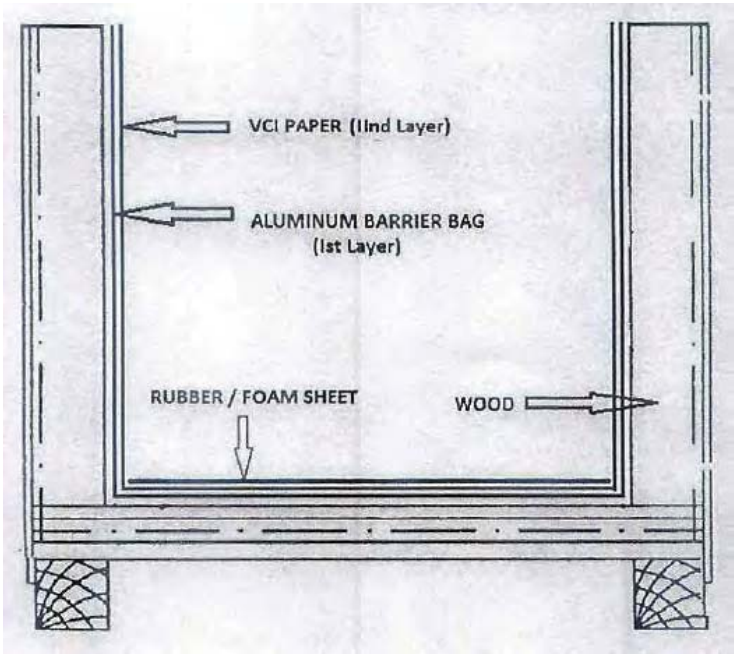


Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

ANNEXURE-VIII

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

Project name :
Project number :
Package Name :
PO reference :
Document number :
Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	**Cover page**				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	**Index**				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	**Description of Plant/System**				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				
4.0	**Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)**				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	**Operation Guidelines for plant personal/user/operator**				
5. 1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5. 2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with				

	Equipment isolating procedures to be mentioned.				
5. 3	Do's & Don't of the equipments.				
5. 4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5. 5	Parameters to be monitored with normal values and limiting values				
5. 6	Trouble shooting with causes and remedial measures				
5. 7	Routine operational checks, recommended logs & records				
5. 8	Changeover schedule if more than one auxiliary for the same purpose is given				
5. 9	Painting requirement and schedule				
5. 10	Inspection, repair , Testing and calibration procedures				
6.0	**Maintenance guidelines for plant personal**				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	**Statutory and other specific requirements considerations.**				
8.0	**List of reference documents**				
9.0	**Binding as per requirement**				

ANNEXURE-IX

INPUT DRAWINGS

LIST OF DRAWINGS

S.NO.	DRAWING	DRAWING NO.
1.	P & ID OF EFFLUENT TREATMENT PLANT	PE-DG-497-164-W001
2.	PLOT PLAN	PE-DG-497-100-M001

OILY WASTE FROM TRANSFORMER YARD UNIT 1 (THROUGH GRAVITY) (BY BHEL)

TRANSFORMER YARD UNIT-1 OILY WASTE TRANSFER PUMPS CAP. - 10 M3/HR (1W+1S) TYPE : VERTICAL SCREW

TRANSFORMER YARD OILY WASTE SUMP UNIT-1 (E4) M.O.C.-RCC (UNDER GROUND)

OILY WASTE FROM TRANSFORMER YARD UNIT 2 (THROUGH GRAVITY) (BY BHEL)

TRANSFORMER YARD UNIT-2 OILY WASTE TRANSFER PUMPS CAP. - 10 M3/HR (1W+1S) TYPE : VERTICAL SCREW

TRANSFORMER YARD OILY WASTE SUMP UNIT-2 (E5) M.O.C.-RCC (UNDER GROUND)

OILY WASTE FROM FUEL OIL AREA (THROUGH GRAVITY) (BY BHEL)

FUEL OIL AREA OILY WASTE TRANSFER PUMPS CAP. - 10 M3/HR (1W+1S) TYPE : VERTICAL SCREW

FUEL OIL HANDLING AREA OILY WASTE SUMP (E3) M.O.C.-RCC (UNDER GROUND)

WASTE WATER FROM TDBFP A UNIT-1 (THROUGH GRAVITY) (BY BHEL)
WASTE WATER FROM MDBFP A UNIT-1 (THROUGH GRAVITY) (BY BHEL)
WASTE WATER FROM TG AREA UNIT-1 (THROUGH GRAVITY) (BY BHEL)

TG UNIT-1A FLR WASH WTR TRANSFER PUMPS CAP. - 25 M3/HR (1W+1S) TYPE : VERTICAL SCREW

TG UNIT-1A FLR WASH WTR SUMP M.O.C.-RCC (E1A) (UNDER GROUND) CAPACITY : 12M3

WASTE WATER FROM COT/DOT
WASTE WATER FROM TDBFP B UNIT-1 (THROUGH GRAVITY) (BY BHEL)
WASTE WATER FROM TG AREA UNIT-1 (THROUGH GRAVITY) (BY BHEL)

TG UNIT-1B FLR WASH WTR TRANSFER PUMPS CAP. - 25 M3/HR (1W+1S) TYPE : VERTICAL SCREW

TG UNIT-1B FLR WASH WTR SUMP M.O.C.-RCC (E1B) (UNDER GROUND) CAPACITY : 12M3

WASTE WATER FROM TDBFP A UNIT-2 (THROUGH GRAVITY) (BY BHEL)
WASTE WATER FROM MDBFP A UNIT-2 (THROUGH GRAVITY) (BY BHEL)
WASTE WATER FROM TG AREA UNIT-2 (THROUGH GRAVITY) (BY BHEL)

TG UNIT-2A FLR WASH WTR TRANSFER PUMPS CAP. - 25 M3/HR (1W+1S) TYPE : VERTICAL SCREW

TG UNIT-2A FLR WASH WTR SUMP M.O.C.-RCC (E2A) (UNDER GROUND) CAPACITY : 12M3

WASTE WATER FROM TDBFP B UNIT-2 (THROUGH GRAVITY) (BY BHEL)
WASTE WATER FROM TG AREA UNIT-2 (THROUGH GRAVITY) (BY BHEL)

TG UNIT-2B FLR WASH WTR TRANSFER PUMPS CAP. - 25 M3/HR (1W+1S) TYPE : VERTICAL SCREW

TG UNIT-2B FLR WASH WTR SUMP M.O.C.-RCC (E2B) (UNDER GROUND) CAPACITY : 12M3

ALUM DOSING
LIME DOSING (TYP.)
FLASH MIXER
FLOCCULATION TANK
FRP PLATE/TUBE
SETTLER INCLINED SURFACE

LAMELLA CLARIFIER/TUBE SETTLER CAPACITY: 250 M3/HR. (EACH) (1W+1S)

FROM SERVICE WATER OVER HEAD TANK
TO COMMON SLUDGE SUMP

EXCESS COOLING TOWER BLOWDOWN REFER P&ID OF CW & ACW SYSTEM (4540-001-103-P-ML-035)

SUPERNATANT FROM CHP RUN OFF WTP (4540-001-136-P-VM-F-082)

COMMON MONITORING BASIN (TWO COMPARTMENT) CAPACITY:250M3 EACH MOC-RCC (ABOVE GROUND)

COMMON MONITORING BASIN (TWO COMPARTMENT) (E13) CAPACITY:250M3 EACH MOC-RCC (ABOVE GROUND)

CENTRAL MONITORING BASIN TRANSFER PUMPS (3X50%) TYPE : HORIZONTAL CENTRIFUGAL CAP.-125M3/HR(EACH) LOCATION - ETP AREA

HOSE PIPE (10M)
HOSE PIPE (10M)

TROLLEY MOUNTED SCREW PUMPS WITH SLOPE OIL TANK CAP. 10M3 , (2NOS.)

PRE FILTER BACKWASH WATER FROM CPU UNIT-1 (THROUGH GRAVITY) (BY BHEL)

PRE FILTER BACKWASH WATER SUMP UNIT-1 MOC: RCC (E15) (UNDER GROUND) CAPACITY : 30 M3

PRE FILTER BACKWASH WATER PUMPS UNIT-1 TYPE : VERTICAL CENTRIFUGAL CAP.- 12.5 M3/HR (1W+1S)

TO DM PLANT N.PIT

PRE FILTER BACKWASH WATER FROM CPU UNIT-2 (THROUGH GRAVITY) (BY BHEL)

PRE FILTER BACKWASH WATER SUMP UNIT-2 MOC: RCC (E16) (UNDER GROUND) CAPACITY : 30 M3

PRE FILTER BACKWASH WATER PUMPS UNIT-2 TYPE : VERTICAL CENTRIFUGAL CAP.- 12.5 M3/HR (1W+1S)

TO SERVICE WATER PUMP HOUSE
REFER PLANT WATER SYSTEM P&ID INCLUDING CALCULATIONS (4540-001-136-PVM-L-002)

FOR FUTURE USE

TO ASH HANDLING SYSTEM (ASH WATER TANK)
REFER ASH WATER & ASH SLURRY DISPOSAL SYSTEM SINGLE LINE FLOW DIAGRAM (4540-001-163-PVM-L-004)

LEGEND

	NON RETURN VALVE
	BUTTERFLY VALVE
	BALL VALVE
	RELIEF VALVE
	DIAPHRAGM VALVE
FT	FLOW INDICATING TRANSMITTER
M	MOTOR OPRATED
PHT	PH TRANSMITTER
	MOTORIZED ACTUATED VALVE
TT	TEMPERATURE TRANSMITTER
	GATE VALVE
PG	PRESSURE GAUGE
LT	LEVEL TRANSMITTER
LI	LEVEL INDICATOR
	DIAPHRAGM SEAL
FI	FLOW INDICATOR
FE	FLOW ELEMENT
PT	PRESSURE TRANSMITTER
LG	LEVEL GUAGE
	INTERLOCK
	ISOLATION VALVE
	PLUG VALVE
	VENTURI
	SCREW PUMP
	HORIZONTAL CENTRIFUGAL PUMP
	VERTICAL CENTRIFUGAL PUMP
	BLOWER
	DISSOLVING STRAINER
	AGITATOR
	FLOCCULATOR
	SLUICE GATE
	PIPING
	Y-TYPE STRAINER
TU	TURBIDITY ANALYSER
O/W	OIL IN WATER ANALYSER
TSS	TSS ANALYSER
COD/BOD	BOD/COD ANALYSER
CE	CONDUCTIVITY ANALYSER

WSWS TRANSFER PUMPS (3X50%) TYPE : VERTICAL CENTRIFUGAL CAP.- 125M3/HR. EACH

DRUM TYPE OIL SKIMMER (2 NOS.)

OIL SKIMMER

WASTE SERVICE WATER SUMP (WSWS) MOC: RCC (E12) (UNDER GROUND ,IN TWO COMPARTMENTS) CAPACITY : 250 M3 EACH COMPARTMENT

COT/DOT WASTE WATER TRANSFER PUMPS CAP. - 2 M3/HR (1W+1S) TYPE : HORIZONTAL SCREW

TG UNIT-1B FLR 4540-001-136-PVM-F-084

COT / DOT WASTE WATER (THROUGH GRAVITY)

COT/DOT WASTE WATER COLLECTION SUMP (E1C) CAP. - 1 M3 M.O.C.-RCC (UNDER GROUND)

FROM SERVICE WATER OVERHEAD TANK

DOSING PUMPS

TO LAMELLA CLARIFIER 4540-001-136-PVM-F-084

EQUIPMENT FLUSHING & CHEMICAL PREPARATION

FLUSHING PUMPS TYPE : HORIZONTAL CENTRIFUGAL CAP.- 10 M3/HR (1W+1S)

SERVICE WATER OVERHEAD TANK MOC:RCC

FROM SERVICE WATER TERMINAL POINT

WASTE WATER FROM ESP AREA UNIT-1 (THROUGH GRAVITY) (BY BHEL)

ESP UNIT-1 WASTE WATER TRANSFER PUMPS CAP. - 50 M3/HR (1W+1S) TYPE : VERTICAL SCREW

ESP UNIT-1 WASTE WATER SUMP M.O.C.-RCC (UNDER GROUND) E10 CAPACITY: 50M3

WASTE WATER FROM ESP AREA UNIT-2 (THROUGH GRAVITY) (BY BHEL)

ESP UNIT-2 WASTE WATER TRANSFER PUMPS CAP. - 50 M3/HR (1W+1S) TYPE : VERTICAL SCREW

ESP UNIT-2 WASTE WATER SUMP M.O.C.-RCC (UNDER GROUND) E11 CAPACITY: 50M3

REFER GA & LOAD DATA OF CHP TP-3 (4540-001-155-PVM-B-035)

REFER ASH WATER & ASH SLURRY DISPOSAL SYSTEM SINGLE LINE FLOW DIAGRAM (4540-001-163-PVM-L-004)

SLUDGE SUMP TRANSFER PUMPS (2X100%) TYPE : VERTICAL CENTRIFUGAL CAP. : 12.5M3/H

PT PLANT SLUDGE SUMP

SLUDGE FROM LAMELLA CLARIFIER (THROUGH GRAVITY) 4540-001-136-PVM-F-084

SLUDGE SUMP (E14) (TWO COMPARTMENT) CAPACITY-9.25M3 EACH MOC-RCC (BELOW GROUND)

WASTE WATER FROM SG AREA & APH UNIT-1 (THROUGH GRAVITY) (BY BHEL)

SG UNIT-1 FLR WASH WTR SUMP (E8) M.O.C.-RCC (UNDER GROUND) CAPACITY: 100M3

SG UNIT-1 FLR WASH WTR TRANSFER PUMPS TYPE : VERTICAL SCREW CAPACITY : 100M3/HR (2W)

WASTE WATER FROM SG AREA & APH UNIT-2 (THROUGH GRAVITY) (BY BHEL)

SG UNIT-2 FLR WASH WTR TRANSFER PUMPS TYPE : VERTICAL SCREW CAPACITY : 100M3/HR (2W)

SG UNIT-2 FLR WASH WTR SUMP (E9) M.O.C.-RCC (UNDER GROUND) CAPACITY: 100M3

OILY WASTE FROM FUEL OIL AREA (THROUGH GRAVITY) (BY BHEL)

SWITCHYARD OILY WASTE TRANSFER PUMPS TYPE : HORIZONTAL CENTRIFUGAL CAP.- 10 M3/HR (1W+1S)

SWITCH YARD SOAK PIT REFER DETAILS OF REACTOR FOUNDATIONS (DRG. NO. 4540-001-230-PVC-C-033)

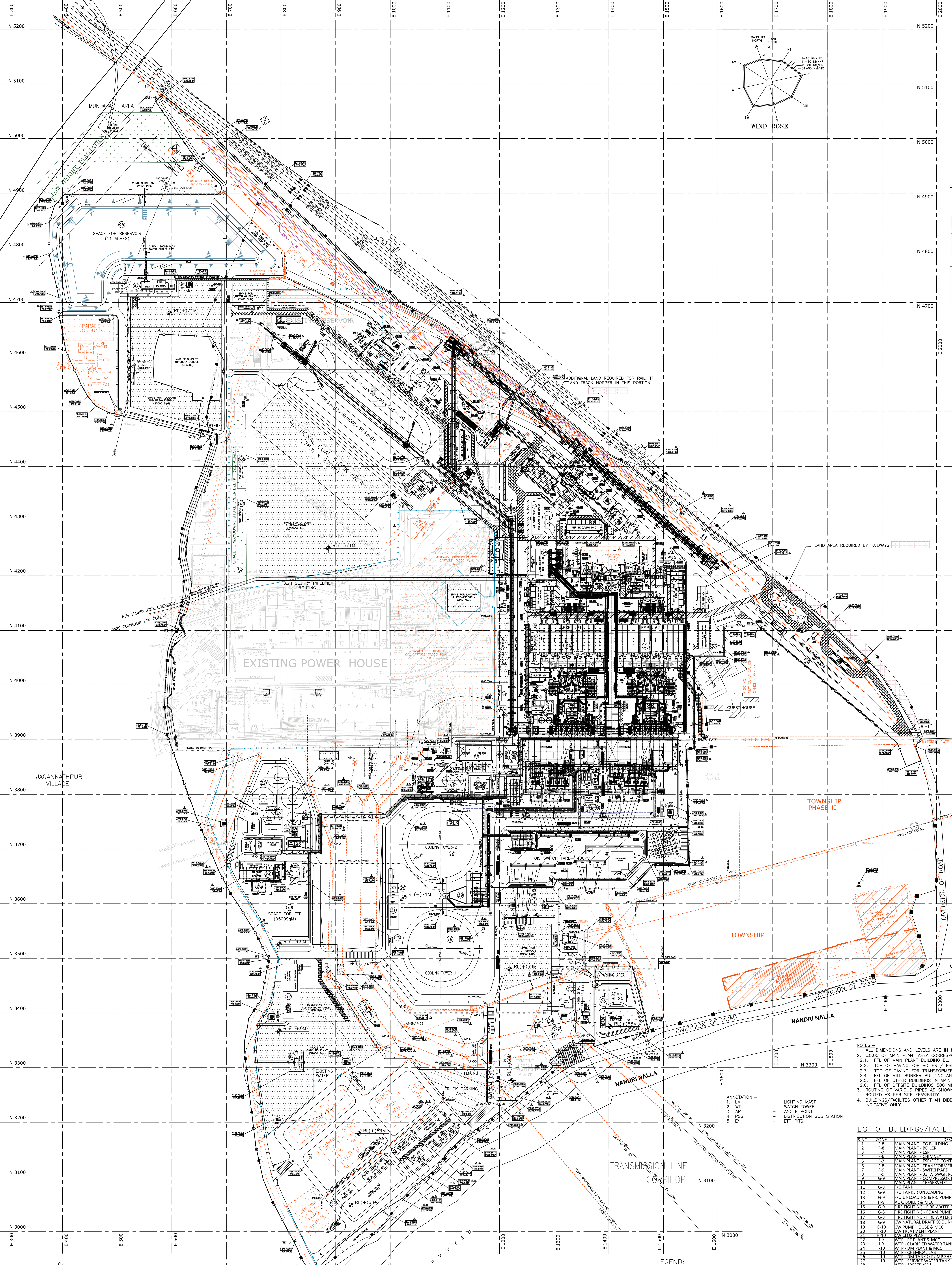
BHEL

ETP BIDDER TRANSFORMER YARD OILY WASTE SUMP UNIT-1 4540-001-136-PVM-F-084

AIR BLOWERS FOR SLUDGE SUMP (1 W+1S)

Notes:
1. ALL ITEMS, INSTRUMENTS, PIPING, VALVES, FITTING, EQUIPMENT ETC SHOWN IN THIS P&ID ARE IN BIDDER'S SCOPE.
2. DEPTH OF SUMPS OUTSIDE ETP AREA MAY VARY FROM 2.0 TO 4.0M. BIDDER TO TAKE CARE WHILE SELECTION OF PUMPS.
3. CPVC PIPES SHALL BE MINIMUM SCH.80 OR AS PER SYSTEM REQUIREMENT WHICH EVER IS HIGHER.
4. MOC OF ANY ITEM NOT MENTIONED SHALL BE SUITABLY CONSIDER BY BIDDER AS PER PROCESS AND SYSTEM REQUIREMENT.
5. INSTRUMENTS, PIPING, VALVES, FITTING, EQUIPMENT ETC SHOWN IN P&ID ARE BARE MINIMUM REQUIREMENT. HOWEVER BIDDER MAY CONSIDER ANY ADDITIONAL ITEM/EQUIPMENT BASED ON PROCESS AND SYSTEM REQUIREMENT TO MAKE THE SYSTEM EFFICIENT AND TROUBLE FREE.
6. INSTRUMENTATION FURNISHED IN THIS P&ID IS A MINIMUM REQUIREMENT. HOWEVER ANY INSTRUMENT REQUIRED FOR COMPLETENESS OF THE SYSTEM SHALL BE PROVIDED BY BIDDER WITHOUT ANY COST IMPLICATION.

ग्राहक द्वारा योजना CUSTOMER DRAWING NO.	
ग्राहक/CUSTOMER	एन टी पी सी लिमिटेड N T P C LIMITED
परियोजना PROJECT	2X660 मेगावाट तालचर थर्मल पावर परियोजना चरण - ■ 2X660MW TALCHER THERMAL POWER PROJECT STAGE - III
कार्य संख्या- JOB NO. 497	
स्थिति STATUS CONTRACT	
मुद्रण स्केल मीटर में PRINT SCALE IN METRE 0.01 0.02 0.03 0.04 0.05	
डिज़ाइन भारत हैवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD पावर सेक्टर: POWER SECTOR परियोजना अभियांत्रिकी प्रबंधन PROJECT ENGINEERING MANAGEMENT नोएडा (उ.प्र.) /NOIDA (U.P.)	DEPT CODE / NAME / SIGNATURE / DATE: DRN DK 05.1.2024; DESIGN VG 05.1.2024; CHD AKS 05.1.2024; APPD SB 05.1.2024
शीर्षक/TITLE P & ID - EFFLUENT TREATMENT PLANT	
एमपीएल MPL; सिविल CIVIL; इलेक्ट्रिकल ELEC; सी&आई C&I; एमएसई MSE; मैक्स MAX	स्केल – SCALE; ड्राॅग. नंबर / DRAWING NO. PE-DG-497-164-W001
डिज़ाइन DESIGN; ड्राफ्ट DRAFT; साइन SIGN; दिनांक DATE	शीट SHEET 1 OF 1; पुनरीक्षण REV. 0



ALIGNMENT OF NEW BOUNDARY WALL CONSTRUCTION

ALIGNMENT OF BOUNDARY WALL TO DISMANTLE

सभी माप मि. मी. मे है/ALL DIMENSIONS ARE IN MM

फर्स्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION

NOTES:–
1. ALL DIMENSIONS AND LEVELS ARE IN METERS.
2. ±0.00 OF MAIN PLANT AREA CORRESPONDS TO RL(+)71.50M.
2.1. FFL OF MAIN PLANT BUILDING EL. 0.00M
2.2. TOP OF PAVING FOR BOILER / ESP AREA EL. (–) 0.20M
2.3. TOP OF PAVING FOR TRANSFORMER YARD EL. (–) 0.10M
2.4. FFL OF MILL BUNKER BUILDING AND CHIMNEY EL. 0.00M
2.5. FFL OF OTHER BUILDINGS IN MAIN PLANT AREA EL. 0.00M
2.6. FFL OF OFFSITE BUILDINGS 500 MM ABOVE FGL OF RESPECTIVE AREA
3. ROUTING OF VARIOUS PIPES AS SHOWN ARE TENTATIVE. SAME WILL BE ROUTED AS PER SITE FEASIBILITY.
4. BUILDINGS/FACILITES OTHER THAN BIDDERS SCOPE ARE SHOWN AS INDICATIVE ONLY.

ANNOTATION:–
1. LM – LIGHTING MAST
2. WT – WATCH TOWER
3. AP – ANGLE POINT
4. PSS – DISTRIBUTION SUB STATION
5. E* – ETP PITS

LEGEND:–
1. ROADS (DOUBLE LANE)
ROADS (SINGLE LANE)
2. EXISTING BOUNDARY WALL
3. TEMP. FENCING BHEL SCOPE
4. RAILWAY LINE
5. FACILITIES/ BUILDINGS (NTPC)
6. WATCH TOWER
7. FORMATION LEVEL — RL(+) 71M/69M
8. NEW BOUNDARY WALL TO BE CONSTRUCTED
9. BOUNDARY WALL TO BE DISMANTLED
10. NEW CHAIN LINK FENCING TO BE CONSTRUCTED
11. TEMPORARY FENCING LINE (NOT IN EPC PKG)
12. ROADS BHEL/PEM
13. PIPE RACK BHEL/PEM
14. CABLE RACK BHEL/PEM
15. ROADS BHEL/ISG
16. PIPE RACK BHEL/ISG
17. CABLE RACK BHEL/ISG

REFERENCE DRAWINGS:–
1. LAYOUT OF ROADS – 4540–001–301–POC–C–107
2. LAYOUT OF DRAINS – 4540–001–301–POC–C–111
3. ROAD & DRAIN IN CHP AREA – 4540–001–155–PVC–C–010
4. LAYOUT AND DETAILS OF ROADS IN SWITCHYARD – 4540–001–230–PVC–C–021
5. LAYOUT AND DETAILS OF DRAINS IN SWITCHYARD – 4540–001–230–PVC–C–022
6. BOUNDARY WALL LAYOUT – 4540–001–301–POG–C–0788
7. RAW WATER RESERVOIR LAYOUT – 4540–001–136–PVC–C–046

LIST OF BUILDINGS/FACILITES:–

S.NO	ZONE	DESCRIPTION
1	F-8	MAIN PLANT - TG BUILDING
2	F-8	MAIN PLANT - BOILER
3	F-7	MAIN PLANT - ESP
4	F-6	MAIN PLANT - CHIMNEY
5	F-7	MAIN PLANT - ESP/FGD CONTROL ROOM (2 No.)
6	F-8	MAIN PLANT - TRANSFORMER YARD
7	F-9	MAIN PLANT - SWITCHYARD
8	F-9	MAIN PLANT - 33 KV SWGR ROOM
9	G-9	MAIN PLANT - COMPRESSOR HOUSE
10		MAIN PLANT - *RESERVED*
11	G-8	F/O TANK
12	G-9	F/O TANKER UNLOADING
13	G-9	F/O UNLOADING & PR. PUMP HOUSE INCL. MCC
14	H-9	AUX. BOILER & MCC
15	G-9	FIRE FIGHTING - FIRE WATER TANKS & PUMP HOUSE
16	G-8	FIRE FIGHTING - FOAM PUMP HOUSE
17	G-8	FIRE FIGHTING - FIRE WATER BOOSTER PUMP HOUSE
18	G-9	CW NATURAL DRAFT COOLING TOWER (2 No.)
19	G-10	CW PUMP HOUSE & MCC
20	H-10	CW TREATMENT PLANT
21	H-10	CW CLO2 PLANT
22	I-9	WTP - PT PLANT & MCC
23	I-9	WTP - CLARIFIED WATER TANK & PUMP SHED
24	I-10	WTP - DM PLANT & MCC
25	I-10	WTP - CHEMICAL LAB
26	I-10	WTP - DM TANK & PUMP SHED
27	I-10	WTP - SERVICE WATER TANK
28		WTP - *RESERVED*
29		WTP - *RESERVED*
30	I-11	ETP - EFFELUENT TREATMENT PLANT & MCC
31	F-11	FIRE FIGHTING - FIRE STATION/DRILL TOWER
32	F-12	MISC. - SAFETY PARK & CONTROL ROOM
33	F-11	MISC. - ADMIN BUILDING
34	F-11	MISC. - GATE COMPLEX & CISF OFFICE
35	E-9	MISC. - CANTEEN BUILDING
36	H-13	MISC. - OWNER CONSTRUCTION OFFICE & PARKING AREA
37	H-13	MISC. - O&M WORKSHOP
38	I-6	MISC. - BHEL STORE
39	H-13	MISC. - BHEL SITE OFFICE
40	H-13	MISC. - FIRST AID CENTRE
41	H-13	MISC. - FQA LAB
42	G-8	MISC. - SERVICE BUILDING & PARKING
43		MISC. - WORKERS REST ROOM (6 No.)
44	H-13	MISC. - CIVIL QUALITY LAB
45		MISC. - *RESERVED*
46	K-3	RAW WATER RESERVIOUR
47	K-3	RAW WATER PUMP HOUSE & MCC
48		*DELETED*
49	F-8	CST PUMP SHED & DG
50	F-8	CENTRAL LUBE OIL BUILDING
51		*DELETED*
52	D-7	AHP - ASH BAGGING
53	D-7	AHP - ASH CLASSIFICATION
54	F-6	AHP - ASH SLURRY PUMP HOUSE
55	F-6	AHP - ASH WATER PUMP HOUSE
56	G-7	AHP - COMPRESSOR HOUSE #1
57	D-7	AHP - COMPRESSOR HOUSE #2 & ASH CLASSIFIER
58	D-7	AHP - FLY ASH SILO
59	D-7	AHP - SILO UTILITY BUILDING & MCC
60	D-7	AHP - CLASSIFIER MCC
61	F-6	AHP - MCC & LHP MCC
62		AHP - *RESERVED*
63	H-5	CHP - COAL STOCKPILE
64	H-5	CHP - COAL CRUSHER HOUSE
65	H-5	CHP - CONTROL ROOM & CHP MCC
66	H-5	CHP - CHP/LHP/GHP PUMP HOUSE
67	G-7	CHP - BUNKER MCC
68	H-5	CHP - DOSER SHED
69	F-5	CHP - TRACK HOPPER & BOBR COMPR. HOUSE
70	F-6	CHP - TH MCC
71	H-5	CHP - WORKSHOP & OFFICE
72		CHP - *RESERVED*
73	H-4	CSSP - SETTLING POND
74	H-4	CSSP - CLARIFIER & TREATMENT PLANT
75		CSSP - *RESERVED*
76	F-6	FGD - ABSORBER
77	G-6	FGD - DG SET
78	F-5	GHP - GYPSUM STORAGE SHED
79	F-5	GHP - GYPSUM DEWATERING BUILDING & TANKS
80		GHP - WEIGH BRIDGE
81	G-5	LHP - TIPPLER/CONVEYOR
82	G-5	LHP - LIMESTONE CRUSHER HOUSE
83	G-6	LHP - BALL MILL BLDG. & TANKS
84		LHP - WEIGH BRIDGE
85		LHP - *RESERVED*
86	I-4	SOLAR EQUIPMENTS
87	F-4	STP - SEWAGE TREATMENT PLANT-1
88	G-7	STP - SEWAGE TREATMENT PLANT-2
89	G-8	STP - SEWAGE TREATMENT PLANT-3
90	G-8	CPU REGEN
91	I-11	GAS CYLINDER STORAGE SHED

4540–001–301–POC–F–001

ग्राहक ड्राइंग संख्या CUSTOMER DRAWING NO.

ग्राहक/CUSTOMER: एन टी पी सी लिमिटेड N T P C LIMITED

परियोजना PROJECT: 2X660 मेगावाट तालचर थर्मल पावर परियोजना चरण–III 2X660MW TALCHER THERMAL POWER PROJECT STAGE–III

भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD
पावर सेक्टर/POWER SECTOR
परियोजना अभियांत्रिकी प्रबंधन PROJECT ENGINEERING MANAGEMENT
नोएडा (उ.प्र.)/NOIDA (U.P.)

NOTE:– SCAN QR CODE FOR CHECKING THE LATEST REV. STATUS OF DRAWING.

कार्य संख्या- JOB NO.: 497

स्थिति STATUS: CONTRACT

मुद्रण स्केल मीटर मे PRINT SCALE IN METRE: 0 2 4 6 8 10 20 30 40 50

DEPT CODE: M

	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DRN	DK	Sd/–	28.11.2022
डिजाइनकर्ता/DESN	DK	Sd/–	28.11.2022
जाँचकर्ता/CHD	KK	Sd/–	28.11.2022
अनुमोदनकर्ता/APPD	BKA	Sd/–	28.11.2022

शीर्षक/TITLE: PLOT PLAN (GENERAL LAYOUT OF PLANT)

एमपीएल MPL | सिविल CIVIL | इलेक्ट्रिकल ELEC | सीएंडआई C&I | एमएसई MSE | मैक्स MAX | विभाग DEPT. | हस्ताक्षर SIGN | दिनांक DATE

स्केल – SCALE– 1:2500

ड्राइंग संख्या / DRAWING NO. PE–DG–497–100–M001

शीट SHEET 1 OF 1

पुनरीक्षण REV. 02

फार्मेट साइज A0 FORMAT SIZE A0

पुनरीक्षण REV.	दिनांक DATE	परीक्षितकर्ता ALTD	जाँचकर्ता CHD	अनुमोदनकर्ता APPD	
01	11.01.2023	DK Sd/–	KK Sd/–	BKA Sd/–	1. ROAD LAYOUT UPDATED. 2. DRAWING REVISED INLINE WITH CUSTOMER COMMENTS. 3. OTHER CHANGES AS MARKED. (1)
02	19.04.2023	DK Sd/–	KK Sd/–	BKA Sd/–	1. ROAD LAYOUT UPDATED. 2. DRAWING REVISED INLINE WITH CUSTOMER COMMENTS. 3. OTHER CHANGES AS MARKED. (2)
03	07.08.2023	DK	KK	BKA	1. ROAD LAYOUT UPDATED. 2. DRAWING REVISED INLINE WITH CUSTOMER COMMENTS. 3. EXISTING BOUNDARY, HT TOWER LOCATION UPDATED AS PER SITE SURVEY. 4. NEW BOUNDARY ON NORTH, EAST AND SOUTH SIDE SHIFTED BY 2M INSIDE AS PER CIVIL REQUIREMENT 5. OTHER CHANGES AS MARKED. (3)
04	07.08.2023	DK	KK	BKA	1. ROAD LAYOUT UPDATED. 2. DRAWING REVISED INLINE WITH CUSTOMER COMMENTS. 3. EXISTING BOUNDARY, HT TOWER LOCATION UPDATED AS PER SITE SURVEY. 4. NEW BOUNDARY ON NORTH, EAST AND SOUTH SIDE SHIFTED BY 2M INSIDE AS PER CIVIL REQUIREMENT 5. OTHER CHANGES AS MARKED. (4)

ड्राइंग संख्या/DRAWING NO. PE–DG–497–100–M001

ELECTRONIC FILE NAME : 497_100_M001_R3b (PLOT PLAN).dwg

ANNEXURE-X

PAINTING SPECIFICATION

SURFACE PREPARATION & PAINTING

TALCHER THERMAL POWER PROJECT **STAGE-III (2X660 MW)** **EPC PACKAGE**	**TECHNICAL SPECIFICATION** **SECTION-VI, PART-B** **BID DOC. NO. CS-4540-001A-2**

1.00.00	**Specification of surface preparation & painting**
1.01.00	Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.
1.02.00	All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labelled by the manufacturer with the manufacturer's name, type of paint, batch number and colour.
1.03.00	Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.
1.04.00	All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering.
1.05.00	**SURFACE PREPARATION**
1.05.01	All surfaces to be painted shall be thoroughly cleaned of oil. Grease and other foreign material. Surfaces shall be free of moisture and contamination from chemicals and solvents.
1.05.02	The following surface preparation schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer.

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

1.06.00	**APPLICATION OF PRIMER/PAINT**
1.06.01	The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.
1.06.02	Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.
1.06.03	Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.
1.06.04	Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.

1.06.05 Following are the Primer/painting schemes envisaged herein:

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

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

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

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

PS9 - Aluminum paint to IS 2339.

PS9* - Heat resistant Aluminum paint to IS-13183 Gr.-I (for temperature 400 degC – 600 degC), IS-13183 Gr.-II (for temperature 200 degC- 400 degC and IS-13183 Gr.-III (for temperature upto 200 degC)

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

PS14 - Weldable primer-Deoxaluminate or equivalent.

PS16 - High Build Epoxy CDC mastic `15'.

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

PS18 - Epoxy based TiO2 pigmented coat

PS19 - Epoxy Zinc rich primer (92% zinc in dry film (min.), %VS=35.0(min.)

PS-20 - Epoxy based finish paint

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

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

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

1.06.09 a) All un-insulated equipments, pipes, valves etc covered in sub-section A-08 (Steam Turbine & Auxiliary system) shall be painted with paint not inferior to Epoxy resin based paints with minimum DFT of 150 micron.

The paint shall be applied in three stages i.e. primer, intermediate and finish coats in following manner:

- Primer coat – Epoxy based zinc phosphate
- Intermediate - Epoxy based TiO2 pigmented coat
- Finish coat - Epoxy based finish coat/Two pack polyurethane coat

b) Equipment, pipes etc. with high temperature shall be painted with heat resistant aluminum paint (to be selected based on the service condition of component as per IS-13183). Two coats of paint shall be applied with total DFT 40 micron.

c) Surface preparation before painting shall be carried out according to requirement indicated in this sub-section and international standard

1.06.10 A) Specification for the application of Epoxy coating for internal protection of DM tank & other vessels/tanks (as applicable) shall be as follows:

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

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

hardener.

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

B) Specification for application of chlorinated Rubber paint for external protection vessel, tanks, piping, valves & other equipments shall be as follows:

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

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

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

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

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

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

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

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

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

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

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

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

Total DFT shall not be less than 300 microns.

1.06.11 Primer/Painting Schedule

Sl. No	Description		Surface Preparation	Primer Coat			Intermediate Coat			Finish Coats			Total Min. Painting DFT (Microns)	Colour Shade
				Type of Primer	No. of Coats	Min. DFT / coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)		
A) Power Cycle Piping														As per NTPC Colour shade/ coding scheme
1.	All insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.		SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
2.	All un-insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipment etc.	Design temperature < or equal to 60^0C	SP3/SP4	PS 5	2	25	-	-	-	PS 4	3 **$**	35 **$**	155 **$**	
		Design temperature above 60^0C-200^0C	SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	
		Design temperature > 200^0C	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
3	Constant Load Hanger (CLH) and Variable Load Hanger (VLH)		SP4*	PS19	1	40	-	-	-	PS17	1	30	70	
4	Piping hangers / supports (other than (3) above. (un-insulated)		SP3/SP5	PS5	2	25	-	-	-	PS4	2	25	100	

	Valves												
5.	Cast/Forged	Design temperature < or equal to 60 degC #	SP3/SP5	PS5	2	35	-	-	-	PS4	2	25	120
		Design temperature above 60 degC	SP3/SP5	PS9*	1	20	-	-	-	PS9*	1	20	40
6.	All auxiliary Structural Steel components for pipe supports	Outside TG building and in SG envelope	SP4*	Inorganic Ethyl Zinc Silicate	1	75	PS18	1	75	a) Epoxy coat b) Final coat of paint PS17	2 1	35 30	250
		Within TG building	SP4*	-do-	1	35	PS18	1	35	a) Epoxy coat b) Final coat of paint PS17	2 1	25 30	150
7.	Weld Edges		SP6 (Hand cleaning by wire brushing)	PS13 (Weldable primer)	1	25	-	-	-	-	-	-	25

1. **$ -** The first 2 finished coats (total min.DFT of 70 microns) shall be done at shop and the 3rd finish coat (min.DFT 35 Microns) shall be applied at site.
2. For valves below 65NB and temperature upto and including 540 DegC, Parkerizing/zinc phosphate corrosion resistant coating as per ASTM F1137 is also acceptable in lieu of Aluminum paint.
3. For corrosion protection of threaded hanger rods and variable spring cages, electro galvanizing in full compliance to minimum Corrosion category C3 as per EN ISO12944 is also acceptable.
4. For spring cages, 2 coats of 30 µm (min) zinc-rich epoxy resin primer with zinc content> 80 weight% in dry film followed by 2 coats of 30 µm (min) top coat of Acrylic resin Co-polymerisate with a total combined minimum DFT of 120µm is also acceptable in lieu of above specified paint scheme.
5. For corrosion protection, all inner parts of the hangers (CLH/VLH) shall be at least in full compliance to Corrosion category C3 as per EN ISO12944.
6. # - For Cast/forged valves upto & including design temperature 60Deg.C, Aluminium painting as per IS-13183 Gr-3 or better with total DFT 40Micron is also acceptable.

B) Steam Generator & Auxiliaries:

1	All surfaces with temperature 95°C or less and which are insulated	SP3/SP4	PS 5	2	30	-	-	-	PS 4	2 **$**	20 **$**	100 **$**
2	All surfaces with temperature above 95°C and which are insulated	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40

Note: **1)** SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.

2) Painting specification for all other exposed steel surfaces not covered above shall be same as that given in Civil Sub-section, Part-B, Section VI for corrosion protection of steel structures.

C) LOW PRESSURE PIPING													
1	All Piping, fittings / components, valves, Equipments etc.	SP3/SP5	PS3/ PS5	2	25	PS 4	1	30	PS 4	2	35	150	As per NTPC Color shade/ coding scheme.
2	Stainless steel surface, Galvanized steel surface and gun metal surface.	No Painting											
3	On the internal surface for pipes 1000 Nb and above	A coat of primer followed by hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.											
D) Fire Detection & Protection System, Compressed air system and Air-conditioning & Ventilation System													
For Fire Detection & Protection System, Surface preparation and painting of Fire Water Storage Tanks, all Steel Surfaces (external) exposed to atmosphere (outdoor & indoor installation), Deluge Valves, Alarm Valves, Foam monitors, Water monitors, Foam Proportioning equipments, Foam makers, etc. should be as per the Part-B, Sub Section-A-18, Fire Detection & Protection System For Air Conditioning System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-17, Air Conditioning System. For Ventilation System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-17, Ventilation System. For compressed air system, Surface preparation and painting of all the steel surfaces should be as per the Part-B, Sub Section--A-16 compressed air system.													
E) ESP													
1	All surfaces with surface temperature 95°C or less (with or without insulation)	SP3/SP4	PS3/ PS3*	1	25	-	-	-	PS 4	1	30	55	
2	All surfaces with surface temperature above 95°C (with or without insulation)	SP3/SP4	PS5	2	30	-	-	-	-	-	-	60	

General Notes (Applicable for all above points A to E)

i) Painting specification for all surfaces with surface temperature 95°C or less (un-insulated) that are not covered above shall be same as that given in Civil Sub-section, Part-B, Section-VI for corrosion protection of steel structures.

ii) Painting specification for inside surfaces (such as inner surfaces of ducts/ tanks/ mills/ dampers/ ESP etc.) that are not covered specifically in above clauses, shall be provided with 2 coats of suitable primer i.e. PS5/ PS9 (Total DFT 60/40 micron) based on the temperature.

F) FGD System

(i) Surface preparation shall be blast cleaned conforming *to* Sa *2-1/2* Swiss Standard.

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

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

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

ANNEXURE-XI

E-LEARNING PACKAGE

e-Learning Package for Effluent Treatment Plant

e-Learning Package:

e-learning packages shall be supplied for the equipment/ system for the complete Effluent Treatment Plant along with associated electrical and C&I system.

These packages shall be installed on the Learning Management Server (LMS) of Power Management Institute (PMI), NTPC located at Noida. The Engineer- In-Charge (EIC) for the e-learning modules shall be from PMI.

1. The objective of the e-Learning package consisting of courses for erection, commissioning, operation and maintenance of equipment / system as specified above is to facilitate the employees to have first-hand information/ requirement with respect to above activities for the supplied equipment/ system.

2. The bidder shall submit e-learning courses each for erection, commissioning, operation and maintenance of each of the equipment/ system supplied as above.

a) The erection course(s) should include instructions on pre-checks, prerequisites, erection strategy, erection procedure etc.

b) The commissioning course(s) should include instructions on pre-commissioning, commissioning, initial operation etc.

c) The operation course(s) should include instructions on the permissive, interlocks, physical check-ups, start up, shutdown and protections etc.

d) The maintenance course(s) should include instructions on predictive, preventive, breakdown and overhauling.

Depth of coverage of above courses shall be as specified for **"Instruction Manuals"** in General Technical Requirement Part-C, Section-VI of technical specification. A literature on caution / safety while handling equipment / system for the above modules shall follow the description of the said equipment /system.

3. The e-Learning packages on equipment / system shall be installed by the vendor and shall be successfully test run in the presence of EIC or representative before acceptance by NTPC. The vendor will also give the master copy in form of Flash Drive/CD/DVD. The respective module for erection & commissioning shall be delivered and successfully test run at least three months before the scheduled start of the corresponding activity at site. The respective module for operation & maintenance shall be delivered and successfully test run at least three months before scheduled first synchronization of first unit.

4. e-Learning course broad requirements:

a) The courses shall be web based and mobile based Application type. It shall run on all possible versions of web browser like Internet Explorer, Google Chrome, Firefox etc. on Laptop/ Desktop and shall be Smartphone/Tablet/Mobile responsive. The Mobile responsive courses shall run on Android, Windows Mobile, Blackberry, iOS etc.

b) The courses shall support liquid/fluid page layout so that the entire screen gets adjusted to PC, Laptop, Smartphone/Mobile, Tablet and any other display devices.

c) Course content text shall be in English language and be associated with a voiceover in English language with Indian accent.

d) Courses shall be SCORM (Sharable Content Object Reference Model) compliant, version 1.2 which is compatible with LMS at PMI.

e) Each course shall have every physical and functional detail of the equipment/ system supplied.

f) Each of the e-Learning course shall be based on multiple web pages and mobile pages with multiple modules.

g) There shall be option for self-assessment test after every course. In case the user doesn't opt for self assessment test the user shall be able to go to the next course. There shall be no restriction in no. of times for repeating the assessments. All correct answers along with the answers marked by the users shall be displayed at the end of test/ quiz.

h) If Java and Flash, as applicable are not available in the system to run the package, then there shall be a prompt message for updating of the same.

i) Each course shall have a self-running interactive content with navigation buttons containing forward, backward, pause, bookmark and menu options in the course window.

j) The course shall contain chapter titled 'Introduction/overview' that explains the purpose of the course.

k) The course content shall contain descriptive text shall be factual, specific, terse, clearly worded, and simply illustrative, so that the user can understand it.

l) The system shall provide the user with the ability to select the information with a Cursor.

m) The course menu should contain table of content linked to concerned pages. The user shall be given the capability to access all of the functions available on the system through a menu system. This shall consist of

active buttons, which shall control a hierarchy of pull down/popup menus. Menu shall appear quickly and exist only while a selection is being made. The user shall be given the capability to position the cursor or pointer on the menu item and use pointer device such as mouse to activate the function.

n) Every course shall contain the 3D design/drawing/exploded view/ 3600 turn around view of the equipment/system, textual description of the equipment/system and its functionality with video (as applicable), animation and audio.

o) The users shall be able to control audio sound level associated with the courses.

p) Drawings / text in the courses shall be scalable (Zoom in/ out).

q) The user shall have the capability to record a bookmark to mark displayed information for later recall, whenever he accesses the same course next time.

Notes:

- e-learning Package of an equipment / system shall include e-learning courses for each of erection, commissioning, operation and maintenance of that equipment / system.
- e-learning courses on erection, commissioning, operation and maintenance of an equipment / system shall include e-learning lessons/chapters/modules (as required) for erection, commissioning, operation and maintenance respectively of that equipment / system.
- The vendor shall get the approval of one sample course from EIC before proceeding for further courses.

DATASHEET A

1.	**TG UNIT-1A FLOOR WASH WATER SUMP (E1A)**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	12 m3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash from TG UNIT 1 containing oil traces 2. Oily effluent from TDBFP-A Unit-1 & MDBFP Unit-1 area
2.	**TG UNIT-1A FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from TG UNIT 1 containing oil traces 2. Oily effluent from TDBFP-A Unit-1 & MDBFP Unit-1 area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	25
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
3.	**TG UNIT-1B FLOOR WASH WATER SUMP (E1B)**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	12 m3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash from TG UNIT 1 containing oil traces 2. Oily effluent from TDBFP-A Unit-1 & MDBFP Unit-1area 3. Oily effluent from COT/DOT area
4.	**TG UNIT-1B FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from TG UNIT 1 containing oil traces 2. Oily effluent from TDBFP-B Unit-1 & MDBFP Unit-1 area 3. Oily effluent from COT/DOT area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	25
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316

5.	**COT/DOT WASTE WATER COLLECTION SUMP (E1C)**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	1 m3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Oily effluent from COT/DOT area
6.	**COT/DOT WASTE WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Horizontal Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Oily effluent from COT/DOT area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	2
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
7.	**TG UNIT-2A FLOOR WASH WATER SUMP (E2A)**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	12 m3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash from TG UNIT 2 containing oil traces 2. Oily effluent from TDBFP-A Unit-2 & MDBFP Unit-2 area
8.	**TG UNIT-2A FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from TG UNIT 2 containing oil traces 2. Oily effluent from TDBFP-A Unit-2 & MDBFP Unit-2 area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	25
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
9.	**TG UNIT-2B FLOOR WASH WATER SUMP (E2B)**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	12 m3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom

e)	Type of fluid to be handled	1. Floor wash from TG UNIT 1 containing oil traces 2. Oily effluent from TDBFP-B Unit-2 & MDBFP Unit-2 area
10.	**TG UNIT-2B FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos..
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from TG UNIT 1 containing oil traces 2. Oily effluent from TDBFP-B Unit-2 & MDBFP Unit-2 area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	25
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
11.	**FUEL OIL HANDLING AREA OILY WASTE SUMP (E3)**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	As specified in FOHS area
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	Oily effluent from FOHS area
12.	**FUEL OIL AREA WASTE TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	Oily effluent from FOHS area
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	10
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
13.	**TRANSFORMER YARD OILY WASTE SUMP UNIT-1 (E4)**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	As specified in Transformer area Oil Water Separator
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	Oily effluent from Transformer area Oil Water Separator
14.	**TRANSFORMER YARD UNIT-1 OILY WASTE TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor

d)	Fluid to be handled	Oily effluent from Transformer area Oil Water Separator
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	10
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
15.	**TRANSFORMER YARD OILY WASTE SUMP UNIT-2 (E5)**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	As specified in Transformer area Oil Water Separator
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	Oily effluent from Transformer area Oil Water Separator
16.	**TRANSFORMER YARD UNIT-2 OILY WASTE TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	Oily effluent from Transformer area Oil Water Separator
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	10
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
17.	**MRS WASTE WATER SUMP UNIT-1 (E6)**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	10 m3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash waste (containing coal laden particles) from MRS area Unit-1 2. Waste water (containing coal laden particles) from Feeder and Tripper Floor Unit-1
18.	**MRS UNIT-1 OILY WASTE WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash waste (containing coal laden particles) from MRS area Unit-1 2. Waste water (containing coal laden particles) from Feeder and Tripper Floor Unit-1
e)	Duty	Intermittent

f)	Rated capacity, each m3/ hr.	10
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS
	• Base plate and soleplate	CS (min. 10 thick)
19.	**MRS WASTE WATER SUMP UNIT-2 (E7)**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	10 m3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash waste (containing coal laden particles) from MRS area Unit-2 2. Waste water (containing coal laden particles) from Feeder and Tripper Floor Unit-2
20.	**MRS UNIT-2 OILY WASTE WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash waste (containing coal laden particles) from MRS area Unit-1 2. Waste water (containing coal laden particles) from Feeder and Tripper Floor Unit-1
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	10
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing	CS as per IS:2062 or eq.
	• Gland packing	TIWA

	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS
	• Base plate and soleplate	CS (min. 10 thick)
21.	**SG UNIT-1 FLOOR WASH WATER SUMP (E8)**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	100 M3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash from SG UNIT 1 containing oil traces 2. Floor wash from APH UNIT 1 containing ash traces
22.	**SG UNIT-1 FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Two (2W) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from SG UNIT 1 containing oil traces 2. Floor wash from APH UNIT 1 containing ash traces
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	100
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
23.	**SG UNIT-2 FLOOR WASH WATER SUMP (E9)**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	100 M3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	1. Floor wash from SG UNIT 1 containing oil traces 2. Floor wash from APH UNIT 1 containing ash traces
24.	**SG UNIT-2 FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Two (2W) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from SG UNIT 1 containing oil traces 2. Floor wash from APH UNIT 1 containing ash traces
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	100
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316

25.	**ESP UNIT-1 FLOOR WASH WATER SUMP (E10)**	
f)	Number required	One (1) nos.
g)	Effective Capacity, m3	50 M3
h)	Material of Construction	RCC (IN BHEL SCOPE)
i)	Type	Underground, Rectangular with Flat bottom
j)	Type of fluid to be handled	Floor wash from ESP UNIT 1 containing ash traces
26.	**ESP UNIT-1 FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	Floor wash from ESP UNIT 1 containing ash traces
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	50
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
27.	**ESP UNIT-2 FLOOR WASH WATER SUMP (E11)**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	50 M3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	Floor wash from ESP UNIT 2 containing ash traces
28.	**ESP UNIT-2 FLOOR WASH WATER TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical Screw type
c)	Location	Outdoor
d)	Fluid to be handled	1. Floor wash from ESP UNIT 2 containing ash traces
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	50
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316
29.	**WASTE SERVICE WATER SUMP (WSWS) (E12)**	
a)	Number required	One (1) nos. (In two compartments)
b)	Effective Capacity (each compartment), m3	250m3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Rectangular with Flat bottom, under ground
e)	Inlet arrangement	Inlet & Outlet chamber with interconnecting gates

f)	Oil removal arrangement	Two (2x100%) numbers Drum Type Oil skimmers and Two (2x100%) numbers trolley mounted Portable Oil Centrifuge.
g)	Oil collection drum (type/ capacity)	One (1) nos. MS Oil Drum (capacity: 200 litre)
h)	Oil Skimmer (each to be installed in each compartment of WSWS)	Type: Drum Capacity: As per system requirements Inlet Oil Level: 50ppm Oil Outlet guarantee: <5ppm MOC: As per system requirements Accessories: Power pack, motor, valves, control panel as required.
i)	Portable Oil Centrifuge	Type: Trolley Mounted Portable Oil Centrifuge Capacity: As per system requirements MOC: As per system requirements Accessories: motor, valves, control panel as required. Purpose: To collect and purify the oil of the WSWS
30.	**WSWS TRANSFER PUMPS**	
a)	Number required	Three (2W+1S) nos.
b)	Type	Vertical Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	Effluent from WSWS
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	125
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing tube	CS as per IS:2062 or eq. (Min. Thickness 8 mm)
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS
	• Base plate and soleplate	CS (min. 10 thick)
31.	**LAMELLA CLARIFIER/ TUBE SETTLER**	
a)	Number required	Two (1W+1S) nos.
b)	Material of Construction	RCC (IN BHEL SCOPE)
c)	Design Flow (Net Output of each clarifier), m3/hr	250
d)	Basis design and components	As per manufacturer standard
e)	Sludge Consistency	2% (minimum)
f)	Type	Counter Flow / Cross Flow
g)	Design Flow velocity	Not more than 5m3/hr/m2
h)	Flash Mixer tank & Flocculator tank	1x100% Flash Mixer Tank and 1x100% flocculation tank (for each Lamella Clarifier/ Tube Settler)
i)	No. of Flash Mixer (for each Lamella Clarifier/ Tube Settler)	One (1) number with required agitator Min. 1-minute storage for Flash Mixer Tank
j)	MOC of Agitator	SS 316

k)	No. of Flocculation Chamber (for each Lamella Clarifier/ Tube Settler)	One (1) number with required Flocculator Min. 10-minute storage for Flocculation Chamber
l)	MOC of Flocculator	SS 316
m)	Type of Fluid to be handled	Wastewater containing traces of oil, suspended solids.
n)	Accessories	Suitable sampling lines for performance monitoring
32.	**CENTRAL MONITORING BASIN (CMB) (E13)**	
a)	Number required	One (1) nos. (In two compartments)
b)	Effective Capacity (each compartment), m3	250m3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Rectangular with Flat bottom, Above ground
e)	Inlet arrangement	Inlet & Outlet chamber with interconnecting gates
33.	**CENTRAL MONITORING BASIN TRANSFER PUMPS**	
a)	Number required	Three (2W+1S) nos.
b)	Type	Horizontal Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	Effluent from WSWS
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	125
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing tube	CS as per IS:2062 or eq. (Min. Thickness 8 mm)
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS
	• Base plate and soleplate	CS (min. 10 thick)
34.	**TROLLEY MOUNTED SCREW PUMPS WITH SLOPE OIL TANK**	
a)	Number required	Two (2W) nos. (1 Set for each unit)
b)	Type	Trolley Mounted Screw type with Slope oil tank and Power station
c)	Location	Outdoor
d)	Fluid to be handled	Oily effluent from Transformers
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	10
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	15 mwc
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260
	• Impeller/Rotor	ASTM A351 CF8M
	• Shaft	SS 316

j)	Slope Oil Tank	Capacity: 1m3 MOC: MSEP
35.	**SLUDGE SUMP (E14)**	
a)	Number required	One (1) nos. (In two compartments).
b)	Effective Capacity, m3 (each compartment)	6.25m3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Rectangular with Flat bottom, under ground
e)	Inlet arrangement	Inlet & Outlet chamber with interconnecting gates
36.	**SLUDGE SUMP TRANSFER PUMPS**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical sump type (Open Impeller, Non-clog type)
c)	Location	Outdoor
d)	Fluid to be handled	Effluent from WSWS
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	12.5
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing tube	CS as per IS:2062 or eq. (Min. Thickness 8 mm)
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS
	• Base plate and soleplate	CS (min. 10 thick)
37.	**CHEMICAL DOSING FOR LAMELLA CLARIFIER/ TUBE SETTLER**	
48.1	**ALUM DOSING SYSTEM (DOSING RATE = 70 PPM)**	
A.	**ALUM DOSING TANK**	
a)	Numbers required	Two (2) nos.
b)	Type	Vertical rectangular with flat bottom
c)	Type of fluid to be handled	10 % w/w Alum Solution.
d)	Effective capacity of each tank, m^3	Adequate to hold the quantity required for twelve (12) hours of operation for treatment of overall waste in LAMELLA CLARIFIER/ TUBE SETTLER + 20% margin excluding free board
e)	Design Pressure, Kg/sq. cm (g)	Atmospheric
f)	Material of Construction	RCC (IN BHEL SCOPE).
g)	Protection	
	• Internal	Acid Proof Tile Lining
	• External	Not applicable
h)	Agitator along with drive motor and all other accessories	
	• Number	One (1) per Tank
	• Material of Construction	SS 316

i)	Dissolving Basket	
	• Number	One (1) per Tank
	• Material of Construction	SS 316
B.	**ALUM SOLUTION DOSING PUMPS**	
a)	Number	Two (2) Number [1W+1S] for LAMELLA CLARIFIER/ TUBE SETTLER.
b)	Type of Pump	Positive displacement and Simplex Hydraulically operated diaphragm type with auto stroke adjustment.
c)	Location	Outdoor
d)	Fluid to be handled	10 % w/w Alum Solution.
e)	Service	To dose Alum solution to LAMELLA CLARIFIER/ TUBE SETTLER.
f)	Duty	Continuous and suitable for parallel operation
g)	Suction Condition	Flooded
h)	Rated Capacity, m^3/hr	100 % requirement at full load condition of the plant
i)	Range of Operation (%)	10 – 100
j)	Pump Speed, (RPM)	1500 (max.)
k)	Pump Stroke speed per minute	100 (max.)
l)	Material of construction	
	• Liquid end (Pump head Valve, valve spring, Housing, etc.)	AISI 316
	• Diaphragm, Packing	PTFE
	• Shaft	Hardened steel (EN8-BS-970)/ AISI-316
m)	Accessories	Pumps shall be provided with accessories such as Y-type suction strainers, check valves, pressure dampeners, Pressure Gauge, safety relief valves along with recirculation to tank etc
n)	Type of drive	Electrical Motor
48.2	**LIME DOSING SYSTEM (DOSING RATE = 30 PPM)**	
A.	**LIME DOSING TANK**	
a)	Numbers required	Two (2) nos.
b)	Type	Vertical rectangular with flat bottom
c)	Type of fluid to be handled	6 % w/w Lime Solution.
d)	Effective capacity of each tank, m^3	Adequate to hold the quantity required for twelve (12) hours of operation for treatment of overall waste in LAMELLA CLARIFIER/ TUBE SETTLER + 20% margin excluding free board
e)	Design Pressure, Kg/sq. cm (g)	Atmospheric
f)	Design Temperature, 0C	80
g)	Material of Construction	RCC (IN BHEL SCOPE) with 2 coats of Bitumastic paint over 2 coats of primer.
h)	Protection	
	• Internal	Acid Proof Tile Lining
	• External	Not applicable
i)	Agitator along with drive motor and all other accessories	
	• Number	One (1) per Tank
	• Material of Construction	SS 316
j)	Dissolving Basket	
	• Number	One (1) per Tank
	• Material of Construction	SS 316
B.	**LIME SOLUTION DOSING PUMPS**	
a)	Number	Two (2) Number [1W+1S] for LAMELLA CLARIFIER/ TUBE SETTLER.

b)	Type of Pump	Screw type
c)	Location	Outdoor
d)	Fluid to be handled	6 % w/w Lime Solution.
e)	Service	To dose Lime solution to LAMELLA CLARIFIER/ TUBE SETTLER.
f)	Duty	Continuous and suitable for parallel operation
g)	Suction Condition	Flooded
h)	Rated Capacity, m^3/hr	100 % requirement at full load condition of the plant
i)	Range of Operation (%)	10 – 100
j)	Pump Speed, (RPM)	1500 (max.)
k)	Material of construction	
	Pump casing	2.5% Ni-Cast Iron to IS 210 FG 260
	Stator	EPDM rubber
	Impeller/Rotor	CF8M
	Shaft and shaft sleeve	SS 410
l)	Accessories	Pumps shall be provided with accessories such as Y-type suction strainers, check valves, pressure dampeners, Pressure Gauge, safety relief valves along with recirculation to tank etc
m)	Type of drive	Electrical Motor
38.	**AIR BLOWER FOR SLUDGE SUMP**	
a)	Number	Two (2) (2X100 %) for Sludge Sump
b)	Type	Rotary Twin Lobe Type
c)	Duty	Intermittent
d)	Capacity & Head	As required
e)	MOC of casing, cover, stator	CI as per IS 210 FG 260
f)	MOC of shaft	Carbon steel to BS-970 En-8/ANSI-I045
g)	Impeller/Lobes	Carbon steel to BS-970, EN9 Forged
h)	Accessories Required	Acoustic Enclosures, Suction Filter, Silencer, relief Valve etc
i)	Location	Outdoor
39.	**CHEMICAL STORAGE SPACE (In industrial shed)**	
48.1	**STORAGE AREA OF CHEMICALS**	15 days
48.2	**WEIGHING SCALE**	
a)	Type	Platform & dial type/Electronic Type
b)	Number	One (1)
c)	Capacity	0-500 Kgs
48.3	**ELECTRIC HOIST**	
a)	Type	Electric monorail in chemical dosing area
b)	Number	One (1)
c)	Capacity	1 Ton
48.4	**Safety arrangement**	
a)	**Safety shower and Eye wash fountain**	One (1) number safety shower and two (2) numbers eye wash fountain shall be provided by bidder
b)	**Personal protection**	Two sets of safety equipment each comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall be provided by the bidder.
40.	**OVERHEAD SERVICE WATER (E15)**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	To cater the requirement of chemical preparation for Alum and Lime dosing for 24 hrs and flushing requirement of equipment.
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Rectangular with Flat bottom, Over head on EQMS Room
41.	**FLUSHING PUMPS**	

a)	Number required	Two (1W+1S) nos.
b)	Type	Horizontal Centrifugal type
c)	Location	Outdoor
d)	Fluid to be handled	Service Water
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	10
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	2.5% Ni CI IS:210 GR. FG 260, S-0.1 (max.) P-0.15 (max.)
	• Stuffing box, Gland	2.5% Ni CI IS:210 GR. FG 260
	• Impeller	ASTM A351 CF8M
	• Shaft, Shaft coupling, shaft sleeves	SS 410
	• Column pipe & discharge pipe, shaft enclosing tube	CS as per IS:2062 or eq. (Min. Thickness 8 mm)
	• Gland packing	TIWA
	• Gasket	Neoprene Rubber
	• Bolts & nuts	SS for coming in water contact else CS
	• Base plate and soleplate	CS (min. 10 thick)
42.	**BELT TYPE OIL SKIMMER**	
a)	Type	Portable Belt Type Oil Skimmer
b)	Location	To be used portably in TG Area sumps E1A, E1B, E2A, E2B
c)	Capacity	To Cater the requirements for either above mentioned TG Area sumps
d)	MOC	As per system requirements
43.	**PRE-FILTER BACKWASH WATER SUMP UNIT-1**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	30 m3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	Pre-Filter Backwash Water (DM Waste water) form CPU Unit-1
44.	**PRE FILTER BACKWASH WATER PUMPS UNIT-1**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical sump type (Open Impeller)
c)	Location	Outdoor
d)	Fluid to be handled	Pre-Filter Backwash Water (DM Waste water) form CPU Unit-1
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	12.5
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	ASTM A743 CF3M (SS316L)
	• Discharge /Column Pipe	ASTM A743 CF3M (SS316L)
	• Impeller / Shaft	ASTM A743 CF3M (SS316L)
	• Shaft coupling, shaft	SS 410

	sleeves	
	• Bolts & nuts	SS 316L (wetted)
	• Base plate and soleplate	CS (min. 10mm thick)
45.	**PRE-FILTER BACKWASH WATER SUMP UNIT-2**	
a)	Number required	One (1) nos.
b)	Effective Capacity, m3	30 m3
c)	Material of Construction	RCC (IN BHEL SCOPE)
d)	Type	Underground, Rectangular with Flat bottom
e)	Type of fluid to be handled	Pre-Filter Backwash Water (DM Waste water) form CPU Unit-2
46.	**PRE FILTER BACKWASH WATER PUMPS UNIT-2**	
a)	Number required	Two (1W+1S) nos.
b)	Type	Vertical sump type (Open Impeller)
c)	Location	Outdoor
d)	Fluid to be handled	Pre-Filter Backwash Water (DM Waste water) form CPU Unit-2
e)	Duty	Intermittent
f)	Rated capacity, each m3/ hr.	12.5
g)	Pump Speed, RPM (max.)	1500
h)	Minimum Head to be developed at rated capacity, MLC	As per System Requirements
i)	Material of Construction	
	• Casing	ASTM A743 CF3M (SS316L)
	• Discharge /Column Pipe	ASTM A743 CF3M (SS316L)
	• Impeller / Shaft	ASTM A743 CF3M (SS316L)
	• Shaft coupling, shaft sleeves	SS 410
	• Bolts & nuts	SS 316L (wetted)
	• Base plate and soleplate	CS (min. 10mm thick)
47.	**PIPING**	All the piping shall generally be conforming to the requirements specified in the Chapter titled "General Technical Requirement Of Low Pressure Piping" considering the following aspects as minimum requirement:

Raw water & Clarified water	Carbon Steel: IS: 1239 Part-I (Heavy grade-Black), ASTM-A-53 Type-E Grade B / ASTM A 36 /IS: 3589 - Grade 410; / IS-2062 Gr.-B (for fabricated from plates) / Equivalent
Coagulant (Alum)	CPVC as per ASTM F441 CPVC 4120 Schedule 80
Lime slurry/Solution/ Suspensions	CPVC as per ASTM F441 CPVC 4120 Sch. 80
Sludge	1) GRP as per ASTM D3517/ AWWA C950-88/AWWA M45 2) HDPE as per ASTM D3350 CL 34543C, FM Class 150/ IS:4984 or Equivalent for buried portion 3) Cast Iron Class A as per IS 1536 (for only from Lamella Clarifier/Tube Settler to Sludge Sump)
Chemical Waste from vessels and tanks	1) HDPE as per ASTM D3350 CL 34543C, FM Class 150/ IS: 4984 or Equivalent for buried portion.
Demineralised Water (Pre-Filter Backwash Water)	Stainless Steel: Stainless steel to ASTM A312, Gr. 304 Sch.40s.

48.	**VALVES**	All the valves shall generally be conforming to the requirements specified in the Chapter titled "General Technical Requirement of Low-Pressure Piping" considering the following aspects as minimum requirement:
48.1	Coagulant (Alum) Services	i. Type of Valves <u>For Isolation</u> a) Saunder's Patented Diaphragm Valves b) Ball Valves in CPVC pipes <u>For non-return / Check</u> Swing Check type /Dual Plate type
		ii. Material of Construction Valves <u>Diaphragm Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40; BS: 1452 Gr.220/Equivalent. OR Cast Steel to ASTM. A 216GR. WCB and Body shall be internally lined with Soft Natural rubber, Ebonite or Polypropylene b) Diaphragm shall be shall be of reinforced rubber /Hypalon/ approved equivalent c) Stem, Compressor & Bush shall be Stainless steel Construction Ball Valves in CPVC Pipe lines a) Body, Ball & stem shall be of CPVC b) Seat ring & Packing shall be EPDM / or equivalent <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron to IS: 210 Gr FG 260/ ASTM A 48 Cl.40; BS: 1452 Gr.220 or Eqvt and shall be lined with natural Rubber, PTFE or Viton or Stainless Steel – 316 b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB and shall be coated with PVDF, or suitable elastomer or Stainless Steel – 316 c) Disc facing ring and Body Seat rings shall be Stainless Steel d) Bearing bushes shall be SS – 316 e) Material of construction of spring in dual type valve shall be of INCONEL or better
48.2	Lime slurry/Solution/ Suspensions	i. Type of Valves <u>For Isolation</u> Non-lubricated Plug Valves <u>For non-return / Check</u> Swing Check type /Dual Plate type
		ii. Material of Construction Valves <u>Plug Valves</u> a) Body shall be Cast Iron to IS: 210 Gr FG 260 / ASTM A 48 Cl.40; BS: 1452 Gr.220 or Eqvt b) Plug shall be Stainless steel to AISI 316 c) Body Sleeve & Seat shall be PTFE d) Gland & Gland nut shall be SS 304/316 e) Cover shall be of Cast Steel to ASTM A 216 Gr WCB <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron to IS: 210 Gr FG 260 / ASTM A 48 Cl.40; BS: 1452 Gr.220 or Eqvt and shall be lined

		with natural Rubber, PTFE or Viton or Stainless Steel – 316 b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB and shall be coated with PVDF, or suitable elastomer or Stainless Steel – 316 c) Disc facing ring and Body Seat rings shall be Stainless Steel d) Bearing bushes shall be SS-316 e) Material of construction of spring in dual type valve shall be of INCONEL or better
48.3	Sludge	i. Type of Valves <u>For Isolation</u> Gate or Sluice or Knife edge type Slide Valves <u>For non-return / Check</u> Swing Check type /Dual Plate type
		ii. Material of Construction <u>Gate / Sluice / Knife Edge Slide Valve</u> a) Body,Disc : Cast Iron b) Stem : Stainless Steel AISI 420 d) Packing : PTFE e) Gland & Gland nut : AISI 420 f) Hand wheel : Cast Iron <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door shall be Cast Iron BS:1452 Gr.220 or Eqvt b) Hinge Pin and Door/Disc Pin shall be of Cast steel ASTM A 216 Gr. WCB / High tensile Brass or BS: 2872 equivalent. c) Disc facing ring and Body Seat rings shall be Stainless Steel. d) Bearing bushes shall be Leaded tin Bronze. e) Material of construction of spring in dual type valve shall be of INCONEL or better
48.4	Demineralised Water (Pre-Filter Backwash Water)	i. Type of Valves <u>For Isolation</u> a) Butterfly type <u>For non-return / Check</u> a) Lift Check type/Swing Check /Dual Plate type for sizes upto 40 mm NB b) Swing Check or Dual Plate type valve for sizes 50 mm NB & above
		ii. Material of Construction Valves <u>Butterfly Valves</u> a) Body shall be of Stainless Steel-316 b) Disc shall be of Stainless Steel-316. c) Shaft shall be of Stainless steel to ASTM. A 296 Gr. CF8M/AISI 316/ AISI 420 /BS:970 Gr.316; BS: 970 Gr.420 S45. d) Seat rings shall be Nitrile rubber /Hypalon/Eqvt. <u>Check Valves</u> a) Body & Cover, Hinge Disk/Door -Stainless Steel – 316 b) Hinge Pin and Door/Disc Pin shall be of Stainless Steel – 316 c) Disc facing ring and Body Seat rings shall be Stainless Steel

		d) Bearing bushes shall be SS – 316. e) Material of construction of spring in dual type valve shall be of INCONEL or better
48.5	For normal water (portable/service water) & Waste Water	i. Type of Valves <u>For Isolation</u> a) Butterfly or Saunder's Patented Diaphragm Valves upto 200 mm NB b) Butterfly type for Sizes 250 mm NB & above <u>For non-return / Check</u> a) Lift Check type/Swing Check /Dual Plate type for sizes upto 40 mm NB b) Swing Check or Dual Plate type valve for sizes 50 mm NB & above
		ii. Material of Construction Valves <u>Diaphragm Valves</u> The Diaphragm shall conform to following requirement i) Design standard: BS: 5156 or equivalent of required rating/ class. (Minimum rating of valves shall be PN 10). Type: Flanged and lined body ends, sealed bonnet, weir pattern, tight shut off type. a) Body , Bonnet: Cast iron IS 210 Gr. FG 260 or equivalent or Cast steel ASTM A-216 Gr. WCB b) Body lining : Soft natural rubber, ebonite , Polypropylene c) Hand wheel : Cast Iron d) Compressor : Stainless Steel e) Stem and Bush : Stainless Steel <u>Butterfly Valves</u> Butterfly valves shall be of Lugged-wafer type of low leakage rate confirming to AWWA-C-504 class 150 (min.) or BS:5155 PN 10 (min.) a) Body: ASTM A48, Gr. 40 with 2% Ni / IS: 210. Gr. FG-260, with 2% Ni / SG iron BSEN 1563, Gr EN GJS-400-15 with 2%Ni and epoxy coated. b) Disc: SS 316. c) Shaft: BS 970 431 S: 291 / EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better. d) Seat rings: 18-8 Stainless steel e) Seal: Nitrile rubber, EPDM, Hypalon All the butterfly valves shall be provided with Hand wheel or lever as per the requirements. All the butterfly valves shall be provided with an indicator to show the position of the disc. Flanges shall conform to ANSI B 16.5 Cl.150 (min). <u>Ball Valves</u> a) Type :Full bore b) Rating: PN 10 (min). c) Body: ASTM A216 Gr. WCB d) Ball: ASTM A276 TYPE 316 e) Seat ring: PTFE

		f) Stem: ASTM A276 TYPE 316 g) Seat: Nitrile rubber, PTFE <u>Check Valves</u> Body – Cast iron IS 210 Gr. FG 260 or equivalent Disc/ door –ASTM A351 Gr. CF8 Hinged pin – SS 316 Piston – SS 316
	Other Requirements: 1) Butterfly valves shall conform to design standard latest revision of AWWA C-504/EN 593/equivalent standard of required class/rating. 2) Plug valves shall be designed as per BS: 5353 Cl.150 or equivalent. 3) Valves for alum solution shall be Saunders's patented Diaphragm type designed as per BS: 5156 or approved equivalent standard. 4) Sluice/Gate Valves shall conform to BS: 5150 (BS: 5163 PN 16) PN16, IS:14846 of rating PN 1.0 (min.). Stem, seat ring and wedge facing ring shall be of stainless-steel construction. Other parts shall be as per IS: 14846 /BS:5163). Flanges shall be designed as per ANSI B 16.5 Cl. 150 (min.) to meet with the piping flanges. Valves shall be of outside screw and rising stem type. Gate valves for sizes below 50 NB and below shall conforms to IS:778 Class-2/ANSI B16.34 straight, rising stem; without side screw. 5) Sluice/Isolation gates shall be provided with the following accessories in addition to the standard items: a. Hand wheel b. Manual Gear reduction unit operator for valves 200 NB and above c. Bypass valve for valve of sizes 350 NB and above. d. Draining arrangement wherever required. e. Arrow indicating flow direction. f. Position indicator. g. Sluice/Isolation gates shall be provided with back seating bush to facilitate gland renewal during full open condition. 6) Design standard for Gates shall be IS: 3042 or Equivalent. Material of Construction a. Frame and Door: Cast Iron IS:210 Gr.260 b. Spindles, bolts & nuts: M.S. to IS:2062 c. Face & seat rings: Gun metal (as per IS: 3042). 7) All the parts of gates shall be applied with the coats of heavy duty bitumastic paint. Each of the gates shall be provided with hand wheel and a position indicator. 8) Sluice valve/knife edge type slide valves shall design by IS 14846. Plug valves shall be used for the application of lime slurry/lime solutions conforming to BS: 5353 Class 150 or Equivalent. 9) Valves will be used to start/stop or control flow. Gates will be primarily used for isolation of flow in open channels although these should be capable of throttling the flow too. However, contractor can provide either isolation gates or butterfly valves in various RCC (IN BHEL SCOPE) tanks/pits/sumps such as sludge pit, etc. Sample valves will be used in sample collection lines. Unless otherwise specified all the valves shall be supplied with counter flanges by the Contractor. 10) All valves shall be suitable for service conditions i.e. flow, temperature and pressure under which they are required to operate. All the valves shall be of standard pressure rating of the relevant design standard. Nonstandard pressure rating shall not be accepted. The pressure and temperature rating of the valve shall not be less than the maximum expected pressure and temperature plus 5% additional margin of the system in which valves are proposed to be installed. The pressure rating of individual piping system components such as valves, flanges etc. shall however be not less than that specified.	

SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS – ELECTRICAL

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER

1.1 Scope for supply, and supervision of erection & commissioning of various equipment forming part of electrical system for this package shall be as per Annexure–I [Scope of Work (Electrical)].

1.2 Bidder shall furnish all AC as well as DC loads required for the system at different voltage levels (eg. 415V AC, 240 V AC, 220 V DC etc.) of all types, such as motor feeders, supply feeders in PEM format along with the offer.

2.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

2.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated.

2.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

3.0 LIST OF ENCLOSURES

3.1 Electrical scope between BHEL & vendor (Annexure-I).
3.2 Motor Datasheet
3.3 Quality Plan for motors.
3.4 Load data format (Annexure-II).
3.5 Explanatory note for Cable routing & Cable schedule format.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES: ETP
SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT
PROJECT: 2 X 660 MW TALCHER TPP STAGE-III (EPC)

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	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 BHEL 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 BHEL.
4	Any special type of cable like compensating, co-axial, prefab, MICC, optical fibre etc.	Vendor	BHEL	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
5	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL BHEL	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm galvanized cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
6	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
7	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	BHEL	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
8	Lighting	BHEL	BHEL	
9	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
10	Below grade grounding	BHEL	BHEL	
11	LT Motors with base plate and foundation hardware	Vendor	BHEL	Makes shall be subject to customer/ BHEL approval at contract stage.
12	Any other equipment/ material/ service required for	Vendor	BHEL	

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES: ETP
SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT
PROJECT: 2 X 660 MW TALCHER TPP STAGE-III (EPC)

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
	completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).			

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract without any commercial implications.
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.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.
5. Electrical Equipment & cable tray layout drawings shall be in the scope of bidder.
6. Input cable schedules / Cable interconnection details / Cable block diagram for Control & Screened Control Cables shall be in the scope of bidder.
7. ISMC / ISMB required for support cable tray shall be supplied by ETP Bidder.

TECHNICAL DATASHEET

S.No.	Parameters	Requirement
1	Applicable Standards	1) Three phase induction motors : IS:325, IEC:60034, IS:12615, IS: 15999 2) Single phase AC motors : IS:996, IEC:60034 3) Energy Efficient motors : IS 12615, IEC:60034-30
2	Rated voltage	415V, 3 Phase
3	Frequency (Hz)	50Hz
4	Permissible variations for	
	a) Voltage	+/-10%
	b) Frequency	+3% & -5%
	c) Combined	10% (Sum of absolute values)
	System fault level at rated voltage	50KA for 1 sec
	Short time rating for terminal boxes	50KA for .25 sec
5	Type of motors	Continuous duty squirrel cage induction motor suitable for direct-on-line starting
6	Efficiency class	IE3 Class confirming to IS 12615 or IEC:60034-30
7	Design margin over continous max. demand of the driven equipment (min)	10%
8	Starting requirement	
	a) Minimum permissible voltage as a percentage of rated voltage, at start to bring the driven equipment upto the driven equipment upto rated speed	(a) Below 110KW : Up to 85% of rated voltage (b) From 110 KW & upto 200 KW : Up to 80% of rated voltage
	b) Maxmum locked rotor current	as per IS 12615
	c) Starting duty	Two hot starts in succession, with motor initially at normal running temperature.
	d) the locked rotor withstand time under hot condition at highest voltage limit	a) atleast 2.5 secs. more than starting time(for motors with starting time upto 20 secs. at minimum permissible voltage during starting b)atleast 5 secs. more than starting time(for motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting c) more than starting time by at least 10% of the starting time(For motors with starting time more than 45 secs.at minimum permissible voltage during starting d) Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
	e)The ratio of locked rotor KVA at rated voltage to rated KW	(a) Below 110KW : 11.0 (b) From 110 KW & upto 200 KW : 9.0
9	Torque (percent of full load torque)	1] Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. 2]Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.
10	Noise level (max.)	85dB(A)
11	Vibration shall be limited within the limits	as per IS:12075 / IEC 60034-14
12	Construction Features	
(i)	Enclosure Details	
	a) Degree of protection	i) Indoor motors - IP 55 ii) Outdoor motors - IP 55 (Additional Canopy to be provided)
	b) Method of ventilation	Totally enclosed fan cooled (TEFC) or totally enclosed tube or ventilated (TETV) or Closed air circuit air cooled (CACA) type.
(ii)	Insulation	Class F temperature rise limited to class -B
(iii)	Bearings	Grease lubricated ball or roller bearings for Horizontal motors Grease lubricated ball or roller bearings or combined trust and guide beaing for Vertical motors
(iv)	Winding Type	Electrolytic grade Copper conductor, Non hygroscopic, oil resistant, flame resistant Insulation.
13	Main terminal box	
(i)	Type	-Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation. -Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame. - The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
(ii)	DOP	same as motor
(iii)	Position when veiwed from the non driving end	- Left hand side
(iv)	Rotation	90 Deg.
(v)	Space heater	Motors rated 30KW and above sapce heater required.Separate terminal box for space heaters & RTDs shall be provided.

(vi)	Cable glands and lugs	-Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used. Cable glands shall conform to BS:6121. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable lugs/ferrules shall be solderless crimping type suitable for power and control cables as per the DIN 46239. Aluminium solderless crimping lugs/ ferrules shall be used for Aluminium cables and Copper lugs/ferrules shall be used for Copper cables. Bimetallic washers or bimetallic type lugs shall be used for bimetallic connections.
(vii)	DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS:	
	Motor MCR in KW	**Minimum distance between centre of stud and gland plate in mm**
	a) UP to 3 KW	As per manufacturer's practice.
	b) Above 3 KW - upto 7 KW	85
	c) Above 7 KW - upto 13 KW	115
	d) Above 13 KW - upto 24 KW	167
	e) Above 24 KW - upto 37 KW	196
	f) Above 37 KW - upto 55 KW	249
	g) Above 55 KW - upto 90 KW	277
	h) Above 90 KW - upto 125 KW	331
	i) Above 125 KW-upto 200 KW	203
	j) For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.	
(viii)	**PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:**	
	NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:	
	Motor MCR in KW	**Clearance**
	a) UP to 110 KW	10mm
	b) Above 110 KW and upto 150 KW	12.5mm
	c) Above 150 KW	19mm
14	Earthing points (2 nos. on diagonally opposite sides) suitable for connection	GS Flat- 50 x 6 OR 25 X 6 OR 25 X 3
15	Paint shade	RAL 5012 (Blue)/Light grey finish No. 631 as per IS: 5 (subject to customer approval)
16	**LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED**	
	a) The following type test reports shall be submitted for each type and rating of LT motor of above 100 KW only	
	1. Measurement of resistance of windings of stator and wound rotor.	
	2. No load test at rated voltage to determine input current power and speed	
	3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors)	
	4. Full load test to determine efficiency power factor and slip	
	5. Temperature rise test	
	6. Momentary excess torque test.	
	7. High voltage test	
	8. Test for vibration severity of motor.	
	9. Test for noise levels of motor(Noise level for all the motors shall be limited to 85dB (A) except for BFP motor for which the maximum limit shall be 90 dB(A). Vibration shall be limited within the limits prescribed in IS/IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.)	
	10. Test for degree of protection and	
	11. Overspeed test.	
	12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1	
	b) All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.	
	c) The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet.	

DATA TO BE FURNISHED BY SUCCESSFUL BIDDER AFTER ORDERING

1. GENERAL		
i)	Manufacturer & Country of origin.	
ii)	Equipment driven by motor)	
iii)	Motor type	
iv)	Country of origin	
v)	Quantity	
2. DESIGN AND PERFORMANCE DATA		
i)	Frame size	
ii)	Type of duty	
iii)	Type of enclosure and method of cooling	
vi)	Type of mounting	
vii)	Direction of rotation as viewed from DE END	
viii)	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)	
ix)	(A) Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
	(B) Rating as specified in load list/Maximum continuous load demand of driven equipment	
xi)	Rated speed at rated voltage and frequency	
xii)	At rated Voltage and frequency	
	a) Full load current (Amps)	
	b) No load current (Amps)	
xiii)	Power Factor at	
	a) 100% load	
	b) At duty point	
	c) 75% load	
	d) 50% load	
	e) NO load	
	f) Starting.	
xiv)	Efficiency at rated voltage and frequrecy	
	a) 100% load	
	b) At duty point	
	c) 75% load	
	d) 50% load	
xv)	Starting current (amps) at	
	a. 100 % voltage	
	b. 85% voltage	
	c. 80% voltage	
xvi)	Starting time with minimum permissible voltage	
	a. Without driven equipment coupled	
	b. With driven equipment coupled	
xvii)	Safe stall time with 110% of rated voltage	
	a. From hot condition	
	b. From cold condition	
xviii)	**Torques :**	
	a. Starting torque at min. permissible voltage(kg-mtr.)	
	b. Pull up torque at rated voltage.	
	c. Pull out torque	
	d. Min accelerating torque (kg.m) available	
	e. Rated torque (kg.m)	
xix)	Stator winding resistance per phase (ohms at 20 Deg.C.)	
xx)	GD^2 value of motors	
xxi)	Locked rotor KVA input (at rated voltage)	
xxii)	Locked rotor KVA/KW.	
xxiii)	**Bearings**	
	a. Type	
	b. Manufacturer	
	c. Self Lubricated or forced Lubricated	
	d. Recommended Lubricants	
	e. Guaranteed Life in Hours	
	f. Whether Dial Type thermometer provided	
	g. Oil pressure Gauge/switch	
	i. Range	
	ii. Contact Nos. & ratings	
	iii. Accuracy	
xxiv)	**Vibration**	
	a) Velocity (mm/s)	
	b) Displacement (microns)	
xxv)	Noise level (DB)	
3. CONSTRUCTIONAL FEATURES		
i)	Stator winding insulation	
	a. Class & Type	
	b. Tropicalised (Yes/No)	
	c. Temperature rise over specified max.	

	i. Cold water temperature of 38 DEG. C.	
	ii. Ambient Air 50 DEG. C.	
	d. Method of temperature measurement	
	e. Stator winding connection	
	f. Number of terminals brought out	
ii)	Type of terminal box for	
	a. stator leads	
	b. space heater	
	c. Temperature detectors	
	d. Instrument switch etc.	
iii)	For main terminal box	
	a. Location	
	b. Entry of cables	
	c. Recommended cable size	
	d. Fault level (MVA)	
	e. No. of Eathing Pads	
iv)	Temperature detector for stator winding	
	a Type	
	b. Nos. provided	
	c . Location	
	d. Make	
	e. Resistance value at 0 deg. C. (ohms)	
vi)	Paint shade	
vii)	Weight of(approx)	
	a. Motor stator (KG)	
	b. Motor Rotor (KG)	
	c. Total weight (KG)	
4. LIST OF CURVES		
i)	Torque speed characteristic of the motor	
ii)	Thermal withstand characteristic	
iii)	Starting. current Vs. Time	
iv)	Starting. current Vs speed	
v)	P.F. and Effi. Vs Load	

NOTE :

1. THESE DETAILS ARE IN ADDITION TO THE DETAILS MENTIONED IN SHEET- I & 2 OF DATASHEET. SHEET - 3 & 4 SHOULD BE READ IN CONJUCTION TO SHEET - I & 2
2. DURING CONTRACT STAGE : SUCCESSFUL BIDDER TO STAMP & SIGN SHEET - I & 2 OF DATASHEET, AND APPEND DULY FILLED UP STAMPED & SIGNED SHEET -3 & 4 OF DATASHEET FOR BHEL/CUSTOMER'S APPROVAL.

REFERENCE QUALITY PLAN

Item /equipment : LT INDUCTION MOTORS (50KW TO 200 KW) sub-system :	QP No.: NTPC-RQP 1 Rev. No.:'4' Date:- PAGE : Page 1 of 5	SIGN OF MANUFACTURER MIQ	QP No.: 0000-999-QVE-P-044 Rev. No.: 4 Date :-20-6-12 Valid upto:19-06-15

To be filled in by NTPC

Reviewed by: V SHRIVASTAV, RAJIV GARG, P K BASU

Approved By: अनुमोदित Approved AK GARG

Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum of check M	Quantum of check C/N	Reference Documents	Acceptance Norms	Format of Record	Agency D*	Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	10				11
A. INCOMING INSPECTION: RAW MATERIAL / COMPONENT														
1	COPPER WIRE dual coated enameled round copper wire	1.Dimension	MA	Measurement	1 Sample / lot	1 Sample/lot	MSA-091-02-R0	MSA-091-02R0	Inspn. Record		P	V	--	
		2.Elongation	MA	Mechanical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		3.Mandrel Winding Test	MA	Visual	-do-	-do-	-do-	-do-	-do-		P	V	--	
		4.Peel Test	MA	Test	-do-	-do-	-do-	-do-	-do-		P	V	--	
		5.BD Voltage Test	CR	Electrical	-do-	-do-	-do-	-do-	-do-		P	V	V	
		6.Cut Through Test	MA	Electrical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		7.Heat Shock Test	MA	Test	-do-	-do-	-do-	-do-	-do-		P	V	--	
		8.Resistance	MA	Electrical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		9.Springiness	MA	Mechanical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		10.Abrasion Test	MA	Performance	-do-	-do-	-do-	-do-	-do-		P	V	--	
		11.Continuity Test	MI	Electrical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		12.Tan Delta bending Point test	MA	Thermal	Each supplier once a month	-do-	-do-	-do-	-do-		V	V	V	
2	STEEL SHAFT Straightened steel bar in black finish	1.Dimension – OD	MA	Measurement	1 Sample/lot/heat	-do-	MSA-072-01R0	MSA-072-01R0	Supp. TC	√	V	V	--	
		2.Hardness	MA	Measurement	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	--	
		3.Chemical comp.	MI	Chemical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	V	
		4.Tensile strength	MA	Mechanical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	V	
		5.Yield strength	MA	Mechanical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	--	
		6.% Elongation	MA	Mechanical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	--	
		7.Ultrasonic test	MA	Mechanical	100%	-do-	-do-	-do-	-do-	√	V	V	V	
		8.Metallographic test	MA	Chemical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	V	
		9 Normalizing	MA	Mechanical	100%	-do-	-do-	-do-	-do-	√	V	V	V	
3	AL INGOTS EC GRADE PURITY 99.5%	Chem. Comp.	MA		1 Sample/Lot	--	IS4026:1992	IS4026:1992	Supp. TC		V	--	--	

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AS APPROPRIATE CHP: NTPC SHALL BE INDICATED IN COLUMN 'N' AS 'W'

Note:# *NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of Inspection*

REFERENCE QUALITY PLAN

Item /equipment : LT INDUCTION MOTORS (50KW TO 200 KW)	QP No.: NTPC-RQP 1 Rev. No.:'4' Date:- PAGE : Page 2 of 5	SIGN OF MANUFACTURER MiQ	QP No.: 0000-999-QVE-P-044 Rev. No.: 4 Date :-20-6-12 Valid upto:19-06-15
sub-system :			

NTPC

To be filled in by NTPC

Reviewed by: V SHRIVASTAV, RAJIV GARG, P K BASU

Approved By: A.K.GARG

Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum of check M	Quantum of check C/N	Reference Documents	Acceptance Norms	Format of Record	Agency D*	Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	10				11
A. INCOMING INSPECTION: RAW MATERIAL / COMPONENT														
4	CI CASTING (Body, End Shields, T.Box, Bearing Covers)	1.Surface defects	MA	Visual	100%	100%	MSA-02-01	No defect	Inspn. Rec		P	V	--	
		2.Dimn. Conformity	MA	Measurement	1 Sample / heat	--	Comp. Drg.	Comp. Drg.	-do-		P	--	--	
		3.Hardness	MA	Mechanical	1 Sample / lot	1 Sample / lot	IS 210:1993	IS 210:1993	Supp. TC		V	V	--	
		4.Tensile strength	MA	Verification	-do-	-do-	-do-	-do-	-do-		V	V	--	
		5.Chemical comp.	MA	Verification	-do-	-do-	-do-	-do-	-do-		V	V	--	
5	ALUMINUM FAN	1.Dimension	MA	Measurement	1Sample/size/lot	--	Fan Drg.	Fan Drg.	Inspn Rec.		P	--	--	
		2.Protective paint	MA	Visual	-do-	--	-do-	-do-	-do-		P	--	--	
6	VARNISH & THINNER	1.Viscosity	MA	Ford cup	1 Sample/ lot	--	MFGR's	MFGR's	Inspn. Rec.		v	--	--	
		2.Shelf life	MA	Verification	-do-	--	Catalogue	Catalogue	Label		v	--	--	
7	Bearing	ID / OD / WIDTH	MA	Measurement	1 Sample / lot	--	MFGR's Catalogue	MFGR's Catalogue	Inspn. Rec.	√	V	--	--	Surveillance verification By NTPC
8	BRAZING ALLOYS	Chemical comp.	MA	Chemical	1 Sample / lot	--	MSA-203-01R0	MSA-203-01R0	-do-		V	--	--	
9	TERMINAL BLOCK (DMC)	1.Dimension	MA	Measurement	1 Sample / lot	--	As per drg	As per drg	Supp. TC		P	--	--	
		2.Chem. Comp.	MA	Chemical	-do-	1 Sample / lot	-do-	-do-	-do-		V	--	--	
		3.Comparative Tracking Index	MA	Electrical	-do-	--	MSA-086-01	MSA-086-01			V	V	--	
10	PAINT	Viscosity at 32 Deg C	MA	Measurement	-do-		MFGR's Catalogue	MFGR's Catalogue	Inspn. Record		P	--	--	
11	SPACE HEATER	1.IR value & HV	MA	Electrical	100%	1sample/Rating/lot	MSA-023-01R0	MSA-023-02R0	Inspn Report		P	--	-	
		2.Resistance	MA	-do-	100%	-do-	-do-	-do-	-do-		P	--	-	
12	STAMPINGS	1.Thickness	MA	Measurement	1 Sample / lot	-do-	Stamping.drg.	Comp. drg.	Supp.TC		V	V	V	
		2.Waviness	MA	Visual	-do-	-do-	MSA-060-01R0	MSA-060-01R0	-do-		V	V	V	
		3.Burr height	MA	Measurement	-do-	-do-	-do-	<50 micron.	-do-		V	V	V	
		4.Coating Thickness	MA	Mechanical	-do-	-do-	-do-	MSA-060-01	-do-		V	V	V	
		5.Permeability	MA	Electrical	-do-	-do-	-do-	-do-	-do-		V	V	V	
		6.Specific core loss	MA	Electrical	-do-	-do-	-do-	-do-	-do-		V	V	V	
		7.IR	MA	Electrical	-do-	-do-	-do-	-do-	-do-		V	V	V-	

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Format No.: QS-01-QA1-P-10/F1-r1

Engg. Div./QA&I

REFERENCE QUALITY PLAN

Item /equipment : LT INDUCTION MOTORS (50KW TO 200 KW)	QP No.: NTPC-RQP 1 Rev. No.:'4' Date:- PAGE : Page 3 of 5	SIGN OF MANUFACTURER MiQ
sub-system :		

NTPC

QP No.: 0000-999-QVE-P-044 Rev. No.: 4 Date :-20-6-12	To be filled in by NTPC	
Valid upto:19-06-15	Reviewed by: V SHRIVASTAV RAJIV GARG P K BASU	Approved By: AK GARG

Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum of check M	Quantum of check C/N	Reference Documents	Acceptance Norms	Format of Record	Agency D*	Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	10				11
13	STATOR CORE PACK	1.Dimn. Conformity (core length. & Dia.)	MA	Measurement	1 Sample / lot	--	MSA-060-02R0	MSA-060-02R0	Inspn. Report		P	--	--	
		2.Alignment of slot	MA	Visual	-do-	--	-do-	-do-	-do-		P	--	--	
		3.Deburring and cleanliness	MA	Visual	-do-	--	-do-	-do-	-do-		P	--	--	
14	SLOT INSULATION (Class 'F')	1.Tensile Strength	MA	Mechanical	1 Sample/lot	--	MSA-088-09R0	MSA-088-09R0	Supp.TC		V	--	--	
		2.Elongation at break	MA	-do-	-do-	--	-do-	-do-	-do-		V	--	--	
		3.BDV as recd. & after ageing	CR	Electrical	-do-	1 Sample / lot	-do-	-do-	-do-		V	V	--	
		4.IR Value	MA	Electrical	-do-	--	-do-	-do-	-do-		V	--	--	
15	VARNISH FG SLEEVE (Class 'F')	1.Dimn. - Bore dia Thickness	MA	Measurement	1 Sample/lot	--	MSA-088-07R0	MSA-088-07R0	Supp.TC		P	--	--	
		2.BDV as recd. &after ageing	CR	Electrical	-do-		-do-	-do-	-do-		P	--	--	
		3.IRValue	MA	-do-	-do-		-do-	-do-	-do-		P	--	--	
		4. Glass content conformity	MA	Chemical	1 Sample/lot	--	MSA-088-07R0	MSA-088-07R0	Supp. TC		V	--	--	
		5. Varnish compatibility	MA	Chemical	-do-	--	-do-	-do-	-do-		V	--	--	
		6. Bending before and after aging	MA	Mechanical	-do-	--	-do-	-do-	-do-		V	--	--	
		7. Voltage proof test in air at room temp & at 150C	MA	Electrical	-do-	--	-do-	-do-	-do-		V	--	--	
		8. Stability of coating	MA	Chemical	-do-	--	-do-	-do-	-do-		V	--	--	
		9. Self extinguishing	MA	Chemical	-do-	--	-do-	-do-	-do-		V	--	--	
16	GASKET	1.Shore hardness	MA	Mechanical	1 Sample/lot	--	MSA 162-01R0	MSA 162-01R0	Inspn Record		P	--	--	
		2.Ageing test	MA	Thermal	-do-	--	-do-	-do-	Supp.TC		V	--	--	
		3.Flame test	MA	Chemical	-do-	1 Sample / lot	-do-	-do-	-do-		V	V	V	
		4.Neoprene conformity	MA	Chemical	-do-	-do-	-do-	-do-	-do-		V	V	V	
		5.Dimn.	MA	Mechanical	1 Sample /lot	--	Gasket Drg	Gasket Drg	Inspn Record		P	--	--	

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Format No.: QS-01-QAI-P-10/F1-r1

Engg. Div./QA&I

REFERENCE QUALITY PLAN

Item /equipment : LT INDUCTION MOTORS (50KW TO 200 KW)	QP No.: NTPC-RQP 1 Rev. No.:'4' Date:- PAGE : Page 4 of 5	SIGN OF MANUFACTURER MiQ	To be filled in by NTPC: QP No.: 0000-999-QVE-P-044 Rev. No.: 4 Date :-20-6-12 Valid upto:19-06-15
sub-system :			Reviewed by: V SHRIVASTAV RAJIV GARG P K BASU
			Approved By: AK GARG

Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum Of check M	Quantum Of check C/N	Reference Documents	Acceptance Norms	Format of Record	Agency D*	Agency M	Agency C	Agency N	Remarks
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B	IN PROCESS INSPN. :													
1	MACHINED CASTINGS (BODY, END SHIELDS, T.BOX, BEARING Covers	1.Dimn.	CR	Measurement	100%		Comp.Drg.	Comp.Drg.	Inspn Record		P	--	--	No blow -holes on machined surface of castings & no welding on casting permitted
		2.Concentricity/ Perpendicularity of machined surface	MA	Mechanical	10%		-do-	-do-	-do-		P	--	--	
		3.Blow holes	MA	Visual	100%	--	No blow hole	No blowhole	-do-		P	--	--	
		4 .Pressure testing [4] (For Flameproof Motors only)	MA	Mechanical	100%	100%	MSA-02-02R0	MSA-02-02R0	Inspn Record		P	V	V	
2	COIL FORMING	1. Conductor dia	MA	Measurement	100%	--	Winding MO.	Winding MO.	-do-		P	--	--	
		2. No. of turns	MA	Visual	100%		-do-	-do-	-do-		P			
3	WOUND STATOR	1.Resistance	MA	Electrical	100%	--	-do-	-do-	-do-		P	--	--	
		2.HV Test	MA	-do-	-do-	--	-do-	-do-	-do-		P	--	--	
		3.Interturn (Surge Test)	MA	-do-	-do-	--	-do-	-do-	-do-		P	--	--	
		4.Polarity	MA	-do-	-do-	--	-do-	-do-	-do-		P	--	--	
		5. Impregnation : VPI	MA	Mechanical	100%	1/RATING/LOT	SP05	SP05	Inspn. Record		P	V	V	
		6.Workmanship (joints, Slot Wedges, tightness & connections)	MA	Visual	100%	--	-do-	-do-	-do-		P	--	--	
4	MACHINED SHAFT	1.Dimn.Conformity	CR	Mechanical	100%	--	Shaft Drg.	Shaft Drg.	Inspn. Record		P		--	
		2.Concentricity of Shaft	MA	-do-	-do-	--	-do-	-do-	-do-		P	--	--	
		3.M/cing finish, radius, chamfer	MA	Visual	-do-	--	-do-	-do-	-do-		P	--	--	
5	DIE CAST ROTOR	1. Core length	MA	Measurement	100%	--	M.O.	M.O.	Inspn. Record		P		--	
		2.Free from blow-holes, cracks	MA	Visual	100%	--	-do-	-do-	-do-		P	--	--	
6	MACHINED ROTOR	1.Dimn. - OD	CR	Measurement	100%	1 Sample / lot	-do-	-do-	Inspn. Record		P	--	--	
		2.Concentricity w.r.t. Bearing seat	MA	Mechanical	10%	-do-	-do-	-do-	-do-		P	--	--	
7	ROTOR	Dynamic balancing of Rotors at rated speed . [4]	MA	Mechanical	100%	100 %	A18 R0 & TS A16 R1	ISO: 1940 Grade- G 2.5	Inspn. Record	√	P	V	V	
8	FAN	Fan Balancing	MA	Mechanical	100%	100%	TS-A19-R0	ISO: 1940 Grade -G2.5	Inspn.Record	√	P	V	V	
9	ASSEMBLED MOTOR	Name Plate data, T. box location,	MA	Visual	100%	1 Sample / lot	TS: A20R5	TS: A20 R5	Inspn. Record		P	V	V	
		Flame path joint Gap for Flame proof motors [4]	MA	Mechanical	100%	100%	IS2148	IS2148	Inspn. Record		P	V	V	

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REFERENCE QUALITY PLAN

Item /equipment : LT INDUCTION MOTORS (50KW TO 200 KW) sub-system :	QP No.: NTPC-RQP 1 Rev. No.:'4' Date:- PAGE : Page 5 of 5	SIGN OF MANUFACTURER MiQ	QP No.: 0000-999-QVE-P-044 Rev. No.: 4 Date :-20-6-12 Valid upto:19-06-15

To be filled in by NTPC

Reviewed by: V SHRIVASTAV, RAJIV GARG, P K BASU

Approved By: AK GARG

Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum of check M	Quantum of check C/N	Reference Documents	Acceptance Norms	Format of Record	Agency D*	Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	10				11
		VERIFICATION OF TYPE TEST CLEARANCE FROM NTPC ENGG												
C.	FINAL INSPECTION:	1. Marking on the Name Plate	MA	Visual	100%	100%	IS:325/ NTPC Specn/	IS:325/ NTPC Specn/	TC	√	P	W	W	
	ROUTINE TEST	2. a) Paint Shade	MA	Mechanical	-do-	-do-	Appd D/S,&Drg	Appd D/S,&Drg	TC	√	P	W	W	
		b) Paint Thickness (On casting surface)	MA	Mechanical	1 sample /Lot	1 sample /Lot	-do-	Min 100 microns	TC	√	P	W	W	
		c) Scratch Test	MA	Mechanical	-do-	-do-	-do-	No Peel-off						
		3.Location of T.Box.	MA	Visual	100%	100%	Appd D/S	Appd D/S	TC	√	P	W	W	
		4.IR test before & after HV on Main wdg. & Sp.Heater.	MA	Electrical	-do-	-do-	IS-325	IS-325	TC	√	P	W	W	
		5.HV on Main Wdg. & Space Heaters	MA	-do-	-do-	-do-	-do-	-do-	TC	√	P	W	W	
		6.Measurement of Wdg. Res.	MA	-do-	-do-	-do-	-do-	CGL-TS-35	TC	√	P	W	W	
		7.No Load Test	MA	-do-	-do-	-do-	-do-	Appd D/S,&Drg	TC	√	P	W	W	
		8.Locked Rotor Test at reduced voltage	MA	-do-	-do-	-do-	-do-	CGL-TS-35	TC	√	P	W	W	
		9.Reduced voltage running in both directions (1/^3 Un)	MA	-do-	-do-	-do-	-do-	IS325	TC	√	P	W	W	
		10.Overspeed test (120% of rated speed) for 2 min.	MA	Mechanical	-do-	-do-	-do-	-do-	TC	√	P	W	W	
		11. Vibration Test at rated speed & voltage	MA	Mechanical	-do-	-do-	IS12075	IS12075	TC	√	P	W	W	
		12.Degree of Protection By insertion of 1 mm thick wire	MA	Mechanical	-do-	-do-	-do-	IS:325/IS:4029	TC	√	P	W	W	
		13.Mounting & overall dimension	MA	Measurement	-do-	1Sample/rating/Lot	-do-	As per D/S & Drg	TC	√	P	W	W	
D.	DISPATCH INSPECT-IONS	Case Marking.	MA	Visual	100%	--	Manufacturing Order	Manufacturing Order	Manufacturing Order		P	--	--	

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Format No.: QS-01-QAI-P-10/F1-r1 Engg. Div./QA&I

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

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

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

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

भेल BHEL	LOAD DATA (ELECTRICAL)	JOB NO.	497	ORIGINATING AGENCY	PEM (ELECTRICAL)
		PROJECT TITLE	2x660 MW, NTPC Talcher	NAME	DATA FILLED UP ON
		SYSTEM / S	ETP	SIGN.	DATA ENTERED ON
		DEPTT. / SECTION		SHEET 1 OF 1 REV. 00	DE'S SIGN. & DATE

CABLE SCHEDULE FORMAT **ANNEXURE III**

UNITCABLENO	FROM	TO	PURPOSE	CABLE SCOPE (BHEL PEM/ VENDOR)	REMARKS	CABLESIZE	PATHCABLENO	TENTATIVE CABLE LENGTH

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
    a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
    b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
    f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
    g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
|	|	|	|
Cable Voltage Code (see B below)	No. of cores (e.g. 01,03,3H, 07)	Cable code (See C below)	Cable size (e.g. 035,185,2.5, 0.5)

(A) SYSTEM VOLTAGE CODES:
(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V
(dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) CABLE VOLTAGE CODES:
A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

B = 6.6KV (Power cables)
C = 3.3KV (Power cables)
D = 1.1KV (LV & DC system power & control cables)
E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

A = Armoured FRLS	B = Armoured Non-FRLS
C = unarmoured FRLS	D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS	F = Armoured Non-FRLS
G = unarmoured FRLS	H = Unarmoured Non-FRLS

XLPE Copper

J = Armoured FRLS	K = Armoured Non-FRLS
L = unarmoured FRLS	M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS	P = Armoured Non-FRLS
Q = unarmoured FRLS	R = Unarmoured Non-FRLS

S = FIRE SURVIVAL CABLES
T = TOUGH RUBBER SHEATH
U = OVERALL SCREENED
V = PAIRED OVERALL SCREENED (G-Type)
W = PAIRED INDIVIDUAL SCREENED (F-type)
Y = COMPENSATING CABLES
I = PRE-FABRICATED CABLES
Z = JELLY FILLED CABLES

6. Once a cable list has been given to PEM for routing, any subsequent changes required in the cable list (which may be in the form of addition of cables, deletion of cables, change of type or size of cable, etc.) must be informed as specific changes (as a separate file MS Excel of the same format as the original file) to the cable list given earlier if the cable list has been routed and cable schedule generated. The routing status of the cable list shall be got confirmed from PEM by the agency that has prepared the cable list before the changes are intimated. In case PEM confirms that the cable list in question has not been taken up for routing, and the revised cable list is acceptable, the same may be sent. Since cable routing through the program involves adding each cable list to the project cable schedule database, the original cable schedule shall not be furnished to PEM with revisions incorporated within.

SECTION – IC

SPECIFIC TECHNICAL REQUIREMENTS – C&I

	GENERAL TECHNICAL REQUIREMENT
C&I TECHNICAL REQUIREMENT	
1	Control of Effluent treatment plant shall be through DCS located in Control Room. DCS in BHEL scope.
2	Complete Field Intrumentation for monitoring and operation of Effluent treatment plant shall be provided by Vendor.
3	The quantity of instruments for the system shall be as per tender P &ID wherever provided of the respective system as a minimum, for bidding purpose.
4	Temperature transmitter shall be provided for all temperature measurement applications. All temperature transmitters shall be suitably grouped together and mounted inside racks in case of covered areas like Turbine Area, Generator Area etc. on as required basis. In case grouping is not possible and temperature transmitter is to be installed individually, canopy with suitable mounting arrangement shall be provided.
5	All the transmitters supplied by Bidder shall be rack mounted. The transmitter racks shall be in Bidder's scope of supply. All conventional transmitters shall be HART compatible.
6	Diaphragm seal shall be provided with Instruments having contact with corrosive media.
7	Redundancy of sensors shall be provided by bidder (i) Triple redundancy for all analog and binary inputs required for protection of system/drives. (ii) For all other control functions dual redundancy of the sensors shall be provided by the bidder.
8	The solenoid operated valves/Dampers/Gate shall have a limit switch for open/close feedback.
9	230 V AC UPS Power supply shall be provided by BHEL at a single point, All necessary hardware for deriving other power supply from given feeder shall be in Vendor's scope. Bidder to furnish electrical load/UPS load data during detailed engineering.
10	Root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold, junction boxes and all other accessories required for erection of local / remote instruments shall be provided by Vendor. Double root valve to be provided where the design pressure is or more than 40kg/cm2.
11	The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes.
12	All instruments other than profibus type shall be terminated on JB/LCP in field. Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 12-15 mtrs) and trunk cable.
13	All the outdoor field instruments such as analysers/transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/panel/rack so that the equipment are protected against rain/ sunlight etc.
14	Painting color scheme for impulse piping for water area/equipment shall be Grey RAL 9002. Identification Tag/band color scheme shall be Sea green, ISC no. 217
15	All electric actuators, pneumatic control valves, Junction Boxes, Solenoid boxes and Local control panels which are not installed inside building, suitable canopy shall be provided and design of canopy shall be approved by Employer during detailed engineering.
16	All weather Local Panel fitted with integral Air Conditioner shall be provided for housing analyzers etc
17	Bidder to provide Comprehensive Annual Maintenance Services (AMS) for three (03) years after warranty period for analysers and profibus instruments of ETP.
18	For all Profibus devices GSD and DTM files are to be provided for configuration/ testing in the DCS for proper interfacing and diagnostics.
19	**REQUIREMENTS SPECIFIC TO LOCAL CONTROL PANEL**

19.1	The panel shall be provided with rear doors with integral lockable handle. The door when locked shall be held at minimum three places. The doors shall be provided with suitable stiffeners to prevent buckling. The door shall be removable type with concealed hinges to facilitate maintenance work. Suitable pocket inside the door shall be provided for keeping the drawings / documents. Double door shall be provided with suitable glass windows, as per the requirement.
19.2	All operable and indicating devices shall be mounted on the front of the panel while aux. Relays, terminal, PVC trough, MCBs etc. required shall be mounted on a mounting plate inside the panel. The devices shall be located in such a way so as to ensure easy access for operation / maintenance. maintenance
20	**TYPE TEST GENERAL REQUIREMENT**
20.1	Submission of type test results and certificate shall be acceptable provided:
20.2	The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment.
20.3	There has been no change in the components from the offered equipment & tested equipment.
20.4	The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening.
20.5	In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the Bidder/ sub-vendor within the quoted price and no extra cost will be payable by the Employer on this account.
20.6	The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.
20.7	For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording, precautions to be taken etc. for the tests to be carried out.
22	**ANNUAL MAINTAINENCE SERVICE (AMS) FOR ANALYSERS**
22.1	SERVICES FOR ANALYSER INSTRUMENTS DURING DEFECT LIABILITY PERIOD
22.1.1	The Contractor shall provide an unlimited warranty on all equipments during the Defect liability period.This warranty shall include repair, replacement, replenishment of consumables (for e.g. reagents, calibration gases etc. as applicable) and correction of identified discrepancies including Analysers, Sample Handling System, Transmitters, (as applicable) etc. at no cost to Employer.
22.1.2	The Contractor shall provide warranty spares including components for each system based on (and keeping adequate over margin) normally experienced failure rate. Exhaustive list of all such items shall be submitted along with Datasheet for Employer's review and approval during details Engg stage regarding adequacy of the same. The warranty spares as per the list mentioned above will be dispatched by the Contractor along with the main equipment consignment. However, for items which have a limited shelf life shall be dispatched in a phased manner during the warranty period. Unused spares/consumables shall be Contractor's property after expiry of warranty period and shall be taken back.
22.2	SERVICES FOR ANALYSER INSTRUMENTS DURING ANNUAL MAINTENANCE SERVICE (AMS) PERIOD
22.2.1	The Contractor shall provide complete maintenance services for each System under comprehensive Annual Maintenance Service (AMS) for period of three years after the Warranty period
22.2.2	The AMS shall cover total maintenance of all Analysers, Sample Handling System, Transmitters etc. coming under the scope of each system and shall include free repair/replacement of each items, replenishment of consumables, correction of problems (if any) and supply of expendable items.
22.2.3	Further, Contractor may note that during the AMS he will be allowed to use Employer's mandatory spares, but has to replenish the same within three months' time or before completion of AMS period whichever is earlier.
22.2.4	The Contractor shall prepare detailed list of faults corrected and parts, expendables utilized during AMS period and shall furnish the same to Employer, properly documented at the end of AMS period. Further, during AMS period the details as required by Employer/ Project Manager shall be made available by Contractor's personnel.
22.2.5	Contractor shall also provide a list of all required AMS spares which shall be finalized along with datasheet during detail Engineering stage. These spares will be dispatched by the Contractor at the beginning of AMS on yearly requirement basis. However, for items which have a limited shelf life shall be dispatched in a phased manner during the AMS period. Unused spare/consumable shall be Contractor's property after expiry of AMS period and shall be taken back.

22.3	DEPUTATION OF ENGINEER/ TECHNICAL EXPERT FOR ANALYSER INSTRUMENTS
22.3.1	Contractor shall depute Technical Experts of the OAM/OEM/OES/ (Original Analyser Manufacturer/Original Equipment Manufacturer/Original Equipment supplier) for each of the above system at Site, who will be fully qualified to perform the required duties, supervision of maintenance, repair etc. for a period of six month. Employer will intimate the contractor two weeks advance notice for start of deputation period.
22.3.2	After expiry of above six month period, Technical expert for each system shall visit site on monthly basis for monitoring the performance and rectify the problem (if any) for each system for the remaining warranty period and during entire AMS period. In the event of any malfunction/fault/failure in the system or any component thereof contractor shall depute Technical expert of respective system to reach site within 48hrs of call raised by site during the remaining warranty period and entire AMS period.
23	**ANNUAL MAINTAINENCE SERVICE (AMS) FOR PROFIBUS INSTRUMENTS**
23.1	The requirements specified below are applicable for warranty (defect liability period) and 3 years AMS period.
23.2	The Contractor's scope shall also include providing Post Warranty Maintenance for 3 years after completion of warranty period of the offered wireless systems and all associated components as per specification. The AMS shall include tools and tackle as required; travel, boarding & lodging of service engineer. In the event of any malfunction of the system hardware/system software, experienced service engineer shall be made available at site within 48 hours on the receipt of such information from Employer.
23.3	**The services under Post Warranty Maintenance Agreement, shall broadly comprise of the following:**
23.3.1	Periodic Maintenance Site visits, minimum four (4) times in a year (total days expected 16 in a year), schedule of visits to be discussed and finalized jointly between Contractor and client after placement of order/ delivery. It shall include inspection of general healthiness of the system, study and advice on daily maintenance, inspection of Hardware & Software, if any problem is reported, running of test programs, on-line servicing and solving reported problems. System shall be checked online.
23.3.2	Software Maintenance/ Support Contractor shall maintain the existing operating & application software for any debugging requirements to have consistent performance of the system.
23.3.3	Emergency Service In the event of any malfunction of the wireless system hardware/system software during this period, Service Engineer must report at site within 48 hrs. of report of failure. The system must be brought back within 48 hours after reporting at site.
23.3.4	Contractor shall note that while carrying out the Annual Maintenance Contract activities, Employer's engineers shall associate with the Contractor. On-job training of these associated engineers shall be covered under this scope. This shall include all items being supplied by Contractor, including any bought out items but not limited to the following: Labour, at no additional cost, to repair any system devices , to provide tests, and adjustment to system devices.
24	**REQUIREMENTS SPECIFIC TO VARIABLE FREQUENCY DRIVE (VFD)**
24.1	The VFD operation shall have no inherent detrimental impact on the Motors/ cables & supply system.
24.2	The panels shall be designed to provide easy access to hardware, to facilitate replacement of cards in case of any failure.
24.3	All the VFDs for particular application shall be of same design so as to ensure 100 % interchangeability of components.
24.4	Fiber optic cable connection shall be provided preferably to ensure high network reliability.
24.5	VFD shall provide stable operation of motor from high-voltage dv/dt stress, regardless of cable length to motor. The vendor shall clearly state the limitations in the motor cable distance in his proposal. However, due to system requirements & constraints if the cable length becomes critical, filters/ chokes etc. shall be provided by the VFD manufacturers as an integral part of the VFD to mitigate the reflected wave effect of harmonics.

TECHNICAL DATA - PART - A

SL.NO	DESCRIPTION	UOM	DETAIL
1.0	**DESIGN CODES & STANDARDS**		
1.1	Impulse pipes, tubes (material, rating)		ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70
1.2	Valves (material, pr. Class, size)		ASTM A182/ASTM A105 as per ASME 16.34
1.3	Fittings (size, rating, material)		ANSI B31.1, ANSI B31.1a, ASME B16.11
1.4	Installation schemes		BS 6739-2009, ANSI/ISA 77.70
1.5	Actuator		EN15714-2
1.6	Fieldbus concepts		IEC 61158
1.7	Instruments and apparatus for pressure measurement		ASME PTC19.2
1.8	Electonic transmitters		BS-6447, IEC-60770
1.9	Bourdon tube pressure and vacuum gauges		IS-3624
1.10	Automatic null balancing electrical measuring instruments		ANSI C 39.4 (Rev. 1973): IS:9319
1.11	Safety requirements for electrical and electronic measuring and controling instrument		ANSI C 39.5
1.12	Code of practice for phosphating of iron and steel.		IS-6005
1.13	Colors for ready mixed paints and enamels.		IS-5
1.14	Direct Acting Indicating Analog Elec Measuring Instruments.		IS-1248
1.15	Low Voltage switchgear & control gear: Part-I (General Rules)		IS/IEC 60947:Part 1
1.16	Circuit breaker for household and similar installations.		IS-8828
1.17	Low Voltage switchgear & control gear : Part-I (General Rules)		IS-13947 (Part-I)
1.18	Annunciator Sequences and Specification		ISA-18.1
1.19	Purged & Pressurised Enclosure for Electrical Equipment in Hazardous Locations		NFPA-496
1.20	Standard digital interface for programmable instrumentation		IEEE-488.2 -1990
1.21	Instrument and apparatus for temperature measurement		ASME PTC 19.3(1974)
1.22	Temperature measurement by electrical Resistance thermometers		IS:2806
1.23	RTD Sensor		IEC-751/ DIN-43760
1.24	Type of Enclosures		NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13)
1.25	Racks, panels and associated equipment		EIA : RS - 310 C- 1983 (ANSI C83.9 - 1972)
1.26	Protection class for enclosures, cabinets, control panels & desks		IS:2147 -1962
1.27	Standard for Silt Density Index (SDI) Analyser		ASTM D4189-07

1.28	**Codes for Orifice plate Design**		
	Orifice plate		ISO 5167
	Flange Standard for Orifice plate		ASME B16.36
1.29	**Codes for Control Valve Design**		
	Control Valve Sizing		ISA S-75
	Pressure / Temperature Rating		ANSI-B16.34
	Seat Leakage		ANSI/FCI 70.2
	Noise		IEC 60534-4
	Face to face dimensions of control valves		ANSI B 16.00
	End Connection: Butt Weld		ANSI B16.25
	End Connection: Socket Weld		ANSI B16.11
	End Connection: Flanged End		ANSI B16.5
	End To End Tolerance		ANSI B16.10
	ISA Hand Book of Control Valves		(ISBN : B: 1047-087664-234-2)
	Codes for pressure piping		ANSI B 31.1
	Control Valve leak class		ISA RP 39.6
1.30	**Codes for VFD Design**		
	DC reactor		IEC:60289
	Bushing		IS: 2099, IEC 60137
	Adjustable Speed Electrical Power Drive Systems		IEC 61800
	Semiconductor converters–General requirements		IEC 60146
	IEEE Recommended practices and requirements for harmonic control in electrical power systems		IEEE 519
	Degrees of protection provided by enclosures (IP Code)		IEC 60529
	Electrostatic immunity test		IEC1000-4-2
	Fast transient immunity test		IEC1000-4-4
	Surge immunity test		IEC1000-4-5
	AC electricity meters		IS: 722
	Metal oxide surge arrestor without gap for AC system		IEC: 60099-4
	Terminal blocks for copper conductors		IEC: 60947-7-1
	Motor		IS:15999, IEC-60034, IEC60034 / NEMA 30 & 31
	Contactor/Switches/Fuses etc.		IEC:60947, IS: 13947
	Harmonics & EM compatibility		IEEE:519/IEC: 61000
	VFD		IEC: 60034/ IEC: 61800
2.0	**DESIGN /SYSTEM PARAMETERS**		
2.1	**DATASHEET - PRESSURE TRANSMITTER, DIFFERENTIAL PRESSURE TRANSMITTER, DP BASED FLOW AND LEVEL TRANSMITTER**		
	Output		Profibus PA complying to IEC 61158, digital output
	Turndown ratio		50:1
	Accuracy	%	0.06%
	Stability (% of calibrated range)	%	+/-0.25% for 10 year
	Diaphragm seal material		Suitable for process fluid
	Diagram fill fluid		Inert liquid
	Wetted parts		All wetted parts upto diaphragm seal shall be suitable for chemical application
	Housing		Metallic housing with durable corrosion resistant coating

	Protection		Weather proof IP-67
	Display		Integral digital display
	Diagonstic feature		Required
	Electrical connection		1/2" NPT (f)
	Manifold		2/3 valve non integral manifold for PT and 5 valve non integral manifold for DPT
2.2	**DATASHEET - PRESSURE GAUGE, DIFFERENTIAL PRESSURE GAUGE**		
	Sensing element		Bourdon for high pressure, diaphragm/bellow for low pressure
	Sensing element material		SS316
	Movement material		SS316
	Body material		SS316
	Dial size	mm	150mm
	End connection	inch	1/2 inch NPT (m)
	Accuracy		±1% of span
	Scale		Linear, 270° arc graduated in metric units
	Range selection	%	Cover 125% of max. of scale
	Diaphragm seal material		Suitable for process fluid
	Diaphragm fill fluid		Inert liquid
	Wetted parts		All wetted parts upto diaphragm seal shall be suitable for chemical application
	Housing		IP-55
	Zero/span adjustment		External
	Accessories		Blow out disc, siphon, snubber, pulsation, dampener, chemical seal, gauge isolation valve
2.3	**DATASHEET - ULTRASONIC LEVEL TRANSMITTER**		
	Transmitter type		Non contact microprocessor based 2 wire type loop powered, HART protocol compatible
	Output signal	mA	4-20 mA DC (analog signal) alongwith superimposed digital signal based on HART protocol
	Accuracy	%	±0.5% of calibrated span or minimum 5mm
	Power supply	V	24V DC +/- 10%
	Temperature compensation		To be provided within transducer
	Housing material		Metallic housing with durable corrosion resistance coating
	Protection		Weather proof as per IP-65
	Sensor material		Corrosion resistant material to suit individual application requirement
	False signal tolerance		Transmitter shall be capable of ignoring false echoes from internal tank/sumped obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry.
	Display		Integral digital display
	Diagnostics		Loss of echo alarm etc.
	Electrical connection		Plug and socket
	Certification		SIL2 certification required
2.4	**DATASHEET - LEVEL GAUGE**		
	Sensing element and material		Tempered toughened borosilicate gauge glass steel armoured reflex or transparent type, bicolour type

	End connection		Process connection as per ASME ptc , 3/4" and drain/vent 15 NB
	Accuracy	%	± 2%
	Diaphragm seal material, fill fluid		Suitable for process fluid
	Diaphragm fill fluid		Inert liquid suitable for application
	Wetted parts		All wetted parts upto diaphragm seal shall be suitable for chemical application
	Accessories		Gasket for all KEL-F shield for transparent type vent and drain valves of steel/SS as per CS /Alloy process requirement.
	Length of Guage glass		Length of gauge glass shall not be more than 1400 mm. If the vessel is higher, multiple gauge glasses with 50 mm overlapping shall be provided.
2.5	**DATASHEET - TEMPERATURE TRANSMITTER**		
	Transmitter Type		Profibus PA complying to IEC 61158 with EMC compatibility as per EN 61326, Dual input (Trip/Protection), Single Input (other application)
	Compatibility		fully compatible with RTDs
	Protection Class		IP-67
	Display		Integral digital display
	Diagonstic feature		self-indicating diagnostics
	Operating ambient temperature (with display)	DegC	70 deg C
	Operating ambient temperature (without display)	DegC	85 deg C
	Electrical Connection	inch	1/2” NPT(F)
	Composite Accuracy	%	RTD =<0.25% of 0-250 deg C span
	Changeover facility		Bump less changeover to second sensor in case first sensor fails with alarm facility.
	Composite accuracy Calculation		Accuracies of temperature transmitter for converting sensor input to output + temperature effect on these accuracies at ambient temperature of 50 deg C (based on the figure/ formula given in the standard product catalogue for span as specified for RTD).
	Emergency/failure Measures		In case of failure (open or burn-out) of RTD, transmitter shall provide low temperature output.
2.6	**DATASHEET - RESISTANCE TEMPERATURE DETECTOR (RTD)**		
	Type		Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).
	No. of element		Duplex
	Housing		Diecast Aluminium
	Protection Class		IP-65
	Head		Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter
	Plug in connectors		Required
	Terminal head		Spring loaded for positive contacts with the thermo well
	Insulation and sheathing		Mineral (magnesium oxide) insulation and SS316 sheath

	Calibration and accuracy		As per IEC-751/ DIN-43760 Class-A for RTD
	Accessories		Thermo well and associated fittings
2.7	**DATASHEET - THERMOWELL**		
	Design		One piece solid bored type of step-less tapered design
	Material		SS316
2.8	**DATASHEET - PH ANALYSER**		
	Type		Cell flow through sample
	Measuring Range	pH	0-14 units of pH
	Temperature Compensation		Automatic
	Accuracy	%	<= +/-1 %
	Output signals	mA	Analog 4-20 mA DC galvanically isolated
	Zero & span Adjustment		To be provided with range selection facility
	Ambient Temp	DegC	50 degC
	Sample Temperature	DegC	40 degC
	Indication		Digital Alphanumeric Display of reading in engineering units
	Type of Electronics		Microprocessor based with self-diagnostic
	Tubing and cabling		Required between sensor and analyzer / analyzer panel etc.
	Enclosure		IP66
	Accessories		Required for mounting the sensor/analyser
	Digital Signal Transmission		Each analyser shall have a provision for bidirectional soft connectivity over Modbus/RS232/RS485 with employer's central cloud server in addition to 4-20mA connectivity to DDCMIS.
	Compliance to standards		Latest regulatory requirements of CPCB/SPCB/other regulatory/statutory body prevailing at the time of award of the contract.
	Power	V	230V AC
2.8	**DATASHEET - CONDUCTIVITY ANALYSER**		
	Type		Continuous flow through type
	Measuring Range	µS/cm	0 – 60000 µS/cm for sea water application 0-5000 µS/cm for other application
	Response Time	second	<= 5 sec (90% of full scale)
	Temperature Compensation		Automatic
	Power	V	230V AC
	Accuracy	%	<= +/-1 %
	Output signals		Analog 4-20 mA DC galvanically isolated
	Zero & span Adjustment		To be provided with range selection facility
	Ambient Temp	DegC	50 degC
	Sample Temperature	DegC	40 degC
	Indication		Digital Alphanumeric Display of reading in engineering units
	Type of Electronics		Microprocessor based with self-diagnostic
	Tubing and cabling		All interconnection between sensor and analyzer / analyzer panel etc to be provided
	Accessories		Required for mounting the sensor/analyser

	Digital Signal Transmission		Each analyser shall have a provision for bidirectional soft connectivity over Modbus/RS232/RS485 with employer's central cloud server in addition to 4-20mA connectivity to DDCMIS.
	Compliance to standards		Latest regulatory requirements of CPCB/SPCB/other regulatory/statutory body prevailing at the time of award of the contract.
2.9	**DATASHEET - CHEMICAL OXYGEN DEMAND (COD)/ BIOLOGICAL OXYGEN DEMAND (BOD) ANALYSER**		
	Output signals	mA	Analog 4-20 mA DC galvanically isolated
	Principle (COD/BOD measurement)		Option A. Total Organic Carbon (TOC) measurement complying to US EPA 415.1 / 415.2 or equivalent standard for effluent/sewage/waste water.
			Option B. UV-VIS spectrometer measuring absorption in UV-VIS spectrum.
	Measuring Range	mg/L	0-50 mg/L for BOD, 0-500 mg/L for COD
	Response Time	min	<= 15 min
	Power	V	230V AC
	Cleaning		Self-cleaning (Automatic)
	Accuracy	%	+/- 3%
	Zero & span Adjustment		To be provided with range selection facility
	Ambient Temp	DegC	50 degC
	Sample Temperature	DegC	40 degC
	Indication		Digital Alphanumeric Display of reading in engineering units
	Type of Electronics		Microprocessor based with self-diagnostic
	Tubing and cabling		All interconnection between sensor and analyzer / analyzer panel etc to be provided
	Accessories		Required for mounting the sensor/analyser
	Digital Signal Transmission		Each analyser shall have a provision for bidirectional soft connectivity over Modbus/RS232/RS485 with employer's central cloud server in addition to 4-20mA connectivity to DDCMIS.
	Compliance to standards		Latest regulatory requirements of CPCB/SPCB/other regulatory/statutory body prevailing at the time of award of the contract.
2.10	**DATASHEET - OIL IN WATER ANALYSER**		
	Output signals	mA	Analog 4-20 mA DC galvanically isolated
	Principle		UV Fluorescence
	Measuring Range	mg/l	0 to 30 mg/l
	Response Time	second	<= 60 sec
	Power		230V AC
	Cleaning		Self-cleaning (Automatic)
	Accuracy	%	+/- 5 % of full scale
	Zero & span Adjustment		To be provided with range selection facility
	Ambient Temp	DegC	50 degC
	Sample Temperature	DegC	40 degC
	Indication		Digital Alphanumeric Display of reading in engineering units
	Type of Electronics		Microprocessor based with self-diagnostic

	Tubing and cabling		All interconnection between sensor and analyzer / analyzer panel etc to be provided
	Accessories		Required for mounting the sensor/analyser
	Digital Signal Transmission		Each analyser shall have a provision for bidirectional soft connectivity over Modbus/RS232/RS485 with employer's central cloud server in addition to 4-20mA connectivity to DDCMIS.
	Compliance to standards		Latest regulatory requirements of CPCB/SPCB/other regulatory/statutory body prevailing at the time of award of the contract.
2.11	**DATASHEET - TOTAL SUSPENDED SOLIDS (TSS) ANALYSER**		
	Output signals	mA	Analog 4-20 mA DC galvanically isolated
	Principle		Light reflection principle
	Measuring Range	mg/l	0-500 mg/l
	Response Time	minute	<= 5 min
	Power	V	230V AC
	Cleaning		Self-cleaning (Automatic)
	Accuracy	%	+/- 5%
	Zero & span Adjustment		To be provided with range selection facility
	Ambient Temp	DegC	50 degC
	Sample Temperature	DegC	40 degC
	Indication		Digital Alphanumeric Display of reading in engineering units
	Type of Electronics		Microprocessor based with self-diagnostic
	Tubing and cabling		All interconnection between sensor and analyzer / analyzer panel etc to be provided
	Accessories		Required for mounting the sensor/analyser
	Digital Signal Transmission		Each analyser shall have a provision for bidirectional soft connectivity over Modbus/RS232/RS485 with employer's central cloud server in addition to 4-20mA connectivity to DDCMIS.
	Compliance to standards		Latest regulatory requirements of CPCB/SPCB/other regulatory/statutory body prevailing at the time of award of the contract.
2.12	**ENCLOSURES /CABINETS / PANELS FOR ANALYSERS**		
	Sheet Material of enclosure/cabinet/panel	mm	Steel plate (SS304) with minimum 2 mm thick
	Frame material & thickness	mm	3 mm thick channel frame of SS304
	Protection Class		IP-65 or better
	Lighting provision		Required
	Design		finalized during detailed engineering
	Type		Free Standing Type
	Canopy		ends of the rack.
2.13	**DATASHEET - SILICA ANALYSER**		
	Type		Continuous Colorimetric Type
	Accuracy	%	≤ ± 5% of reading
	Response Time (90 % of Full Scale)	minute	≤ 15 min. (including sample switching)
	Range	ppb	0-50, 0-100 ,0-500 ppb freely programma ble

	No. of Streams		Single channel
2.14	**DATASHEET - ONLINE ORP MONITOR / ANALYSER**		
2.14.1	**ORP Sensor**		
	Type		Cell -flow through
	Accuracy	mv	< ± 1mv
	Range	mv	-1400mv to +1400mv
	Electrode		Platinum
2.14.2	**Monitor / Analyzer Specification**		
	Type of electronics		Microprocessor based
	Zero & span Adjustment		To be provided
	Ambient temp.	DegC	50 DegC
	Display		LCD
	Enclosure Type / Material		Weather and Dust proof (IP 65)
	Output signals Analog	mA	4-20 mA DC
	Error / fault Diagnostic		To be provided.
	Power supply	V	230V AC
	Load	Ohms	500 Ohms minimum
	Mounting		All weather Local Panel fitted with integral Air Conditioner are to be provided by the Contractor
2.15	**DATASHEET - ORIFICE PLATE**		
	Material		SS316
	Thickness		3 mm for main pipe diameter up to 300 mm and 6 mm for main pipe dia above 300 mm.
	Tappings		Minimum 2 Pairs of Tappings, Flanged weld neck or D & D/2
	Beta Ratio		0.34 to 0.7
	Root Valves		To be provided in all the tappings
2.16	**DATASHEET - SOLENOID VALVE**		
	Type		2/3/4 way SS 316/Forged Brass (depending on the application subject to Employer's approval during detailed Engg.)
	Power supply		24 V DC + 10%.
	Electrical connection		Plug and socket
	Insulation		Class 'H'
	IP Class		IP65
	Limit switches (for open/close feedback)		Required
2.17	**DATASHEET - LIMIT SWITCH**		
	Type		Inductive proximity type
	Mounting arrangement		Inside the enclosure
	Operating voltage Range	V	10-40 V DC
	Sensing system		Inductive Proximity type , 2 Wire
	Sensor Contact Type		NO

	Reverse polarity and short circuit protection		Yes
	IP Class-Sensor		IP67
	IP Class-Enclosure(Switch box)		IP67
	Cable entry-Enclosure(Switch box)		2 no-1/2" NPT
	Casing material-Sensor		Brass /SS
	Enclosure(Switch box) Housing material		FRP or SS
	Operating Ambient temp(sensors)	DegC	-5 to 70 deg C
	Max allowed Voltage Drop across sensor	V	5 V
	Standard applicable		EN 60947-5-2 or equivalent.
	Applicable for		Manual valves and solenoid operated on-off valves
2.18	**DATASHEET - CHLORINE ANALYSER**		
	Accuracy	%	± 5 % or ±0.03 mg/L (ppm) as CL2, whichever is greater
	Cycle Time		2.5 minutes
	Power Supply	V	230V AC
	Display		LCD
	Enclosure Construction		IP62
	Accessories		Mounting Bracket (CS/ MS) U bolts, nuts, screws, Washers
2.19	**DATASHEET - TURBIDITY ANALYSER**		
	Type		Light reflection principle
	Accuracy	%	≤ 2% for range 0-50 NTU, ≤ 5% for range 50 – 200 NTU
	Range	MTU	0 – 100, 0- 200 MTU, programmable
	Response Time (90 % of Full Scale)	min	≤ 5 min.
2.20	**DATASHEET - SILT DENSITY INDEX (SDI) ANALYSER**		
	Power supply		230V AC
	Output		4-20mA
2.21	**DATASHEET - CONTROL VALVE**		
	The Control valve, Actuator and the accessories operating conditions		Continuous operation under an ambient temperature : 0-60°C, Relative Humidity : 0-95%.
2.21.1	**Valve Selection Criteria**		
	Valve Opening at maximum flow conditions		not greater than 80% of total Valve stem travel
	Valve Opening at minimum flow conditions		not less than 10% of total Valve stem travel
	Stem travel range from minimum flow to maximum flow		not less than 50% of total Valve stem travel
	Flow capability		at least 120% of maximum flow
	Trim requirement for cavitation / flashing service		Anticavitation Trim/ Hardened Trim
	Bonnet joints type		Flanged and Bolted type
	Body Material		Carbon steel ASTM-A216 Gr. WCB
	Trim material		316SS stellited with stellited faced guide posts and bushings.

	Plug Type		Plug shall be of one-piece construction cast, forged or machined from solid bar stock, BALANCED type
	Plug connection with stem		Plug shall be screwed and pinned to valve stems or shall be integral with the valve stems.
	Control Valve Guide type		High lift cage guided plugs
	Trim type		Quick-change
	Noise limitation		noise shall be limited to 85 dBA at 1 meter from valve surafce under actual operating condition.
	Noise abatement method		The noise abatement shall be achieved by valve body and trim design and not by use of silencers
	Flow action for vacuum application		Above the Seat
	End connection		Butt weld end (BWE)
	Leakage class		Class IV
	Packing material / Number / Type		Grafoil / Single / Standard
	Valve outlet velocity		< 7 m/sec (WATER)
	Valve actuators		Valve actuators and stems shall be adequate to handle the unbalanced forces occurring under the specified flow conditions or the maximum differential pressure specified. An adequate allowance for stem force, at least 0.15 Kg/sq.cm. per linear millimeter of seating surface, shall be provided in the selection of the actuator to ensure tight seating.
	Travel time		less than 10 seconds.
	Control Valve accessory devices		Air locks, hand wheels/hand-jacks, limit switches, microprocessor based electronic Positioner, diffusers, external volume chambers, position transmitters (capacitance or resistance type only), reversible pilot for Positioner, tubing and air sets, solenoid valves and junction boxes etc.
2.21.2	**Specifications for Microprocessor based Electronic Positioner**		
	Type		Pneumatic with smart positioner (profibus)
	Protection class.		IP-65 Minimum
	EMC & CE Compliance		EN50081-2 & EN50082 or equivalent.
	Smart positioner & position limit switch		Required
	Position transmitter & E/P converter		Part of smart positioner
	Air filter regulator & air lock relay		Required
	Junction box		Required
	Hand wheel (side mounted) & local positioner indicator		Required
2.21.3	**Accessories**		
	In-built Operator Panel		Display with push buttons for configuration and display on the positioner itself (Password protected/Hardware lock).
	Hand Held Calibrator		Profibus compatible calibrator
2.22	**DATASHEET - MOTORISED VALVE ACTUATOR**		
2.22.1	**General**		

	Duty		☐ On / Off ☐ Inching
	Valve type		☐ Globe ☐ Gate ☐ Reg. Globe ☐ Butterfly
	Ambient condition		Shall be suitable for continuous operation under an ambient temp. Of 0-60 deg c and relative humidity of 0-95%
2.22.2	**Construction and sizing**		
	Construction		Totally enclosed weather proof, minimum IP:68
	Mechanical position indicator		To be provided for 0-100% travel
	Bearings		Double shielded, grease lubricated anti-friction.
	Gear train for limit switch/torque switch operation		Metal (not fibre gears). Self-locking to prevent drift under torque switch spring pressure when motor is de-energized.
	Sizing		Open/close at rated speed against designed differential pressure at 90% of rated voltage. For isolating service three successive open-close operations or 15 mins. Whichever is higher. **For inching service - 150 starts/hr or required cycles whichever is higher.**
2.22.3	**Handwheel**		
	Required		■ Yes ☐ No
	Orientation		☐ Top Mounted ☐ Side Mounted
	Additional requirement		To disengage automatically during motor operation.
2.22.4	**Electric actuator**		
	Motor type		Squirrel cage induction motor suitable for Direct On-Line (DOL) Starting
	Power supply to motor / starter		415V +/- 10%, 3 Ph, 3W & 50Hz +/- 5%
	Control voltage requirement		To be derived from the Power Supply to the Starter ☐ 230 V ■ 110 V AC / 24 V DC
	Enclosure class of motor		IP 68
	Insulation class		Class F. Temperature Rise 70 Deg C. Over 50 Deg C Ambient
	Winding temp protection		Thermostat (3 Nos.,1 In Each Phase)
	Single phasing protection & wrong phase sequence protection		Required, suitable means shall be provided to diagnose the type of fault locally.
2.22.5	**Integral starter**		
	Integral starter		Required with built in SPP (Single Phasing Preventer)
	Type of switching device		■ Contactors ☐ Thyristors
	Type		Non-Intrusive Profibus Actuator
	Feature		All actuator settings including torque, limit shall be possible without opening the actuator cover.
	If smart		
	A) Serial link protocol		☐ Foundation Field-Bus ■ Profibus DP
	B) Redunadant profibus DP port		Required
	C) Hand held programmer		Required
	D) Profibus DP cable connection		Suitable connector integral to the actuator, or external devices/ accessories (mounted inside minimum IP65 protection class enclosure) shall be provided so that the actuator can be isolated online from the profibus network without disturbing the profibus communication of other actuators of the segment.
	E) Open/Close command termination logic		Shall be suitably built inside actuator
	F) GSD and DTM files		To be provided which shall be configured/ tested with DCS for proper interfacing and diagnostics
	G) Available signals to DCS (through profibus network)		Open/ close commands, open/ close feedback status, disturbance signal etc. along with diagnostics. The detailed diagnostics including the actuator operating data shall be available to the DCS

	Step down cont. Transformer		Required
	Open / close PB		Required
	Stop PB		Required
	Indicating lamps		Required
	Local remote s/s		Required (Lockable)
	Status contacts for monitoring		Required
2.22.6	**Position/ torque transmitter**		
	Position/torque transmitter		i. Position/limit measurement shall be done using absolute encoders which will give information of position/limit in both the directions.
			ii. Electronic measurement of torque shall be provided.
	Supply		24V DC
	Accuracy		+ 1% FS
2.22.7	**Space heater**		
	Space heater		Required
	Power supply (non integral)		230V AC,1 Ph.,50 Hz
	Power supply (integral)		Power supply derived from main power supply available at actuator end
2.22.8	**Terminal block**		
	Actuator/motor terminal block		Required. For power cables, the grade of TBs shall be minimum 650V
	Terminals / connectors		Suitable terminals/ connectors, integral to actuator, for terminating fieldbus cables and power cables shall be provided
	Earthing terminal		Required (2nos.)
2.22.9	**Cable glands**		
	Type		Double Compression
	Material		Brass Material
	Armored fieldbus cable glands		Required
	Power cable glands		Required
2.22.10	**Wiring**		Suitable voltage grade copper wire
2.22.11	**LCD Display**		
	LCD Indication		Integral to actuator body
	Local display information		Regarding actuator alarms, status and valve position indications as a minimum.
2.22.12	**Motor considerations**		
	Power Supply		shall operate satisfactorily under the +/- 10% supply voltage variation at rated frequency, -6% to +4% variation in frequency at rated supply voltage, simultaneous variation in voltage & frequency the sum of absolute percentage not exceeding 10%.
2.22.13	**SIL certification**		SIL2
2.22.14	**Accessories**		
	Accessories for calibration / settings / configuration of various parameters of actuator		Required
2.23	**LOCAL INSTRUMENT ENCLOSURE AND LOCAL INSTRUMENT RACK**		
	Scope		LIE and LIR complete with all fittings, mountings & accessories, drains and utility lighting, cable & grounding cable etc.
	Construction		
	Rack	mm	1.6mm sheet plate
	Frame	mm	3mm thick channel frame of steel
	Free standing type		Yes
	Canopy		Yes, >=3mm thick steel, extended beyond the ends of the rack.
	Degree of Protection		IP-55 for LIE & JB of LIE/LIR

	Junction Box		Applicable
2.24	**JUNCTION BOX**		
	No. of ways		12/24/36/48/64/72/96/128
	Material and Thickness		4mm thick Fiberglass Reinforced Polyester(FRP)
	Type of terminal blocks		Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm2. A M6 earthing stud shall be provided.
	Protection Class		IP- 55 min. for indoor & IP-65 min for outdoor applications.
	Grounding		To be provided
	Color		RAL 7035
	Spare Terminals		At least 20% unused terminals
2.25	**DATASHEET - LOCAL CONTROL PANEL**		
2.25.1	**Construction**		
	Type		Skid mounted
	Construction		Folded
	Devices & equipments		Panel enclosure, secondary instruments, annuniciation system, selector switch, push buttons, indicating lamps/ led cluster, relays, MCBs, clamp on terminals, plug socket, panel light, space heater, nameplate, earth bus
	Enclosure sheet material		Cold rolled sheet steel
	Enclosure sheet thickness		Minimum 3.0 mm for load bearing sections (mounted with instruments)
			2.0 mm for doors
			Minimum 2.0 mm for other sections
	Height		Minimum 1100 mm
	Frame thickness		Minimum 3.0 mm
	Internal plate thickness		2.5 mm
	Gland plate thickness		3.0 mm
	Cable gland		Double compression
	Base channel		ISMC 100 with anti-vibration mounting & foundation bolts
	Class of protection		IP-55
2.25.2	**Power & control supply**		
	Input power supply		415V 3 phase AC
	No. Of feeders		Two
	Control supply		230v ac
	Additonal requirement for control supply		MCBs
			Supervisory relay along with a pilot lamp to indicate control supply 'on'
			Auto changeover unit mounted on panel
2.25.3	**Internal wiring**		
	Voltage	V	1100 V
	Material & size		PVC insulated copper multi strand wire /flexible of 1.5mm2, power cable 2.5sqmm

	Routing and runs		Through PVC troughs, AC & DC wires shall be kept separately
	Colour		Separate colours for AC & DC wires
	Ferruling		Cross ferruling
2.25.4	**Painting details***		
	Painting shade & thickness - exterior / interior (these details shall be finalised during detailed engineering)		RAL 5012 & minimum 85 microns / glossy white & minimum 70 microns
2.25.5	**Gasket**		
	At door & removable cover		Neoprene
2.25.6	**Ventilation system along with louvers**		
	Cooling fan		2 x 100%, covered with removable wire mesh
2.25.7	**Terminal block**		
	Type		Clip on, separate for AC & DC circuits
	Voltage		1100 V
	Tb points		Cage clamp
	Mounting height from finished floor		>=250 mm
	Spare		20%
	Identification strip		To be provided
2.25.8	**Illumination**		
	Light		Led tubelight
	Shrouded cover	W	15W minimum
	Operating power supply		240V 50 Hz AC
	Operable through		Panel door switch
	Power receptacle		15 Amp, 3-pin
2.25.9	**eathing studs**		
	Termination to main station earth		Internally with 10 mm bolts at extreme ends for connection
2.25.10	**Alarm annunciator system**		
	No. Of windows	Nos.	Minimum 20
	Facia		Solid state discrete
	Hooter		10W
	Annunciator spare (with electronics)		10% spare window or minimum 2nos. Whichever is more
	Lamp test provision		Required
2.26	**DATASHEET - VARIABLE FREQUENCY DRIVE (VFD)**		
2.26.1	**OPERATING CONDITIONS**		
	Ambient Temperature		50 Deg
	Relative Humidity		95% at 40DegC
	Rated frequency		50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.
	Voltage level for the VFD output to be fed to motor (Upto 400 kW)		415V/690V, Low Voltage, Three Phase AC (LV VFD)
2.26.2	**SYSTEM DESCRIPTION**		
	Type of drive		3-Phase Diode / Thyristor / Multi Stage IGBT / IGCT / SGCT/ IEGT
	Type of Cooling of VFD		Naturally air cooled/forced air cooled/Liquid cooled

	Converter Type		Full wave diode rectifier/active front end type
	Inverter Type		Thyristor/IGBT/IGCT/SGCT/IEGT
2.26.3	**GENERAL REQUIREMENTS**		
	Design		Modern proven design in power plant/industry
	415 V/690 V LV VFD		Current Source Inverter (CSI) or Voltage Source Inverter (VSI) type with minimum Twelve (12) pulse design / 6 pulse with active front end harmonic filter.
			For drives less than 100 KW Six (6) pulse
2.26.4	**TECHNICAL AND OPERATIONAL REQUIREMENTS**		
	System Design		shall be designed to deliver the motor input current and torque for the complete speed torque characteristics of the driven equipment, with worst input supply voltage and frequency variation.
			shall be suitable for the load characteristics and the operational duty of the driven equipment
	Overload capacity of the controller :		
	- for constant torque applications		150% of the rated current for one minute
	- for variable torque applications at rated voltage		110% of rated current for one minute
	- If the motor load exceeds the limit		Automatically reduction of the frequency and voltage to the motor to guard against overload.
	Operating modes		Variable torque changing as a function of speed / Constant torque over a specific speed range / Constant power over a specific speed range / Any other
	Total harmonic voltage and current distortion limits		shall comply to IEEE 519 & IEC 61000
	Withstanding power		capable of thermal, dynamic stresses and transient mechanical torque, resulting from short circuit
	Damage control		Any damage resulting from short circuit or internal fault shall be limited to the component concerned.
	Allowable speed variation		within range 10-110% or as per the requirement of driven equipment with speed set accuracy of +1% of rated maximum speed and steady state regulation of +0.5% of rated speed as per system requirement
	Power Factor for LV VFD		0.95 (minimum)
	Maximum allowable audible noise		85 dB (A) at a distance of one meter under rated loaded with all cooling fan operating conditions.
	Circuit components protection		Suitably protected against over voltages, surges, lightning etc
	Programmed warning and fault protection function		Display a message in complete English words or Standard English abbreviations
	Drive's fault history		At least 30 time tagged fault messages to be stored
	AC environment for VFDs (>=100KW)		Required
	AC environment for VFDs (<100KW)		Not required
2.26.5	**VFD COMPATIBILITY WITH THE MOTOR**		
	Inherent output harmonic resonance		shall not be present in operating speed range
2.26.6	**BYPASS ARRANGEMENT (Optional)**		
	Bypass mode		operation of Motor with VFD bypassed
	Bypass mode operation		During starting (under rated conditions) the motor will be switched on in VFD Mode to limit the starting current and after gaining speed, the load would be switched over to bypass mode.

	Comprehensive motor protection scheme for protection and control		Shall be decided during detailed engineering
2.26.7	**STANDBY VFD ARRANGEMENT (Optional)**		
	Common standby arrangement with auto/manual switchover		Required
	Changeover module		Complete protection, interlocks & control required
2.26.8	**EFFICIENCY**		
	Efficiency		minimum 98%
	Efficiency evaluation parameters		Input transformer, harmonic filters and power factor correction (if applicable), VFD converters, cooling fans and output filter, as applicable in the system. Auxiliary controls : VFD control boards, cooling fans/pumps
	Valid test report		Required
2.26.9	**COOLING SYSTEM**		
	Type		Air cooled Design
	Air-flow pressure switches		Required for monitoring purpose
	Temperature detectors		Required for monitoring purpose
	Cooling fans		integral to the VFD/ enclosure, If the fan fails, the system must generate the alarm/trip for the fan failure
2.26.10	**MOTOR**		
	Type		Three (3) phase squirrel cage inverter duty Induction motor with VPI insulation (Resin poor) suitable for VFD
	Bearings		Insulated bearing on at least one side for motor frame size above 250 frame
	Power Supply Requirement		Solid state power supply consisting of an adjustable frequency inverter for speed control
			Motor shall be suitable for the current waveforms produced by the power supply including the harmonics generated by the drive.
	Motor Insulation design		To accept the applied voltage waveform, within the Vpeak and dv/dt limits as per IEC-61800
2.26.11	**OUTPUT FILTER (AS APPLICABLE):**		
	Output/ dv/dt filter		Required for protection of motor from high voltage dv/dt stress.
			Shall be included within the VFD enclosure
2.26.12	**DC LINK CAPACITOR (AS APPLICABLE):**		
	Type		self-healing film or electrolytic type having high life time
	Discharge resistors		Required, shall be capable of reducing the residual charges to zero just after the capacitor is disconnected from the supply source.
	Suitable for high ripple currents		Yes
2.26.13	**AC/DC Reactor (As applicable)**		
	Type		Dry type, air cored, self cooled, indoor type. Suitable for withstanding earth fault continuously
	Insulation		Thermal Class 155(F), temperature rise is limited to thermal class 130 (B)
	Noise level		shall not exceed value specified in NEMA TR-1
2.26.14	**VFD PANEL REQUIREMENTS**		
	Enclosure frames		Required
	Load bearing members		Required
	Cable entry		bottom of the panel with a removable bolted un-drilled gland plate.
	Protection (as per IS/IEC 60947)		IP: 4X or better for LV VFD
	Enclosure Design Criteria		shall avoid harmonic and inductive heating effects and to shield any outside equipment from interference, to eliminate any radio frequency interference
	Protection against electromagnetic emissions		To be provided
	Illuminating lamp		Required

	Space heater with switch fuse		Required
	Variable setting thermostat.		Required
	Ventilation using air filters and fans/pumps		Required, to ensure that maximum temperature inside the cubicle is within permissible limits for reliable and continuous operation of the system.
2.26.15	**LT & HT CABLES**		Required, suitable for VFD system
2.26.16	**CONTROL AND PERFORMANCE REQUIREMENTS**		
	Automatic current limiting feature		Required, to control motor currents during startup and provide a “soft start” torque profile for the motor load combination
	Current and torque limit adjustments		Required
	Drive Speed control		Local or Remote mode
	Local / Remote selection provision		from VFD panel
	Parameter Monitoring		- Input and output voltage of Drive - Input and output current of Drive - Motor speed - Input and output power frequency of Drive - Torque - Output kWhr of Drive - Ambient temperature - Run/stop and local/remote status displayed
	Operator console panel features		front mounted
			backlit alphanumeric display
			a keypad with keys for parameterization and adjusting parameter
			facility / port to connect external hardware
			Upload and download of all parameter settings from one drive to another drive for start up and operation
			User-friendly licensed software for operation and fault diagnostic
	Operator Control Panel (on the front panel door)		Start / stop (in local/remote mode)
			Speed control (Raise / lower)
			Acknowledge/Accept/ Test Push Button for annunciation
			Auto / Manual / Test Mode select
			Emergency stop
			Trip-Remote Breaker
2.26.17	**DIAGNOSTIC FEATURES**		microprocessor/PLC based digital diagnostic system which monitors its own control functions and displays faults and operating conditions
			information regarding failure of any of the system including shut down of the system shall be available.
			It shall be possible to retrieve the record of events prior to tripping of the system or de-energization.
			Auxiliary supply to the system components or to the electronics (firmware) for the diagnostics / display shall be taken care of by the manufacturer for this purpose.
2.26.18	**SERVICEABILITY / MAINTAINABILITY**		
	Power Component Accessibility		All power components in the converter sections shall be designed for rack-out accessibility for ease of maintenance and to minimize repair downtime
	Marking / Labeling		Sleeve type wire marker tags or other acceptable means of permanent identification shall be applied to power and control wiring. Individual labels shall be provided for all major components of the VFD system
3.0	**INSPECTION/TESTING**		
3.1	Type Test requirement		Yes

	Item-1		Electronic Transmitters
	Test & Standard -1		As per Standard, BS-6447 / IEC-60770
	Item-2		Control Valve
	Test & Standard -2		CV Test, ISA 75.02 & 75.11
	Item-3		Orifice Plate
	Test & Standard -3		Calibration, ISO 5167
	Test to be specifically conducted		No
	NTPC’s approval required. on Test certificate		Yes

CONTROL VALVE ACTUATORS AND ACCESSORIES.

TESTS / ITEMS	MAKE,MODEL, TAG (R)	DIMENSION®	SURFACE FINISH®	HEAT TREATMENT®	MATERIAL TEST CERTIFICATES®	IBR CERTIFICATES®	HYDRAULIC TEST , SEAT LEAKAGE ®	UT/RADIOGRAPHY FOR >900 LB RATING®	MPI/DP®	PRESSURE RESISTANCE®	TIMING OPEN/CLOSE®	LINEARITY/HYSTERISIS®	FUNCTIONAL TEST, REVIEW FOR MAKE AND TC OF ACCESSORIES®
CONTROL VALVE AND ACTUATOR													
OVERALL	Y	Y	Y			Y	Y				Y	Y	Y
BODY		Y	Y	Y	Y			Y	Y	Y			
BONNET		Y	Y	Y	Y								
TRIM		Y			Y			Y*					
PNEUMATIC ACTUATOR	Y	Y								Y			
ELECTRO PNEUMATIC POSITIONER	Y												Y

R- ROUTINE TEST A - ACCEPTANCE TEST Y - TEST APPLICABLE

Y* - UT ON SPINDLE DIA >= 40 MM.

NOTE : 1) THIS IS AN INDICATIVE LIST OF TESTS/CHECKS. THE MANUFACTURE IS TO FURNISH A DETAILED QUALITY PLAN INDICATING HIS PRACTICE & PROCEDURE ALONG WITH RELEVANT SUPPORTING DOCUMENTS DURING QP FINALISATION FOR ALL ITEM.

ELECTRICAL ACTUATOR WITH INTEGRAL STARTER

Test/Attributes Characteristics ITEM/ COPONENT/ SUB SYSTEM ASSEMBLY/ TESTING	RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position indicator ®	EPT output ®	Local/ Remote (Open-Stop-Close) Operation®	Safety check (Single phasing, Phase correction, Tripping etc.) (A)
ELECTRICAL ACTUATOR with Integral Starter , Non-Intrusive Electrical Actuator (EN15714-2)													
Motor	Y	Y	Y	Y	Y								
Final Testing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the practices and procedure adopted along with relevant supporting documents.

- SIL 2 certificate if applicable

® - Routine Test (A) - Acceptance Test Y - Test applicable

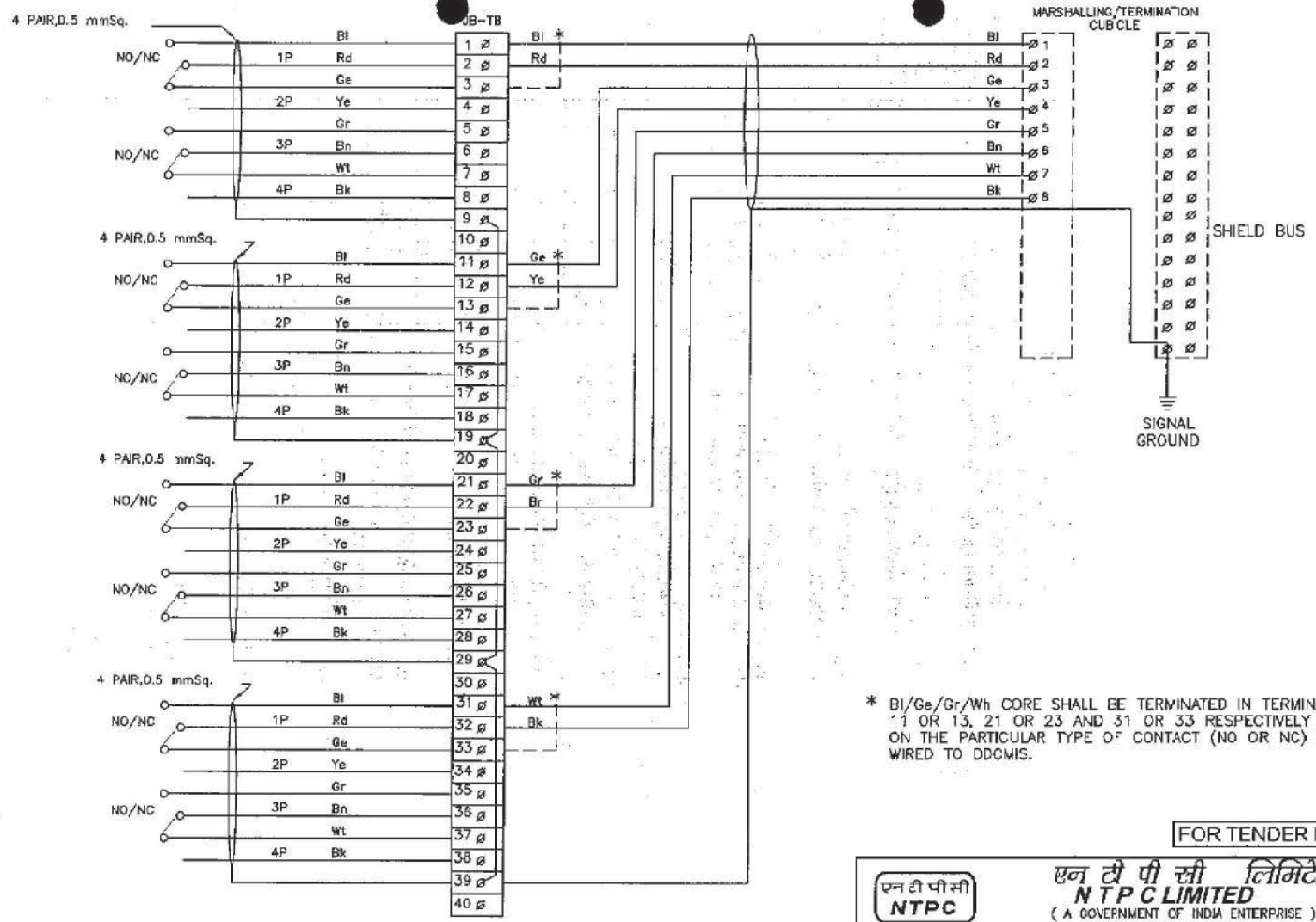
Process, Connection & piping FOR C&I SYSTEMS

TESTS / ITEMS	Visual & Dimensions ®	GA, BOM, Layout of component & construction feature, Paint Shade/thickness ®	Flattening,flaring,hydrotest,hardness check as per ASTM standard (A)	Component Ratings ®	Wiring ®	Make, Model, Type, Rating®	IR & HV ®	Review of TC for instrument/devices (R)	Accessability of TBs/Devices Illumination,grounding ®	Tubing ®	Leak/Hydro test(A)	Chemical/physical properties of material (A)	Proof pressure test,Dismantling & reassembly test,Hydrulic impulse and vibration test (R)	Tests as per standards & specification
Local Instrument enclosure	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y			
Local instruments racks	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y			
Junction Box	Y	Y*		Y		Y	Y							
Gauge Board	Y	Y		Y		Y		Y		Y	Y			
Impulse pipes and tubes	Y		Y			Y						Y		
Socket weld fittings ANSI B-16.11	Y					Y						Y		Y
Compression fittings	Y					Y					Y	Y	Y	
Instrument valves & Valve manifolds	Y					Y					Y	Y		
Copper tubings ASTM B75	Y					Y								Y

*-applicable for painted junction boxes.

Note: R-Routine Test A- Acceptance Test Y – Test applicable

Note: This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.



* Bl/Ge/Gr/Wh CORE SHALL BE TERMINATED IN TERMINAL 1 OR 3, 11 OR 13, 21 OR 23 AND 31 OR 33 RESPECTIVELY DEPENDING ON THE PARTICULAR TYPE OF CONTACT (NO OR NC) IS TO BE WIRED TO DDCMIS.

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ENGINEERING DIVISION

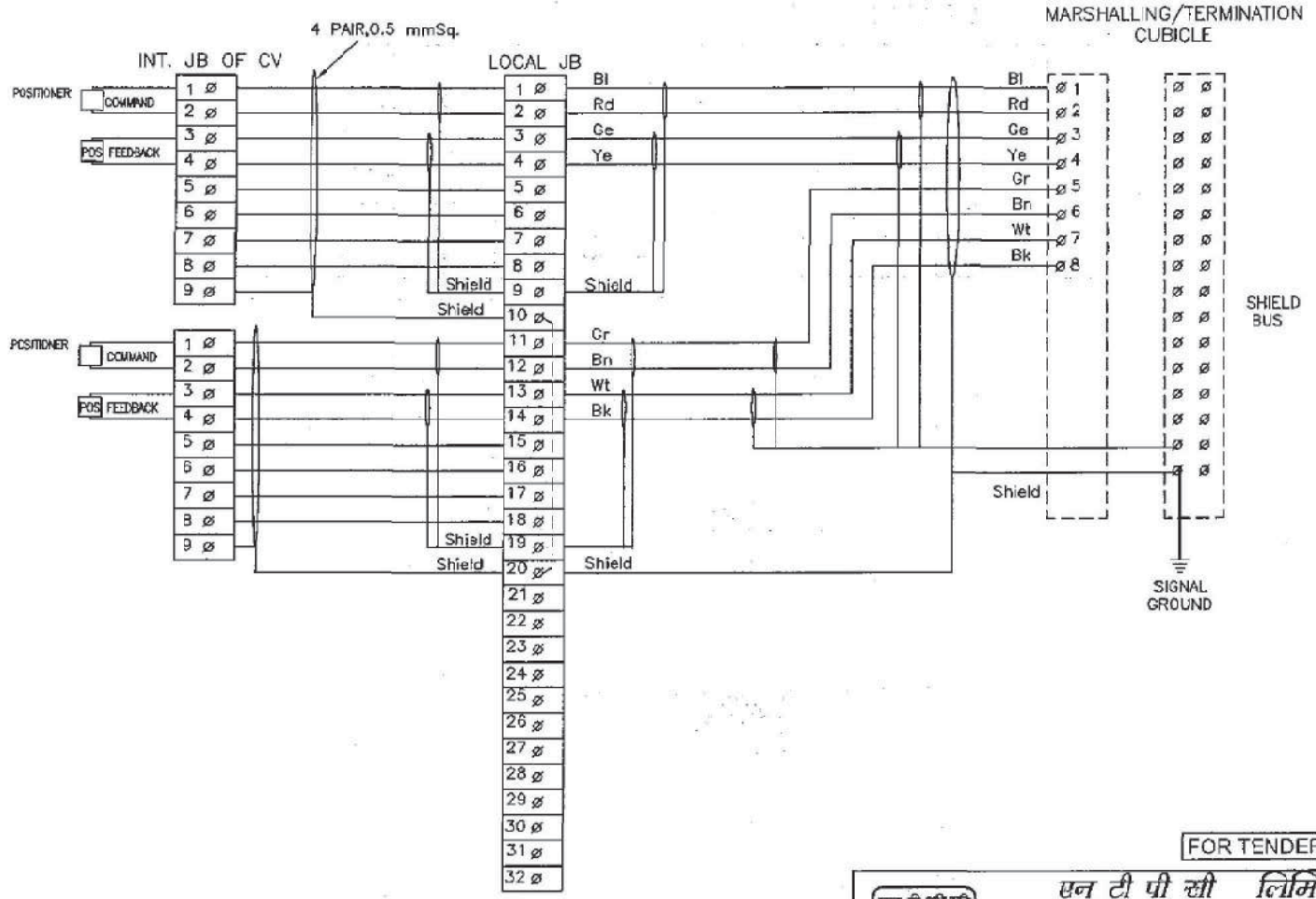
PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
SWITCH TERMINATION DETAILS
NO/NC

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										29.04.06

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065 SH 02 OF 14	A



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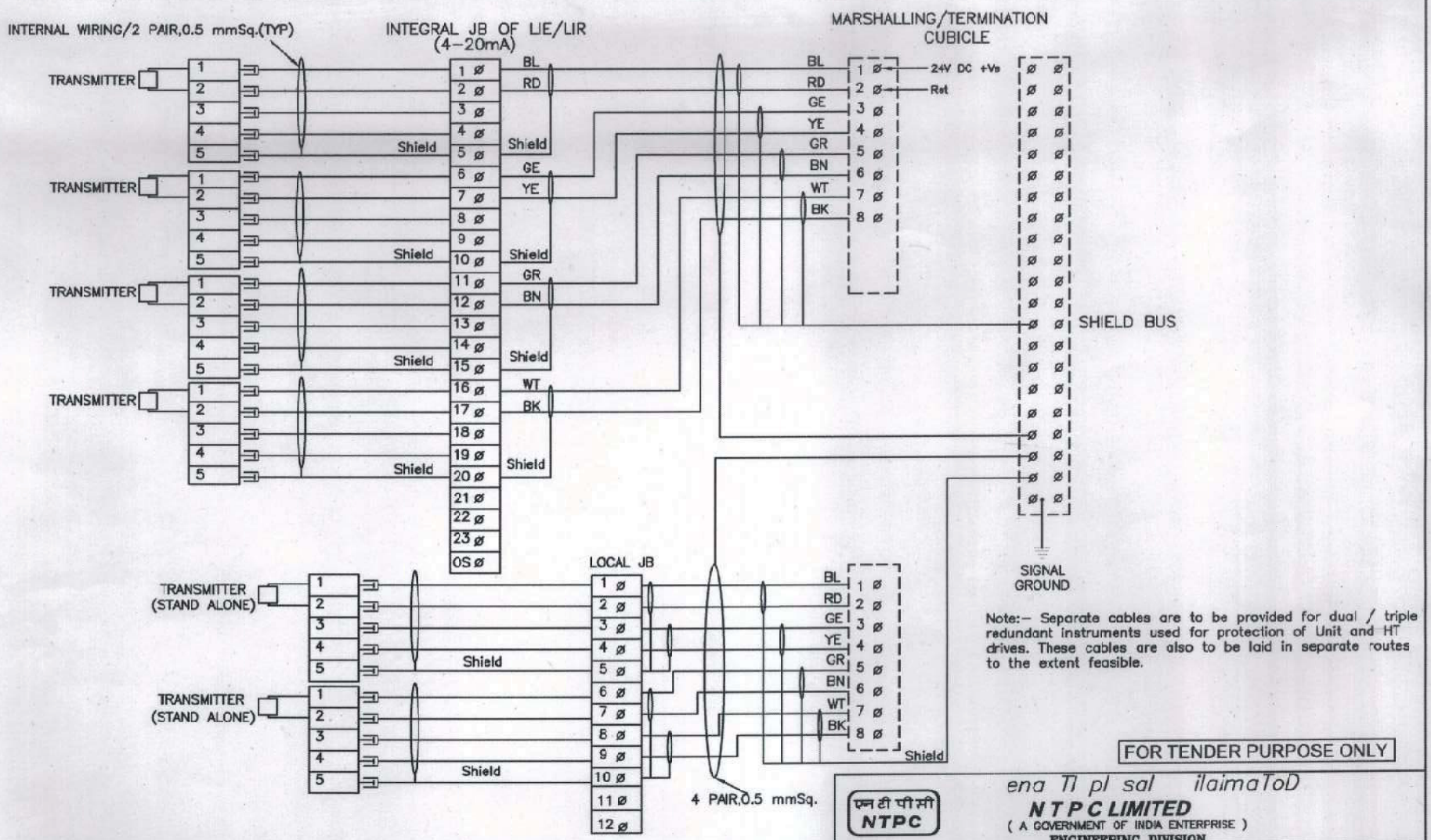
PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS CONTROL VALVE

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										29.04.06

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065 SH 03 OF 14	A



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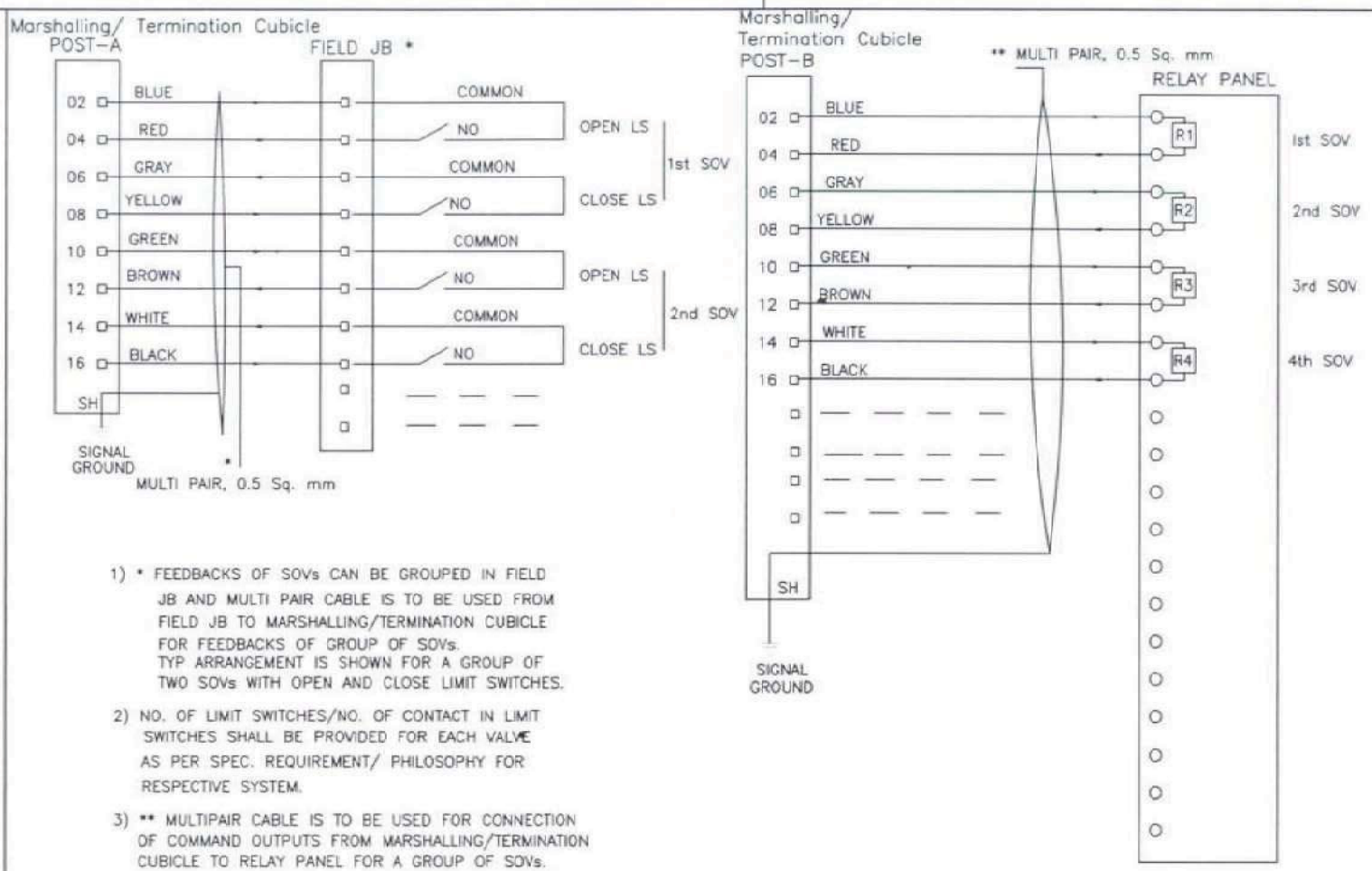
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
C	NOTE REGARDING CABLE IS ADDED.										10.12.13
B	INTERNAL WIRING FOR LIE/LIR MOUNTED SHOWN WIRING OF STAND ALONE TXTR SHOWN										10.12.06
A	FIRST ISSUE										12.1.05

CLEARED BY

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS 4-20mA

SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065 SH 04 OF 14	C



1) * FEEDBACKS OF SOVs CAN BE GROUPED IN FIELD JB AND MULTI PAIR CABLE IS TO BE USED FROM FIELD JB TO MARSHALLING/TERMINATION CUBICLE FOR FEEDBACKS OF GROUP OF SOVs. TYP ARRANGEMENT IS SHOWN FOR A GROUP OF TWO SOVs WITH OPEN AND CLOSE LIMIT SWITCHES.

2) NO. OF LIMIT SWITCHES/NO. OF CONTACT IN LIMIT SWITCHES SHALL BE PROVIDED FOR EACH VALVE AS PER SPEC. REQUIREMENT/ PHILOSOPHY FOR RESPECTIVE SYSTEM.

3) ** MULTIPAIR CABLE IS TO BE USED FOR CONNECTION OF COMMAND OUTPUTS FROM MARSHALLING/TERMINATION CUBICLE TO RELAY PANEL FOR A GROUP OF SOVs.

एन टी पी सी NTPC
नेशनल थर्मल पावर कारपोरेशन लिमिटेड
National Thermal Power Corporation Ltd.
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

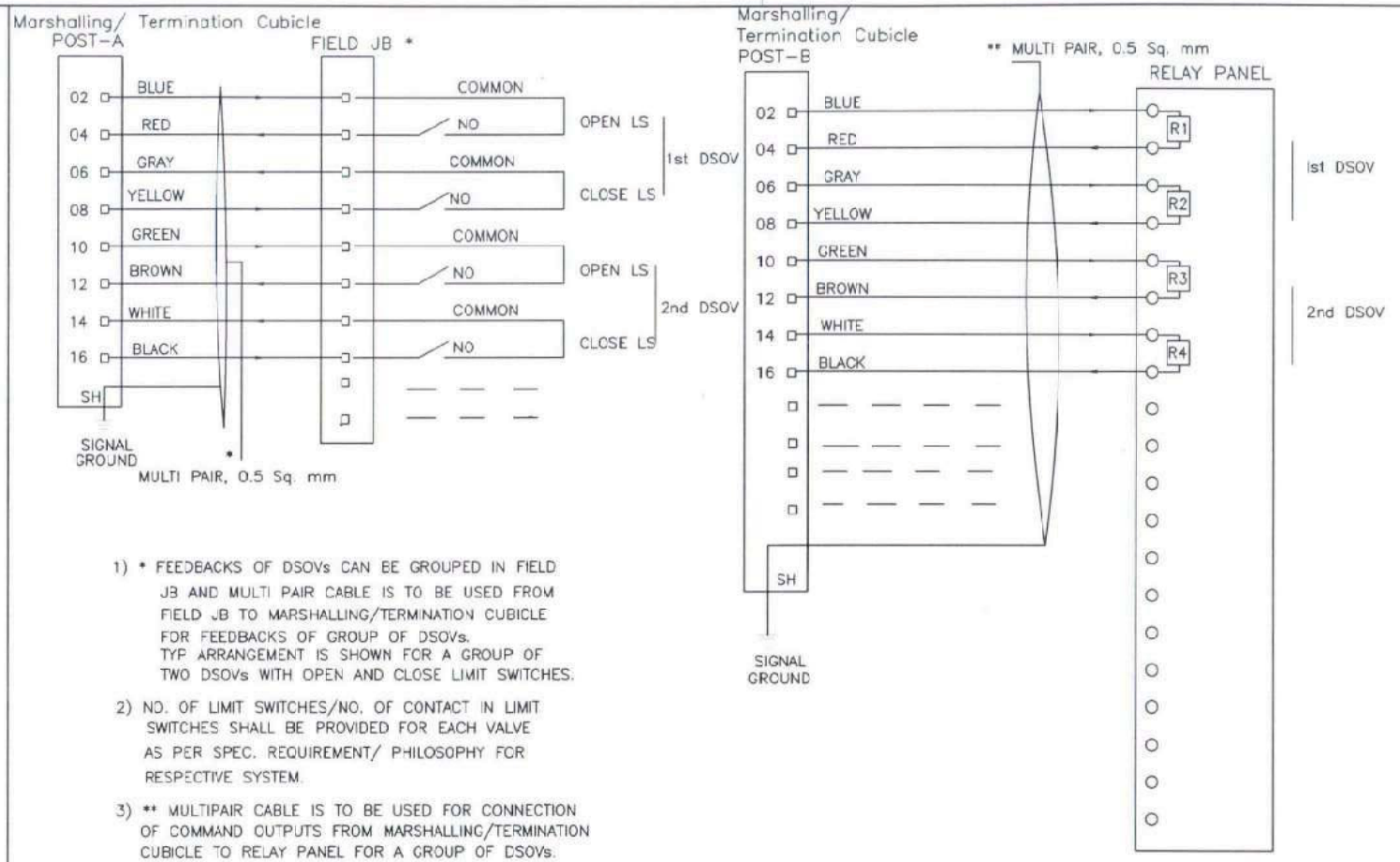
PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR
(SINGLE COIL SOLENOID)

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
B	FIRST ISSUE										30.10.02

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065 SH 08 OF 14	C



1) * FEEDBACKS OF DSOVs CAN BE GROUPED IN FIELD JB AND MULTI PAIR CABLE IS TO BE USED FROM FIELD JB TO MARSHALLING/TERMINATION CUBICLE FOR FEEDBACKS OF GROUP OF DSOVs. TYP ARRANGEMENT IS SHOWN FOR A GROUP OF TWO DSOVs WITH OPEN AND CLOSE LIMIT SWITCHES.

2) NO. OF LIMIT SWITCHES/NO. OF CONTACT IN LIMIT SWITCHES SHALL BE PROVIDED FOR EACH VALVE AS PER SPEC. REQUIREMENT/ PHILOSOPHY FOR RESPECTIVE SYSTEM.

3) ** MULTIPAIR CABLE IS TO BE USED FOR CONNECTION OF COMMAND OUTPUTS FROM MARSHALLING/TERMINATION CUBICLE TO RELAY PANEL FOR A GROUP OF DSOVs.

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नैशनल थर्मल पावर कारपोरेशन लिमिटेड
National Thermal Power Corporation Ltd.
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REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
B	FIRST ISSUE										30.10.02

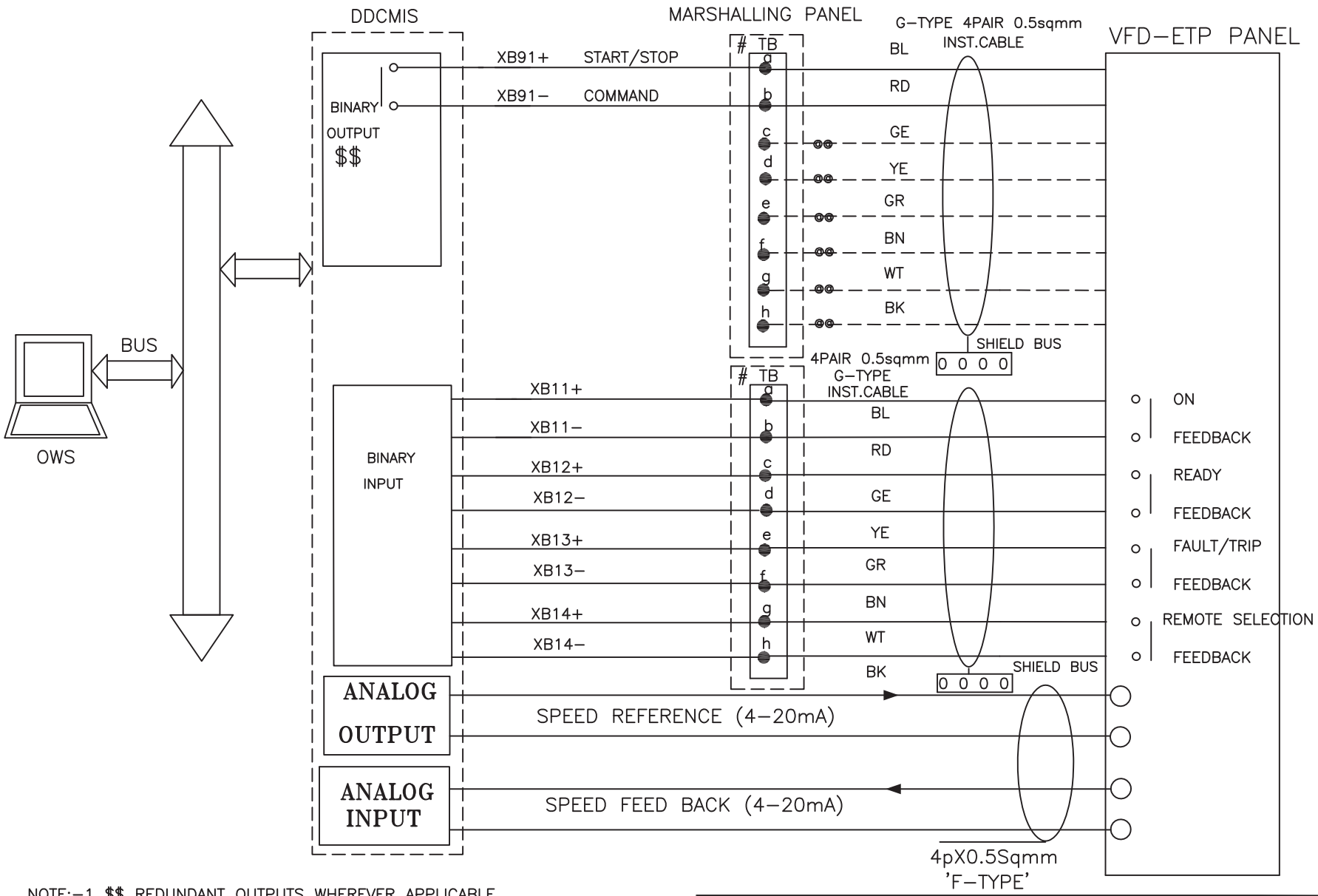
CLEARED BY

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR
(DOUBLE COIL SOLENOID)

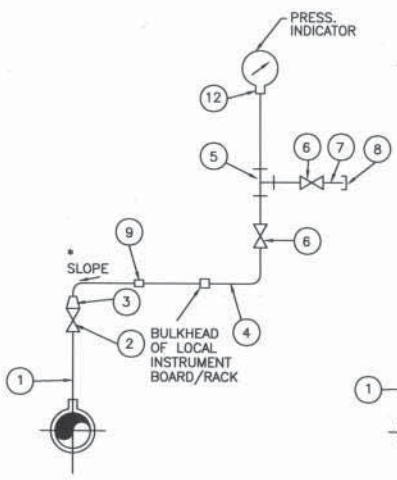
SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065 SH 09 OF 14	C

DDCMIS INTERFACE WITH VFD OF ETP (VFD-ETP)

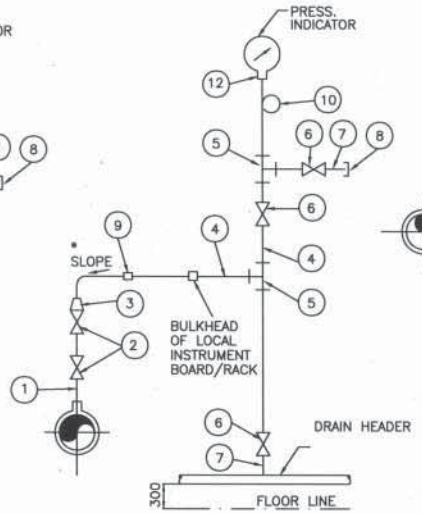


NOTE:-1 $$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
NOTE:-2 # 8 LEVEL TERMINAL BLOCK
NOTE:-3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.
NOTE:-4 OTHER VFD SIGNALS WILL BE CONSIDERED AS PER IO LIST.

BHEL	2X660MW TALCHER TPP STAGE-III	DRG.NO.	9585-001-405-PVI-B-152B
	DDCMIS INTERFACE WITH VFD OF ETP (VFD-ETP)	SHT	13 OF 34

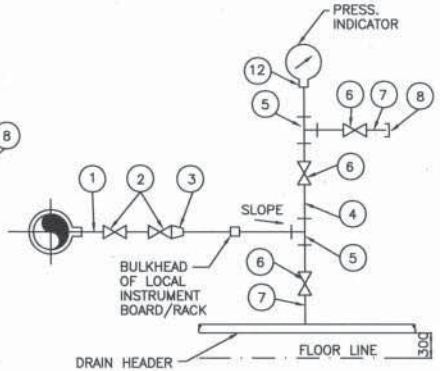


ELEVATION
INST./ SERVICE AIR



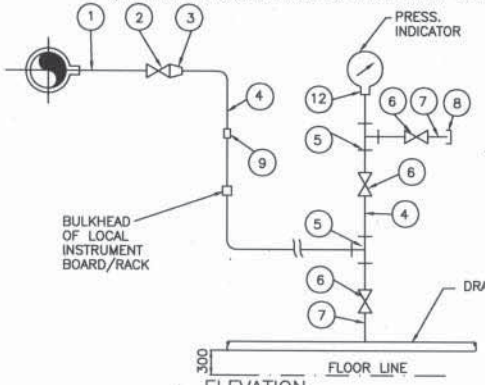
ELEVATION
STEAM SERVICE

(PRESSURE INDICATORS MOUNTED REMOTE FROM INSTRUMENT SOURCE POINT)



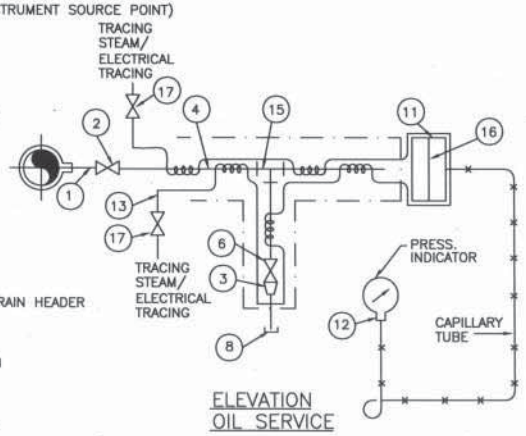
ELEVATION
LIQUID SOURCE

(GAUGE MOUNTED ABOVE INSTRUMENT SOURCE POINT)



ELEVATION
LIQUID SOURCE

(GAUGE MOUNTED BELOW INSTRUMENT SOURCE POINT)



ELEVATION
OIL SERVICE

(GAUGE MOUNTED BELOW INSTRUMENT SOURCE POINT)

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1/2" , 3/4" , 1" NPS SCH 40/80/160/XXS/P91 (AS PER PROCESS REQUIREMENT) NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	1/2"/3/4"/1' SW GLOBE VALVE/GATE VALVE
3.	3/4" / 1" x 1/2" SW REDUCING INSERT
4.	1/2" / 3/4" PIPE
5.	1/2" / 3/4" SW EQUAL TEE
6.	1/2" / 3/4" SW GLOBE VALVE.
7.	1/2" / 3/4" NPS SW x 1/2" / 3/4" NPT(M) CARBON/ALLOY STEEL NIPPLE.
8.	1/2" / 3/4" NPT(F) CAP.
9.	1/2" / 3/4" PIPE UNION.
10.	6" SS SYPHON
11.	1/2" BLIND 300lbs RF ANSI FLANGE DRILLED AND TAPED FOR 1" NPT PIPE.
12.	SUITABLE ADAPTER.
13.	1/4" CHROME MOLY STEEL TUBE.
14.	
15.	1"/3/4" SW EQUAL TEE.
16.	DIAPHRAGM(WAFER ELEMENT)
17.	ISOLATION VALVE 316 SS,1/4"SW

NOTES:-

1. THE MATERIAL SPECIFICATION AND SCHEDULE NO. OF IMPULSE PIPE & NIPPLE AS LISTED HEREIN SHALL BE AS PER TECHNICAL SPECIFICATIONS.
2. THE MATERIAL SPECIFICATION AND RATING OF FITTINGS AS LISTED SHALL BE AS PER SPECIFICATIONS. WELDED/THREADED FITTINGS SHALL CONFIRM TO ANSI-B.16-11.
3. INSTRUMENTS VALVES BODY STEM MATERIAL AND PRESSURE CLASS SHALL BE AS PER TECHNICAL SPECIFICATIONS.
4. FOR BOILER AIR/FLUE GAS SERVICES SOURCE CONNECTIONS IMPULSE PIPING AND ALL FITTINGS SHALL BE OF 3/4" NB SIZE.
5. GAUGES SHALL NOT BE MOUNTED ON THE PIPE. IT WILL BE MOUNTED ON A CHANNEL OR FRAME OR A RACK..
6. * SLOPE APPROX. 50 MM / METRE.

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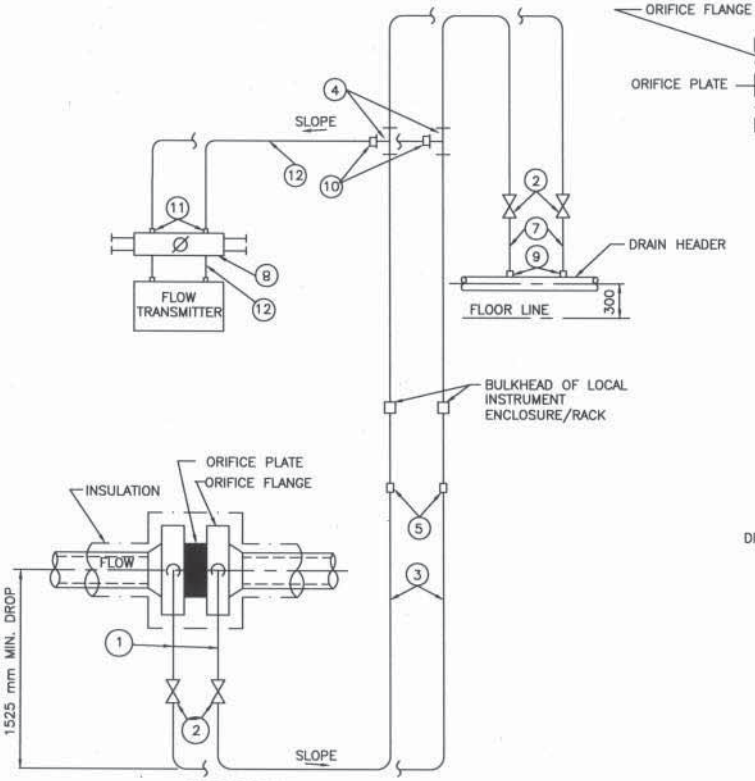
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE							T.G.			21.08.12
		CLEARED BY									

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INSTRUMENT INSTALLATION DIAGRAM (FOR PRESSURE GAUGE)

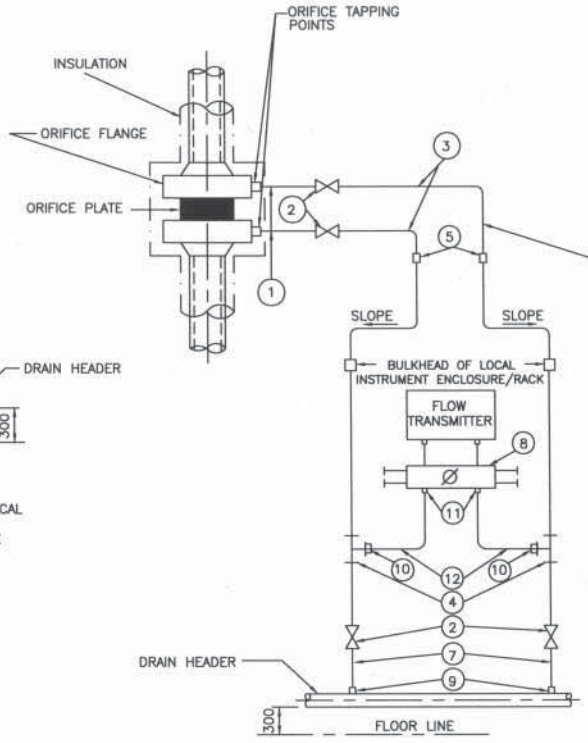
SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-022	A



ELEVATION

HORIZONTAL PIPE RUN

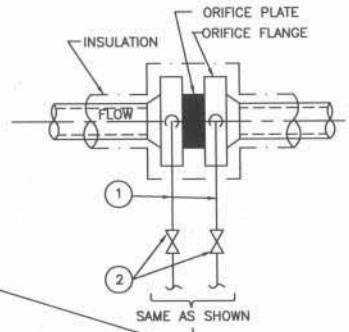
TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT



ELEVATION

VERTICAL PIPE RUN

TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT



ELEVATION

HORIZONTAL PIPE RUN

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1/2"NPS SCH. 80 NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE WITH NECESSARY ATTACHMENT TO FLANGE OF ORIFICE
2.	1/2"SW GLOBE VALVE.
3.	1/2" NPS PIPE
4.	1/2" SW EQUAL TEE
5.	1/2" PIPE UNION
6.	–
7.	1/2"NPS SCH. 80 SWx1/2"NPT (M) S.S. NIPPLE
8.	5 VALVE MANIFOLD FOR DETAIL REFER DRAWING NO.0000–102–POI–A–026.
9.	1/2" T SW HALF COUPLET
10.	1/2" PIPE x 1/2" TUBE UNION
11.	SUITABLE ADAPTER
12.	SS TUBE

NOTES:–

1. SAME NOTES AS UNDER DRG. NO. 0000–999–POI–A–023.

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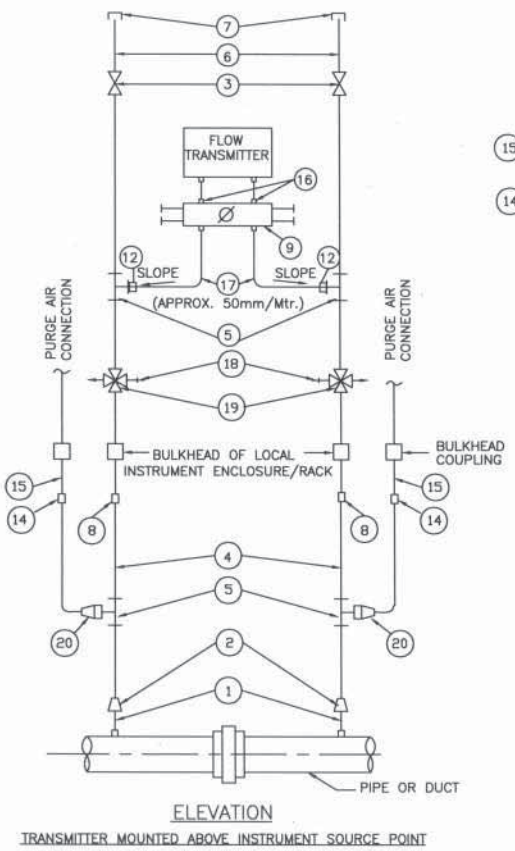
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE							T.G.			21.08.12
					CLEARED BY						

PROJECT: TYPICAL THERMAL POWER PROJECT

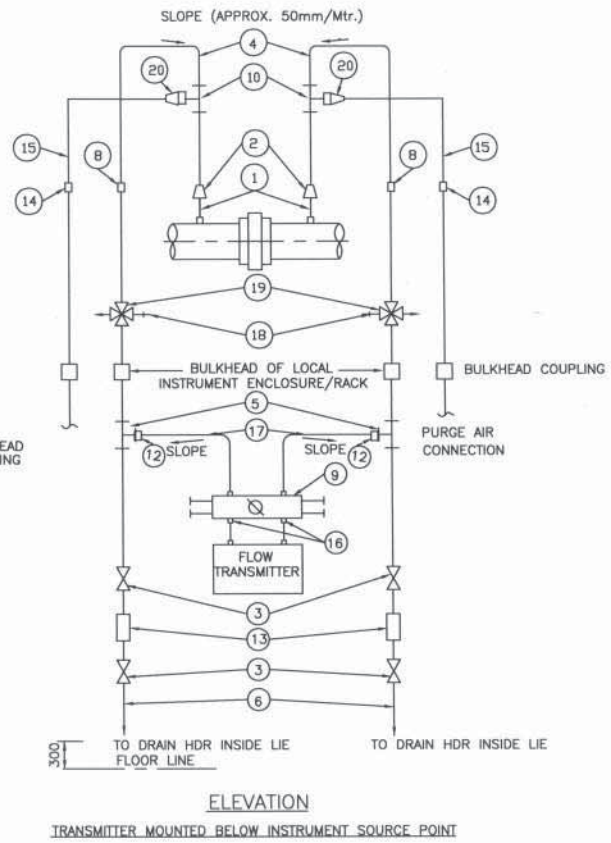
TITLE: INSTRUMENT INSTALLATION DIAGRAM
FLOW MEASUREMENT (USING ORIFICE PLATES)
CONDENSATE & SERVICE WATER

SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-027	A



ELEVATION

TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT



ELEVATION

TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	42x4.05mm M.S. BLACK PIPE.
2.	M 42x2 TO 3/4"SW REDUCING INSERT.
3.	3/4" SW GLOBE VALVE.
4.	3/4" PIPE.
5.	3/4" SW EQUAL TEE.
6.	3/4" SCH. 80 SWx3/4" NPT (M) CS/AS NIPPLE
7.	3/4" NPT (F) CAP.
8.	3/4" PIPE UNION.
9.	5 VALVE MANIFOLD FOR DETAIL REFER DRAWING NO.0000-102-POI-A-026.
10.	3/4" SW EQUAL TEE.
11.	3/4" SW GATE VALVE.
12.	3/4" PIPE x 1/2" TUBE UNION
13.	DRAIN POT.
14.	1/2" GI FITTING
15.	1/2" NB GI PIPE
16.	SUITABLE ADAPTER
17.	SS TUBE
18.	QUICK DISCONNECT FITTINGS.
19.	3/4" SW 4 WAY VALVE.
20.	3/4" x1/2" REDUCER.

NOTES:-

1. SAME NOTES AS UNDER DRG. NO. 0000-999-POI-A-023.

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AIR/GAS FLOW MEASUREMENT USING HEAD TYPE PRIMARY ELEMENT

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REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	T.G. C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										21.08.12

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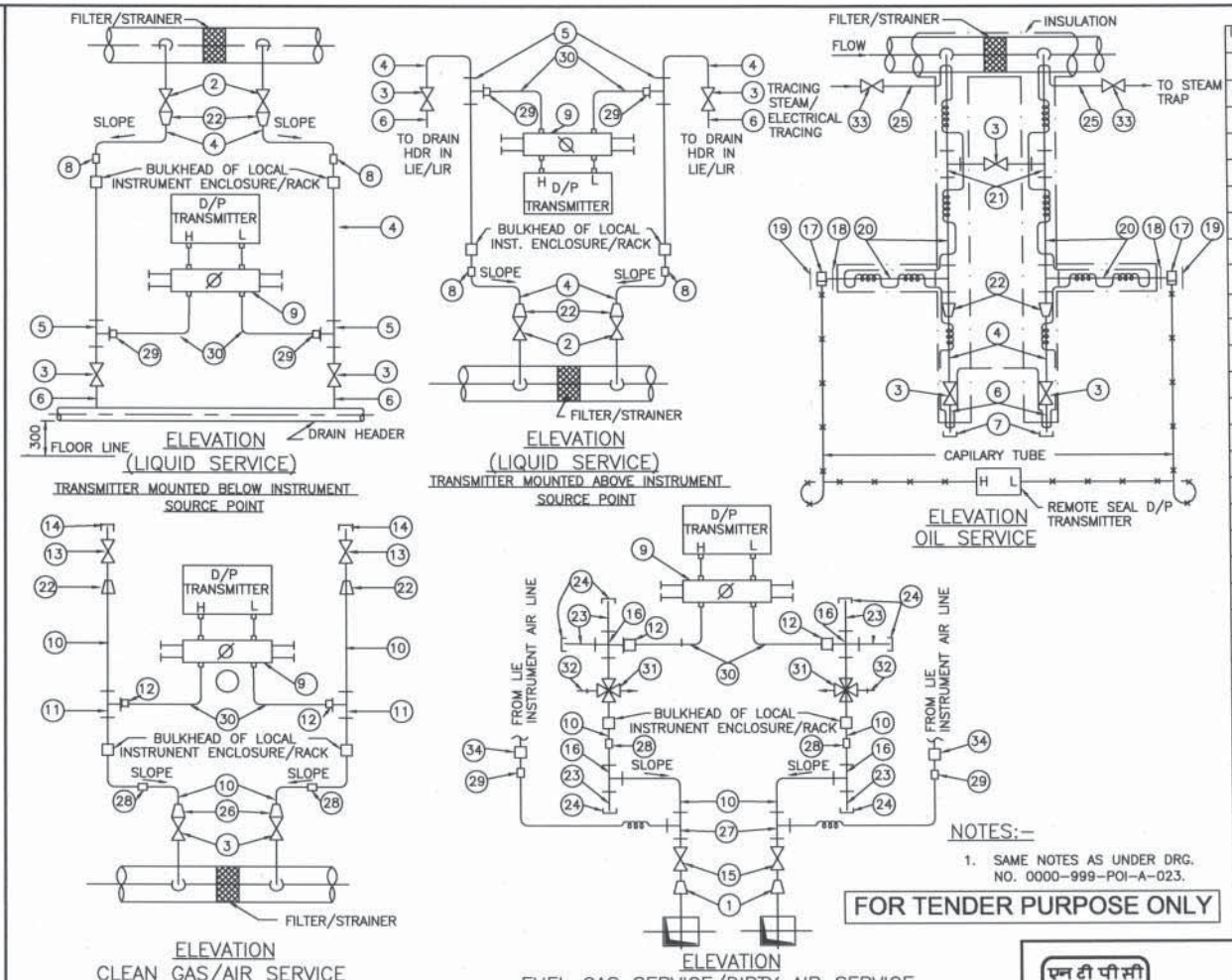
PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INSTRUMENT INSTALLATION DIAGRAM (FLOW MEASUREMENT AIR/GAS)

SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-028	B



NOTES:-

1. SAME NOTES AS UNDER DRG. NO. 0000-999-POI-A-023.

FOR TENDER PURPOSE ONLY

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	42x2 TO 3/4" SW REDUCING INSERT.
2.	3/4" SW GLOBE VALVE.
3.	1/2" SW GLOBE VALVE FOR LIQUID APPLICATION & 3/4"/1" IN GAS/AIR APPLICATION
4.	1/2" NPS 40/80/160 (AS PER PROCESS REQUIREMENT) CARBON/ALLOY STEEL PIPE.
5.	1/2" SW EQUAL TEE.
6.	1/2" NPS SW x 1/2" NPT (M) NIPPLE.
7.	1/2" NPT (F) CAP.
8.	1/2" PIPE x 1/2" PIPE UNION.
9.	5 VALVE MANIFOLD (FOR DETAIL REFER DRAWING NO.0000-999-POI-A-026.
10.	3/4" SCH 80 CARBON/ALLOY STEEL PIPE.
11.	3/4"/1/2" SW EQUAL TEE.
12.	3/4"x1/2" TUBE UNION.
13.	1/2" SCREWED GLOBE VALVE.
14.	1/2" NPT (M) PLUG.
15.	3/4" SW GATE VALVE.
16.	3/4" SW EQUAL CROSS.
17.	WAFER ELEMENT FOR USE WITH 3"ANSI R.F. VALVE.
18.	3"BLIND 300lbs R.F. WELD NECK FLANGE DRILLED FOR 1" SCH. 40/80 PIPE.
19.	3" BLIND FLANGE.
20.	1"NPS SCH. 40/80 (AS PER PROCESS REQUIREMENT) CS PIPE.
21.	1" SW EQUAL TEE.
22.	3/4" x 1/2"SW REDUCING INSERT.
23.	3/4" SW x 3/4" NPT (M) CS/AS NIPPLE
24.	3/4" NPT (F) CS/AS CAP.
25.	1/4" NPS ALLOY STEEL PIPE.
26.	1" x 3/4" SW REDUCING INSERT.
27.	3/4" SW x 1/2" PSW BRANCH TEE.
28.	3/4" PIPE UNION
29.	1/2" CLAMP UNION (THREADED) SUITABLE FOR FLEXIBLE CONNECTION OF NYLON REINFORCED PVC TUBE.
30.	SS TUBE
31.	3/4" SW 4 WAY VALVE.
32.	QUICK DISCONNECT FITTINGS.
33.	1/4" SW ISOLATION VALVE 316SS
34.	1/2" x 1/2" SS PIPE UNION.

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ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INSTRUMENT INSTALLATION DIAGRAM
DIFF. PRESS.MEASUREMENT (LIQUID, OIL, AIR/GAS SERVICE)

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE							T.G.			21.08.12

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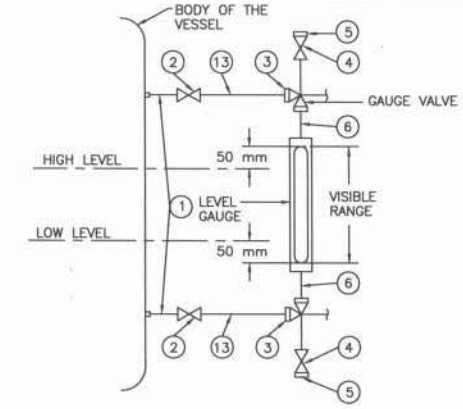
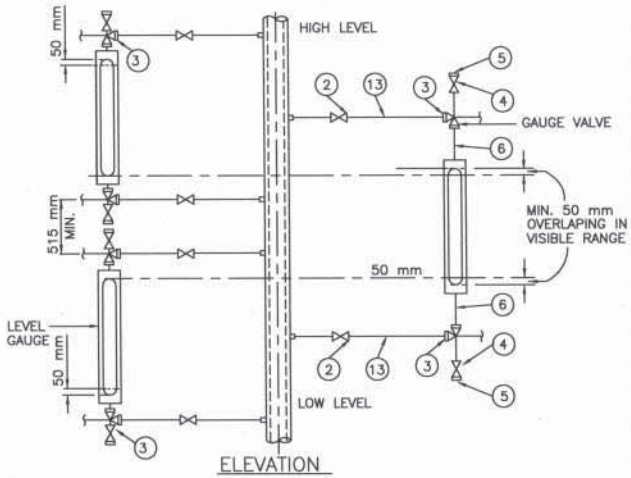
SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-030	A



ELEVATION

LOCAL LEVEL INDICATION USING GAUGE GLASS

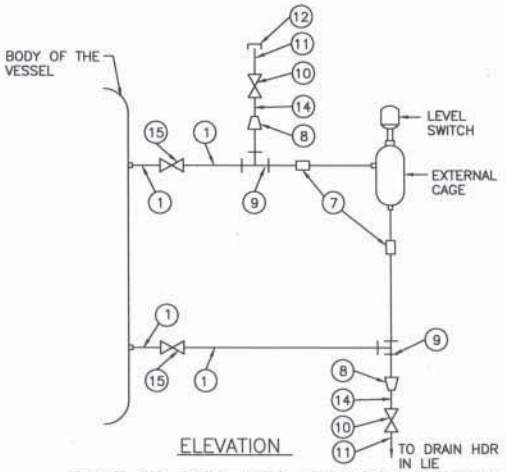


ELEVATION

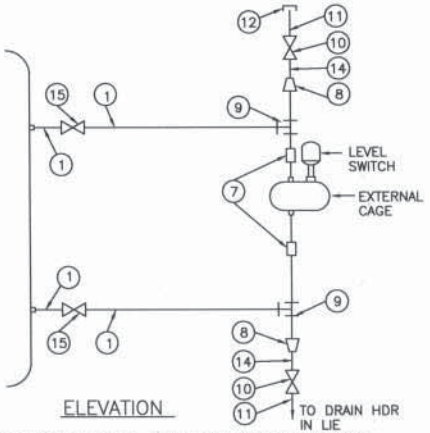
LOCAL LEVEL INDICATION USING MULTIPLE GAUGES
FOR INCREASED RANGE NOT COVERED IN A SINGLE UNIT

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	3/4"/1" NPS SCH.40/80/160/P91 (AS PER PROCESS REQUIREMENT) CARBON /ALLOY STEEL PIPE.
2.	3/4" SW GLOBE VALVE.
3.	3/4" SW UNION.
4.	3/4" NPT GLOBE VALVE.
5.	3/4" NPT (M) CAP.
6.	3/4" NPT (F) UNION CONNECTION.
7.	1" SW EQUAL UNION.
8.	1" x 1/2" SW REDUCING INSERT.
9.	1" SW EQUAL TEE.
10.	1/2" SW GLOBE VALVE.
11.	1/2" NPS SWx1/2" NPT(M) CS/AS NIPPLE.
12.	1/2" NPT (F) CAP
13.	3/4"x1/2" NPS SCH.40/80 CS/AS PIPE.
14.	1/2" NPS SCH.80/160 CS/AS NIPPLE.
15.	1" SW GLOBE VALVE.



ELEVATION



ELEVATION

FLOAT OR DISPLACER OPERATED EXTERNAL CAGE TYPE LEVEL SWITCH INSTALLATION

NOTES:–

1. FOR LEVEL GAUGE 3/4" AND FOR LEVEL SWITCH 1" PROCESS CONNECTION SHALL BE PROVIDED.
2. NOTES UNDER DRG. NO. 0000–999–POI–A–023 (WHICHEVER ARE RELEVENT).

FOR TENDER PURPOSE ONLY

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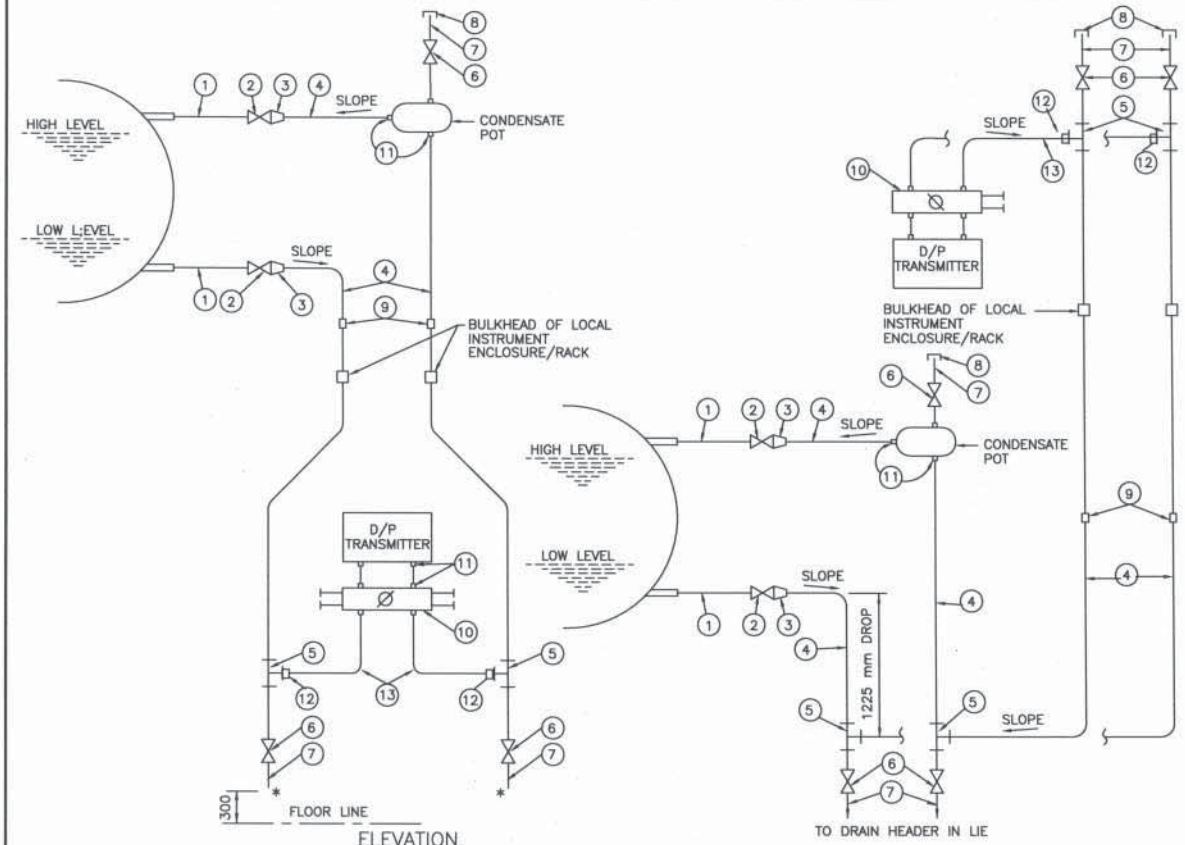
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE							T.G.			21.08.12
					CLEARED BY						

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INSTRUMENT INSTALLATION DIAGRAM (LEVEL GAUGE & SWITCHES)

SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-031	A



ELEVATION
TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT

ELEVATION
TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1" NPS SCH.40/80/160/XXS/P91 (AS PER PROCESS REQUIREMENT) CARBON /ALLOY STEEL PIPE.
2.	1" SW GLOBE VALVE.
3.	3/4"/1" TO 1/2" REDUCING INSERT.
4.	1/2" NPS SCH.80/160/XXS(AS PER PROCESS REQ.)CS/AS PIPE.
5.	1/2" SW EQUAL TEE.
6.	1/2" SW GLOBE VALVE.
7.	1/2" NPS SWx1/2" NPT(M) CS/AS NIPPLE.
8.	1/2 NPT (F) CAP.
9.	1/2" PIPE UNION.
10.	5-VALVE MANIFOLD (FOR DETAILS REF. DRG. NO.0000-999-POI-A-026.
11.	SUITABLE ADAPTER.
12.	1/2" PIPE x 1/2" TUBE UNION.
13.	S.S. TUBE.

NOTES:-

1. SAME NOTES AS UNDER DRG. NO.0000-999-POI-A-023. (WHICHEVER ARE RELEVENT).

* TO DRAIN HEADER IN LIE/LIR.

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LEVEL MEASUREMENT OF CLEAR NON-VISCOUS OR NON-CORROSIVE LIQUID IN CLOSED VESSEL WITH CONDENSABLE ATMOSPHERE USING D/P TRANSMITTER

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A	FIRST ISSUE							T.G.			21.08.12

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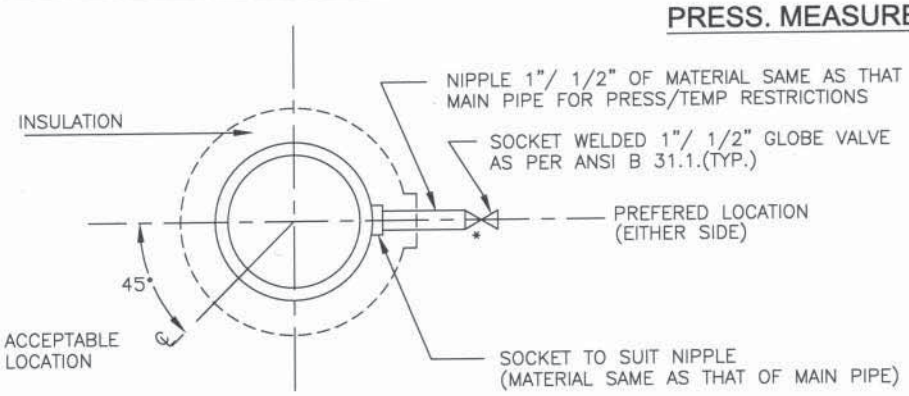
PROJECT: TYPICAL THERMAL POWER PROJECT

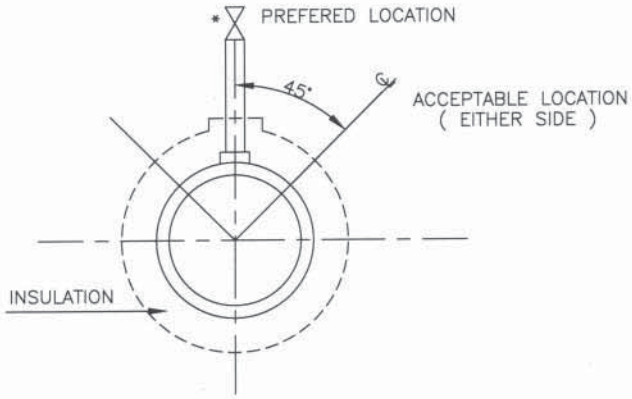
TITLE: INSTRUMENT INSTALLATION DIAGRAM (LEVEL MEASUREMENT USING D/P TRANSMITTERS)

SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-032 SH 1 OF 2	A

PRESS. MEASUREMENT

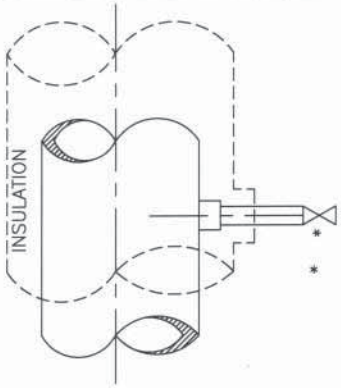


ELEVATION
LIQUID SERVICE



ELEVATION
STEAM SERVICE

PRESSURE CONNECTION ON HORIZONTAL PIPE



* USE DOUBLE ISOLATION VALVES FOR PRESSURE EQUAL TO OR EXCEEDING 40 Kg/Cm2.

ELEVATION
LIQUID OR STEAM SERVICE

PRESSURE CONNECTIONS ON VERTICAL PIPES

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REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE
A	FIRST ISSUE						T.G.				21.08.15

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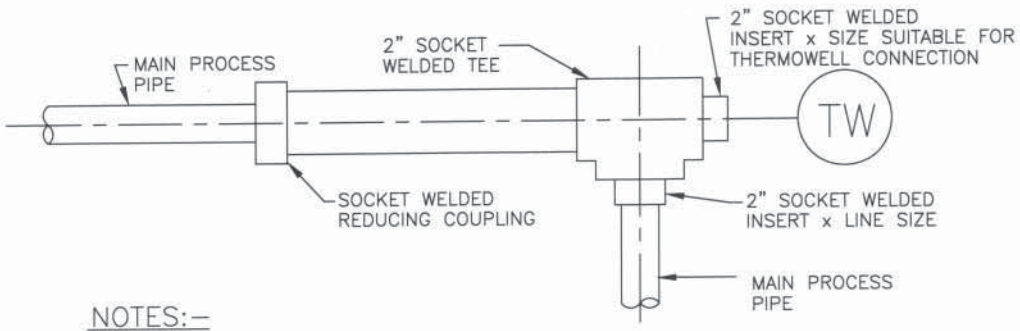
PROJECT: TYPICALTHERMAL POWER PROJECT

TITLE: INSTRUMENT SOURCE CONNECTION DETAILS

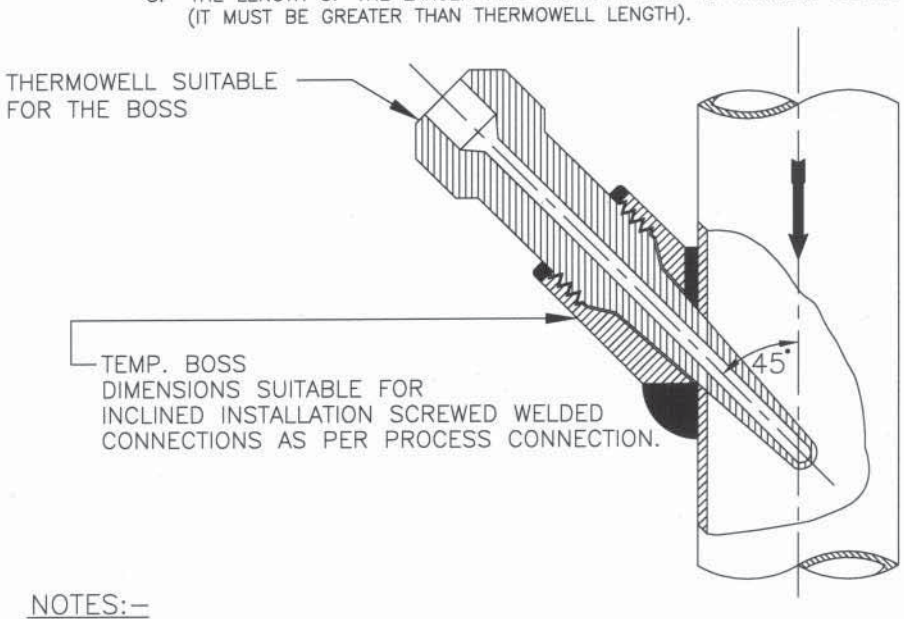
SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035 Sh-1 Of 14	A

TEMP. MEASUREMENT



NOTES:–

1. THIS TYPE OF THERMOWELL INSTALLATION IS SUITABLE FOR THE PROCESS PIPE OF 2" NPS AND SMALLER.
2. FOR STEAM SERVICE THIS TYPE OF THERMOWELL INSTALLATION 90° BEND MAY BE USED ONLY IN VERTICAL PLANE.
3. THE LENGTH OF THE LARGER PIPE SECTION SHALL BE MINIMUM 150mm (IT MUST BE GREATER THAN THERMOWELL LENGTH).



NOTES:–

1. INCLINED INSTALLATION OF THERMOWELL SHALL BE APPLICABLE FOR 4" AND SMALLER LINE SIZE BUT LIMITED TO MIN. 3" LINE SIZE.
2. FOR 2" AND SMALLER LINE SIZE NECESSARY EXPANDER OF MIN. 3" SIZE OF MAIN PIPING SPECIFICATION SHALL BE USED.
3. THIS TYPE OF INSTALLATION IS APPLICABLE FOR HORIZONTAL AND VERTICAL PIPE SECTION.
4. FOR STEAM SERVICES EXPANDER SECTION MAY BE USED ONLY IN VERTICAL RUN.
5. THE EXPANDER SECTION SHALL BE OF ADEQUATE LENGTH (ATLEAST 3–4 TIMES DIA OF THE MAIN PROCESS PIPE AT BOTH SIDE OF THE INSTALLED THERMOWELL).

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REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE
A	FIRST ISSUE							T.G.			21.06.13

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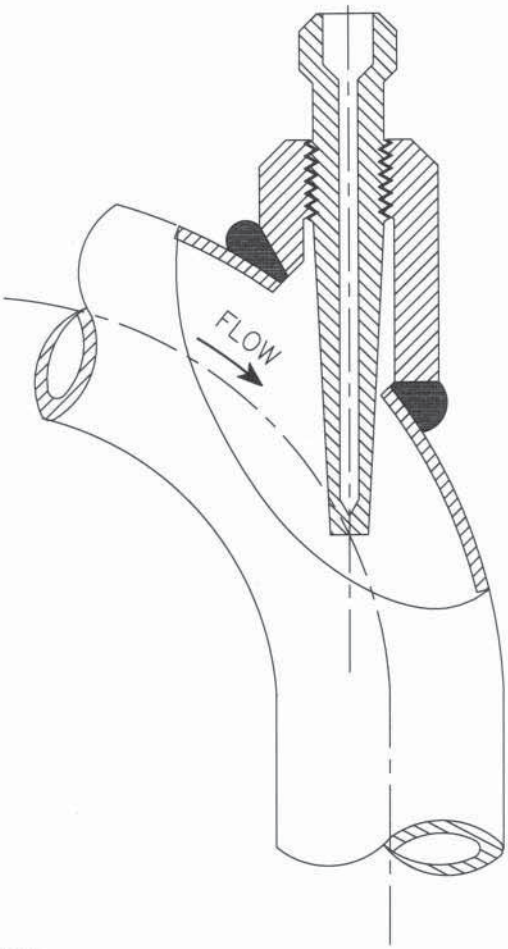
PROJECT	TYPICALTHERMAL POWER PROJECT (SG PACKAGE)			
TITLE	INSTRUMENT SOURCE CONNECTION DETAILS			
SIZE	SCALE	DRG. NO.		REV. NO.
A4	N.T.S.	0000-999/102-POI-A-035 Sh–4 Of 14		A

TEMP. MEASUREMENT



NOTES:–

1. FLOW INSTALLATION OF THERMOWELL SHALL BE APPLICABLE FOR 4" AND SMALLER LINE SIZE BUT LIMITED TO MINIMUM 3" LINE SIZE.
2. FOR 2" AND SMALLER LINE SIZE NECESSARY EXPANDER OF ELBOW FORM (AS SHOWN) OF MINIMUM 3" SIZE SHALL BE USED.
3. ELBOW EXPANDER SECTION IN HORIZONTAL PLANE MAY BE USED FOR LIQUID SERVICES. ONLY STEAM SERVICES EXPANDER SECTION MAY BE USED IN VERTICAL PLAN.

FOR TENDER PURPOSE ONLY

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	T.G. C&I	ARCH.	APPD.	DATE
A	FIRST ISSUE										01.06.12

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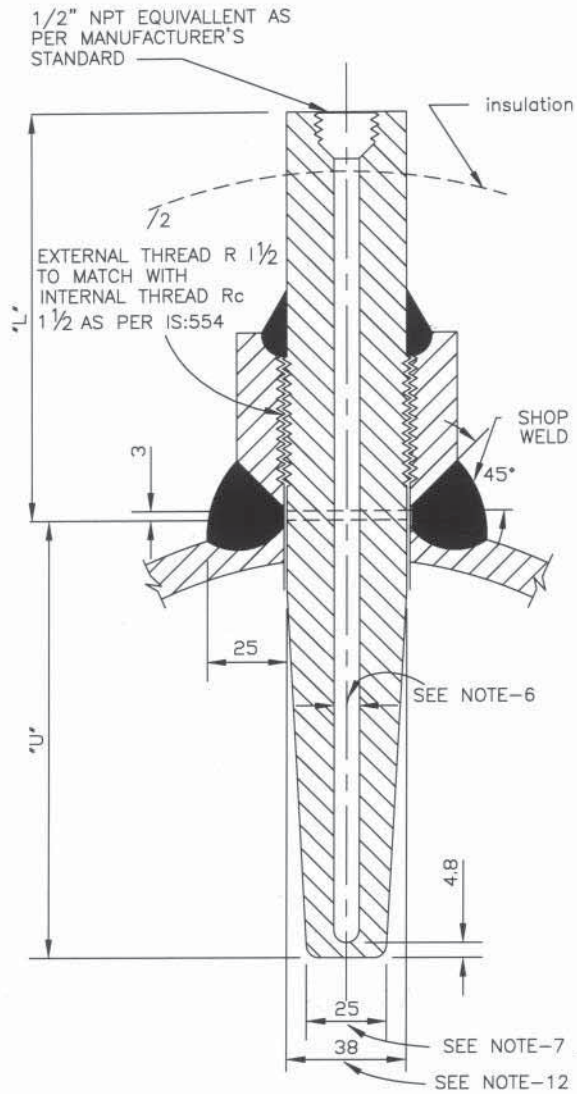
PROJECT: TYPICALTHERMAL POWER PROJECT

TITLE: INSTRUMENT SOURCE CONNECTION DETAILS

SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035 Sh–5 Of 14	A

TEMP. MEASUREMENT



NOTES:-

1. THIS TYPE OF TEMPERATURE BOSS SHALL BE USED FOR THE PROCESS PRESS EQUAL/ABOVE 40 Kg/Cm2(g).
2. THE MATERIAL OF THE BOSS SHOULD BE SIMILAR TO THAT OF PIPING MATERIAL OF SPECIFICATION.
3. ALL WELD TO BE TESTED IN ACCORDANCE WITH APPLICABLE CODES BY MANUFACTURER.
4. MATERIAL OF THE THERMOWELL SHALL BE OF 316SS.
5. THERMOWELL SHALL BE DRILLED BARSTOCK TYPE.
6. INTERNAL BORE OF THE THERMOWELL SHOULD BE SELECTED BASED ON THE NORMAL SIZE OF THE SENSING ELEMENT AS PER ASME,PTC-19.3.
7. THE BOTTOM DIAMETER OF THE THERMOWELL TYPICALLY SHOWN HERE SHALL BE SUBJECT TO VARIATION BASED ON THE INTERNAL BORE OF THERMOWELL AND THICKNESS OF THERMOWELL MATERIAL TO WITHSTAND THE PROCESS PRESS.AND TEMP.,AS PER ASME,PTC-19.3.
8. THE TYPE OF TAPERED THERMOWELL SHALL BE USED FOR LIQUID VELO-CITIES UP TO 92M.P.S.(300F.T.P.S.).
9. THERMOWELL WITH THE INSULATION LAG EXTENSIONS SHALL BE USED WHEREVER APPLICABLE.
10. ACTIVITIES TO BE COMPLETED AT THE SHOP. WELD THE BOSS ON THE PIPE AND DRILL THE HOLE IN THE PIPE IN ALLIGNMENT WITH HOLE IN THE BOSS. PROVIDE INTERNAL THREAD AS PER IS:554 TO MATCH WITH THE THERMO-WELL EXTERNAL THREAD.
11. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
12. WIILL BE SUITABLE TO MATCH THE STUB DIMENSIONS AS PER RC 1½
13. THE "U" & "L" DIMENSIONS SHALL BE BE SELECTED BASED ON PARTICULAR APPLICATION AND THE SAME SHALL BE SUBJECT TO OWNER'S APPROVAL DURING DETAILED ENGINEERING.
14. ALL DIMENSIONS ARE INDICATIVE ONLY.

FOR TENDER PURPOSE ONLY

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	T.G. C&I	ARCH.	APPD.	DATE
A	FIRST ISSUE										21.06.12
					CLEARED BY						

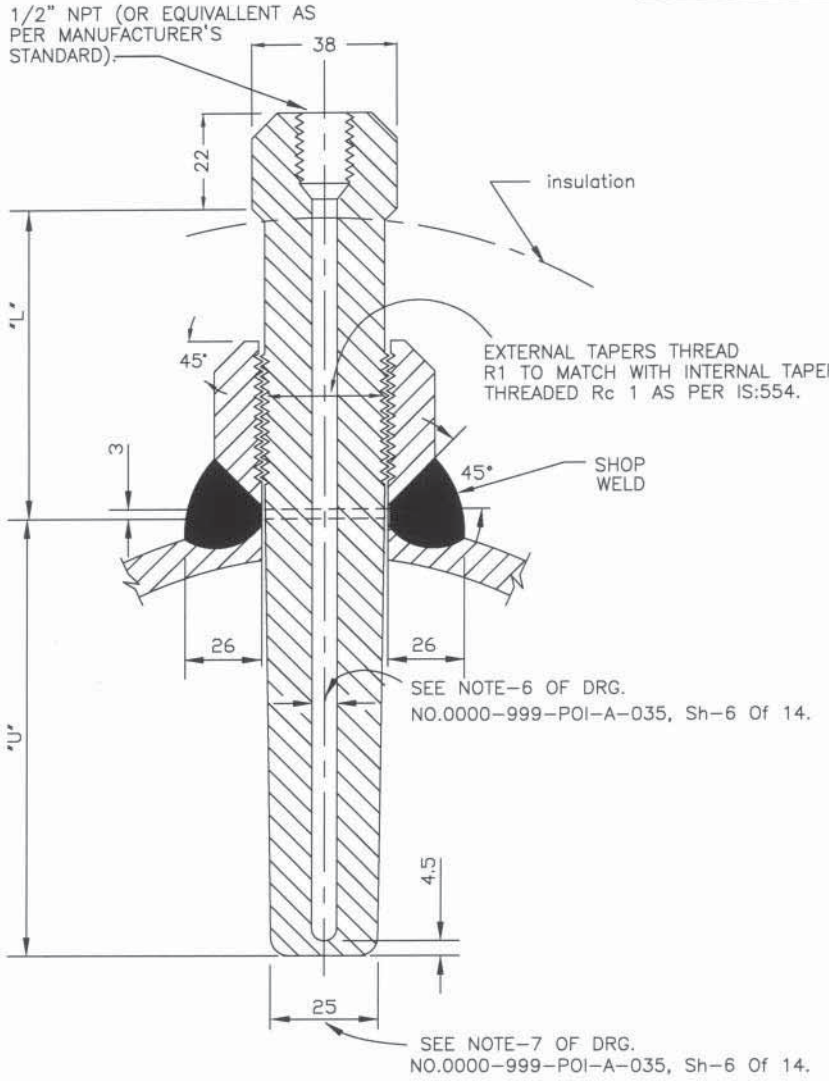
NTPC — **N T P C LIMITED** (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION

PROJECT: TYPICALTHERMAL POWER PROJECT

TITLE: INSTRUMENT SOURCE CONNECTION DETAILS

SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035 Sh-6 Of 14	A

TEMP. MEASUREMENT



NOTES:-

1. THIS TYPE OF TEMPERATURE BOSS IS APPLICABLE FOR THE PROCESS PRESSURE/TEMPERATURE BELOW 40 Kg/Cm2(g)/400°C
2. FOR PRESSURE TIGHT JOINTS THE BOSS SHOULD HAVE INTERNAL TAPERED PIPE THREAD Rc 1 AS PER IS:554. THE LENGTH OF THREAD ENGAGEMENT SHOULD BE AS PER ABOVE STANDARD.
3. PIPES HAVING PROBABILITY OF PROLONGED VIBRATION SEAL WELDING MAY BE DONE ALL AROUND AFTER TIGHTENING THERMOWELL WITHIN THE BOSS.
4. SEE NOTES-2 TO 14 OF DRG. NO. 0000-999-POI-A-035, Sh-6 Of 14.

FOR TENDER PURPOSE ONLY

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	T.G. C&I	ARCH.	APPD.	DATE
A	FIRST ISSUE										

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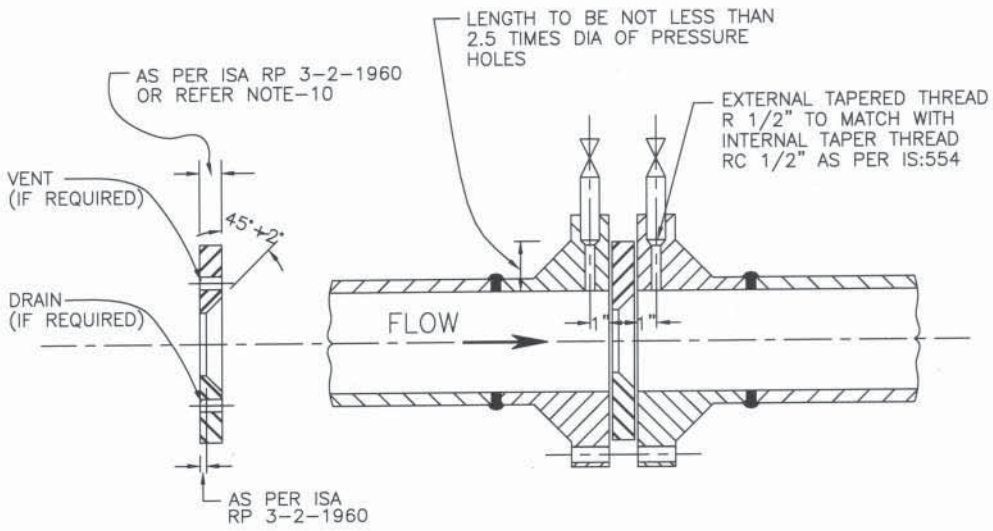
NTPC — N T P C LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION

PROJECT: TYPICALTHERMAL POWER PROJECT

TITLE: INSTRUMENT SOURCE CONNECTION DETAILS

SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035 Sh-7 Of 14	A

FLOW MEASUREMENT



NOTES:-

1. ORIFICE PLATE MOUNTED BETWEEN FLANGES WITH FLANGE TAPPING (AS SHOWN ABOVE) SHOULD BE LIMITED TO PIPE SIZES OF 2" OR LARGER.
2. ORIFICE PLATE SHALL BE MOUNTED BETWEEN PIPING FLANGES WITH THE SHARP EDGE FACING UPSTREAM SUCH THAT CENTRE OF THE CONCENTRIC ORIFICE SHOULD BE WITHIN 0.79 mm (1/32") OF THE AXIS OF THE PIPE.
3. TWO GASKETS SHALL BE INSERTED BETWEEN THE PLATE AND THE FLANGES AND INSIDE DIAMETER OF THE GASKETS SHOULD BE ATLEAST 1.5 mm (1/16") GREATER THAN THE INSIDE DIAMETER OF THE PIPE SO THAT THEY DO NOT PROTRUDE INTO THE PIPE.
4. PIPING FLANGES SHALL BE ANSI WELD NECK, RAISED FACE TYPE. THE FLANGE IS TO BE ALIGNED WITH THE FACE PERPENDICULAR TO THE FLOW AXIS.
5. BIDDER TO SUPPLY ORIFICE PLATE SPECIAL TYPE (HAVING PRESS. CONNECTIONS) OF FLANGES ALONG WITH GASKETS, NIPPLES AND SOURCE VALVES.
6. ON HORIZONTAL PIPE RUN PRESSURE CONNECTIONS ARE TO BE TAKEN FROM SIDES FOR LIQUID AND STEAM SERVICE AND FROM TOP FOR DRY GAS SERVICE. FOR PROCESS LIQUIDS INSTALLATION OF PRESSURE TAPS MAY BE ALLOWED WITHIN AN ANGLE OF 45° ELBOW THE HORIZONTAL IN SPECIAL CASES BUT NO BOTTOM CONNECTIONS ARE ALLOWED.
7. THE LOCATION OF PRESSURE TAPS MUST BE WITHIN 1.5 mm (1/16") OF THE DISTANCE SPECIFIED.
8. MAXIMUM DIAMETER OF PRESS. CONNECTION HOLES SHALL BE AS PER RECOMMENDATIONS OF ASME PTC 19.5. THE DIAMETER OF THE HOLE SHOULD REMAIN THE SAME FOR A DISTANCE NOT LESS THAN 2.5 TIMES OF THE DIAMETER BEFORE EXPANDING INTO THE PRESSURE PIPE.
9. THERE MUST BE NO BURRS WIRE EDGES OR OTHER IRREGULARTIES ALONG THE EDGE OF THE HOLE AND IT MUST BE SQUARE AND ROUNDED SLIGHTLY (1/64" RADIUS).
10. ORIFICE PLATE SHOULD BE FLAT WITHIN 0.02 mm (0.001") AND THE SURFACE ROUGHNESS SHOULD NOT EXCEED 20 MICRO INCH. THE THICKNESS OF THE ORIFICE PLATE SHOULD BE AS PER EN ISO 5167:2003.
11. FOR HORIZONTAL PIPE RUN DRAIN HOLES IN ORIFICE PLATES ARE AT THE BOTTOM (APPROX. TANGENT TO INSIDE DIA OF PIPE) FOR STEAM OR GAS SERVICE. VENT HOLES SHOULD BE LOCATED ON UPPER SIDE FOR INCOMPRESSIBLE FLUID.
12. ORIFICE PLATE SHOULD BE OF 316 SS (ASTM A167-54 GRADE-II).
13. RECOMMENDED MINIMUM LENGTHS OF STRAIGHT PIPE PRECEDING AND FOLLOWING ORIFICES SHALL BE AS PER EN ISO 5167:2003.
14. THREE PAIRS OF PRESSURE TAPS SHALL BE PROVIDED WITH NIPPLES OF REQUIRED LENGTH AND SOURCE VALVES AND THE UN-USED TAPS ARE PLUGGED.
15. THE INTERNAL TAPERED CONNECTION WITHIN THE FLANGE FOR PRESSURE TAPS SHOULD BE RC 1/2" AND THE NIPPLE SHOULD ALSO OF EXTERNAL THREADED R 1/2" AS PER IS:554. THE LENGTH OF THREADED ENGAGEMENT SHALL BE AS PER ABOVE STANDARD.

FOR TENDER PURPOSE ONLY

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE
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A	FIRST ISSUE							T.G.			31.08.12

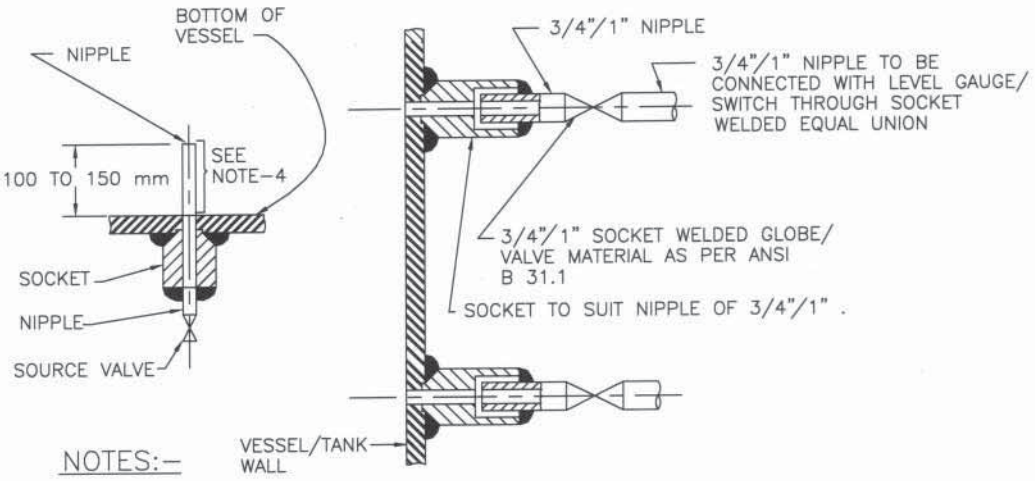
NTPC — NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION

PROJECT: TYPICALTHERMAL POWER PROJECT

TITLE: INSTRUMENT SOURCE CONNECTION DETAILS

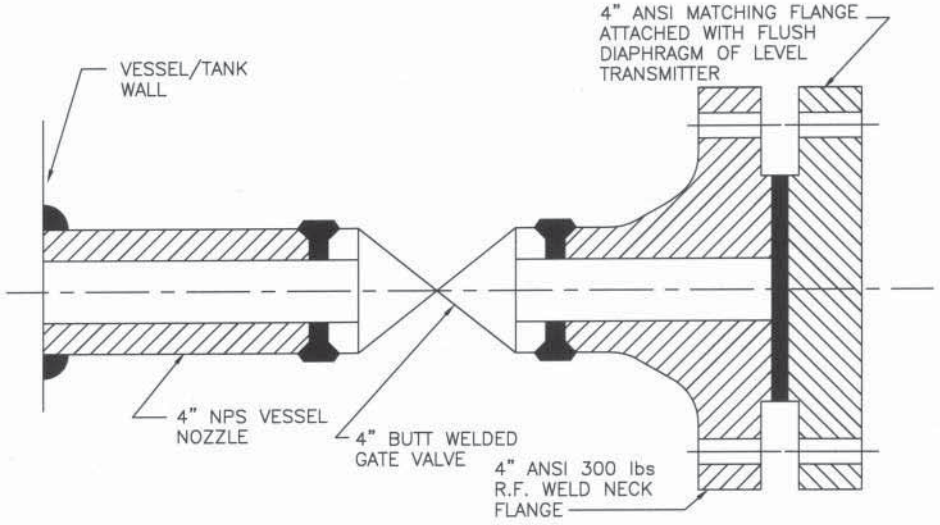
SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035 Sh-12 Of 14	A

LEVEL MEASUREMENT



NOTES:-

1. THIS TYPE OF PROCESS CONNECTION SHALL BE USED FOR LEVEL GAUGE AND EXTERNAL CAGE TYPE FLOAT OR DISPLACER OPERATED LEVEL SWITCH.
2. FOR GAUGES 3/4" NIPPLE ALONG WITH 3/4" SW SOURCE VALVE AND FOR SWITCHES 1" NIPPLE ALONG WITH 1" SW SOURCE VALVE SHALL BE PROVIDED AS PROCESS CONNECTION.
3. SOURCE CONNECTION ON VESSEL SHOULD NOT BE LOCATED AT PLACES SUBJECTED TO INTERFACE AND TURBULENCE FROM INLETS AND OUTLETS.
4. IF LOWER CONNECTION IS TAKEN FROM BOTTOM OF THE VESSEL THEN THE NIPPLE MUST BE 100 mm TO 150 mm ABOVE THE BOTTOM OF THE VESSEL.



NOTES:-

1. THIS TYPE OF PROCESS CONNECTION SHALL BE PROVIDED FOR TANK LEVEL MEASUREMENT OF VISCOUS OR CORROSIVE LIQUID USING FLUSH DIAPHRAGM/WAFER TYPE LEVEL TRANSMITTER.
2. WELDING OF MATCHING FLANGE TO GATE VALVE SHALL BE DONE BY BIDDER.

FOR TENDER PURPOSE ONLY

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE
A	FIRST ISSUE							T.G.			01.08.13
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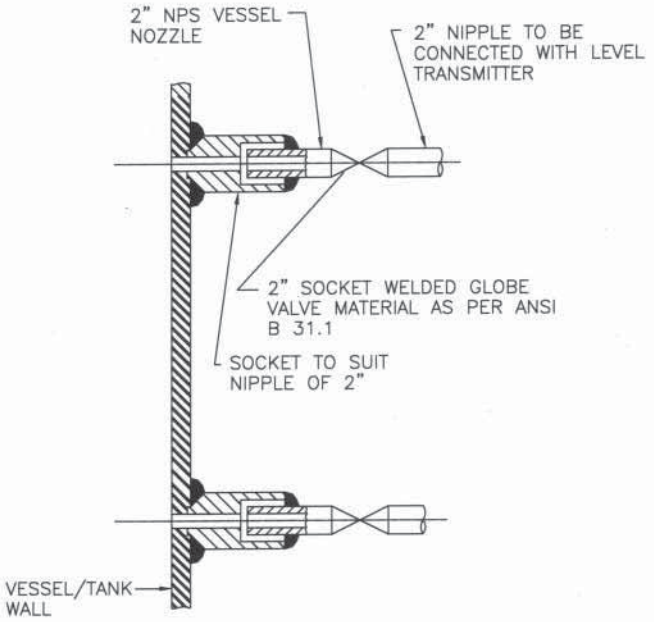
PROJECT	TYPICALTHERMAL POWER PROJECT
TITLE	INSTRUMENT SOURCE CONNECTION DETAILS

SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035 Sh-13 Of 14	A

LEVEL MEASUREMENT



NOTES:–

1. THIS TYPE OF PROCESS CONNECTION SHALL BE USED FOR DISPLACER TYPE LEVEL TRANSMITTER.
2. SOURCE CONNECTION ON VESSEL SHOULD NOT BE LOCATED AT PLACES SUBJECTED TO INTERFACE AND TURBULENCE FROM INLETS AND OUTLETS.
3. IF LOWER CONNECTION IS TAKEN FROM BOTTOM OF THE VESSEL THEN THE NIPPLE MUST BE 100 mm TO 150 mm ABOVE THE BOTTOM OF THE VESSEL.

FOR TENDER PURPOSE ONLY

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE
A	FIRST ISSUE							T.G.			21.06.13
					CLEARED BY						

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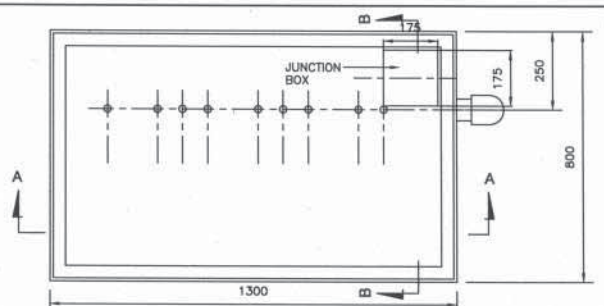
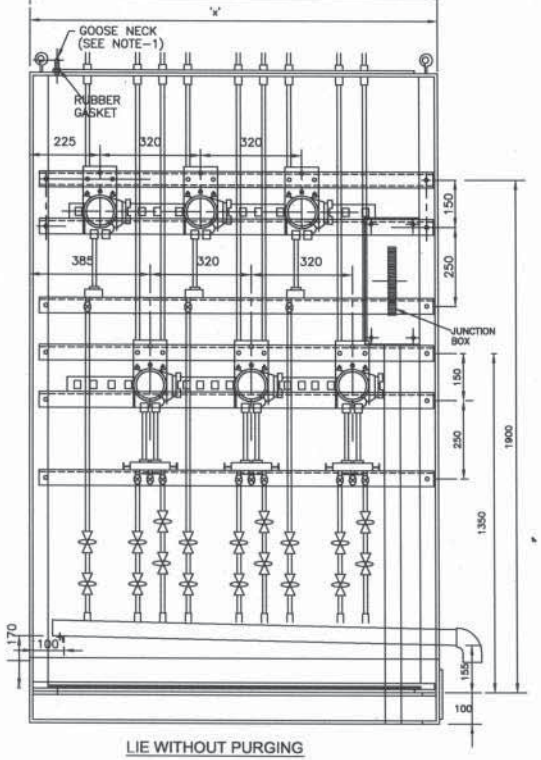
PROJECT: TYPICALTHERMAL POWER PROJECT

TITLE: INSTRUMENT SOURCE CONNECTION DETAILS

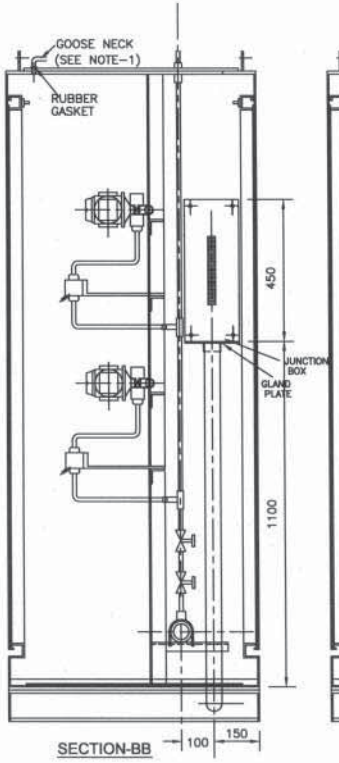
SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035 Sh-14 Of 14	A



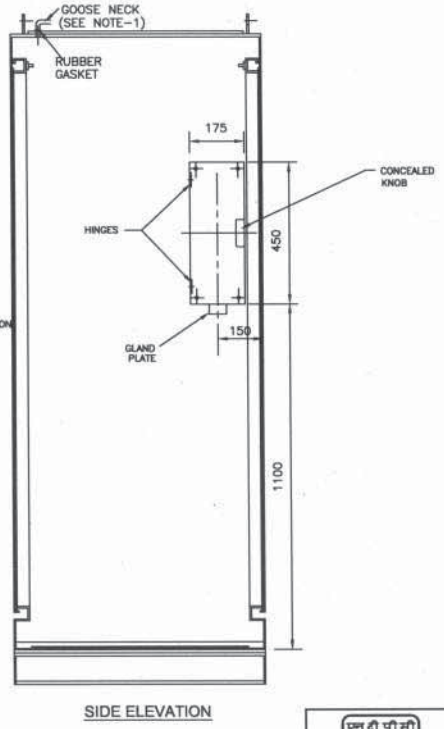
LIE TYPE	MAX. NO. OF TRANSMITTERS	DIMENSION 'X' (mm)
A	6	1250
B	4	930
C	2	630



LIE WITHOUT PURGING



SECTION-BB



SIDE ELEVATION

NOTES:-

1. TO BE PROVIDED FOR LIEs USED IN STEAM & WATER APPLICATION.
2. MATERIAL OF JBs FOR LIEs SHALL BE SAME AS THAT OF LIE.

FOR TENDER PURPOSE ONLY

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE						T.G.				21.08.12
					CLEARED BY						

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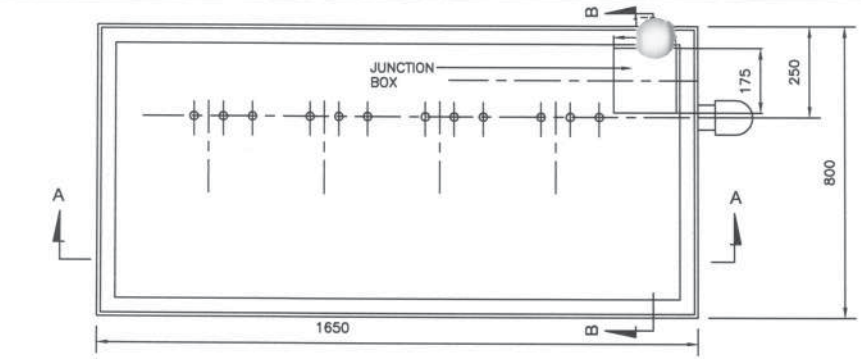
ENGINEERING DIVISION

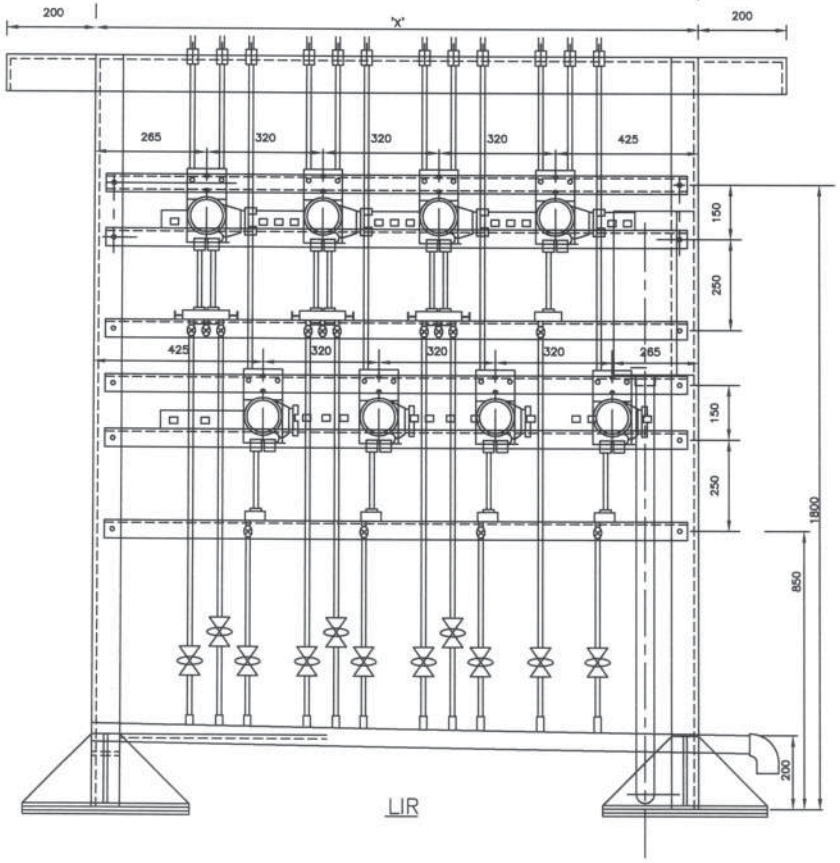
PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: TYPICAL GA OF LOCAL INSTRUMENT ENCLOSURE / RACK

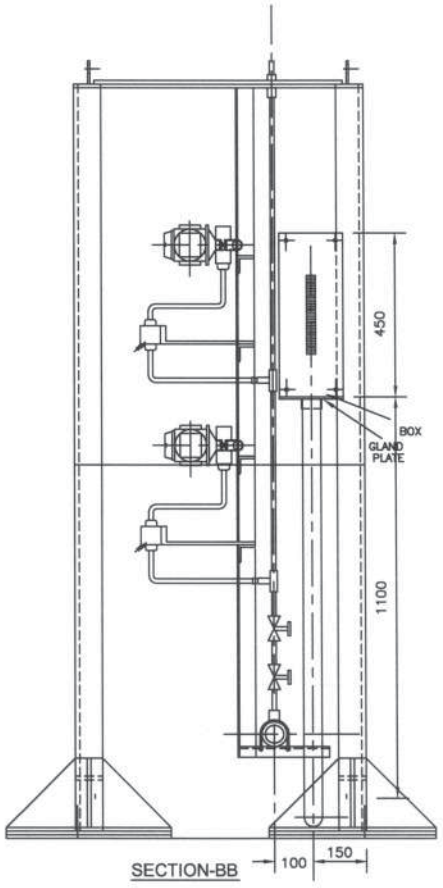
SIZE	SCALE	DRG. NO.	REV. NO.
A2	N.T.S.	0000-999-POI-A-064 SHEET 01 OF 03	B



LIR TYPE	MAX. NO. OF TRANSMITTERS	DIMENSION 'X' (mm)
A	8	1650
B	6	1330
C	4	1010



LIR



SECTION-BB

NOTE:–

1. MATERIAL OF JBs FOR LIRs SHALL BE SAME AS THAT OF LIR.

SECTION-AA
LIR WITHOUT PURGING

FOR TENDER PURPOSE ONLY

NTPC — N T P C LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: TYPICAL GA OF LOCAL INSTRUMENT ENCLOSURE / RACK

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE						T.G.				21.08.12

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SIZE	SCALE	DRG. NO.	REV. NO.
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SECTION – II

GENERAL TECHNICAL REQUIREMENTS

1.00.00 **INTRODUCTION**

This part covers technical requirements which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical specifications and requirements brought out in Section-VI, the Technical Specification and the Technical Data Sheets.

2.00.00 **BRAND NAME**

Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item mentioned shall be understood to be indicative of the function and quality desired, and not restrictive; other manufacturer's products may be considered provided sufficient information is furnished to enable the Employer to determine that the products proposed are equivalent to those named.

3.00.00 **BASE OFFER & ALTERNATE PROPOSALS**

The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognized that the Contractor may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Employer. Sufficient amount of information for justifying such proposals shall be furnished to Employer alongwith the bid to enable the Employer to determine the acceptability of these proposals.

4.00.00 **COMPLETENESS OF FACILITIES**

4.01.00 Bidders may note that this is a EPC Package contract. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure a completely engineered plant shall be provided.

4.02.00 All equipments furnished by the Contractor shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions.

All same standard components/ parts of same equipment provided, shall be interchangeable with one another.

4.03.00 For the C&I systems, the Contractor shall be required to provide regular information about future upgrades and migration paths to the Employer.

5.00.00 **CODES & STANDARDS**

5.01.00 In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following :

a) Indian Electricity Act

b) Indian Electricity Rules

c) Indian Explosives Act

d) Indian Factories Act and State Factories Act

e) Indian Boiler Regulations (IBR)

f) Regulations of the Central Pollution Control Board, India

g) Regulations of the Ministry of Environment & Forest (MoEF), Government of India

h) Pollution Control Regulations of Department of Environment, Government of India

i) State Pollution Control Board.

(j) Rules for Electrical installation by Tariff Advisory Committee (TAC).

(k) Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996

(l) Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998

(m) Explosive Rules, 1983

(n) Petroleum Act, 1984

(o) Petroleum Rules, 1976,

(p) Gas Cylinder Rules, 1981

(q) Static and Mobile Pressure Vessels (Unified) Rules, 1981

(r) Workmen's Compensation Act, 1923

(s) Workmen's Compensation Rules, 1924

(t) NTPC Safety Rules for Construction and Erection

(u) NTPC Safety Policy

(v) Any other statutory codes / standards / regulations, as may be applicable.

5.02.00 Unless covered otherwise in the specifications, the latest editions (as applicable as on the date of bid opening), of the codes and standards given below shall also apply:

a) Bureau of Indian standards (BIS)

b) Japanese Industrial Standards (JIS)

c) American National Standards Institute (ANSI)

d) American Society of Testing and Materials (ASTM)

e) American Society of Mechanical Engineers (ASME)

f) American Petroleum Institute (API)

g) Standards of the Hydraulic Institute, U.S.A.

h) International Organization for Standardization (ISO)

i) Tubular Exchanger Manufacturer's Association (TEMA)

j) American Welding Society (AWS)

k) National Electrical Manufacturers Association (NEMA)

l) National Fire Protection Association (NFPA)

m) International Electro-Technical Commission (IEC)/ European Norm (EN)

n) Expansion Joint Manufacturers Association (EJMA)

o) Heat Exchange Institute (HEI)

p) IEEE standard

	q) JEC standard
5.03.00	Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English.
5.04.00	As regards highly standardized equipments such as Steam Turbine and Generator, National /International standards such as JIS, DIN, VDI, ISO, SEL, SEW, VDE, IEC & VGB shall also be considered as far as applicable for Design, Manufacturing and Testing of the respective equipment. However, for those of the above equipment not covered by these National / International standards, established and proven standards of manufacturers shall also be considered.
5.05.00	In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.
5.06.00	Two (2) English language copies of all national and international codes and/or standards used in the design of the plant and equipment shall be provided by the Contractor to the Employer within two calendar months from the date of the Notification of Award.
5.07.00	In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Employer shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect.
5.08.00	A detailed list of standards apart from those mentioned in the respective detailed specifications in other parts of Section-VI to which all equipment/systems/civil works should conform as indicated in this Part C and elsewhere in the specification.
6.00.00	**EQUIPMENT FUNCTIONAL GUARANTEE**
6.01.00	The functional guarantees of the equipment under the scope of the Contract is given in Section-VI Part - A & B of Technical Specifications. These guarantees shall supplement the general functional guarantee provisions covered under Defect liabilities Section-IV, General Conditions of Contract.

6.02.00 Liquidated damages for shortfall in meeting functional guarantee(s) during the performance and guarantee tests shall be assessed and recovered from the Contractor as specified elsewhere in this specification.

7.00.00 **DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS**

7.01.00 **DESIGN OF FACILITIES**

All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.

The Contractor shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic requirements are detailed out in various clauses of the Technical Specifications. The design of various components, assemblies and subassemblies shall be done so that it facilitates easy field assembly and dismantling. All the rotating components shall be so selected that the natural frequency of the complete unit is not critical or close to the operating range of the unit.

7.02.00 **MAINTENANCE AND AVILABILITY CONSIDERATIONS**

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

Bidder shall state in his offer the various maintenance intervals, spare parts and man-hour requirement during such operation. The intervals for each type of maintenance namely inspection of the furnace, inspection of the entire hot gas path, turbine & equipments, inspection of the steam path and the minor and major overhauls shall be specified in terms of fired hours, clearly defining the spare parts and man-hour requirement for each stage.

Lifting devices i.e. hoists and chain pulley jacks, etc. shall be provided by the contractor for handling of any equipment or any of its part having weight in excess of 500 Kgs during erection and maintenance activities.

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

8.00.00 **DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY CONTRACTOR**

8.01.00 Bidders may note that this is an **EPC Package contract**. Each of the plant and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical specification. All engineering and technical services required to ensure a completely engineered plant shall be provided in respect of mechanical, electrical and power systems, control & instrumentation, civil & structural works as per the scope.

Each main and auxiliary equipment/item of the plant including instruments shall be assigned a unique tag number. The assignment of tag numbers shall be in accordance with KKS system. In all drawings/documents/data sheet etc. KKS tag number of the equipment/item/instrument etc. shall be indicated.

The Contractor shall furnish engineering data /drawings in accordance with the schedule of information as specified in Technical Data Sheets and Technical Specification.

A comprehensive engineering and quality coordination procedure shall be finalized with the successful bidder covering salient features as described in this section of specifications.

8.02.00 The number of copies/prints/CD-ROMs/manuals to be furnished for various types of document is given in **Annexure-VI** to this Part-C, Section-VI of the Technical Specification.

8.03.00 The documentation that shall be provided by the Contractor is indicated in the various sections of specification. This documentation shall include but not be limited to the following:

8.03.01 A) **BASIC ENGINEERING DOCUMENTATION**

Prior to commencement of the detailed engineering work, the Contractor shall furnish a Plant Definition Manual within 12 weeks from the date of the Notification of Award. This manual shall contain the following as a minimum:

i) System description of all the mechanical, electrical, control & instrumentation & civil systems.

ii) Technology scan for each system / sub-system & equipment.

iii) Selection of appropriate technology / schemes for various systems/ subsystems including techno-economic studies between various options.

iv) Optimization studies including thermal cycle optimization.

v) Sizing criteria of all the systems, sub-systems/ equipments/ structures/ equipment foundations alongwith all calculations justifying and identifying the sizing and the design margins.

vi) Schemes and Process & Instrumentation diagrams for the various systems/ sub-system with functional write-ups.

vii) Water Balance diagram.

viii) Operation Philosophy and the control philosophy of the Main Plant and other plants.

ix) General Layout plan of the power station incorporating all facilities in Bidder's as well as those in the Employer's scope. This drawing shall also be furnished in the form of CD-ROMs to the Employer for engineering of areas not included in bidder's scope.

x) Basic layouts and cross sections of the main plant building (various floor elevations), boiler, fuel oil area, transformer yard, switchyard and other areas included in the scope of the bidder.

xi) Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.

The successful bidder shall furnish within three (3) weeks from the date of Notification of Award, a list of contents of the Plant Definition Manual (PDMs) including techno-economic studies, which shall then be mutually discussed & finalised with the Employer.

B) **DETAILED ENGINEERING DOCUMENTS**

i) General layout plan of the station.

ii) Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant.

iii) Flow diagram, Process and Instrumentation diagrams along with write up and system description.

iv) Start-up curves for boiler and both turbines and boiler combined together as a unit for various start-ups, viz. Cold, Warm and Hot start up.

v) Piping isometric, composite layout and fabrication drawings.

vi) Piping engineering diagrams, pipe and fittings schedules, valve schedules, hanger and support schedules, insulation schedules.

vii) Technical data sheets for all bought out and manufactured items. Contractor shall use the Employer's specifications as a base for placement of orders on their sub vendors.

viii) Detailed design calculations for components, system, piping etc., wherever applicable including sizing calculations for all auxiliaries like Mills, Fans, BFPs, CEPs, Heaters/ Deaerators, Air cooled Condensers, Vacuum pumps etc.

ix) Boiler pressure part schedule and sizing calculations. Boiler performance data and boiler design dossier.

x) Transient, hydraulic and thermal stress analysis of piping and system wherever applicable & input and output data alongwith stress analysis isometrics showing nodes.

xi) Thermal cycle information (heat balance diagrams, boiler performance calculations, condenser and heat exchanger thermal calculations etc.).

xii) Characteristic Curves/ Performance Correction Curves. Hydraulic & Mechanical design calculations for condensers & heaters.

xiii) Comprehensive list of all Terminal Points which interface with Employer's facilities, giving details of location, terminal pressure, temperature, fluid handled & end connection details, forces, moments etc.

xiv) Power supply single line diagram, block logics, control schematics, electrical schematics, etc.

xv) Protection system diagrams and relay settings.

xvi) Cables schedules and interconnection diagrams.

xvii) Cable routing plan.

xviii) Instrument schedule, measuring point list, I/O list, Interconnection & wiring diagram, functional write-ups, installation drawings for field mounted instruments, logic diagrams, control schematics, wiring and tubing diagrams of panels and enclosures etc. Drawings for open loop and close loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc.

xix) Alarm and annunciation/ Sequence of Event (SOE) list and alarms & trip set points.

xx) Sequence and protection interlock schemes.

xxi) Type test reports, insulation co-ordination study report and power system stability study report.

xxii) Control system configuration diagrams and card circuit diagrams and maintenance details.

xxiii) Detailed DDCMIS system manuals.

xxiv) Detailed flow chart for digital control system.

xv) Mimic diagram layout, Assignment for other application engg.

xxvi) Civil and Structural works drawings and documents for all structures, facilities, architectural works, foundations underground and overground works and super-structural works as included in the scope of the bidder civil calculation sheets including structural analysis and design alongwith output results.

xxvii) Underground facilities, levelling, sanitary, land scaping drawings.

xxviii) Geotechnical investigation and site survey reports (if and as applicable).

xxix) Model study reports wherever applicable.

xxx) Functional & guarantee test procedures and test reports.

xxxi) Documentation in respect of Quality Assurance System, and Documentation in respect of Commissioning, as listed out elsewhere in this specification.

The Contractor's while submitting the above documents/ drawings for approval/ reference as the case may be, shall mark on each copy of submission the reference letter alongwith the date vide which the submissions are made.

8.03.02 **INSTRUCTION MANUALS**

The Contractor shall submit to the Employer, draft Instruction Manuals for all the equipments covered under the Contract by the end of one year from the date of his acceptance of the Letter of Award. The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each

equipment. The manual shall be specifically compiled for this project. After finalisation and approval of the Employer the Instruction Manuals shall be submitted as indicated in **Annexure-IV.** The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals have been supplied to the Employer. The Instruction Manuals shall comprise of the following.

A) ERECTION MANUALS

The erection manuals shall be submitted at least three (3) months prior to the commencement of erection activities of a particular equipment/system. The erection manual should contain the following as a minimum.

a) Erection strategy.

b) Sequence of erection.

c) Erection instructions.

d) Critical checks and permissible deviation/tolerances.

e) List of tools, tackles, heavy equipments like cranes, dozers, etc.

f) Bill of Materials

g) Procedure for erection and General Safety procedures to followed during erection/installation.

h) Procedure for initial checking after erection.

i) Procedure for testing and acceptance norms.

j) Procedure / Check list for pre-commissioning activities.

k) Procedure / Check list for commissioning of the system.

l) Safety precautions to be followed in electrical supply distribution during erection.

B) OPERATION & MAINTENANCE MANUALS

a) The manual shall be a two rim PVC bound stiff sided binder able to withstand constant usage or where a thicker type is required it shall have locking steel pins, the size of the manual shall not be larger than international size A3. The cover shall be printed with the Project

Name, Services covered and Volume / Book number Each section of the manual shall be divided by a stiff divider of the same size as the holder. The dividers shall clearly state the section number and title. All written instructions within the manual not provided by the manufacturers shall be typewritten with a margin on the left hand side.

b) The arrangement and contents of O & M manuals shall be as follows:

1) Chapter 1 - Plant Description: To contain the following sections specific to the equipment/system supplied

(a) Description of operating principle of equipment / system with schematic drawing / layouts.

(b) Functional description of associated accessories / controls. Control interlock protection write up.

(c) Integrated operation of the equipment alongwith the intended system. (This to be given by the supplier of the Main equipment by taking into account the operating instruction given by the associated suppliers).

(d) Exploded view of the main equipment, associated accessories and auxiliaries with description. Schematic drawing of the equipment alongwith its accessories and auxiliaries.

(e) Design data against which the plant performance will be compared.

(f) Master list of equipments, Technical specification of the equipment/ system and approved data sheets.

(g) Identification system adopted for the various components, (it will be of a simple process linked tagging system).

(h) Master list of drawings (as built drawing - Drawings to be enclosed in a separate volume).

2) Chapter 2.0 - Plant Operation: To contain the following sections specific to the equipment supplied

(a) Protection logics provided for the equipment alongwith brief philosophy behind the logic, Drawings etc.

(b) Limiting values of all protection settings.

(c) Various settings of annunciation/interlocks provided.

(d) Startup and shut down procedure for equipment alongwith the associated systems in step mode.

(e) Do's and Don'ts related to operation of the equipment.

(f) Safety precautions to be taken during normal operation. Emergency instruction on total power failure condition/lubrication failure/any other conditions.

(g) Parameters to be monitored with normal value and limiting values.

(h) Equipment isolating procedures.

(i) Trouble shooting with causes and remedial measures.

(j) Routine testing procedure to ascertain healthiness of the safety devices alongwith schedule of testing.

(k) Routine Operational Checks, Recommended Logs and Records

(l) Change over schedule if more than one auxiliary for the same purpose is given.

(m) Preservation procedure on long shut down.

(n) System/plant commissioning procedure.

3) Chapter 3.0 - Plant Maintenance- To contain the following sections specific to the equipment supplied.

(a) Exploded view of each of the equipments. Drawings alongwith bill of materials including name, code no. & population.

(b) Exploded view of the spare parts and critical components with dimensional drawings (In case of Electronic cards, the circuit diagram to be given) and spare parts catalogue for each equipment.

(c) List of Special T/ P required for Overhauling /Trouble shooting including special testing equipment required for calibration etc.

(d) Stepwise dismantling and assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained etc. Clearance to be maintained etc.

(e) Preventive Maintenance schedules linked with running hours/calendar period alongwith checks to be carried out.

(f) Overhauling schedules linked with running hours/calendar period alongwith checks to be done.

(g) Long term maintenance schedules

(h) Consumables list alongwith the estimated quantity required during normal running and during maintenance like Preventive Maintenance and Overhauling.

(i) List of lubricants with their Indian equivalent, Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation and quantity required for complete replacement.

(j) Tolerance for fitment of various components.

(k) Details of sub vendors with their part no. in case of bought out items.

(l) List of spare parts with their Part No, total population, life expediency & their interchangeability with already supplied spares to NTPC.

(m) List of mandatory and recommended spare list along with manufacturing drawings, material specification & quality plan for fast moving consumable spares.

(n) Lead time required for ordering of spares from the equipment supplier, instructions for storage and preservation of spares.

(o) General information on the equipment such as modification carried out in the equipment from its inception, equipment population in the country / foreign country and list of utilities where similar equipments have been supplied.

8.03.03 After finalization and approval of the Employer, the O & M Manuals shall be submitted as indicated in Annexure-VI. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals (both erection and O & M manuals have been supplied to the Employer.

If after the commissioning and initial operation of the plant, the instruction manuals (Erection and /or O &M manuals) require modifications/additions/ changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by

the Contractor to the Employer for records and number of copies shall be as mentioned in Annexure-VI.

8.03.03 **PLANT HANDBOOK AND PROJECT COMPLETION REPORT**

8.03.03.01 **PLANT HANDBOOK**

The Contractor shall submit to the Employer a preliminary plant hand book preferably in A-4 size sheets which shall contain the design and performance data of various plants, equipments and systems covering the complete project including

i) Design and performance data.

ii) Process & Instrumentation diagrams.

iii) Single line diagrams.

iv) Sequence & Protection Interlock Schemes.

v) Alarm and trip values.

vi) Performance Curves.

vii) General layout plan and layout of main plant building and auxiliary buildings

viii) Important Do's & Don't's

The plant handbook shall be submitted within twelve (12) months from the date of award of contract. After the incorporation of Employer's comments, the final plant handbook complete in all respects shall be submitted three (3) months before start-up and commissioning activities.

8.03.03.02 **PROJECT COMPLETION REPORT**

The Contractor shall submit a Project Completion Report at the time of handing over the plant.

8.03.04 **DRAWINGS**

a) i) All the plant layouts shall be made in computerized 3D modelling system. The Employer reserves the right to review the 3D model at different stages during the progress of engineering. The layout drawings submitted for Employer's review shall be fully dimensioned and extracted from 3D model after interference check.

ii) All documents submitted by the Contractor for Employer's review shall be in electronic form (soft copies) along with the desired number

of hard copies as per **Annexure-VI** of Part-C. The soft copies shall be uploaded by the vendors in C-folders, a Web-based system of NTPC ERP, for which a username and password will be allotted to the new vendor by NTPC.

Similarly, the vendor can download the drawings/documents, approved/ commented by NTPC, through above site.

The soft copies of identified drawings/documents shall be in pdf format, whereas the attachments/reply to the submitted document(s) can be in .doc, .xls, .pdf, .dwg or .std formats.

iii) Final copies of the approved drawings along with requisite number of hard copies shall be submitted as per **Annexure-VI** of Part-C.

iv) Contractor shall prepare the model of all the facilities located within plant boundary covering facilities in Main Plant Block area and Balance of plant (BOP) area in an integrated & intelligent 3D software solution. Main Plant Block area shall include Transformer Yard, TG building (including all facilities), Boiler area, ESP area, chimney area, FGD area and any other facility located in main plant block. BOP area shall include all facilities pertaining to AHP, CHP, LHP, GHP, DM PT plant, pipe & cable racks and any other facility located within plant boundary.

All piping layouts, equipment layouts, floor plans, ducting layout (Air/flue gas, A/C, Ventilation etc.), General Arrangement drawings and RCC layout of major buildings and structural arrangement drawings shall necessarily be extracted from the aforesaid 3D model and submitted for employer's review along with the 3D review model to enable NTPC to review and approve these drawings.

Contractor shall prepare and provide 3D design review model (network ready, which shall include visual interference check, walk-through animation, video simulation for major equipment placement and removal, visual effect, photo realism etc.), which is extracted from intelligent 3D model and shall make a presentation of the same every 3 months from LOA to enable NTPC to review the progress of engineering or as & when required by employer.

The complete 3D data (editable model) which shall be utilised for all future detailed engineering related to maintenance, operation, R&M, efficiency improvement of the project etc. Complete 3D model along with as built GADs, layout, isometrics, reports extracted and 3D models for all disciplines , with any other document generated from 3D model and naming conventions with as-built updates along with complete reference databases, component catalogues for all the size range shall be handed over to owner. Apart from the 3D Model, all

drawings like GADs, Isometrics etc. extracted from the model shall also be submitted by the Contractor in Electronic form. 3D model along with complete Project databases shall be submitted at each model review stage and as final as-built. The contractor shall also submit all the configuration files, customization files, templates and all referenced databases.

All input files of software used for design of Equipments / Piping like CAESAR2 files, input files for Pressure vessel design, data sheets etc., shall be handed over to NTPC as per NTPC specifications for hand over of Engineering Information.
Further, two Licenses of the used 3D Modelling Software (One for Engineering View and One for Site View) shall be provided along with compatible Hardware for possible review and study of the Model Files
being submitted by the Bidder Time to time.
All software provided shall necessarily include cost for perpetual license(s) for use on all the machines and an Annual maintenance contract (AMC) which shall include software upgrades as & when released by the software agency for a period of three years after warranty/guarantee period .
Hand over Plan: There shall be continuous hand over of documents and data at various stages of the project including rules and trigger points for hand over of data to NTPC shall be at 30%, 60% and 90 % of 3D model stage.
Database backup shall be taken every month and handed over to NTPC.

b) All documents/text information shall be in latest version of MS Office/MS Excel/PDF format as applicable.

c) All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, the external connection, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearance and spaces required between various portions of equipment and any other information specifically requested in the drawing schedules.

d) Each drawing submitted by the Contractor (including those of sub-vendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and revisions. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, notings, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

e) The drawings submitted by the Contractor (or their subvendors) shall bear Employer's drawing number in addition to contractor's (their sub-vendor's)

own drawing number. Employer's drawing numbering system shall be made available to the successful bidder to enable him to assign Employer's drawing numbers to the drawings to be submitted by him during the course of execution of the Contract.

Similarly, all the drawings/ documents submitted by the Contractor during detailed engineering stage shall be marked "FOR APPROVAL" or "FOR INFORMATION" prior to submission **in line with suggestive MDL**.

Further, space shall be identified on each drawing for Approval stamp and electronic signature.

f) The furnishing of detailed engineering data and drawings by the Contractor shall be in accordance with the time schedule for the project. The review of these documents/ data/ drawings by the Employer will cover only general conformance of the data/ drawings/ documents to the specifications and contract, interfaces with the equipments provided by others and external connections & dimensions which might affect plant layout. The review by the Employer should not be construed to be a thorough review of all dimensions, quantities and details of the equipments, materials, any devices or items indicated or the accuracy of the information submitted. The review and/ or approval by the Employer/ Project Manager shall not relieve the Contractor of any of his responsibilities and liabilities under this contract.

g) After the approval of the drawings, further work by the Contractor shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Employer.

h) All manufacturing, fabrication and execution of work in connection with the equipment / system, prior to the approval of the drawings, shall be at the Contractor's risk. The Contractor is expected not to make any changes in the design of the equipment /system, once they are approved by the Employer. However, if some changes are necessitated in the design of the equipment/system at a later date, the Contractor may do so, but such changes shall promptly be brought to the notice of the Employer indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification.

i) Drawings shall include all installations and detailed piping layout drawings. Layout drawings for all piping of 65 mm and larger diameter shall be submitted for review/ approval of Employer prior to erection. Small diameter pipes shall however be routed as per site conditions in consultation with site authority/ representative of Employer based on requirements of such piping indicated in approved/ finalised Flow Scheme/ Process & Instrumentation Diagrams and/or the requirements cropping up for draining & venting of larger diameter piping or otherwise after their erection as per actual physical condition for the entire scope of work of this package.

Assessing & anticipating the requirement and supply of all piping and equipment shall be done by the contractor well in advance so as not to hinder the progress of piping & equipment erection, subsequent system charging and its effective draining & venting arrangement as per site suitability.

j) As Built Drawings

After final acceptance of individual equipment / system by the Employer, the Contractor will update all original drawings and documents for the equipment / system to "as built" conditions and submit no. of copies as per **Annexure VI**.

k) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to Engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission. The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data/ drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same.

l) The Contractor shall submit adequate prints of drawing / data / document for Employer's review and approval. The Employer shall review the drawings and return soft copy to the Contractor authorizing either to proceed with manufacture or fabrication or marked to show changes desired. When changes are required, drawings shall be re-submitted promptly, with revisions clearly marked, for final review. Any delays arising out of the failure of the Contractor to submit/rectify and resubmit in time shall not be accepted as a reason for delay in the contract schedule.

m) All engineering data submitted by the Contractor after final process including review and approval by the Project Manager/ Employer shall form part of the contract documents and the entire works covered under these specification shall be performed in strict conformity with technical specifications unless otherwise expressly requested by the Project Manager in writing.

8.03.05 **e-Learning Package:**

e-learning packages shall be supplied for the equipment / system for the following Steam Turbine Generator & auxiliaries and Steam Generator & auxiliaries along with associated electrical and C&I system.

8.03.05.01 Steam Turbine Generator & Auxiliaries

Steam Turbine including stop valves, control valves, overload valves and cross over piping. Steam Turbine Auxiliary Systems including Quick Closing and Ordinary NRVs, Turbine gland sealing system, Lubricating oil system and its purification system, Centralized oil storage and its purification system, Control fluid and its purification system, governing and protection system, exhaust hood spray cooling system, drainage and vent system, turbine preservation system, HP/LP Bypass system.

Generator and Auxiliary System including Generator, complete hydrogen cooling, carbon dioxide and nitrogen gas systems as applicable, complete seal oil system, complete water cooling system where applicable and complete excitation system.

Condensing Plant including Condenser, Condenser air evacuation system and Condenser on load tube cleaning system as applicable etc.

Drip Pump along with all accessories as applicable, Condensate Extraction Pumps along with all accessories, Deaerator level Control Station, Feed Water Heating Plant including Drain Cooler, low pressure heaters, deaerator and feed storage tank, high pressure heaters and associated accessories, Boiler Feed Pumps along with all accessories, Drive Turbine for Boiler Feed Pump along with all accessories, Feed regulating station, Make up system to Condenser, Gland Steam Condenser Recirculation System, Turbine Hall EOT Cranes and EOT Crane for Boiler Feed Pump as applicable.

8.03.05.02 **Steam Generator & Auxiliaries**

Furnace/evaporator, separator & drain collection vessel, superheater, reheater, economiser, startup recirculation & drain system, desuperheating spray system, safety valves, soot blowing system, draft plant including FD & ID fans, PA fan, air preheaters, SCAPH, coal preparation and firing system including raw coal feeder and pulverisers, coal burners, fuel oil system and oil burners, Electrostatic precipitator, NOx control system and Flue gas desulphurisation system, Aux. PRDS system.

8.03.05.03 These packages shall be installed on the Learning Management Server (LMS) of Power Management Institute (PMI), NTPC located at Noida. The Engineer- In-Charge (EIC) for the e-learning modules shall be from PMI.

1. The objective of the e-Learning package consisting of courses for erection, commissioning, operation and maintenance of equipment / system as specified

above is to facilitate the employees to have first hand information / requirement with respect to above activities for the supplied equipment / system .

2. The bidder shall submit e-learning courses each for erection, commissioning, operation and maintenance of each of the equipment / system supplied as above.

a. The erection course(s) should include instructions on pre-checks, prerequisites, erection strategy, erection procedure etc.

b. The commissioning course(s) should include instructions on pre-commissioning, commissioning, initial operation etc.

c. The operation course(s) should include instructions on the permissive, interlocks, physical check-ups, start-up, shutdown and protections etc.

d. The maintenance course(s) should include instructions on predictive, preventive, breakdown and overhauling.

Depth of coverage of above courses shall be as specified for **"Instruction Manuals"** in above clauses. A literature on caution / safety while handling equipment / system for the above modules shall follow the description of the said equipment /system.

3. The e-Learning packages on equipment / system shall be installed by the vendor and shall be successfully test run in the presence of EIC or representative before acceptance by NTPC. The vendor will also give the master copy in form of Flash Drive/CD/DVD. The respective module for erection & commissioning shall be delivered and successfully test run at least three months before the scheduled start of the corresponding activity at site.

The respective module for operation & maintenance shall be delivered and successfully test run at least three months before scheduled first synchronization of first unit.

4. e-Learning course broad requirements:

a. The courses shall be web based and mobile based Application type. It shall run on all possible versions of web browser like Internet Explorer, Google Chrome, Firefox etc. on Laptop/Desktop and shall be Smartphone/Tablet/Mobile responsive. The Mobile responsive courses shall run on Android, Windows Mobile, Blackberry, iOS etc.

b. The courses shall support liquid/fluid page layout so that the entire screen gets adjusted to PC, Laptop, Smartphone/Mobile, Tablet and any other display devices.

c. Course content text shall be in English language and be associated with a voiceover in English language with Indian accent.

d. Courses shall be SCORM (Sharable Content Object Reference Model) compliant, version 1.2 which is compatible with LMS at PMI.

e. Each course shall have every physical and functional detail of the equipment / system supplied.

f. Each of the e-Learning course shall be based on multiple web pages and mobile pages with multiple modules.

g. There shall be option for self-assessment test after every course. In case the user doesn't opt for self-assessment test the user shall be able to go to the next course. There shall be no restriction in no. of times for repeating the assessments. All correct answers along with the answers marked by the users shall be displayed at the end of test/quiz.

h. If Java and Flash, as applicable are not available in the system to run the package, then there shall be a prompt message for updation of the same.

i. Each course shall have a self-running interactive content with navigation buttons containing forward, backward, pause, bookmark and menu options in the course window.

j. The course shall contain chapter titled 'Introduction/overview' that explains the purpose of the course.

k. The course content shall contain descriptive text shall be factual, specific, terse, clearly worded, and simply illustrative, so that the user can understand it.

l. The system shall provide the user with the ability to select the information with a Cursor.

m. The course menu should contain table of content linked to concerned pages. The user shall be given the capability to access all of the functions available on the system through a menu system. This shall consist of active buttons, which shall control a hierarchy of pull down/pop-up menus. Menu shall appear quickly and exist only while a selection is being made. The user shall be given the capability to position the cursor or pointer on the menu item and use pointer device such as mouse to activate the function.

n. Every course shall contain the 3D design/drawing/exploded view/360^0 turn around view of the equipment/system, textual description of the equipment/system and its functionality with video (as applicable), animation and audio.

o. The users shall be able to control audio sound level associated with the courses.

p. Drawings / text in the courses shall be scalable (Zoom In/ Out).

q. The user shall have the capability to record a **bookmark** to mark displayed information for later recall, whenever he accesses the same course next time.

Notes:

1. e-learning Package of an equipment / system shall include e-learning courses for each of erection, commissioning, operation and maintenance of that equipment / system.
2. e-learning courses on erection, commissioning, operation and maintenance of an equipment / system shall include e-learning lessons/chapters/modules (as required) for erection, commissioning, operation and maintenance respectively of that equipment / system.
3. The vendor shall get the approval of one sample course from EIC before proceeding for further courses.

8.04.00 **Provision for Fail Safe operation of vital Equipments**

All the Plant and equipments / Systems supplied under the contract shall be designed following “Fail Safe” concept. In case of failure of Power supply like Electric power, Hydraulic pressure, Pneumatic pressure, Vacuum etc. the system should be designed in such a way that the equipment/Valves/dampers etc. shall always move/remains (as applicable) to safest position as per system requirement to ensure safety of Man and Machinery.

8.05.00 **Engineering Co-ordination Procedure**

8.05.01 The following principal coordinators will be identified by respective organizations at time of award of contract:

NTPC Engineering Coordinator (NTPC EC):

Name :

Designation :

Address :

a) Postal :

b) Telegraphic / e-Mail :

c) FAX : TELEPHONE :

Contractor’s/ Vendor’s Engineering Coordinator (VENDOR EC):

Name :

Designation :

	Address : a) Postal : b) Telegraphic / e-Mail : c) FAX : TELEPHONE :
8.05.02	All engineering correspondence shall be in the name of above coordinators on behalf of the respective organizations.
8.05.03	Contractor's/Vendor's Drawing Submission and Approval Procedure: a) All data/information furnished by Vendor in the form of drawings/ documents/catalogues or in any other form for NTPC's information/ interface and or review and approval are referred by the general term "drawings". b) Not used c) All drawings (including those of subvendor's) shall bear at the right hand bottom corner the 'title plate' with all relevant information duly filled in. The Contractor shall furnish this format to his sub-vendor along with his purchase order for sub-vendor's compliance. d) Not used e) The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data / drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same. f) **Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper endorsement for checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission.** g) The Contractor shall submit drawing / data / document for Employer's review and approval. The drawings submitted by the Contractor/vendor shall be reviewed by NTPC and their comments shall be forwarded within three (3) weeks of receipt of drawings. Upon review of each drawing, depending on

the correctness and completeness of the drawing, the same will be categorized and approval accorded in one of the following categories:

CATEGORY- I: Approved

CATEGORY- II Approved, subject to incorporation of comments/ modification as noted. Resubmit revised drawing incorporating the comments.

CATEGORY –III Not approved. Resubmit revised drawings for approval after incorporating comments/ modification as noted.

CATEGORY -IV For information and records.

h) Contractor shall resubmit the drawings approved under Category II, III & IVR within two (2) weeks of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision Number enclosed in a triangle (eg. 1, 2, 3 etc). Contractor shall not make any changes in the portions of the drawing other than those commented. If changes are required to be made in the portions already approved, the Contractor shall resubmit the drawing identifying the changes for Employer's review and approval. **Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents.**

i) In case, the Contractor/ Vendor does not agree with any specific comment, he shall furnish the explanation for the same to NTPC for consideration. In all such cases the Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.

j) It is responsibility of the Contractor/ Vendor to get all the drawings approved in the Category I & IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule.

k) If Contractor/ Vendor fails to resubmit the drawings as per the schedule, construction work at site will not be held up and work will be carried out on the basis of comments furnished on previous issues of the drawing.

l) These comments will be taken care by the contractor while submitting the revised drawing.

	The contractor shall use a single transmittal for drawings. Submission. This shall include transmittal numbers and date, number of copies being sent, names of the agencies to whom copies being sent, drawing number and titles, remarks or special notes if any etc.
8.06.00	**ENGINEERING PROGRESS AND EXCEPTION REPORT**
8.06.01	The Contractor shall submit every month an Engineering progress and Exception Report giving the status of each engineering information including a) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission b) Drawings which were not submitted as per agreed schedule.
8.06.02	The draft format for this report shall be furnished to the Employer within four (4) weeks of the award of the contract, which shall then be discussed and finalised with the Employer.
9.00.00	**TECHNICAL CO-ORDINATION MEETING**
9.01.00	The Contractor shall be called upon to organise and attend monthly Design/ Technical Co-ordination Meetings (TCMs) with the Employer/Employer's representatives and other Contractors of the Employer during the period of contract. The Contractor shall attend such meetings at his own cost at NEW DELHI / NOIDA or at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during the discussions.
9.02.00	The Contractor should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the comments of the Employer shall be discussed across the table during the above Technical Co-ordination Meeting (s) wherein best efforts shall be made by both sides to ensure the approval of the drawing.
9.02.01	The Contractor shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Contractor shall be equipped with necessary tools and facilities so that the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.
9.02.02	Should any drawing remain unapproved for more than six (6) weeks after it's first submission, this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof.

9.03.0 Any delays arising out of failure by the Contractor to incorporate Employer's comments and resubmit the same during the TCM shall be considered as a default and in no case shall entitle the Contractor to alter the Contract completion date.

10.00.00 **DESIGN IMPROVEMENTS**

The Employer or the Contractor may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly.

If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.

11.00.00 **EQUIPMENT BASES**

A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base, unless otherwise specifically agreed to by the Employer. Each base plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.

12.00.00 **PROTECTIVE GUARDS**

Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.

13.00.00 **LUBRICANTS, SERVO FLUIDS AND CHEMICALS**

13.01.00 All the first fill and one year's topping requirement of consumables such as greases, oils, lubricants, servo fluids / control fluids, gases (excluding H_2, CO_2 and N_2 for Generator) etc. which will be required to put the equipment covered under the scope of specifications into successful commissioning/initial operation and to establish completion of facilities shall be supplied by the contractor. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.

Bidder scope shall include supply of H_2, CO_2 and N_2 as applicable for the Generator till successful commissioning of Generator.

Bidder shall supply a quantity not less than 10% of the full charge or one (1) year topping requirement mentioned above (Whichever is higher) of each variety of lubricants, servo fluids, gases etc. (as detailed above) used which is expected to be

	utilized during the first year of operation. This additional quantity shall be supplied in separate containers.
13.02.00	As far as possible lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible. Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals etc. required for the complete plant covered herein shall be furnished. On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Employer alongwith lubrication requirements.
14.00.00	**LUBRICATION**
14.01.00	Equipment shall be lubricated by systems designed for continuous operation. Lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.
15.00.00	**MATERIAL OF CONSTRUCTION**
15.01.00	All materials used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilised for various components shall be those which have established themselves for use in such applications.
16.00.00	**RATING PLATES, NAME PLATES & LABELS**
16.01.00	Each main and auxiliary item of plant shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer.
16.02.00	Each item of plant shall be provided with nameplate or label designating the service of the particular equipment. The inscriptions shall be approved by the Employer or as detailed in appropriate section of the technical specifications.
16.03.00	Such nameplates or labels shall be of white non-hygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back.
16.04.00	Items of plant such as valves, which are subject to handling, shall be provided with an engraved chromium plated nameplate or label with engraving filled with enamel. The name plates for valves shall be marked in accordance with MSS standard SP-25 and ANSI B 16.34 as a minimum.

16.05.00 Hanger/ support numbers shall be marked on all pipe supports, anchors, hangers, snubbers and restraint assemblies. Each constant and variable spring support shall also have stamped upon it the designed hot and cold load which it is intended to support.

16.06.00 Valves, steam traps and strainers shall be identified by Employer's tag number of a metal tap permanently attached to non-pressure parts such as the yoke by a stainless steel wire. The direction of flow shall also be marked on the body.

16.07.00 Safety and relief valves shall be provided with the following:

a) Manufacturer's identification.

b) Nominal inlet and outlet sizes in mm.

c) Set pressure in Kg/cm^2 (abs).

d) Blowdown and accumulation as percentage of set pressure.

e) Certified capacity in Kg of saturated steam per hour or in case of liquid certified capacity in litres of water per minute.

16.08.00 All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.

16.09.00 All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system.

17.00.00 **TOOLS AND TACKLES**

The Contractor shall supply with the equipment one complete set of all special tools and tackles and other instruments required and other instruments for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder alongwith the offer.

The price of each tool / tackle shall be deemed to have been included in the total bid price. These tools and tackles shall be separately packed and sent to site. The Contractor shall also ensure that these tools and tackles are not used by him during erection, commissioning and initial operation. For this period the Contractor should bring his own tools and tackles. All the tools and tackles shall be of reputed make acceptable to the Employer.

18.00.00 **WELDING**

18.01.00 If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipments to be performed by others the requirements shall be submitted to the Employer in advance of commencement of erection work.

19.00.00 **COLOUR CODE FOR ALL EQUIPMENTS/ PIPINGS/ PIPE SERVICES**

19.01.00 All equipment/ piping/ pipe services are to be painted by the Contractor in accordance with Employer's standard colour coding scheme, which will be furnished to the Contractor during detailed engineering stage.

20.00.00 **PROTECTION AND PRESERVATIVE SHOP COATING**

20.01.00 **PROTECTION**

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either metallic or a non-metallic protection device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. All primers/paints/coatings shall take into account the hot humid, corrosive & alkaline, subsoil or over ground environment as the case may be. The requirements for painting specification shall be complied with as detailed out in Part-A & B of the Technical Specification.

20.02.00 **PRESERVATIVE SHOP COATING**

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted as per the requirements covered in the relevant part of the Technical Specification.

Transformers and other electrical equipments, if included shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colors shall be as per manufacturer's standards, to be selected and specified by the Employer at a later date.

20.03.00 Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Contractor after obtaining specific approval of the Employer regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature

	higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Employer.
20.04.00	All other steel surfaces which are not to be painted shall be coated with suitable dust preventive compound subject to the approval of the Employer.
20.05.00	All piping shall be cleaned after shop assembly by shot blasting or other means approved by the Employer. Lube oil piping or carbon steel shall be pickled.
20.06.00	Painting for Civil structures and equipment/system covered under this package shall be done as specified under technical requirements on civil works in relevant part of this specifications.
21.00.00	**QUALITY ASSURANCE PROGRAMME**
21.01.00	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 Employer's site or at any other place of 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 Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with ISO-9001/IS-14001. 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) Quality System Manual c) Design Control System d) Documentation Control System e) Qualification data for Bidder's key Personnel. f) 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. g) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls. h) Control of non-conforming items and system for corrective actions. i) Inspection and test procedure both for manufacture and field activities.

j) Control of calibration and testing of measuring testing equipments.

k) System for Quality Audits.

l) System for indication and appraisal of inspection status.

m) System for authorising release of manufactured product to the Employer.

n) System for handling storage and delivery.

o) System for maintenance of records, and

p) 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 .Formats for the same will be shared along with QA Coordination procedure.

22.00.00 **GENERAL REQUIREMENTS - QUALITY ASSURANCE**

22.01.00 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 Employer. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award on enclosed format No. QS-01-QAI-P-1/F3-R0. Monthly progress reports shall be furnished.

22.02.00 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/ Sub-contractor's/ sub-supplier'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. The Quality Plan shall be submitted on electronic media through C-folders, a web based system of NTPC ERP, for review and approval.

22.03.00 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 starting from receipt of materials/equipment at site.

22.04.00	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 Employer's approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.
22.05.00	The contractor shall submit to the Employer Field Welding Schedule for field welding activities in the format enclosed at **Annexure-V.** The field welding schedule shall be submitted to the Employer along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site.
22.06.00	The contractor shall have suitable Field Quality Organization with adequate manpower at Employer's site, to effectively implement the Field Quality Plan (FQP) and Field Quality Management System for site activities. The contractor shall submit the details of proposed FQA setup (organizational structure and manpower) for employer's approval. The FQA setup shall be in place at least one month before the start of site activities.
22.07.00	No material shall be despatched from the manufacturer's works before the same is accepted by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of Material Dispatch Clearance Certificate (MDCC / CHP Clearance).
22.08.00	All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details
22.09.00	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 Employer. All welding/brazing procedures shall be submitted to the Employer or its authorized representative prior to carrying out the welding/brazing.
22.10.00	All brazers, welders and welding operators employed on any part of the contract either in Contractor's/his sub-contractor's works or at site or elsewhere shall be

	qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer. All welding / brazing procedures qualified / used at shop, will be made available to NTPC during audit / inspection. Procedures to be qualified at site will be submitted to NTPC for approval.
22.11.00	Not Used.
22.12.00	For all IBR pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. However, other piping shall be as per relevant code. Similarly, any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding
22.13.00	All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.
22.14.00	No welding shall be carried out on cast iron components for repair.
22.15.00	Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.
22.16.00	All non-destructive examination shall be performed in accordance with written procedures as per International Standards, The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job. In general all plates of thickness greater than 40mm & for pressure parts plates of thickness equal to or greater than 25mm shall be ultrasonically tested otherwise as specified in respective equipment specification. All bar stock/Forging of diameter equal to or greater than 40 mm shall be Ultrasonically tested.
22.17.00	The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub-vendors proposed by the Main contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval on enclosed format as Annexure-III. List of NTPC approved sub vendors against similar Pkg/items is attached as Section-VI, Part-B ,Chapter E-60 Indicative sub-vendor list. The contractor’s proposal for any new sub vendor for any of the items identified in indicative sub-vendor list shall necessarily be furnished in the sub vendor questionnaire & main Contractor Evaluation report format attached as Annexure- VII with all relevant documents and main contractor's own assessment report

assessed as per their quality management system for NTPC review and acceptance .

New sub vendor proposal will only be considered for NTPC review, provided the proposal is received sufficiently in time: 90 days prior to ordering date of a Bought-Out Items/Start of Manufacturing so as not to impede the progress of the contract.

Major checks and quality requirements as mentioned below shall necessarily be assessed by main contractor and complied with documentary support in case the same is not the part of their Quality management system.

i. Duly Filled Main supplier Evaluation Report.
ii. Duly Filled Sub-Supplier Questionnaire.
iii. Factory Registration Certificate.
iv. Overall Organization Chart with Manpower details (Design, Manufacturing, Quality etc.)
v. Supply reference list of the Sub-Supplier indicating similar product supply order reference no., customer name, rating of product, date /year of supply, date / year of commissioning.
vi. List of Manufacturing Equipment available with sub vendor.
vii. List of Testing Equipment available with sub vendor.
viii. Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any.
ix. Details of Outsourced Manufacturing Processes, if any.
x. Quality control exercised during receipt, in-process & final inspection.
xi. Compliance of Statutory requirements (As applicable)

After first submission of proposal to NTPC , In absence of relevant documents/ Incompleteness of the proposal, The main contractor will be given a period of maximum 10 days to submit the compliance of the NTPC comments. In case of noncompliance it will be presumed that main contractor is not serious about pursuing the proposal & the proposal will be foreclosed.

The proposed Sub vendor will be assessed broadly on following criteria

i) Quality Management System Compliance including raw material/BOI control, traceability & control over outsources process
ii) Design Capabilities (As applicable)
iii) Manufacturing, Testing & Storage Facility
iv) Processing Capabilities
v) Supply Experience
vi) Safety Aspect

In case of major observations or non-compliance observed during sub vendor works visit (Jointly with the main contractor) with respect to the submitted documents, proposed sub vendor will not be considered for acceptance and Main contractor will be solely responsible in such cases.

Monthly progress reports on sub-vendor detail. Submission / approval shall be furnished preferably on enclosed format at Annexure-IV. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.

22.18.00	For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalised with the Employer and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor. Within two (2) weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Employer on the monthly basis by the Contractor along with a report of the Purchase Order placed so far for the contract.
22.19.00	Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-contractor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.
22.20.00	The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his subcontractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.
22.21.00	Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.
22.22.00	For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.
22.23.00	Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.
22.24.00	**Environmental Stress Screening** Environmental stress screening test process / procedure for eliminating infant mortile components for DDCMIS / PLC based system & for other systems having

	substantial electronics components (as determined by employer) like Electronic transmitter, CCTV components, PA systems etc. shall be furnished for NTPC acceptance
22.25.00	The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / sub-contractor's works. The quantum of check / test for routine & acceptance test by employer shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering stage.
22.26.00	**Software Reliability / Quality Certification** Certification from OEM's authorized signatory that software offered with DDCMIS, PLC, CCTV, PA, Pyrometer, CEMS, AAQMS, EQMS, BHMS etc. declaring that the all the offered software(s) had gone through the established software quality test and offered software is not of β-version and offered software is also free from all known bugs as on date of approval of systems documents by NTPC as a part of quality documentation review and approval process during detail engineering.
23.00.00	**QUALITY ASSURANCE DOCUMENTS**
23.01.00	The Contractor shall be required to submit the QA Documentation in soft copies, as identified in respective quality plan with tick (✓)mark.
23.01.01	Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document. The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing. The final quality document will be compiled and issued at the final assembly place of equipment before despatch. However, **soft copies will be furnished** not later than two (2) weeks.
23.02.00	Typical contents of QA Documentation is as below:- (a.) Quality Plan (b.) Material mill test reports on components as specified by the specification and approved Quality Plans. (c.) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans. (d.) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

(e.) Heat Treatment Certificate/Record (Time- temperature Chart)

(f.) All the accepted Non-conformance Reports (Major/Minor)/deviation, including complete technical details / repair procedure).

(g.) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.

(h.) Certificate of Conformance (COC) wherever applicable.

(i.) MDCC

23.03.00 Similarly, the contractor shall be required to submit soft copies containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.

23.04.00 Before despatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

(a.) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.

(b.) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.

(c.) If a decision is made for despatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than two (2) weeks after the despatch of equipment.

23.05.00 **TRANSMISSION OF QA DOCUMENTATION**

On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer.

For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than two (2) weeks after the date of the last delivery of equipment.

24.00.00 **PROJECT MANAGER'S SUPERVISION**

24.01.00 To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Arbitration' clause in Section GCC, the Contractor shall proceed to comply with the Project Manager's decision.

24.02.00 The work shall be performed under the supervision of the Project Manager.

The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:

(a.) Interpretation of all the terms and conditions of these documents and specifications

(b.) Review and interpretation of all the Contractor's drawing, engineering data, etc.

(c.) Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract

(d.) Inspect, accept or reject any equipment, material and work under the contract

(e.) Issue certificate of acceptance and/or progressive payment and final payment certificates

(f.) Review and suggest modifications and improvement in completion schedules from time to time, and

(g.) Supervise Quality Assurance Programme implementation at all stages of the works.

25.00.00	**INSPECTION, TESTING AND INSPECTION CERTIFICATES**
25.01.00	The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.
25.02.00	The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer 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 Project Manager 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.
25.03.00	The Contractor shall give the Project Manager/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's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days of the date on which the equipment is noticed 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 two (2) copies.
25.04.00	The Project Manager 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 inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.
25.05.00	When the factory tests have been completed at the Contractor's or subcontractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Failure on the part of Project Manager /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 Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.

25.06.00	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, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /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 Project Manager/Inspector or to his authorised representative to accomplish testing.
25.07.00	The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.
25.08.00	To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no. 25.03.00 - of this chapter, 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.
25.09.00	All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipment in the presence of Project Manager / Inspector.
25.10.00	**ASSOCIATED DOCUMENT FOR QUALITY ASSURANCE PROGRAMME**
25.10.01	List of items requiring quality plan and sub supplier approval. Format No.: QS-01-QAI-P-01/F3-R0 **(Annexure-III).**
25.10.02	Status of items requiring Quality Plan and sub supplier approval. Format enclosed at **Annexure-IV.**
25.10.03	Field Welding Schedule Format enclosed at **Annexure-V.**
25.11.00	**TESTING OF MAJOR DESIGN FEATURES:**
	The major design features of the system shall be demonstrated by the Contractor at the Contractor's works or any other place mutually agreed within Six months from the date of LOA. These are the system function tests, which have a major impact on the detailed system design & finalization of important engineering documents like configuration, functional grouping, BOM etc., but do not require a fully engineered system for conductance. Bidder shall identify these features & include detailed test procedures in the bid, which shall be finalized during discussions with the bidder

before award. The developments and any augmentation of standard features undertaken by the Bidder to fulfill the various specification requirements, shall be also be tested during these major design tests. This shall include but not be limited to the following.

a) System accuracy tests of DDCMIS for the various type of inputs identified in Part-B.

b) Loop reaction time for sample loops/ logics.

c) SOE functionality tests.

d) Server changeover.

e) Various response times, having serious implication on operation & maintenance philosophy.

f) Duty cycle of controller/ HMIPIS with simulated load, representative of the final engineered load.

g) Connectivity of Switchgear DDCMIS with Switchgear Relay Network.

The results of the above tests, after its acceptance by the Employer, shall be properly documented and submitted to Employer.

If any of the envisaged tests have been carried out by Bidder in a previous NTPC project, then the same need not be specifically conducted by the Bidder for this project, provided it is clearly established by the Bidder & accepted by the Employer that there is no difference between the system offered for this project & the previous NTPC project with respect to the test. However, even in such a case, test report of the previous project shall be submitted by the Bidder as a part of MDFT (Major Design Feature Test) test report.

25.12.00 **DEMONSTRATION OF APPLICATION ENGINEERING**

25.12.01 Contractor shall prepare and submit typical implemented scheme in their system (Control system & HMI) on sample basis. The typical cases to be covered shall include but not be limited to the following.

(i) Logics/Loops:

a) Drive logics implementation for each type of binary drive along with its display in HMI.

b) Sequence implementation along with its display in HMI.

c) Single non-cascade controller implementation.

d) Cascade loop implementation.

e) Master slave implementation with different slave combination.

f) Temperature & pressure compensation for flow signals & pressure compensation for level signals as applicable.

(ii) HMI Functions:

a) LVS Annunciation.

b) Graphics.

c) HSR

d) Logs/Reports.

e) Calculations (Basic & Performance Calculations).

25.12.02 The above typical cases shall be finalized with the Employer through Technical Co-ordination meetings.

After review and finalization of the typical cases, the implementation of each logic & control loop shall be carried out by the Contractor. After implementation of these logics & loops, the Contractor shall test each logic /loop and record the observations and demonstrate to Employer at Employer premises during engineering finalization. Any modifications as a result of the demonstration shall be done and documented as part of the test report along with the final scheme. Similarly, HMI functions shall also be demonstrated by the Contractor at Employer premises & the results shall be documented as part of test report.

25.12.03 During the integrated testing at the Contractor's works, only sample checks shall be done by the Employer for the items covered in above application engineering demonstration.

26.00.00 **PRE-COMMISSIONING AND COMMISSIONING FACILITIES**

26.01.00 (a) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Employer and the Contractor for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and

included in the Contractor's quality assurance programme as well as those included in Part-D, Section-VI and elsewhere in the Technical Specifications.

(b) The Contractor's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipments shall be operated integral with sub-systems and supporting equipment as a complete plant.

(c) All piping system shall be flushed, steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be submitted for approval to the Employer six months prior to the respective implementations. The Employer will approve final verification of cleanliness.

(d) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.

(e) The check outs during the pre-commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Employer's commissioning (start-up) Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed schedule to be agreed by Employer.

(f) The Contractor during initial operation and performance testing shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable.

26.01.00 Contractor shall furnish the commissioning organization chart for review & acceptance of employer at least eighteen months prior to the schedule date of synchronization of 1st unit. The chart should contain:

(1.) Biodata including experience of the Commissioning Engineers.
(2.) Role and responsibilities of the Commissioning Organisation members.
(3.) Expected duration of posting of the above Commissioning Engineers at site.

26.02.00 **Initial Operation**

(a) On completion of all pre-commissioning activities/ tests and as a part of commissioning the complete facilities shall be put on 'Initial Operation' during which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests.

(b) The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the unit shall operate continuously at full rated load for a period not less than 72 hours.

The Initial Operation shall be considered successful, provided that each item/ part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility.

The Contractor shall intimate the Employer about the commencement of initial operation and shall furnish adequate notice to the Employer in this respect.

(c) Any loss of generation due to constraints attributable to the Employer shall be construed as Deemed Generation.

(d) An Initial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Initial Operation shall be prepared by the Contractor. This report, besides recording the details of the various observations during initial operation shall also include the dates of start and finish of the Initial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the Initial Operation. Based on the observations, necessary modifications/repairs to the plant shall be carried out by the Contractor to the full satisfaction of the Employer to enable the latter to accord permission to carry out the Guarantee tests on the facilities. However, minor defects which do not endanger the safe operation of the equipment, shall not be considered as reasons for with- holding the aforesaid permission.

26.03.00 **Guarantee Tests**

a) The final test as to prove the Functional Guarantees shall be conducted at Site by the Contractor in presence of the Employer. The contractor's Commissioning, start-up **Engineer** shall make the unit ready to conduct such test **before start of initial operation**. Such test **shall be conducted along with the** Initial Operations.

b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee.

c) For performance/ demonstration tests instrumentations, of accuracy class shall be as per specified test codes. The numbers and location of the instruments shall be as per the specified test codes. In addition the values of parameters shall be logged from the information system provided under Employer's Distributed Digital Control Monitoring and Information system. Test will be conducted at specified load points.

d) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Contractor, free of cost.

e) The Guarantee tests and specific tests to be conducted on equipments have been brought out in detail elsewhere in the specifications.

26.04.00 Before start of commissioning of critical equipment, Commissioning Clearance Certificate (CCC) to be submitted by Main contractor. List of the critical equipments **and CCC format will be provided along with QA Coordination procedure.**

27.00.00 **TAKING OVER**

Upon successful completion of Initial Operations and all the tests conducted to the Employer's satisfaction, the Employer shall issue to the Contractor a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be withheld nor will the Employer delay the issuance thereof, on account of minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.

28.00.00 **TRAINING OF EMPLOYER'S PERSONNEL**

28.01.00 The scope of service under training of Employer’s engineers shall include a training module covering the areas of Operation & Maintenance.

Such training should cover the following areas as a minimum in order to enable these personnel to individually take the responsibility of operating and maintaining the power station in a manner acceptable to the Employer:

(a) Training for Steam Generator & ESP Equipment, TG & Auxiliaries and related equipments.

(b) Training for Electric Systems including VFD and Electric power supply system.

(c) Training for other SG/TG related C&I systems/equipments including training on Flame Monitoring System, Furnace and Flame Viewing System , Turbine Supervisory System (TSS) including vibration analyzer, vibration monitoring system axial shift, eccentricity measurements etc. for Main Turbine, BFP Turbine etc. Burner management study, control loop study, misc. system for SG C&I, EHTC, Turbine stress control system, Turbine protection system, ATRS, instrumentation etc.

c1: Training on Engineering, Model building,pre-testing, Post -test fine tuning of Advance process control systems with faculty having experience of atleast 5 years in Model Process Control.

(d) Training for special packages specified elsewhere in Technical Specification, Section-VI.

(e) Training for various C&I systems/equipment supplied includes the following:

i) DDCMIS - Human Machine Interface – Hardware & Operating System

ii) DDCMIS-Human Machine Interface System Engineering & Application Software.

iii) DDCMIS – Control System Hardware and Control system Application Software.

iv) DDCMIS – Operator Training : Use of the system at Works + at site.

v) DDCMIS – Specialized Network security.

(f) Training for power cycle piping/critical piping.

(g) Training for UPS systems Annunciation system, SWAS, PA system, flue gas analyzers, CCTV and 24 VDC system.

(h) Training on following aspects of fieldbus (i) Hardware & Software features (ii) System design, diagnostic and testing (iii) maintenance, troubleshooting and fault analysis.

(i) Training on Non-Intrusive hardwired Electric Actuator and Fieldbus based Electric Actuator along with detail training on Foundation Fieldbus/ Profibus interface used in actuator

(k) Training for numerical relays & networking systems supplied under MV & LT switchgear system.

(l) Training courses on offered PLC system in the following areas:

(a.) Operator training

(b.) Hardware Maintenance training

(c.) Software training

(d.) Any other specialized training as required for system operation and maintenance.

(m) Training for Ash Handling System & Coal Handling Plant Equipment and Auxiliaries

Area	Topics	Mandays
Ash Handling Plant	Product design - Basic design features - Theory & principle of operation - Latest technological trends in Ash handling plant and design Plant Visit - Operational feedback	300

	- O&M history/problems related to Ash handling plant Visit to Manufacturer's Work - Manufacturing process of Ash handling equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization	
Coal Handling Plant	Product design - Basic design features - Theory & principle of operation - Latest technological trends in Coal handling plant and design Plant Visit - Operational feedback - O&M history/problems related to Coal handling plant Visit to Manufacturer's Work - Manufacturing process of Coal handling equipments - Testing facilities Operation & Maintenance of Plant - Trouble shooting and fault analysis - Familiarization of special maintenance techniques - Special tool and tackles familiarization	150

n) Training for UF Membranes, RO membranes, Zero Liquid Discharge (ZLD) Chlorine Di-Oxide (ClO_2) generation & dosing system, Condensate Polishing Plant (CPU) and CW Treatment System.

Area	Topics	MANDAYS
UF Membranes	**Product design** -Basic design features -Theory & principle of operation -Latest technological trends in Ultrafiltration membranes and design -CIP & CEB of UF system **Plant Visit**	**7**

	-Operational feedback -O&M history/problems related to UF membranes **Visit to Manufacturer's Work** -Manufacturing process of UF membranes and equipment -Testing facilities **Operation & Maintenance of Plant** -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization	

Area	Topics	MANDAYS
RO membranes	**Product design** -Basic design features -Theory & principle of operation -Latest technological trends in RO membranes and design -Failure analysis, types of failures, causes & its evaluation, remedies -CIP of RO system **Plant Visit** -Operational feedback -O&M history/problems related to RO membranes **Visit to Manufacturer's Work** -Manufacturing process of RO membranes and equipment -Testing facilities **Operation & Maintenance of Plant** -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization	**7**

Zero Liquid Discharge (ZLD)	**System Design** - Plant water optimization and Scheme to achieve the ZLD - Basic design features - Latest technological trends for ZLD in Thermal Power Plant **Plant Visit** - Operational feedback - O&M history/problems related to plant	**5**
Chlorine Di-Oxide (ClO_2) generation & dosing system	**System/Product Design** - Basic design features - Theory & principle of operation - Latest technological trends in Chlorine Di-Oxide (ClO2) generation & dosing system and design aspects & Selection criteria. **Plant Visit** - Operational feedback - O&M history/ problems related to ClO2 plant **Performance Test of generator** **-** Generator capacity performance testing. **Operation & Maintenance of Plant** -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization	**5**
Condensate Polishing Plant (CPU)	**System/Product Design** - Basic design features including Pre-filters - Theory & principle of operation - Latest technological trends in CPU & Pre-filters and design aspects & Selection criteria. **Plant Visit** - Operational feedback - O&M history / problems related to CPU plant **Visit to Manufacturer's Work** -Manufacturing process of pre-filters and major equipment	**3**

	-Testing facilities **Operation & Maintenance of Plant** -Trouble shooting and fault analysis -Familiarization of special maintenance techniques -Special tool and tackles familiarization	
CW Treatment System	**System/Product Design** - Basic design features - Theory & principle of operation - Latest technological trends and design aspects & Selection criteria. **Operation & Maintenance of Plant** - Operational feedback - O&M history / problems related to plant - Trouble shooting and fault analysis Familiarization of special maintenance techniques - Special tool and tackles familiarization	**3**
Note: One week shall constitute of five (5) man days.		

(o) Training for **Substation Automation System**

PRODUCT	**AREAS OF TRAINING REQUIEMENT**
	PRODUCT/SYSTEM DESIGN
Substation Automation System	The contractor shall provide training for NTPC personnel comprehensively covering following courses. 1 Computer System Hardware 2 Computer System Software 3 Application Software

MANDAYS: 60 (Total) inclusive of visit to Manufacturer's site)

(p) Training on Erection methodologies for all the Sub-packages, System and Equipments associated with the EPC Package, including a visit to power plant construction site.

The exact details, extent and schedule for training shall be as finalized during detailed engineering and shall be subject to Employer's approval.

28.03.00	The scope of services under training shall also necessarily include training of Employer's Engineering personnel covering entire scope for the package. This shall cover all disciplines viz, Mechanical, Electrical, C&I , QA etc. and shall include all the related areas like Design familiarization, training on product design features and product design software of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of equipment, quality assurance and testing, plant visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing erection, welding etc.
28.04.00	Contractor shall also arrange for training of Employer's personnel in respect of fire detection and protection systems and other Balance of Plant equipments.
28.05.00	Contractor shall provide training on application of PAUT (Phased array ultrasonic testing) and TOFD (Time of flight diffraction) techniques for two weeks (at least 80 Hours). The training shall be arranged at least six months prior to the start of erection works of SG & TG works.
28.06.00	Exact details, extent of training and the training schedule shall be finalized based on the Bidder's proposal within two (2) months from placement of award.
28.07.00	In all the above cases, the lodging and boarding of the Employer's personnel shall be at the cost of Bidder. The Bidder shall make all necessary arrangements towards the same.
28.08.00	Take off prices (product wise) should be indicated by the Bidder in the Bid Proposal Sheets. Employer reserves the right to include or exclude these item(s) during placement of Award. **Note**: 1. For training purposes, one (1) man month implies 30 working days (excluding all intervening holidays) per person. 2. The total man months in each area shall be divided into suitable number of modules which shall be discussed and finalized during post award stage. 3. Duration of each module shall not be less than 10 (ten) working days out of which 20 % shall be for plant/manufacturers' works visits and 80% shall be classroom training. 4. A) Location of classroom training for engineering shall be at Design/Engineering office. B) Classroom training for erection/O&M shall be at location of Manufacturers' works.

28.09.00 **TRAINING REQUIRED IN MAN MONTH**

Area	Engineering (Man months)	Erection (Man months)	O&M (Man months)
Steam Turbine Generator and its Auxiliaries including electricals	6.5	9.0	23
Steam Generator and its Auxiliaries including electricals	6.5	9.0	23
Station C&I (Control and Instrumentation)	3.5	5.5	10
Ash Handling Plant	2.0	3.0	5.0
Coal Handling Plant	1.0	1.5	2.5
UF Membranes, RO Membranes, ZLD, Chlorine Di Oxide (ClO2) generation & dosing system, Condensate Polishing Plant (CPU), CW Treatment System	0.2	0.3	0.5
Substation Automation System	0.3	0.7	1
Total	**20**	**29**	**65**

29.00.00 **SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION**

In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover:

i) Working platforms should be fenced and shall have means of access.

ii) Ladders in accordance with Employer's safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection.

30.00.00 **NOISE LEVEL**

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

i) Safety valves and associated vent pipes for which it shall not exceed 105 dBA-115 dBA.

ii) Regulating drain valves in which case it shall be limited to 90 dBA-115 dBA.

iii) Mill noise which will be limited to 85-90 dBA.

iv) TG unit in which case it shall not exceed 90 dBA.

v) For HP-LP bypass valves and other intermittently operating control valves, the noise level shall be within the limit of 90 dBA.

vi) For BFP Motor Noise level shall be within the limit of 90 dBA.

31.00.00 **PACKAGING, TRANSPORTATION AND STORAGE**

All the equipments 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 limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage at site due to improper packing and presevation. The Contractor shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before despatch of materials for transportation.

In addition to above, the contractor shall take all necessary measures for storage of all electronic equipment / systems at site in a dust free Air conditioned space ensuring proper temperature & humidity.

32.00.00 **ELECTRICAL EQUIPMENTS/ENCLOSURES**

32.01.00 All electrical equipments and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specifications.

33.00.00 **INSTRUMENTATION AND CONTROL**

All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.

33.01.00 All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale.

All scales and charts shall be calibrated and printed in Metric Units as follows:

1 Temperature	-	Degree centigrade (deg C)
2. Pressure	-	Kilograms per square centimetre (Kg/cm^2). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.
3. Draught	-	Millimetres of water column (mm wc).
4. Vacuum	-	Millimeters of mercury gauge (mm Hg) or water column (mm Wcl).
5. Flow (Gas)	-	Tonnes/ hour
6. Flow (Steam)	-	Tonnes/ hour
7. Flow (Liquid)	-	Tonnes / hour
8. Flow base	-	760 mm Hg. 15 deg.C
9. Density	-	Grams per cubic centimetre.

33.02.00 All instruments and control devices provided on panels shall be of miniaturized design, suitable for modular flush mounting on panels with front draw out facility and flexible plan-in connection at rear.

34.00.00 **ELECTRICAL NOISE CONTROL**

The equipment furnished by the Contractor shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Contractor's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-61000-2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems as per EN-50082-2 (1995).

35.00.00 **SURGE PROTECTION FOR SOLID STATE EQUIPMENT**

All solid state systems /equipment shall be able to withstand the electrical noise and surge as encountered in actual service conditions and inherent in a power plant and shall meet the requirements of surge protection as defined in ANSI C37.90.1-1989 on its suitable equivalent class of IEC 254-4. Details of the features incorporated and relevant tests carried out. The test certificates. etc. shall be submitted by the Bidder.

36.00.00 **INSTRUMENT AIR SYSTEM**

The instrument air supply system as supplied by the Bidder for various pneumatic control & instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc.

Each pneumatic instrument shall have an individual air shut - off valve. The pressure regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve.

37.00.00 **TAPPING POINTS FOR MEASUREMENTS**

Tapping points shall include probes, wherever applicable, for analytical measurements and sampling.

For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Contractor will be intimated about thread standard to be adopted.

The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Contractor.

i) Temperature test pockets with stub and thermowell

ii) Pressure test pockets

38.00.00 **SYSTEM DOCUMENTATION**

The Bidder shall provide drawings, system overview & description, hardware/ software details, technical literature, functional & hardware schemes, bill of material, parts list, interconnection diagrams, data sheets, erection/ installation/ commissioning procedures, instruction/ operating manuals, etc. for each of the C& I system / sub-systems/ equipment supplied under this package. The documentation shall include complete details of the C&I systems/ sub-systems/ equipment to enable review by Employer during detailed engineering stage and to provide information to plant personnel for operation & Maintenance (including quick diagnostics & trouble shooting) of these C&I systems/ sub-systems/ equipment at site. The minimum documentation requirements for C&I systems shall be as stipulated under C&I "Techncial Data Sheets" Part of specifications. In addition to this, system documentation for DDCMIS shall include as a minimum to that specified elsewhere in the Technical Specification.

The exact format, submission schedule and contents of various documents shall be as finalised during detailed engineering stage.

38.01.00 Bill of material (instrument list) for all C&I equipment/ devices shall be furnished by the bidder in standard formats as approved by the Employer.

39.00.00 **MAINTENANCE MANUALS OF ELECTRONIC MODULES**

The Contractor shall have to furnish two (2) sets of all maintenance manual of each and every electronic card/module as employed on the various systems and equipment including peripherals etc., offered by him. The Contractor will also have to furnish the data regarding the expected failure rate of various modules and other system components. Further, the contractor shall furnish a set of operating manuals which should include block diagrams, make, model/type, details wiring and external connection drawings etc. as required to do the testing and maintenance of the electronic modules.

Backup & Restoration Procedures of DDCMIS, Station LAN & Advance Process Control shall be provided.

40.00.00 **MAKE IN INDIA REQUIREMENTS**

a) The bidder shall follow Indian laws, regulations and standards. There shall not be any restriction in terms of compliance to codes & standards of foreign origin only. The compliance to equivalent/better Indian as well as other codes & standards, wherever available, shall also be acceptable.

b) The technologies/ products offered shall be environmentally friendly, consuming less energy, and safe, energy efficient, durable and long lasting under the prescribed operational conditions.

c)	The bidder/its sub vendor/supplier shall ensure supply of spares, materials and technological support for the entire life of the project.
d)	The bidder shall list out the products and components producing Toxic E-waste and other waste as specified. It shall have an Extended Producers Responsibility (EPR) so that after the completion of the lifecycle, the materials are safely recycled/ disposed of by the contractor and for this, the bidder has to establish recycling/disposal unit as specified.
e)	The equipment/ material sourced from foreign companies will be tested in accredited labs in India before acceptance wherever such facilities are available. The testing shall be carried out in accordance with MOP extant order/guidelines.
f)	The bidder shall have to furnish a certificate regarding cyber security/safety of the equipment/process to be supplied/services to be rendered as safe to connect.
g)	All applicable safety requirements shall be met. Regular safety audit shall be carried out by the manufacturer/ supplier.
h)	Wherever required, the foreign supplier shall establish fully functional service centers in India and shall keep spares/material locally for future needs of Employer.
i)	To protect the security, integrity and reliability of equipment in this package, it is essential to remove vulnerabilities arising out of the possibility of cyber-attack through malware/ Trojans etc. embedded in imported equipments. This requirement shall apply to any item imported for end use or to be used as a component, or as a part in manufacturing, assembling of any equipment or to be used in this package. Contractor shall comply all the requirements of Order No 25-11/6/2018-PG, dated 02/07/2020 (attached as **Appendix-I**), issued by Ministry of Power, Government of India and its subsequent amendments/revisions. Contractor shall furnish declaration of compliance of MOP order dated 02/07/2020 requirements with dispatch of equipment/ item. Further, Contractor shall furnish back up testing certificates, whenever Employer asks the same.
j)	All equipment/materials/parts/items required in this package which are domestically manufactured with sufficient domestic capacity as identified in Annexure-I of MOP order dated 16/11/2021 including its subsequent revisions (copy attached as **Appendix-II**) shall necessarily be sourced from the class-I local suppliers only as per the extant provisions of the Public Procurement (Preference to Make in India) Orders issued by DPIIT and MoP. Any violation w.r.t Make in India and minimum local content (MLC) requirements as specified shall be sole responsibility of the Bidder.

Appendix-I

No.25-11/6/2018-PG
Government of India
Ministry of Power
Shram Shakti Bhawan, Rafi Marg, New Delhi – 110001
Tele Fax: 011-23730264
*****

Dated 02/07/2020

ORDER

Power Supply System is a sensitive and critical infrastructure that supports not only our **national defence**, **vital emergency services** including health, disaster response, **critical national infrastructure** including classified data & communication services, defence installations and manufacturing establishments, logistics services but also the **entire economy** and the **day-to-day life** of the citizens of the country. Any danger or threat to Power Supply System can have catastrophic effects and has the potential to cripple the entire country. Therefore, the Power Sector is **a strategic and critical sector.**

The vulnerabilities in the Power Supply System & Network mainly arise out of the possibilities of cyber attacks through malware / Trojans etc. embedded in imported equipment. Hence, **to protect the security, integrity and reliability of the strategically important and critical Power Supply System & Network** in the country, the following directions are hereby issued :-

(1) All equipment, components, and parts imported for use in the Power Supply System and Network shall be tested in the country to check for any kind of embedded malware/trojans/cyber threat and for adherence to Indian Standards.

(2) All such testings shall be done in certified laboratories that will be designated by the Ministry of Power (MoP).

(3) Any import of equipment/components/parts from "prior reference" countries as specified or by persons owned by, controlled by, or subject to the jurisdiction or the directions of these "prior reference" countries will require prior permission of the Government of India

(4) Where the equipment/components/parts are imported from "prior reference" countries, with special permission, the protocol for testing in certified and designated laboratories shall be approved by the Ministry of Power (MoP).

This order shall apply to any item imported for end use or to be used as a component, or as a part in manufacturing, assembling of any equipment or to be used in power supply system or any activity directly or indirectly related to power supply system.

This issues with the approval of Hon'ble Minister of State for Power and New & Renewable Energy (Independent Charge).

(Goutam Ghosh)
Director
Tel: 011-23716674

To:
1. All Ministries/Departments of Government of India (As per list)
2. Secretary (Coordination),Cabinet Secretariat
3. Vice Chairman, NITI Aayog
4. Comptroller and Auditor General of India
5. Chairperson, CEA
6. CMDs of CPSEs/Chairman of DVC & BBMB/MD, EESL/DG,NPTI/DG,CPRI/DG,BEE/
7. All ASs/JSs/EA, MoP

Copy:
1. PS to Hon'ble PM, Prime Minister's Office
2. PS to Hon'ble MOS(IC) for Power and NRE
3. Sr. PPS to Secretary(Power)

Appendix-II

No. A-1/2021-FSC-Part(5)
Government of India
Ministry of Power
Shram Shakti Bhawan, New Delhi
Dated: 16th November, 2021

ORDER

Subject: Public Procurement (Preference to Make in India) to provide for Purchase Preference (linked with local content) in respect of Power Sector.

Reference: Department for Promotion of Industry and Internal Trade (DPIIT) Notification No. P-45021/2/2017-PP (BE-II) dated 16.09.2020.

The Government of India, Department for Promotion of Industry and Internal Trade (DPIIT) issued Public Procurement (Preference to Make in India), Order 2017, for encouraging 'Make in India' and promoting manufacturing and production of goods and services in India with a view to enhancing income and employment. Subsequently, DPIIT vide order No. P-45021/2/2017-PP (BE-II) dated 4th June, 2020 and further vide order dated 16th September, 2020 have issued the revised Public Procurement (Preference to Make in India) Order 2017.

2. In light of the Public Procurement (Preference to Make in India) Order 2017, this Ministry had notified purchase preference (linked with local content) for Hydro and Transmission sectors vide Order No. 11/05/2018-Coord dated 20.12.2018, for Thermal sector vide Order dated 28.12.2018 and for Distribution sector vide Order dated 17.03.2020. Further, a combined order dated 04.04.2020 was also issued in supersession of all previous orders to indicate equipment/material/components for which there was sufficient local capacity and competition and also to indicate conditions for including suitably in the tenders to be issued by the procurers. In furtherance of Para 19 of the DPIIT Notification No. P-45021/2/2017-PP(BE-II) dated 04.06.2020, Ministry of Power (MoP) issued a revised comprehensive Order dated 28.07.2020 (Annexure-I amended by order dated 17.09.2020).

3. DPIIT Notification No. P-45021/2/2017-PP(BE-II) dated 16.09.2020 has further revised its order dated 04.06.2020. Therefore, in supersession of all the aforementioned orders including order No.10/1/2019-St.Th. (Part-II) dated 20.03.2020 issued by this Ministry, the following has been decided:

i. For the purpose of this order, the definitions of various terms used in the order, and provisions relating to (i) Eligibility of 'Class-I local supplier'/'Class-II local supplier'/'Non-local suppliers' for different types of procurement, (ii) purchase preference (iii) exemption to small purchases and (iv) margin of purchase preference shall be the same as in DPIIT order dated 16.09.2020, referred to above and extracts of the same is given at **Appendix**.

ii. In procurement of all goods and services or works in respect of which there is sufficient local capacity and local competition as in **Annexure-I,** only "Class–I local supplier" shall be eligible to bid irrespective of purchase value. "Class-I local supplier" is a supplier or service provider whose goods, services or works offered for procurement meets the Minimum Local Content (MLC) as prescribed in Annexure-I of this order. "Class-II local supplier" means a

supplier, as defined by DPIIT in its Order No. P-45021/2/2017-PP (BE-II) dated 16-09-2020.

iii. In the procurement of all goods and services or works other than those listed in Annexure-I, only "Class-I local supplier" and "Class-II local supplier" as defined in the order of this Ministry herewith shall be eligible to bid in procurement undertaken by procuring entities, except when Global Tender Enquiry has been issued. In Global tender enquiries, "Non-local suppliers" shall also be eligible to bid along with "Class-I local suppliers" and "Class-II local suppliers". In procurement of all goods, services or works not covered by sub-para 3(ii) above, and with estimated value of purchases less than Rs. 200 crores, in accordance with Rule 161(iv) of GFR, 2017, Global Tender Enquiry(GTE) shall not be issued except with the approval of the competent authority as designated by Department of Expenditure.

iv. For the purpose of this order, 'Works' means all works as per Rule 130 of GFR- 2017, and will also include *'turnkey works'*, Engineering, Procurement and Construction (EPC) contracts and service contracts including System Integrator (SI) contracts.

4. The list of items, in respect of which, local capacity with sufficient competition exists as per **Annexure-I,** will be reviewed at regular intervals with a view to increase number of items in this list and also to increase the MLC for each item, wherever it is less than 100%.

5. Purchase preference shall be given to local suppliers in accordance with **para 3A** of DPIIT Order dated 16.09.2020, and extracts of the same are given at **Appendix**.

6. Further, it has been decided to constitute a committee for independent verification of self-declarations and auditor's / accountant's certificates on random basis and in the case of complaints. The composition of the committee is given below:

Member (Planning), Central Electricity Authority (CEA)	Chairperson
Chief Engineer (PSETD), CEA	Member
Chief Engineer (HETD), CEA	Member
Chief Engineer (TETD), CEA	Member
Chief Engineer (DP&R), CEA	Member
As may be co-opted by CEA	External Expert
Chief Engineer (R&D), CEA	Convener

7. Further, it has also been decided to constitute a committee to examine the grievances in consultation with stakeholders and recommend appropriate actions to the Competent Authority in MoP. The composition of the Committee is given below:

Chairperson, CEA	Chairperson
Member (Hydro), CEA	Member

Member (Power System), CEA	Member
Member (Thermal), CEA	Convener

8. The complaint fee of Rs. 2 Lakhs or 1% of the value of the local item being procured (subject to maximum of Rs. 5 Lakhs), whichever is higher, shall be paid in the form of Demand Draft, drawn in favour of **PAO, CEA, New Delhi.** In case the complaint is found to be incorrect, the complaint fee shall be forfeited. In case, the complaint is upheld and found to be substantially correct, the deposited fee of the complainant would be refunded without any interest.

9. All other conditions, not stipulated in this order, shall be as laid down in the DPIIT's order No. P-45021/2/2017-PP (BE-II) dated 16.09.2020.

10. This order shall be applicable in respect of the procurement made by all attached or subordinate offices or autonomous bodies under the Government of India including Government Companies as defined in the Companies Act, and /or the States and Local Bodies making procurement under all Central Schemes/ Central Sector Schemes where the Scheme is fully or partially funded by the Government of India. The aforesaid orders shall also be applicable in respect of projects wherein funding of goods, services or works is by Power Finance Corporation (PFC) /Rural Electrification Corporation (REC) and any Financial Institution in which Government of India/ State Government share exists. This order shall be applicable to Tariff Based Competitive Bidding (TBCB) projects also. Procuring entities as defined in the DPIIT's Order dated 16.09.2020 are advised to revise their tender documents to fully comply with the said DPIIT's Order and the subsequent Orders that would be issued in this regard by DPIIT/ this Ministry from time to time.

11. All tenders for procurement by Central Government Agencies or the States and Local Bodies, as the case may be, have to be certified for compliance of the Public Procurement (Preference to Make in India) 'PPP-MII' Order by the concerned procurement officer of the Government Organization before uploading the same on the portal.

12. Exemption from meeting the stipulated local content is allowed as per clause 13 and 13A of PPP-MII Order dated 16.09.2020, if the manufacturer declares that the item is manufactured in India under a License from a foreign Manufacturer who holds Intellectual Property Rights (IPRs) and there is Transfer of Technology (ToT) with phasing to increase Minimum Local Content. For such items, if any CPSE under the administration of Ministry of Power requests exemption for any item, it shall be considered by Ministry of Power, on case to case basis.

13. In order to further encourage Make in India initiatives and promote manufacturing and production of goods and services in India, general guidelines as enclosed at **Annexure-II** may be adopted in an appropriate manner according to the circumstances by the procuring entities in their tendering process.

14. The procurers may specify the higher values of MLC than those specified in this Order in respect of goods, services or works covered in their tenders and award the weightage to the product of higher MLC for which they have to specify the criteria beforehand in their tender. The values given in Annexure-I are the minimum prescribed values for becoming a class-I local supplier for the products indicated therein.

15. This issues with the approval of Hon'ble Minister for Power and New & Renewable Energy.

(S. Majumdar)
Under Secretary to the Government of India
Tele No. 011- 23356938

To:

1. Secretary to Government of India (All Ministries/ Departments of Government of India) (As per list)
2. Secretary (Coordination), Cabinet Secretariat
3. CEO, NITI Aayog
4. Chief Secretaries of all States/ UTs
5. Comptroller and Auditor General of India
6. Secretary, DPIIT, Chairman of Standing Committee for implementation of Public Procurement Order, 2017
7. Director General, Bureau of Indian Standards (BIS)
8. Joint Secretary, DPIIT, Member-Convener of Standing Committee for implementation of Public Procurement Order, 2017
9. Chairperson, CEA
10. CMDs of CPSEs, CMD NLC, Chairman of DVC/ BBMB/ EESL, DGs of BEE/ CPRI/ NPTI
11. All Additional Secretaries/ JSs/ EA/ CE, Ministry of Power

Copy to:

Director (Technical), NIC with a request to publish the Order on the website of Ministry of Power

APPENDIX

Extracts of important provisions contained in DPIIT Order No. P-45021/2/2017-PP (BE-II) dated 16-09-2020

1. **Definitions** *(Para 2 of DPIIT order)*:
'Local content' means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value, in percent.

'Class-I local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-I local supplier' under this Order.

'Class-II local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-II local supplier' but less than that prescribed for "Class-I Local supplier" under this Order.

'Non-Local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, has local content less than that prescribed for 'Class-II local supplier' under this Order.

'L1' means the lowest tender or lowest bid or the lowest quotation received in a tender, bidding process or other procurement solicitation as adjudged in the evaluation process as per the tender or other procurement solicitation.

'Margin of purchase preference' means the maximum extent to which the price quoted by a 'Class-I local supplier' may be above the L1 for the purpose of purchase preference.

'Nodal Ministry' means the Ministry or Department identified pursuant to this order in respect of a particular item of goods or services or works.

'Procuring entity' means a Ministry or department or attached or subordinate office of, or autonomous body controlled by, the Government of India and includes Government companies as defined in the Companies Act.

'Works' means all works as per Rule 130 of GFR- 2017, and will also include *'turnkey works'*.

2. **Eligibility of 'Class-I local supplier'/ 'Class-II local supplier'/ 'Non-local suppliers' for different types of procurement** *(Para 3 of DPIIT order)*
(a) In procurement of all goods, services or works in respect of which the Nodal Ministry / Department has communicated that there is sufficient local capacity and local competition, only 'Class-I local supplier', as defined under the Order, shall be eligible to bid irrespective of purchase value.

(b) Only 'Class-I local supplier' and 'Class-II local supplier', as defined under the Order, shall be eligible to bid in procurements undertaken by procuring entities, except when Global tender enquiry has been issued. In global tender enquiries, 'Non-local suppliers' shall also be eligible to bid along with 'Class-I local suppliers' and 'Class-II local suppliers'. In procurement of all goods, services or works, not covered by 3(a)above, and with estimated value of purchases less than Rs 200 crores, in accordance with Rule 161(iv) of GFR, 2017 Global tender enquiry shall not

be issued except with the approval of competent authority as designated by Department of Expenditure.

(c) For the purpose of this Order, works includes Engineering, Procurement and Construction (EPC) contracts and services include System Integrator (SI) contracts.

3. **Purchase Preference** *(Para 3A of DPIIT order)*
(a) Subject to the provisions of this Order and to any specific instructions issued by the Nodal Ministry or in pursuance of this Order, purchase preference shall be given to 'Class-I local supplier' in procurements undertaken by procuring entities in the manner specified here under.

(b) In the procurements of goods or works, which are covered by para 3(b) of DPIIT Order No. P-45021/2/2017-PP(BE-II) dated 16-09-2021 and which are divisible in nature, the " Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

i. Among all qualified bids, the lowest bid will be termed as L1 If L1 is 'Class-I local supplier', the contract for full quantity will be awarded to L1.
ii. If L1 bid is not a 'Class-I local supplier', 50% of the order quantity shall be awarded to L1. Thereafter, the lowest bidder among the 'Class-I local supplier' will be invited to match the L1 price for the remaining 50% quantity subject to the Class-I local supplier's quoted price falling within the margin of purchase preference, and contract for that quantity shall be awarded to such 'Class-I local supplier' subject to matching the L1 price. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price or accepts less than the offered quantity, the next higher 'Class-I local supplier' within the margin of purchase preference shall be invited to match the L1 price for remaining quantity and so on, and contract shall be awarded accordingly. In case some quantity is still left uncovered on Class-I local suppliers, then such balance quantity may also be ordered on the L1 bidder.

(c) In the procurements of goods or works, which are covered by para 3(b) of DPIIT Order No. P-45021/2/2017-PP(BE-II) dated 16-09-2021 and which are not divisible in nature, and in procurement of services where the bid is evaluated on price alone, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

iii. Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract will be awarded to L1,
iv. If L1 is not 'Class-I local supplier', the lowest bidder among the 'Class-I local supplier', will be invited to match the L1 price subject to Class-I local supplier's quoted price falling within the margin of purchase preference, and the contract shall be awarded to such 'Class-I local supplier' subject to matching the L1 price.
v. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price, the 'Class-I local supplier' with the next higher bid within the margin of purchase preference shall be invited to match the L1 price and so on and contract shall be awarded accordingly. In case none of the 'Class-I local supplier' within the margin of purchase preference matches the L1 price, the contract may be awarded to the L1 bidder.

(d) "Class-II local supplier" will not get purchase preference in any procurement, undertaken by procuring entities.

4. **Applicability in tenders where contract is to be awarded to multiple bidders** *(Para 3B of DPIIT order)*-
In tenders where contract is to be awarded to multiple bidders subject to matching of L1 rates or otherwise, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:
a) In case there is sufficient local capacity and competition for the items to be procured, as notified by the Nodal Ministry, only 'Class-I local supplier' shall be eligible to bid. As such, the multiple supplier who would be awarded the contract, should be all and only 'Class-I local suppliers'.

   b) In other cases, 'Class-II local suppliers' and 'Non-Local suppliers' may also participate in the bidding process along with 'Class-I local supplier' as per provisions of this order.

   c) If 'Class-I local supplier' qualify for award of contract for at least 50% of the tendered quantity in any tender, the contract may be awarded to all the qualified bidders as per award criteria stipulated in the bid documents. However, in case 'Class-I local supplier' do not qualify for award of the contract for at least 50% of the tendered quantity, purchase preference should be given to the 'Class-I local supplier' over 'Class-II local supplier'/'Non-local suppliers' provided that their quoted rate falls within 20% margin of purchase preference of the highest quoted bidder considered for award of contract so as to ensure that the 'Class-I local suppliers' taken in totality or considered for award of contract for at least 50% of the tendered quantity.

   d) First purchase preference has to be given to the lowest quoting 'Class-I local supplier', whose quoted rates fall within 20% margin of purchase preference subject to its meeting the prescribed criteria for award of contract as also the constraints of maximum quantity that can be sourced from any single supplier. If the lowest quoting 'Class-I local supplier', does not qualify for purchase preference because of aforesaid constraints or does not accept the offered quantity, an opportunity may be given to next higher 'Class-I local supplier' falling within 20% margin of purchase preference, and so on.

   e) To avoid any ambiguity during bid evaluation process, the procuring entities may stipulate its own tender specific criteria for award of contract amongst different bidders including the procedure for purchase preference to 'Class-I local supplier' within the broad policy guidelines stipulate in sub-paras above.

5. **Exemption of small purchases** *(Para 4 in DPIIT order)*: Procurements where the estimated value to be procured is less than Rs. 5 lakhs shall be exempt from this Order. However, it shall be ensured by procuring entities that procurement is not split for the purpose of avoiding the provisions of this Order.

6. **Minimum Local Content** *(Para 5 in DPIIT order)*: The 'local content' requirement to categorize a supplier as 'Class-I local supplier' is minimum 50%. For 'Class-II local supplier', the local content requirement is minimum 20%. Nodal Ministry/Department may prescribe only a higher percentage of minimum local content requirement to categorize a supplier as 'Class-I local supplier'/'Class-II local supplier'. For the item for which Nodal Ministry/Department has not prescribed higher minimum local content notification under the order, it shall be 50% and 20% for 'Class-I local supplier'/'Class-II local supplier' respectively.

7. Vide DPIIT OM No. P-45021/102/2019-BE-IIPart(1) (E-50310) dated 4.03.2021 services such as transportation, insurance, installation, commissioning, training and after sales service support like AMC/CMC etc. shall not be considered as local value addition. Bidders offering imported products will fall under the category of Non- local suppliers. They can't claim themselves as Class-I local suppliers/Class-II local suppliers by claiming the services such as transportation, insurance, installation, commissioning, training and after sales service support like AMC/CMC etc. as local value addition.

8. **Margin of Purchase Preference** *(Para 6 of DPIIT order)*: The margin of purchase preference shall be 20%.

9. **Specifications in Tenders and other procurement solicitations** *(Para 10 of DPIIT order)*:
   a. Every procuring entity shall ensure that the eligibility conditions in respect of previous experience fixed in any tender or solicitation do not require proof of supply in other countries or proof of exports.
   b. Procuring entities shall endeavour to see that eligibility conditions, including on matters like turnover, production capability and financial strength do not result in unreasonable exclusion of 'Class-I local supplier'/ 'Class-II local supplier' who would otherwise be eligible, beyond what is essential for ensuring quality or creditworthiness of the supplier.
   c. Procuring entities shall, within 2 months of the issue of this Order review all existing eligibility norms and conditions with reference to sub-paragraphs 'a' and 'b' above.
   d. **Reciprocity Clause:**
      i. When a Nodal Ministry/Department identifies that Indian suppliers of an item are not allowed to participate and/ or compete in procurement by any foreign government, due to restrictive tender conditions which have direct or indirect effect of baring Indian companies such as registration in the procuring country, execution of projects of specific value in the procuring country etc. it shall provide such details to all its procuring entities including CMDs/CEOs of PSEs/PSUs, State Governments and other procurement agencies under their administrative control and GeM for appropriate reciprocal action.
      ii. Entities of countries which have been identified by the nodal Ministry/Department as not allowing Indian companies to participate in their Government procurement for any item related to that nodal Ministry shall not be allowed to participate in Government procurement in India for all the items related to that nodal Ministry/Department, except for the list of items published by the Ministry/Department permitting their participation.
      iii. The stipulation in (ii) above shall be part of all tenders invited by the Central Government procuring entities stated in (i) above. All purchase on GeM shall also necessarily have the above provisions for items identified by nodal Ministry/Department.
      iv. State Governments should be encouraged to incorporate similar provisions in their respective tenders.
      v. The term 'entity' of a country shall have the same meaning as under the FDI Policy of DPIIT as amended from time to time.
   e. Specifying foreign certification/ unreasonable technical specifications/ brands/ models in the bid document is restrictive and discriminatory practice against local

suppliers. If foreign certification is required to be stipulated because of non-availability of Indian Standards and/ or for any other reason, the same shall be done only after written approval of Secretary of Department concerned or any other authority having been designated such power by the Secretary of the Department concerned.

f. "All administrative Ministries/Departments whose procurement exceeds Rs. 1000 Crore per annum shall notify/ update their procurement projections every year, including those of PSEs/PSUs, for the next 5 years on their respective website."

Annexure-I

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficent local capacity and competition	Class-I Local Supplier (Minimum Local Content (%)
	(A) Common items for Transmission, Distribution and Generation Sector	
1	Power Transformers (up to 765 kV, including Generator transformers)	60
2	Instrument Transformer (up to 765 kV)	60
3	Transformer Oil Dry Out System (TODOS)	60
4	Reactors up to 765 kV	60
5	Oil Impregnated Bushing (up to 400 kV)	60
6	Resin Insultated Paper (RIP) bushings (up to 145 kV)	50
7	Circuit Breakers (up to 765 kV AC - Alternating Current)	60
8	Disconnectors/Isolators (up to 765 kV AC)	60
9	Wave trap (up to 765 kV AC)	60
10	Oil Filled Distribution Transformers up to & Including 33 kV [Cold Rolled Grain Oriented (CRGO)/Amorphous, Aluminium/Copper wound]	60
11	Dry Type Distribution Transformer upto and including 33 kV (CRGO/Amorphous, Aluminium/Copper wound)	60
12	Conventional Conductor	60
13	Accessories for Conventional conductors	60
14	High Temperature/High Temperature Low Sag (HTLS) conductors (such as Composite core, GAP, ACSS, INVAR, AL59) and Accessories	60
15	Optical ground wire (OPGW) – all designs	60
16	Fiber OpticTerminal Equipment (FOTE) for OPGW	50
17	OPGW related Hardware and Accessories	60
18	Remote Terminal Unit (RTU)	50
19	Power Cables and accessories up to 33 kV	60
20	Control cables including accessories	60
21	XLPE Cables up to 220 kV	60
22	Substation Structures	60
23	Transmission Line Towers	60
24	Porcelain (Disc/Long Rod) Insulators	60
25	Bus Post Insulators (Porcelain)	60
26	Porcelain Disc Insulators with Room Temperature Vulcanisation (RTV) coating	50
27	Porcelain Longrod Insulators withRoom Temperature Vulcanisation (RTV) coating	50
28	Hardware Fittings for Porcelain Insulators	60
29	Composite/Polymeric Long Rod Insulators	60
30	Hardware Fittings for Polymer Insulators	60
31	Bird Flight Diverter (BFD)	60
32	Power Line Carrier Communication (PLCC) System (up to 800 kV)	60
33	Gas Insulated Switchgear (up to 400 kV AC)	60
34	Gas Insulated Switchgear (above 400 kV AC)	50
35	Surge/Lightning Arrester (up to 765 kV AC)	60
36	Power Capacitors	60
37	Packaged Sub-station (6.6 kV to 33 kV)	60
38	Ring Main Unit (RMU) (up to 33 kV)	60
39	Medium Voltage (MV) GIS Panels (up to 33 kV)	60
40	Automation and Control System/Supervisory Control and data Acquisition (SCADA) System in Power System	50
41	Control and Relay Panel (including Digital/Numerical Relays)	50
42	Electrical Motors 0.37 kW to 1 MW	60
43	Energy Meters excluding smart meters	50
44	Control & power cables and Accessories (up to 1.1 kV)	60
45	Diesel Generating (DG) set	60

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficent local capacity and competition	Class-I Local Supplier (Minimum Local Content (%)
46	DC system (DC Battery & Battery Charger)	60
47	AC & DC Distribution Board	60
48	Indoor Air Insulated Switchgear (AIS) upto 33 kV	60
49	Poles (PCC, PSCC, Rolled Steel Joist, Rail Pole, Spun, Steel Tubular)	60
50	Material for Grounding/earthing system	60
51	Illumination system	60
52	Overhead Fault Sensing Indicator (FSI)	50
53	Power Quality Meters	50
54	Auxilliary Relays	50
55	Load Break Switch	50
	(B) Hydro Sector	
56	Hydro Turbine & Associated equipment	
	a) Francis Turbine	60
	b) Kaplan Turbine	60
	c) Pelton Turbine	50
57	Main Inlet Valve & Associated Equipment	60
58	Penstock Protection Valve and Associated Equipment	60
59	Governing system & Accessories	60
60	Generator for Hydro Project & Associated Equipment	60
61	Static Excitation System	60
62	Workshop Equipment	60
63	Cooling Water System	60
64	Compressed Air System	60
65	Drainage/Dewatering System	60
66	Fire Protection System	60
67	Heating, Ventilation & Air Conditioning System (HVAC)	60
68	Oil Handling System	60
69	Mechanical Balance of Plant (BOP) Items	60
	(C) Thermal Sector	
	Boiler Auxiliaries	
70	Air Pre-Heater	60
71	Steam Coil Air Pre Heater (SCAPH)	60
72	Steam soot blowers [wall blowers & Long Retractable Soot Blower (LRSB)]	60
73	Auxiliary Steam Pressure Reducing & Desuperheating (PRDS)	60
74	Fuel oil system	60
75	Seal air Fan	60
76	Ducts and dampers	60
77	Duct expansion joints	60
78	Blowdown tanks	60
79	Coal burners and oil burners	60
80	Coal mills	60
81	Gear Box of Coal Mill	50
82	Coal feeders	60
83	Primary Air Fans	60
84	Forced Draft Fans	60
85	Induced Draft Fans	60
86	Forced Draft (FD)/Induced Draft (ID)/ Primary Air (PA) Fan Servo Motor Assembly	50
87	Tubes (Carbon Steel)	50
88	Steam pipes (Carbon Steel)	50
89	Steam drum	50
90	Separator	50
91	Selective Catalytic Reduction (SCR)	50

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficent local capacity and competition	Class-I Local Supplier (Minimum Local Content (%)
	Electro-Static Precipitators (ESPs)	
92	Casing	60
93	Electrodes	60
94	Rapping System	60
95	Hopper Heaters	60
96	Transformer Rectifiers	60
97	Insulators	60
	Turbine & Auxiliaries	
98	Turbine (High Pressure/Intermediate Pressure/Low Pressure)	50
99	Condensate Extraction Pumps	60
100	Condenser On line Tube Cleaning System (COLTC)	60
101	Debris filters	60
102	Deaerator	60
103	Drain Cooler and Flash Tank	60
104	ECW Pump	50
105	Plate Heat Exchanger	50
106	Self- cleaning filters	50
107	Condensate Polishing Units (CPUs)	60
108	Chemical Dosing System	60
109	Oil Filter	60
110	Gland Steam Condenser	60
111	Oil Purifying Centrifuge	50
112	Water Cooled Condenser	50
113	Boiler Feed Pumps (BFPs)	50
	Generator and Auxillieries	
114	Generator (including Seal Oil System, Hydrogen Cooling System, Stator water cooling system)	60
	Electrical Works	
115	Control and metering equipment	60
	Control & Instrumentation System (C&I System)	
116	Thermocouples	50
117	Measuring instruments [Resistance Temperature Detectors (RTDs)], Local gauges	50
118	Actuators (Pneumatic and conventional electric)	50
119	Interplant Communication/ Public Address (PA) system except IP based	50
	Coal Handling Plant	
120	Conveyors	60
121	Wagon Tippler	60
122	Side Arm Charger	60
123	Paddle feeder	60
124	Crushers & Screens	60
125	Dust suppression (dry fog & plain water) system	60
126	Air Compressors	50
127	Magnetic separators & metal detectors	60
128	Coal Sampling System	60
129	Stacker cum reclaimer	60
130	Belt weighing & monitoring system.	60
131	Wheel & axle assembly (without bearings) for Bottom Opening Bottom Release (BOBR) Wagons	60
	Ash Handling System	
132	Clinker grinder	60
133	Water jet ejectors	60
134	Scrapper chain conveyor	60
135	Dry fly ash vacuum extraction system	60
136	Pressure pneumatic conveying system	60

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficent local capacity and competition	Class-I Local Supplier (Minimum Local Content (%)
137	Ash water & ash slurry pumps	60
138	Compressors, air dryers & air receivers	50
139	Ash water recovery system	60
	Raw Water Intake & Supply System	
140	Travelling water screens	60
141	Raw water supply pumps	60
142	Valves, RE joints etc.	60
	Water Treatment System and Effluent Treatment System	
143	Clarification plant	60
144	Filtration plant	60
145	Ultra filtration plant	50
146	Reverse Osmosis (RO) plant and its membrane	55
147	De-Mineralised water plant (DM Plant)	60
148	Chlorination plant	60
149	Chemical dosing system	60
150	Effluent Treatment Plant	60
	Circulationg Water (CW) & Auxiliary Circulating Water (ACW) System	
151	CW & ACW Pumps	60
152	Butter Fly (BF) valves, Non-return Valves (NRVs) etc.	60
153	Rubber Expansion (RE) joints	60
154	Air release valves	60
	Cooling Towers (NDCT/ IDCT)-Natural-Draft and Induced Draft Cooling Tower	
155	Water Distribution System	60
156	Spray nozzles	60
157	Packing	60
158	Drift eliminators	60
159	Cooling Tower (CT) Fans (for Induced Draft Cooling Towers IDCT)	60
160	Gear boxes, shafts & motors (for IDCT)	60
	Air Conditioning & Ventilation System	
161	Split & window air conditioners	60
162	Chilling/ condensing unit [upto 500 ton of refrigeration(TR)]	55
163	Air Handling Unit (AHU) and Fresh air unit	60
164	Cooling Towers	60
165	Air Washing Units (AWUs), axial fans, roof extractors	60
166	Ducts, louvers & dampers	60
	Flue Gas Desulphurization (FGD)	
167	Spray Nozzles,	50
168	Spray header	50
169	Oxidation Blowers	50
170	Limestone wet Ball Mill	50
171	Slurry Handling Pumps for FGD system	50
172	Booster Fans for FGD system	50
173	Carbon Steel Ducts and Dampers for FGD	60
174	Storage Tanks and Silos	60
175	Process Water Pump for FGD system	50
	(D) Other Common Items	
	Fire protection and detection system	
176	Motor driven fire water pumps	60
177	Diesel engine driven fire water pumps	60
178	Hydrant system for the power plant.	60
179	High velocity water spray system	60
180	Medium velocity water spray system	60
181	Foam protection system	60
182	Inert gas flooding system	60

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficent local capacity and competition	Class-I Local Supplier (Minimum Local Content (%)
183	Fire tenders	60
184	Portable fire-extinguishers	60
185	Cranes, EOT cranes, gantry crane & chain pulley blocks etc.	60
186	Elevator	60

(E) Minimum Local Content percentages in Engineering, Procurement & Construction (EPC) / Turnkey project

In case the contract is awarded through the EPC route, the contractor should comply with the requirement of MLC for individual items as listed in Annexure-I and should purchase these items only from Class-I Local supplier. In addition, MLC for complete EPC project may also be prescribed as below:

	(1) Package Based Works	Minimum Local Content (%)
1	Boiler	60
2	TG System (Water Cooled Condenser)	60
3	Ash Handling Plant	60
4	Coal Handling Plant	60
5	Electro-static Precipitator (ESP)	60
6	Circulating Water (CW) System	60
7	Cooling Tower	60
8	Water Treatment System	60
9	Air Conditioning System (below 500TR)	60
10	Flue Gas Desusphurisation (FGD) System	60
11	Station Control & Instrumentation (C&I)	50
12	Hydro Power Projects (Electro-Mechanical Works)	60
	Gas based generation	
	Overall Gas Turbine Package (on finished Product basis)	
13	< 44 MW	60
14	44 –145 MW	50
	Overall Combined Cycle Gas Turbine (CCGT) Package (on finished Product basis)	
15	< 44 MW	60
16	44 – 145 MW	60
17	> 150 MW	60
	(2) Project as a whole	
1	Works and service contracts in Power Sector	60
2	Transmission Line with Conventional conductors (ACSR, AAAC, AL-59 etc.)	60
3	Transmission Line with High temperature Low Sag (HTLS) conductors	60
4	HVAC Substation Air Insulated (AIS)	60
5	HVAC Substation Gas Insulated (GIS)	60
6	HVDC Substation	60
7	Distribution Sector	60

Annexure-II

General guidelines to be adopted selectively in an appropriate manner by the procuring entities in their tender documents.

1. The bidder shall have to be an entity registered in India in accordance with law.
2. The bids shall be in the language as prescribed by the tenderer/procurer.
3. The bids shall be in Indian Rupees (INR) (in respect of local content only).
4. Indian subsidiaries of foreign bidders shall have to meet the qualifying criteria in terms of capability, competency, financial position, past performance etc.
5. The bidder shall follow Indian laws, regulations and standards.
6. To be eligible for participation in the bid, foreign bidders shall compulsorily set up their manufacturing units on a long term basis in India as may be specified by the tenderer/ procurer.
7. Similar or better technology than the technology offered in respect of material, equipment and process involved shall be transferred to India. Along with the transfer of technology, adequate training in the respective field shall also be provided.
8. Country of origin of the equipment/material shall be provided in the bid.
9. For supply of equipment / material from the country of origin other than India, the bidder shall submit performance certificate in support of satisfactory operation in India or a country other than the country of origin having climatic and operational conditions including ambient temperature similar to that of India for more than _____ years (to be specified by the procurer).
10. The technologies/ products offered shall be environmental friendly, consuming less energy, safe, energy efficient, durable and long lasting under the prescribed operational conditions.
11. The supplier shall ensure supply of spares, materials and technological support for the entire life of the project.
12. The manufacturers/ supplier shall list out the products and components producing Toxic E-waste and other waste as may be specified. It shall have an Extended Producers Responsibility (EPR) so that after the completion of the lifecycle, the materials are safely recycled / disposed of by the Manufacturer/ supplier and for this, the Manufacturer/supplier along with procurer has to establish recycling / disposal unit **or** as may be specified.
13. Minimum Local Content requirement for goods, services or works shall be in accordance with the conditions laid down in respective Order(s) of the sectors on Public Procurement (Preference to Make in India) to provide for purchase preference (linked with local content).

14. The equipment/ material sourced from foreign companies may be tested in accredited labs in India before acceptance wherever such facilities are available.
15. The Tender fee and the Bank Guarantee (BG) shall be in Indian Rupees only.
16. The bidder shall have to furnish a certificate regarding cyber security/safety of the equipment/process to be supplied/services to be rendered as safe to connect.
17. Applicable safety requirements shall be met. Regular safety audit shall be carried out by the manufacturer/ supplier.
18. Statutory laws/regulations including the labour and environmental laws shall be strictly complied with during supply, storage, erection, commissioning and operation process. A regular compliance report shall be submitted to the procurer/appropriate Authorities.
19. Formation of new joint venture in India shall be permitted only with the Indian companies.
20. Tendering by the agent shall not be accepted.
21. In case local testing is not considered necessary by the procurer, theoriginal test report in the language prescribed by the procurer may be accepted. The translated test report shall not be accepted unless it is notarised.
22. Certification/compliance as per the Indian Standards/ International Standards/ Indian Regulations/ specified Standards shall be mandatory, where ever applicable.
23. Quality assurance of the product shall be carried out by the procurer or an independent third party agency appointed by the procurer. Manufacturing Quality Plan as approved by the procurer shall be followed by the manufacturer/supplier.
24. Wherever required by the procurer, foreign supplier shall establish fully functional service centers in India and shall keep spares/material locally for future needs of utilities.
25. Arbitration proceedings shall be instituted in India only and all disputes shall be settled as per applicable Indian Laws.

LIST OF CODES AND STANDARDS

Indian Standards	Title	International and Internationally recognised standards
IS:277	Galvanised steel sheets (plain or corrugated)	
IS:655	Specification for metal air duct	
IS:800	Code of practice for use of structural steel in general building construction	BS 449:1969 BS 5950 ASA A57, 1-1952
IS:807	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists 6588 (Issued by Standards Association of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573:part-I:1960	Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc:No. BU/4 Rev
IS:875	Code of practice for design loads (other than earthquake) for buildings and structures Leading standards (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)	National Building code of Canada (1953)-Part-IV Design section 4.1

IS:1239 Part-I	Mild steel tubes	(ISO/R 65-1957) (ISO/R-64-1958) (ISO/R-65-1958) (BS 1387 : 1957)
IS:1239 Part-II	Mild steel tubulars and other wrought steel pipe fittings	BS 1387 : 1967 BS 1387 :1967 BS 1740 :1965
IS:2825	Code for unfired vessels	
IS:1520	Horizontal centrifugal pumps for clear cold and fresh water	
IS:1600	Code for practice for performance of constant speed IC Engines for general purpose	
IS:1601	Specification for perform-ance of constant speed IC Engines for general Purpose	
IS:1893	Criteria for earthquake resistant design of structures	
IS1978-1971	Line Pipe April 1969.	API Standards 5L
IS:2254-1970	Dimensions of vertical shaft motor for pumps	IEC Pub 72-1 part I NEMA Pub MG 1 1954
IS:2266	Steel wire ropes for general engineering purposes	BS :302 : 1968
IS:2312	Propellant type Ventilation fans	
IS:2365	Steel wire suspension ropes for lifts and hoists	BS : 1957

IS:3346	Method for the determination of thermal conductivity of thermal insulation materials (two slab guarded hot plate method)	DIN 52612 (Deutscher Normenausschuss) ASTM C 163-1964 (American Society of Testing and materials) ASTM C 167-1974 ASTM C 177-1963
IS:3354	Outline dimensions for electric lifts.	
IS:3401	Silica gel	
IS:3588	Specification for electrical axial flow fans	
IS:3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000 mm Nominal Diametre)	
IS:3677	Unbonded rock and slag wool for thermal insulation	
IS:3815	Point hook with shank for general engineering purposes	BS 482 - 1968 Doc.:67/3 1284 (Revision of BS 2903) (Issued BS)
IS:3895	Specification for monocrystallines semiconductor rectifier cells and stacks	
IS:3963	Roof extractor unit	
IS:3975	Mild steel wires, strips and tapes for armouring cables	
IS:4503	Shell and tube type heat Exchanger	

IS:4540	Specification for monory-stallines rectifire assembly equipment	
IS:4671	Expanded polystyrene for thermal insulation purpose	
IS:4736	Hot dip zinc coating on steel tubes	
IS:4894	Centrifugal fans	
IS:5456	Code of practice for testing of positive displacement type air compressors and exhauster (For Test Tolerance Only)	
IS:5749	Forged ramshorn hooks	Entwurf DIN 15402 Blett 1 Entwurf DIN 15402 BS 3017-1958
IS:6392	Steel pipe flanges	BS 4504 : 1969
IS:6524 Part-I	Code of practice for design of tower cranes Static and rail mounted	BS 2799 : 1956
IS:7098	Cross linked Polyethylene insulated PVC sheathed cables	Standard No. 1 to IPCEA (USA) Pub. No. 5-66-524
IS:7373	Specification for wrought aluminium and aluminium sheet and strips	
IS:7938	Air receivers for compressed air installation	
ISO:1217	Displacement compressor-Acceplance test	
ASHRAE-33 and air heating coils.	Methods of testing for rating of forced circulation air cooling	
ASHRAE-52-76 particle matter.	Air cleaning device used in general ventilation for removing	

ASHRAE-22-72	Method of testing for rating of water cooled refrigerant condensers.
ASHRAE 23-67	Methods of testing for rating of positive displacement refrigerant compressors.
ARI-450-6	Standard for water cooled refrigerant condensers.
ARI-550	Standard for centrifugal water chilling packages.
ARI-410	Standard for forced circulation air cooling and air heating coils
ARI-430/435	Central station AHU/Application of Central Station AHU
BS:848 (Part-1,2)	Fans
BS:400	Low carbon steel cylinders for the storage & transport of permanent gases.
BS:401	Low carbon steel cylinders for the storage & transport of liquified gases.
CTI Code ACT-105	Acceptance test code for Water Cooling Tower.
ANSI-31.5	Refrigerant piping
ASME-PTC-23-1958	Atmospheric Water Cooling Equipment
AMCA A-21C	Test Code for air moving devices
API:618	Reciprocating Compressor for general refinary services.

HYDRAULIC INSTITUTE STANDARDS.

HYDRANT SYSTEM MANUALS OF TAC.

TAC MANUALS OF SPRAY SYSTEM

NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS.

INDIAN EXPLOSIVES ACT.

INDIAN FACTORIES ACT.

STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION.

CODE AND STANDARD FOR CIVIL WORKS

Some of the applicable Standards, Codes and references are as follows:

Excavation & Filling

IS: 2720 (Part-II, IV TO VIII, XIV, XXI, XXIII, XXIV, XXVII TO XXIX, XL) Methods of test for soils-determination for water content etc.

IS: 4701	Code of practice for earth work on canals.
IS: 9758	Guidelines for Dewatering during construction.
IS: 10379	Code of practice for field control of moisture and compaction of soils for embankment and sub-grade.

Properties, Storage and Handling of Common Building Materials

IS: 269	Specification for ordinary Portland cement, 33 grade.
IS: 383	Specification for coarse and fine aggregates from natural sources for concrete.
IS: 432	Specification for mild steel and (Parts 1&2) medium tensile steel bars and hard-drawn steel wires for concrete reinforcement.
IS: 455	Specification for Portland slag cement.
IS: 702	Specification for Industrial bitumen.
IS: 712	Specification for building limes.
IS: 808	Rolled steel Beam channel and angle sections.
IS: 1077	Specification for common burnt clay building bricks.
IS: 1161	Specification of steel tubes for structural purposes.
IS: 1363	Hexagon head Bolts, Screws and nuts of production grade C.
IS: 1364	Hexagon head Bolts, Screws and Nuts of Production grade A & B.
IS: 1367	Technical supply conditions for Threaded fasteners.

IS: 1489	Specification for Portland-pozzolana cement:
(Part-I)	Fly ash based.
(Part-II)	Calcined clay based.
IS: 1542	Specification for sand for plaster.
IS: 1566	Specification for hard-drawn steel wire fabric for concrete reinforcement.
IS: 1786	Specification for high strength deformed bars for concrete reinforcement.
IS: 2062	Specification for steel for general structural purposes.
IS: 2116	Specification for sand for masonry mortars.
IS: 2386 (Parts-I to VIII)	Testing of aggregates for concrete.
IS: 3150	Hexagonal wire netting for general purpose.
IS: 3495 (Parts-I to IV)	Methods of tests of burnt clay building bricks.
IS: 3812	Specification for fly ash, for use as pozzolana and admixture.
IS: 4031	Methods of physical tests for hydraulic cement.
IS: 4032	Methods of chemical analysis of hydraulic cement.
IS: 4082	Recommendations on stacking and storage of construction materials at site.
IS: 8112	Specification for 43 grade ordinary portland cement.
IS: 8500	Medium and high strength structural steel.
IS: 12269	53 grade ordinary portland cement.
IS: 12894	Specification for Fly ash lime bricks.

Cast-In-Situ Concrete and Allied Works

IS: 280	Specification for mild steel wire for general engineering purposes.
IS: 456	Code of practice for plain and reinforced concrete.
IS: 457	Code of practice for general construction of plain & reinforced concrete for dams & other massive structures.
IS: 516	Method of test for strength of concrete.
IS: 650	Specification for standard sand for testing of cement.
IS: 1199	Methods of sampling and analysis of concrete.
IS: 1791	General requirements for batch type concrete mixers.
IS: 1838 (Part-I)	Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type).
IS: 2204	Code of practice for construction of reinforced concrete shell roof.
IS: 2210	Criteria for the design of reinforced concrete shell structures and folded plates.
IS: 2438	Specification for roller pan mixer.
IS: 2502	Code of practice for bending and fixing of bars for concrete reinforcement.
IS: 2505	General requirements for concrete vibrators, immersion type.
IS: 2506	General requirements for concrete vibrators, screed board type.
IS: 2514	Specification for concrete vibrating tables.
IS: 2645	Specification for Integral cement water proofing compounds.
IS: 2722	Specification for portable swing weigh batches for concrete. (single and double bucket type)
IS: 2750	Specification for Steel scaffolding.

	IS: 2751	Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction.
	IS: 3025	Methods of sampling and test waste water.
	IS: 3366	Specification for Pan vibrators.
	IS: 3370 (Part I to IV)	Code of practice for concrete structures for the storage of liquids.
	IS: 3414	Code of practice for design and installation of joints in buildings.
	IS: 3550	Methods of test for routine control for water used in industry.
	IS: 3558 concrete.	Code of practice for use of immersion vibrators for consolidating
	IS: 4014 (Parts I & II)	Code of practice for steel tubular scaffolding.
	IS: 4326 of buildings.	Code of practice for earthquake resistant design and construction
	IS: 4461	Code of practice for joints in surface hydro-electric power stations.
	IS: 4656	Specification for form vibrators for concrete.
	IS: 4925	Specification for batching and mixing plant.
	IS: 4990	Specification for plywood for concrete shuttering work.
	IS: 4995 (Parts I & II)	Criteria for design of reinforced concrete bins for the storage of granular and powdery materials.
	IS: 5256	Code or practice for sealing joints in concrete lining on canals.
	IS: 5525	Recommendations for detailing of reinforcement in reinforced concrete work.
	IS: 5624	Specification for foundation bolts.
	IS: 6461	Glossary of terms relating to cement concrete.

	IS: 6494	Code of practice for water proofing of underground water reservoirs and swimming pools.
	IS: 6509	Code of practice for installation of joints in concrete pavements.
	IS: 7861	Code of practice for extreme weather concreting. (Parts I & II)
	IS: 9012	Recommended practice for shot concreting.
	IS: 9103	Specification for admixtures for concrete.
	IS: 9417	Recommendations for welding cold worked steel bars for reinforced concrete construction.
	IS: 10262	Recommended guidelines for concrete mix design.
	IS: 11384	Code of practice for composite construction in structural steel and concrete.
	IS: 11504	Criteria for structural design of reinforced concrete natural draught cooling towers.
	IS: 12118	Specification for two-parts poly sulphide.
	IS: 12200	Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams.
	IS: 13311	Method of non-destructive testing of concrete.
	Part-1	Ultrasonic pulse velocity.
	Part-2	Rebound hammer.
	SP:23	Handbook of concrete mixes
	SP: 24	Explanatory Handbook on IS: 456-1978
	SP: 34	Handbook on concrete reinforcement and detailing.
	Precast Concrete Works	
	SP: 7(PartVI/	National Building Code- Structural design of prefabrication and Sec.7) systems building.

IS: 10297	Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units.
IS: 10505	Code of practice for construction of floors and roofs using pre-cast reinforced concrete units.

Masonary and Allied Works

IS: 1905	Code of Practice for Structural Safety of Buildings-Masonry walls.
IS: 2212	Code of Practice for Brickwork.
IS: 2250	Code of Practice for Preparation and use of Masonry Mortar.
SP: 20	Explanatory handbook on masonry code.

Sheeting Works

IS:277	Galvanised steel sheets (plain or corrugated).
IS: 459	Unreinforced corrugated and semi-corrugated asbestos cement sheets.
IS: 513	Cold-rolled carbon steel sheets.
IS: 730	Specification for fixing accessories for corrugated sheet roofing.
IS: 1626	Specification for Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings.
IS: 2527	Code of practice for fixing rain water gutters and down pipe for roof drainage.
IS: 3007	Code of practice for laying of asbestos cement sheets.
IS: 5913	Methods of test for asbestos cement products.
IS: 7178	Technical supply conditions for tapping screw.
IS: 8183	Bonded mineral wool.

IS: 8869	Washers for corrugated sheet roofing.
IS: 12093	Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets.
IS: 12866	Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced).
IS: 14246	Specification for continuously pre-painted galvanised steel sheets and coils.

Fabrication and Erection of Structural Steel Work

IS: 2016	Specification for plain washers.
IS: 814	Specification for covered Electrodes for Metal Arc Welding for weld steel.
IS: 1852	Specification for Rolling and Cutting Tolerances for Hot rolled steel products.
IS: 3502	Specifications for chequered plate.
IS: 6911	Specification for stainless steel plate, sheet and strip.
IS: 3757	Specification for high strength structural bolts
IS: 6623	Specification for high strength structural nuts.
IS: 6649	High Tensile friction grip washers.
IS: 800	Code of practice for use of structural steel in general building construction.
IS: 816	Code of practice for use of Metal Arc Welding for General Construction.
IS: 4000	Code of practice for assembly of structural joints using high tensile friction grip fasteners.
IS: 9595	Code of procedure of Manual Metal Arc Welding of Mild Steel.
IS: 817	Code of practice for Training and Testing of Metal Arc Welders.

	IS: 1811	Qualifying tests for Metal Arc Welders (engaged in welding structures other than pipes).
	IS: 9178	Criteria for Design of steel bins for storage of Bulk Materials.
	IS: 9006	Recommended Practice for Welding of Clad Steel.
	IS: 7215	Tolerances for fabrication steel structures.
	IS: 12843	Tolerance for erection of structural steel.
	IS: 4353	Recommendations for submerged arc welding of mild steel and low alloy steels.
	SP: 6 (Part 1 to 7)	ISI Handbook for structural Engineers.
	IS: 1608	Method of Tensile Testing of Steel products other than sheets, strip, wire and tube.
	IS: 1599	Method of Bend Tests for Steel products other than sheet, strip, wire and tube
	IS : 228	Methods of chemical Analysis of pig iron, cast iron and plain carbon and low alloy steel.
	IS : 2595	Code of Practice for Radio graphic testing.
	IS : 1182	Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates.
	IS : 3664	Code of practice for Ultra sonic Testing by pulse echo method.
	IS : 3613	Acceptance tests for wire flux combination for submerged Arc Welding.
	IS : 3658	Code of practice for Liquid penetrant Flaw Detection.
	IS : 5334	Code of practice for Magnetic Particle Flaw Detection of Welds.

Plastering and Allied Works

IS : 1635	Code of practice for field slaking of Building lime and preparation of putty.
IS : 1661	Application of cement and cement lime plaster finishes.
IS : 2333	Plaster-of-paris.
IS : 2402	Code of practice for external rendered finishes.
IS : 2547	Gypsum building plaster.
IS : 3150	Hexagonal wire netting for general purpose.

Acid and Alkali Resistant Lining

IS : 158	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting.
IS : 412	Specification for expanded metal steel sheets for general purpose.
IS : 4441	Code of practice for use of silicate type chemical resistant mortars.
IS : 4443	Code of practice for use of resin type chemical resistant mortars.
IS : 4456	Method of test for chemical resistant tiles. (Part I & II)
IS : 4457	Specification for ceramic unglazed vitreous acid resistant tiles.
IS : 4832	Specification for chemical resistant mortars.
	Part I Silicate type
	Part II Resin type
	Part III Sulphur type
IS : 4860	Specification for acid resistant bricks.
IS : 9510	Specification for bitumasitc, Acid resisting grade.

Water Supply, Drainage and Sanitation

IS : 458	Specification for concrete pipes.
IS : 554	Dimensions for pipe threads, where pressure tight joints are made on thread.
IS : 651	Specification for salt glazed stoneware pipes.
IS : 774	Flushing cisterns for water closets and urinals.
IS : 775	Cast iron brackets and supports for wash basins and sinks.
IS : 778	Copper alloy gate, globe and check valves for water works purposes.
IS : 781	Cast copper alloy screw down bib taps and stop valves for water services.
IS : 782	Caulking lead.
IS : 783	Code of practice for laying of concrete pipes.
IS : 1172	Basic requirements for water supply, drainage and sanitation.
IS : 1230	Cast iron rain water pipes and fittings.
IS : 1239	Mild steel tubes, tubulars and other wrought steel fittings.
IS : 1536	Centrifugally cast (Spun) iron pressure pipes for water, gas and sewage.
IS : 1537	Vertically cast iron pressure pipes for water, gas and sewage.
IS : 1538	Cast iron fittings for pressure pipe for water, gas and sewage.
IS : 1703	Ball valves (horizontal plunger type) including float for water supply purposes.
IS : 1726	Cast iron manhole covers and frames.
IS : 1729	Sand cast iron spigot and socket, soil, water and ventilating pipes, fittings and accessories.

	IS : 1742	Code of practice for building drainage.
	IS : 1795	Pillar taps for water supply purposes.
	IS : 1879	Malleable cast iron pipe fittings.
	IS : 2064	Code of practice for selection, installation and maintenance of sanitary appliances.
	IS : 2065	Code of practice for water supply in building.
	IS : 2326	Automatic flushing cisterns for urinals.
	IS : 2470 (Part-I & II)	Code of practice for installation of septic tanks.
	IS : 2501	Copper tubes for general engineering purposes.
	IS : 2548	Plastic seat and cover for water-closets.
	IS : 2556 (Part 1 to 15)	Vitreous sanitary appliances (vitreous china).
	IS : 2963	Non-ferrous waste fittings for wash basins and sinks.
	IS : 3114	Code of practice for laying of cast iron pipes.
	IS : 3311	Waste plug and its accessories for sinks and wash basins.
	IS : 3438	Silvered glass mirrors for general purposes.
	IS : 3486	Cast iron spigot and socket drain pipes.
	IS : 3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000mm nominal diameter).
	IS : 3989	Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.
	IS : 4111 (Part I to IV)	Code of practice for ancillary structure in sewerage system.
	IS : 4127	Code of practice for laying of glazed stone-ware pipes.

	IS : 4764	Tolerance limits for sewage effluents discharged into inland-surface waters.
	IS : 4827	Electro plated coating of nickel and chromium on copper and copper alloys.
	IS : 5329	Code of practice for sanitary pipe work above ground for buildings.
	IS : 5382	Rubber sealing rings for gas mains, water mains and sewers.
	IS : 5822	Code of practice for laying of welded steel pipes for water supply.
	IS : 5961	Cast iron grating for drainage purpose.
	IS : 7740	Code of practice for road gullies.
	IS : 8931	Cast copper alloy fancy bib taps and stop valves for water services.
	IS : 8934	Cast copper alloy fancy pillar taps for water services.
	IS : 9762	Polyethylene floats for ball valves.
	IS : 10446	Glossary of terms for water supply and sanitation.
	IS : 10592	Industrial emergency showers, eye and face fountains and combination units.
	IS : 12592	Specification for precast concrete manhole covers and frames.
	IS : 12701	Rotational moulded polyethylene water storage tanks.
	SP: 35	Handbook on water supply and drainage.
	-	Manual on Sewerage and sewage treatment (Published by CPH & EEO) As updated.
	Doors, Windows and Allied Works	
	IS : 204	Tower Bolts
	Part-I	Ferrous metals.
	Part-II	Nonferrous metals.

IS : 208	Door Handles.
IS : 281	Mild steel sliding door bolts for use with padlocks.
IS : 362	Parliament Hinges.
IS : 420	Specification for putty, for use on metal frames.
IS : 1003 Part-I door	Specification for timber panelled and glazed shutters- (Part-I) shutters.
IS : 1038	Steel doors, windows and ventilators.
IS : 1081	Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators.
IS : 1341	Steel butt hinges.
IS : 1361	Steel windows for industrial buildings.
IS : 1823	Floor door stoppers.
IS : 1868	Anodic coatings on Aluminium and its alloys.
IS : 2202 (Part-II)	Specification for wooden flush door shutters (solid core type); particle board face panels and hard board face panels
IS:2209	Mortice locks (vertical type).
IS:2553	Safety glass
IS:2835	Flat transparent sheet glass.
IS:3548	Code of practice for glazing in buildings.
IS:3564	Door closers (Hydraulically regulated).
IS : 3614	Fire check doors; plate, metal covered and rolling type.
IS:4351	Steel door frames.
IS:5187	Flush bolts.
IS:5437	Wired and figured glass

	IS:6248	Metal rolling shutters and rolling grills.
	IS:6315	Floor springs (hydraulically regulated) for heavy doors.
	IS:7196	Hold fasts.
	IS:7452	Hot rolled steel sections for doors, windows and ventilators.
	IS:10019	Mild steel stays and fasteners.
	IS:10451	Steel sliding shutters (top hung type).
	IS:10521	Collapsible gates.
	Roof Water Proofing and Allied Works	
	IS:1203	Methods of testing tar and bitumen.
	IS:1322	Specification for bitumen felts for water proofing and damp proofing.
	IS:1346	Code of practice for water proofing of roofs with bitumen felts.
	IS:1580	Specification for bituminous compound for water proofing and caulking purposes.
	IS:3067	Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings.
	IS:3384	Specification for bitumen primer for use in water proofing and damp proofing.
	Floor Finishes and Allied Works	
	IS:1237	Specification for cement concrete flooring tiles.
	IS:1443	Code of practice for laying and finishing of cement concrete flooring tiles.
	IS:2114	Code of practice for laying in-situ terrazzo floor finish.
	IS:2571	Code of practice for laying in-situ cement concrete flooring.
	IS:3462	Specification for unbacked flexible PVC flooring.
	IS:4971	Recommendations for selection of industrial floor finishes.

	IS:5318	Code of practice for laying of flexible PVC sheet and tile flooring.
	IS:8042	Specification for white portland cement.
	IS:13801	Specification for chequered cement concrete flooring tiles.
	Painting and Allied Works	
	IS:162	Specification for fire resisting silicate type, brushing, for use on wood, colour as required.
	IS:1477	Code of practice for painting of ferrous metals in buildings.
	Part-I	Pretreatment.
	Part-II	Painting.
	IS:1650	Specification for colours for building and decorative finishes.
	IS:2074	Specification for red oxide-zinc chrome, priming, ready mixed paint air drying.
	IS:2338	Code of practice for finishing of wood and wood based materials.
	Part-I	Operations and workmanship
	Part-II	Schedules
	IS:2395	Code of practice for painting concrete, masonry and plaster surfaces.
	Part-I	Operations and workmanship.
	Part-II	Schedule.
	IS:2524	Code of practice for painting of nonferrous metals in buildings.
	Part-I	Pretreatment.
	Part-II	Painting.
	IS:2932	Specification of synthetic enamel paint, exterior, under-coating and finishing.
	IS:2933	Specification enamel paint, under coating and finishing.
	IS:4759	Code of practice for hot dip zinc coating on structural steel and other allied products.
	IS:5410	Specification for cement paint

IS:5411 (Part-I)	Specification for plastic emulsion paint-for exterior use
IS:6278	Code of practices for white washing and colour washing.
IS:10403	Glossary of terms relating to building finishes.
Piling and Foundation	
IS:1080	Code of practice for design and construction of simple spread foundations.
IS:1904	Code of practice for design and construction of foundations in Soils; General Requirements.
IS:2911	Code of practice for designs and construction of Pile foundations (Relevant Parts).
IS:2950 (Part-I)	Code of practice for designs and construction of Raft foundation.
IS:2974 (Part-I TO V)	Code of practice for design and construction of machine foundations.
IS:6403	Code of practice for determination of Allowable Bearing pressure on Shallow foundation.
IS:8009	Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads.
Part-I	Shallow foundations.
Part-II	Deep foundations.
IS:12070	Code of practice for design and construction of shallow foundations on rocks.
DIN:4024	Flexible supporting structures for machines with rotating machines.
VDI:2056	Criteria for assessing mechanical vibrations of machines.
VDI:2060	Criteria for assessing rotating imbalances in machines.
Stop Log and Trash Rack	
IS:4622	Recommendations for fixed - wheel gates structural design.
IS:5620	Recommendations for structural design criteria for low head slide gates.
IS:11388	Recommendations for design of trash rack for intakes.
IS:11855	General requirements for rubber seals for hydraulic gates.
Roads	

	IRC:5	Standard specifications and Code of practice for road bridges, section-I general Features of Design.
	IRC:14	Recommended practice of 2cm thick bitumen and tar carpets.
	IRC:16	Specification for priming of base course with bituminous primers.
	IRC:19	Standard specifications and code of practice for water bound macadam.
	IRC:21	Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced).
	IRC:34	Recommendations for road construction in waterlogged areas.
	IRC:36	Recommended practice for the construction of earth embankments for road works.
	IRC:37	Guidelines for the Design of flexible pavements.
	IRC:56	Recommended practice for treatment of embankment slopes for erosion control.
	IRC:73	Geometric design standards for rural (non-urban) highways.
	IRC:86	Geometric Design standards for urban roads in plains.
	IRC:SP:13	Guidelines for the design of small bridges & culverts.
	IRC - Public-	Ministry of Surface Transport (Roads Wing), Specifications
	ation	for road and bridge works.
	IS:73	Specification for paving bitumen
	Loadings	
	IS:875	Code of practice for design loads other than earthquake) for
	(Pt. I to V)	buildings and structures.
	IS:1893	Criteria for earthquake resistant design of structures.
	IS:4091	Code of Practice for design and construction of foundation for transmission line towers & poles.
	IRC:6	Standard specifications & code of practice for road bridges, Section-II Loads and stresses.
	M.O.T.	Deptt. of railways Bridge Rules.
	Safety	
	IS:3696	Safety code for scaffolds and ladders.
	(Part I & II)	

IS:3764	Safety code for excavation work.
IS:4081	Safety code for blasting and related drilling operations.
IS:4130	Safety code for demolition of buildings.
IS:5121	Safety code for piling and other deep foundations.
IS:5916	Safety code for construction involving use of hot bituminous materials.
IS:7205	Safety code for erection on structural steelwork.
IS:7293	Safety code for working with construction machinery.
IS:7969	Safety code for handling and storage of building materials
IS:11769	Guidelines for safe use of products containing asbestos.

- Indian Explosives Act. 1940 as updated.

Architectural design of buildings

SP:7	National Building Code of India
SP:41	Handbook on functional requirements of buildings (other than industrial buildings)

Miscellaneous

IS:802	Code of practice for use of structural steel in
(Relevant parts)	overhead transmission line towers.
IS:803	Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks.
IS:10430	Creteria for design of lined canals and liner for selection of type of lining.
IS:11592	Code of practice for selection and design of belt conveyors.
IS:12867	PVC handrails covers.
CIRIA	Design and construction of buried thin-wall pipes.
Publication	

REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION

The design, manufacture, inspection, testing & installation of all equipment and system covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable VDE, IEEE, ANSI, ASME, NEC, NEMA, ISA AND Indian Standards and their equivalents.

Temperature Measurements

1. Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974).
2. Temperature measurement - Thermocouples ANSI MC 96.1 - 1982.
3. Temperature measuremnet by electrical Resistance thermometers - IS:2806.
4. Thermometer - element - Platinum resistance - IS:2848.

Pressure Measurements

1. a) Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964).
   b) Electonic transmitters BS:6447.
2. Bourdon tube pressure and vacuum gauges - IS:3624 - 1966.
3. Process operated switch devices (Pr. Switch) BS-6134.

Flow Measurements

Instruments and apparatus for flow measurements - ASME PTC 19.5 (1972) Interim supplement, Part-II.

Measurement of fluid flow in closed conduits - BS-1042.

Electronic Measuring Instrument & Control Hardware/ Software

1. Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973): IS:9319.
2. Safety requirements for electrical and electronic measuring and controling instrument - ANSI C 39.5 - 1974.
3. Compatability of analog signals for electronic industrial process instruments - ISA - S 50.1 (1982) ANSI MC 12.1 - 1975.
4. Dynamic response testing of process control instrumentation ISA - S 26 (1968).

5. Surge Withstand Capability (SWC) tests - ANSI C 37.90 a/IEEE-472 or suitable class of IEC-255-4 equivalent to ANSI C37.90a/IEEE-472.

6. Printed circuit boards - IPC TM - 650, IEC 326 C.

7. General requirement and tests for printed wiring boards - IS 7405 (Part-I) 1973.

8. Edge socket connectors - IEC 130-11.

9. Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2.

10. Dimensions of attachment plugs & receptacles - ANSI C 73 - 1973 (Supplement ANSI C 73 a - 1980).

11. Direct acting electrical indicating instrument - IS:1248 - 1968 (R).

12. Standard Digital Interface for Programmable Instrumentation - IEEE-488.2 - 1990.

13. Information Processing Systems - Local Area Networks - Part 2 : Logical Link Control - IEEE-802.2 - 1989.

14. Standard for Local Area Networks : Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1985.

15. Supplements A, B, C and E to Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1988.

16. Standard for Local Area Networks : Token - Passing Bus Access Method - IEEE-802.4 - 1985.

17. Standard for Local Area Networks : Token - Ring Access Method and Physical Layer Specification - IEEE-802.5 - 1985.

18. IEEE Guide to Software Requirements Specifications - IEEE-830 - 1984.

19. Hardware Testing of Digital Process Computers - ISA RP55.1 - 1983.

20. Electromagnetic Susceptibility of Process Control Instrumentation - SAMA PMC 33.1 - 1978.

21. Interface Between the Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary Data Interchange - EIA-232-D-1987.

22. Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 3 : Radiated Electromagnetic Field Requirements - IEC 801-3-1984.

Instrument Switches and Contact

1. Contact rating - AC services NEMA ICS 2 - 1978 (with revision through May 1983), Part - 2-125, A6000.

2. Contact rating - DC services NEMA ICS 2-1978 Part-2 125, N600.

Enclosures

1. Type of Enclosures - NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13).

2. Racks, panels and associated equipment - EIA : RS - 310 C- 1983 (ANSI C 83.9 - 1972).

3. Protection class for Enclosures, cabinets, control panels & desks - IS:2147 - 1962.

Apparatus, enclosures and installation practices in hazardous area

1. Classification of hazardous area - NFPA 70 - 1984, Article 500.

2. Electrical Instruments in hazardous dust location - ISA - 512.11, 1973.

3. Instrinsically safe apparatus - NFPA 493 1978.

4. Purged and pressurised enclosure for electrical equipment in hazardous location - NFPA 496-1982.

5. Enclosures for Industrial Controls and Systems - NEMA IS 1.1 - 1977.

Sampling System

1. Stainless steel material of tubing and valves for sampling system - ASTMA 296-82, Grade 7 P 316.

2. Submerged helical coil heat exchangers for sample coolers ASTM D11 92-1977.

3. Water and steam in power cycle - ASME PTC 19.11.

4. Standard methods of sampling system - ASTM D 1066-99.

Annunciators

1. Specifications and guides for the use of general purpose annunciators - ISA S 19.1, 1979.

2. Surge withstand capability tests - ANSI C 37.90a - 1989/IEEE-472 or suitable class of IEC 255-4 equivalent to ANSI C37.90a 1989/IEEE-472

3. Damp heat cycling test - IS:2106

4. Specification for Electromagnetic Susceptibility - SAMA DMC 33, 1/78

Protections

1. Relays and relay system associated with electric power apparatus. ANSI C 37.90, 1 - 1989.
2. General requirements & tests for switching devices for control and auxiliary circuits including contactor relays - IS:6875 (Part-I) - 1973.
3. Turbine water damage prevention - ASME TDP-1-1980.
4. Boiler safety interlocks - NFPA Section 85 B - 1984, 85 C - 1991.

UPS System

1. Practices and requirements for semi-conductor power rectifiers - ANSI C 34.2, 1973.
2. Relays and relays system associated with electrical power apparatus - ANSI C 3.90 - 1983.
3. Surge withstand capability test - ANSI C 37.90 1 -1989.
4. Performance testing of UPS - IEC 146.
5. Stationary cells & Batteries Lead Acid type (with tubular positive plates) specification IS-1651-1991.
6. Recommended practice for sizing large lead storage batteries for generating stations & sub-stations - IEEE-485-1985.
7. Printed Circuit Board - IPC TM 650, IEC 326C.
8. General Requirements & tests for printed wiring boards, IS:7405 (Part-I) 1973.

Control Valves

1. Control valve sizing - Compressible & Incompressible fluids - ISA S 75.01-1985.
2. Face to face dimensions of control valves - ANSI B 16.00 - 1973.
3. ISA Hand Book of Control Valves - (ISBN : B: 1047-087664-234-2).
4. Codes for pressure piping - ANSI B 31.1
5. Control Valve leak class - ISA RP 39.6

Process Connection & Piping

1. Codes for pressure piping "power piping" - ANSI B 31.1.
2. Seamless carbon steel pipe ASTM - A - 106.
3. Forged & Rolled Alloy steel pipe flanges, forged fittings and valves and parts - ASTM - A - 182.
4. Material for socket welded fittings - ASTM - A - 105.
5. Seamless ferritic alloy steep pipe - ASTM - A - 335.
6. Pipe fittings of wrought carbon steel and alloy steel - ASTM - A - 234.
7. Composition bronze of ounce metal castings - ASTM - B - 62.
8. Seamless Copper tube, bright annealed - ASTM - B - 168.
9. Seamless copper tube - ASTM - B - 75.
10. Dimension of fittings - ANSI - B - 16.11.
11. Valves flanged and butt welding ends - ANSI - B - 16.34.

Instrument Tubing

1. Seamless carbon steel pipe - ASTM - A 106.
2. Material of socketweld fittings - ASTM - A105.
3. Dimensions of fittings - ANSI - B - 16.11.
4. Code for pressure piping, welding, hydrostatic testing - ANSI B 31.1.

Cables

1. Thermocouples extension wires/cables - ANSI MC 96.1 - 1992.
2. Requirements for copper conductor-Wiring cables for telecommunications & information processing system - VDE:0815.
3. Colour coding of single or multi-pair cables - ICEA - S - 61-402 (third edition) NEMA WCS - 1979 with revisions thorugh 2/83.
4. Insulation & Sheathing compounds for cables : VDE 0207 (Part-4, 5 & 6).
5. Guide design and installation of cable systems in power generating stations (insulation, jacket materials) - IEEE Std. 422-1977.
6. Rules for Testing insulated cables and flexible cables : VVDE - 0472
7. Requirements of vertical flame propagation test - IEEE 383 - 1974 (R 1980)

8. Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B-33-81.

9. Oxygen index and temperature index test - ASTM D - 2863.

10. Smoke density measurement test - ASTMD - 2843.

11. Acid gas generation test - IEC - 754 - 1.

12. Swedish Chimney test - SEN - 4241475 (F3).

13. Teflon (FEP) insulation & sheath test - ASTMD - 2116.

14. Thermocouple compensating cables - Testing requirements & sampling plan IS:8784.

15. PVC insulated electric cables for working voltage upto and including 1100 V - IS:1554 (Part-I).

Cable Trays, Conduits

1. Guide for design and installation of cable systems in power generating staiton (Cable trays, support systems, conduits) - IEEE Std. 422, 1977, NEMA VE-1 1979, NFPA 70-1984.

2. -do- Test Standards. NEMA VE-1-1979.

3. Zinc coating "hot dip" on assembled products for galvanising of carbon steel cable trays - ASTMA - 386-78.

Public Address System

1. Specifications for lod speakers - IS:7741 (Part-I, II and III)

2. Code of safety requirement for electric mains operated audio amplifiers - IS:1301

3. Specification for Public Address Amplifiers - IS:10426.

4. Code of practice for outdoor installation of PA system - IS:1982.

5. Code of practice for installation for indoor amplifying and sound distribution system - IS:1881.

6. Basic environmental testing procedures for electronic and electrical items - IS:9000.

7. Characteristics and methods of measurements for sound system equipment - IS:9302

8. Code of practice of electrical wiring installations (System voltage not exceeding 650 volts) - IS:732

9. Rigid steel conduits for electric wiring - IS:9537 (Part-I and II)

10. Fittings for rigid steel conduits for electrical wiring - IS:2667

11. Degree of protection provided by enclosure for low voltage switchgear and control gear - IS:2147.

Vibration Monitoring System

1. API 670 - 1994

2. BS : 4675 Part-2

ANNEXURE-III

एनटीपीसी NTPC	Project : Stage :: Package : Supplier : Contractor No. :	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL SUB-SYSTEM :	DOC. NO.: REV. NO.: DATE : PAGE : OF

S. N.	Item	QP/ Insp. Cat.	QP No.	QP Sub. Schedule	QP approval schedule	Proposed sub-supplier	Place	Sub-suppliers approval status / category	Sub-supplier Details submission schedule	Remarks

LEGENDS

SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC)

A – **For these items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list alongwith the condition of approval, if any.**

DR – **For these items "Detailed required" for NTPC review. To be identified with letter "DR" in the list.**

NOTED – **For these items vendors are approved by Main Supplier and accepted by NTPC without specific vendor approval from NTPC. To be identified with "NOTED.'**

QP/INSPN CATEGORY:

CAT-I : **For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC.**

CAT-II : **For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP.**

CAT-III : **For these items Main Supplier approves the Quality Plans. The final acceptance by NTPC shall be on the basis certificate of conformance by the main supplier.**

UNITS/WORKS : **Place of manufacturing Place of Main Supplier of multi units/works.**

FORMAT NO.: QS-01-QAI-P-1/F3-R0 1/1 Engg. Div. / QA&I

ANNEXURE-IV

एनटीपीसी NTPC	Project : Stage :: Package : Contractor : Contractor No. :	STATUS OF ITEM REQUIRING QP& SUB-SUPPLIER APPROVAL	DOC. NO.: REV. NO.: DATE : PAGE : OF

S. N.	Item / Service	QP/ Insp. Cat.	QP Sub. Schedule Approval schedule	Date of sub-mission	Date of commt Appl.	Status Code C/II/I	Proposed Sub-suppliers	Place of manufacturing works	Approval Status	Sub-supplier detail submission schedule	Remarks

FORMAT 1/1 Engg. Div. / QA&I

ANNEXURE-V

एनटीपीसी NTPC	Project : Stage : Contractor : Contractor No. : System :					FIELD WELDING SCHEDULE (To be raised by the contractor) Welding Code: ……						DOC. NO.: REV. NO.: DATE : PAGE : OF				
Sl. No.	DRG No. for Weld Location and Identification mark	Description of parts to welded	Matl. Spec.	Dimensions		Process of welding	Type of Weld	Electrode filler spec.	WPS. No.	Min. pre-heat	Heat treatment		NDT method/ Quantum	REF		Remarks
											Temp.	Holding time		Spec. No.	ACC Norm Ref.	
NOTES:																
SIGNATURE																
FORMAT						1/1							Engg. Div. / QA&I			

S. No.	Description of Drgs./Docs.	No. of Prints	No. of Portable Hard Disk
1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents		
	First submission and submission with major changes		
	▪ Layout (A0&A1 sizes)	4	-
	▪ Other Drawings/Documents (A0 & A1 sizes)	2	-
	▪ P&ID (All sizes)	4	-
	a) Final drawings/documents (Directly to site)	6	2
	b) "As Built" Drawing/Documents (Directly to site)	6	2
	c) Analysis reports of Equipments / piping / structures components/system employing software packages as detailed in the specifications.	2	2
2	Erection Manual (Directly to site)	4 sets	2
3	Operation & Maintenance manual i) First Submission	1 set	--
	ii) Final Submission (Directly to site)	4 sets	2
4	Plant Hand Book i) First Submission	1	1
5	Commissioning and Performance Test Procedure manual i) First Submission	1 set	--
	ii) Final Submission (Directly to site)	4 sets	2

S. No.	Description of Drgs./Docs.	No. of Prints	No. of Portable Hard Disk
6	Performance and Functional Guarantee Test Report i) First Submission	2 sets	--
	ii) Approved Copies (Direct to Site)	4 sets	2
7	Project Completion Report (Directly to site)	6 sets	2

CORPORATE QUALITY ASSURANCE/ कॉरपोरेट गुणवत्ता आश्वासन

MAIN CONTRACTOR'S PROPOSAL CUM EVALUATION REPORT

मुख्य संविदाकार प्रस्ताव सह मुल्यांकन रिपोर्ट

Ref No: संदर्भ सं.:			***Date:*** तिथिः		
i.	***Main Contractor*** मुख्य संविदाकार				
ii.	***Project*** परियोजना				
iii.	***Package Name*** पैकेज का नाम		***Package No*** पैकेज सं.		
iv.	***Proposed Item/Scope of Sub-contracting*** उप-संविदा(अनुबंध) का प्रस्तावित मद/ दायरा				
v.	***Item covered under*** *निम्नलिखित के अंतर्गत शामिल मद*	***Schedule-1*** */अनुसूची- 1*	☐	***As per contract clause No-*** *अनुबंध के अनुसार खंड सं.-- -*	
		Schedule-2 *अनुसूची- -2*	☐		
vi.	***If item is Schedule-1 and proposed sub-vendor is indigenous, Main Contractor to explain how the contractual provisions will be fulfilled*** /यदि मद अनुसूची **-1** है और प्रस्तावित उप-विक्रेता स्वदेशी है, तो मुख्य संविदाकार को स्पष्ट करना होगा कि संविदा/अनुबंध के प्रावधान कैसे पूरे किए जाएंगे				
vii.	***Name and Address of the proposed Sub-vendor's works*** /प्रस्तावित सब-वेंडर का नाम तथा पता				
viii.	***PO placement date/ Start of manufacturing (if self-manufactured) as per L2 network*** **पीओ नियोजन की तिथि / एल-** 2 **नेटवर्क के अनुसार विनिर्माण (यदि स्व-निर्मित है) की शुरुआत**				

ix.	***Item Description (Type/Size/Rating/Scope of Sub-Contracting)*** मद का विवरण (प्रकार / आकार / रेटिंग / उप-अनुबंध का दायरा)	***Total quantity of proposed item envisaged in this package (Nos/ Running Meters/ Kgs/ Tons etc)*** इस पैकेज में परिकल्पित प्रस्तावित मद की कुल मात्रा (संख्या / क्रियाशील मीटर / किलोग्राम / टन आदि)	***Quantity proposed to be procured from proposed sub-vendor (Nos/ Running Meters /Kgs /Tons etc)*** प्रस्तावित उप-विक्रेता (संख्या / क्रियाशील मीटर / किलोग्राम / टन आदि) से खरीदी जाने वाली मात्रा	***Timeline for quantity requirements as per project schedule & whether the proposed Sub-vendor equipped with adequate capacity to supply proposed order quantity in time*** / परियोजना समय सूची के अनुसार मात्रा आवश्यकताओं के लिए समय-सीमा और क्या प्रस्तावित उप-विक्रेता समय पर प्रस्तावित मांग की मात्रा की आपूर्ति करने में पूरी तरह से सक्षम है

x.	***Supply experience of the proposed sub-vendor (including supplies to Main Contractor, if any) for similar item/scope of sub-contracting, for last 3 years (Note:- Only relevant experience details w.r.t. proposed item/scope of subcontracting to be brought out here)*** पिछले **3** वर्षों के लिए उप-अनुबंध के समान मद / दायरे के लिए प्रस्तावित सब-वेंडर (मुख्य संविदाकार हेतु

आपूर्ति, यदि कोई हो, सहित) का आपूर्ति अनुभव (नोट: - उप-अनुबंध के प्रस्तावित मद / दायरे के संबंध में केवल प्रासंगिक अनुभव के विवरण का उल्लेख हो

Project/Package परियोजना/पैकेज	***Customer Name*** ग्राहक का नाम	***Supplied Item (Type/Rating/Model /Capacity/Size etc)*** आपूर्तित मद (प्रकार/रेटिंग /मॉडल /क्षमता/आकार आदि)	***PO ref no/date*** पीओ संदर्भ सं. /तिथि	***Supplied Quantity*** आपूर्ति की मात्रा	***Date of Supply*** आपूर्त्ति की तिथि

We confirm that as per our assessment, the proposed sub-vendor has requisite capabilities & supply experience and is suitable for supplying the proposed item/scope of sub-contracting/हम अपने आकलन के अनुसार इस बात की पुष्टि करते हैं कि, प्रस्तावित उप-विक्रेता के पास अपेक्षित क्षमता और आपूर्ति करने का अनुभव है और उप-अनुबंध के दायरे /प्रस्तावित मद की आपूर्ति के लिए उपयुक्त है।

Name: नाम:		***Desig:*** पद:		***Contact No:*** दूरभाष सं.:		***Sign:*** हस्ताक्षर:		***Date:*** तिथि:	

Company's Seal/Stamp:- कंपनी का मुहर:-

एनटीपीसी NTPC	**CORPORATE QUALITY ASSURANCE/ कॉरपोरेट गुणवत्ता आश्वासन** **SUB-VENDOR QUESTIONNAIRE/ सब-वेंडर प्रश्नावली**

i.	***Item/Scope of Sub-contracting*** **उप-संविदा(अनुबंध) का मद/ दायरा**			
ii.	***Address of the registered office*** पंजीकृत कार्यालय का पता	***Details of Contact Person*** संपर्क व्यक्ति का विवरण ***(Name, Designation, Mobile, Email)*** (नाम, पदनाम, मोबाइल, ईमेल)		
iii.	***Name and Address of the proposed Sub-vendor's works where item is being manufactured*** प्रस्तावित उप-विक्रेता के कार्यों का नाम और पता, जहां मद का निर्माण किया जा रहा है	***Details of Contact Person:*** संपर्क व्यक्ति का विवरण ***(Name, Designation, Mobile, Email)*** (नाम, पदनाम, मोबाइल, ईमेल)		
iv.	***Annual Production Capacity for proposed item/scope of sub-contracting*** **उप-संविदा(अनुबंध)** के प्रस्तावित मद / दायरे के लिए वार्षिक उत्पादन क्षमता			
v.	***Annual production for last 3 years for proposed item/scope of sub-contracting*** **उप-संविदा(अनुबंध)** के प्रस्तावित मद / दायरे के लिए पिछले 3 वर्षों का वार्षिक उत्पादन			
vi.	***Details of proposed works*** **प्रस्तावित कार्यों का विवरण**			
1.	***Year of establishment of present works*** वर्तमान फैक्टरी की स्थापना का वर्ष			
2.	***Year of commencement of manufacturing at above works*** उपरोक्त फैक्टरी में निर्माण कार्य शुरू होने का वर्ष			
3.	***Details of change in Works address in past (if any*** पूर्व में फैक्टरी स्थल में परिवर्तन का विवरण (यदि कोई हो)***)***			
4.	***Total Area*** कुल क्षेत्र			
	Covered Area शामिल क्षेत्र			
5.	***Factory Registration Certificate*** फैक्टरी पंजीकरण प्रमाण पत्र	***Details attached at Annexure – F2.1*** विवरण अनुलग्नक- एफ 2.1 पर संलग्न है		
6.	***Design/ Research & development set-up*** डिजाइन / अनुसंधान और विकास सेटअप ***(No. of manpower, their qualification, machines & tools employed etc.)*** (श्रमिकों की संख्या, उनकी योग्यता, मशीन और उपलब्ध उपकरण आदि)	***Applicable / Not applicable if manufacturing is as per Main Contractor/purchaser design)*** ***Details attached at Annexure – F2.2*** ***(if applicable)*** लागू / लागू नहीं, अगर विनिर्माण मुख्य संविदाकार / खरीददार के डिजाइन के अनुसार है) विवरण अनुलग्नक –एफ 2.2 पर संलग्न है। (यदि लागू हो)		
7.	***Overall organization Chart with Manpower Details (Design/Manufacturing/Quality etc)*** मैनपावर विवरण के साथ समग्र संगठन का चार्ट(डिजाइन / विनिर्माण / गुणवत्ता आदि)	***Details attached at Annexure – F2.3*** विवरण अनुलग्नक – F2.3 में संलग्न है।		
8.	***After sales service set up in India, in case of foreign sub-vendor(Location, Contact Person, Contact details etc.)*** भारत	***Applicable / Not applicable*** लागू / लागू नहीं		

	में बिक्री सेवा की स्थापना के बाद, विदेशी उप-विक्रेता के मामले में(स्थल , संपर्क व्यक्ति, संपर्क विवरण आदि)	***Details attached at Annexure – F2.4*** विवरण अनुलग्नक -2.4 पर संलग्न है।
9.	***Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any*** फ्लोचार्ट सहित विनिर्माण प्रक्रिया निष्पादन योजना , जिसमें आउटसोर्स प्रक्रिया, यदि कोई हो, सहित कच्चे माल से तैयार उत्पाद तक विनिर्माण के विभिन्न चरणों को दर्शाया गया हो,	***Details attached at Annexure – F2.5*** विवरण अनुलग्नक - F2.5में संलग्न है।
10.	***Sources of Raw Material/Major Bought Out Item*** कच्चे माल के स्रोत / खरीदे हुए मुख्य मद	***Details attached at Annexure – F2.6*** विवरण अनुलग्नक - F2.6में संलग्न है।
11.	***Quality Control exercised during receipt of raw material/BOI, in-process , Final Testing, packing*** कच्चे माल / खरीदे हुए मद, प्रक्रियाबद्ध, अंतिम परीक्षण, पैकिंग करते समय गुणवत्ता नियंत्रण	***Details attached at Annexure – F2.7*** विवरण अनुलग्नक - F2.7 पर संलग्न है
12.	***Manufacturing facilities*** ***(List of machines, special process facilities, material handling etc.)*** विनिर्माण सुविधा(मशीनों की सूची , विशेष प्रक्रिया सुविधाएं, सामग्री रख-रखाव आदि)	***Details attached at Annexure – F2.8*** विवरण अनुलग्नक - F2.8में संलग्न है।
13.	***Testing facilities (List of testing equipment)*** परीक्षण सुविधाएं(परीक्षण उपकरण की सूची)	***Details attached at Annexure – F2.9*** विवरण अनुलग्नक – F2. 9 में संलग्न है।
14.	***If manufacturing process involves fabrication then-*** यदि निर्माण प्रक्रिया में फेब्रिकेशन की गई है तो-	***Applicable / Not applicable*** लागू / लागू नहीं ***Details attached at Annexure – F2.10*** विवरण अनुलग्नक - F2.10में संलग्न है। ***(if applicable)*** लागू / लागू नहीं
	List of qualified Welders पात्र वेल्डर की सूची	
	List of qualified NDT personnel with area of specialization विशेषज्ञता के क्षेत्र सहित पात्र एनडीटी कार्मिकों की सूची	
15.	***List of out-sourced manufacturing processes with Sub-Vendors' names & addresses*** सब-वेंडर द्वारा बाह्य स्रोतों (उनके नाम और पते सहित)से करवाएं गए निर्माण प्रक्रियाओं की सूची	***Applicable / Not applicable*** लागू / लागू नहीं ***Details attached at Annexure. –F2.11*** विवरण अनुलग्नक - F2.10में संलग्न है। ***(if applicable)*** (यदि लागू हो)
16.	***Supply reference list including recent supplies*** नवीनतम आपूर्ति सहित आपूर्ति संदर्भ सूची	***Details attached at Annexure – F2.12*** विवरण अनुलग्नक - F2.12 में संलग्न है। ***(as per format given below)*** (नीचे दिए गए प्रारूप के अनुसार)

Project/ package परियोजना /पैकेज	*Customer Name* ग्राहक का नाम	*Supplied Item (Type/Rating/Model /Capacity/Size etc)* आपूर्ति की गई वस्तु (प्रकार / रेटिंग / मॉडल / क्षमता / आकार आदि)	*PO ref no/date* पीओ संदर्भ सं. / तिथि	*Supplied Quantity* आपूर्ति की मात्रा	*Date of Supply* आपूर्ति की तारीख

17.	***Product satisfactory performance feedback letter/certificates/End User Feedback*** उत्पाद के संतोषजनक प्रदर्शन संबंधी फीडबैक पत्र / प्रमाण पत्र / अंतिम उपयोगकर्ता फ़ीडबैक	***Attached at annexure - F2.13*** अनुलग्नक F2. 3पर संलग्न है
18.	***Summary of Type Test Report (Type Test Details, Report No, Agency, Date of testing) for the proposed product***	***Applicable / Not applicable*** लागू / लागू नहीं

	(similar or higher rating) प्रस्तावित उत्पाद (एक समान या उच्च रेटिंग वाले) के लिए टाइप टेस्ट रिपोर्ट (टाइप टेस्ट विवरण, रिपोर्ट संख्या, एजेंसी, जांच की तारीख) का सारांश नोट: - रिपोर्ट प्रस्तुत करने की आवश्यकता नहीं है ***Note:- Reports need not to be submitted***	***Details attached at Annexure – F2.14*** विवरण अनुलग्नक - F2.1 4में संलग्न है ***(if applicable)*** (यदि लागू हो)
19.	***Statutory / mandatory certification for the proposed product*** प्रस्तावित उत्पाद के लिए वैधानिक / अनिवार्य प्रमाणीकरण	***Applicable / Not applicable*** लागू / लागू नहीं ***Details attached at Annexure – F2.15*** ***(if applicable)*** (यदि लागू हो)
20.	***Copy of ISO 9001 certificate*** आईएसओ 9001 प्रमाण पत्र की प्रति ***(if available***(यदि उपलब्ध हो)	***Attached at Annexure – F2.16*** अनुलग्नक में संलग्न - F2.1 6 है
21.	***Product technical catalogues for proposed item (if available)*** प्रस्तावित मद के लिए उत्पाद तकनीकी कैटलॉग (यदि उपलब्ध हो)	***Details attached at Annexure – F2.17*** विवरण अनुलग्नक - F2.1 7 में संलग्न है

Name: ***नाम:***		***Desig:*** ***पद:***		***Sign:*** ***हस्ताक्षर:***		***Date:*** ***तिथि:***	

Company's Seal/Stamp:- कंपनी की मुहर / मोहर: -

hand railing for the clarifiers for good approach. Permanent ladder shall also be provided (not rungs) for approaching the sludge pipeline valves for maintenance.

6) The sludge valves shall be operatable from the top of the sludge chamber through head stock and extended spindle arrangement.

2.02.00 **Chemical House** **FOR ETP CHEMICAL SHED GENERAL POINTS SHALL BE APPLICABLE**

1) The storage rooms shall have suitable bins/partitions sufficiently large to accommodate for lime and alum. The chemical house shall have sufficient unloading space, wide corridors for movement of chemicals, office, toilet etc. as required.

2) In the first floor of chemical house, all chemical preparation tanks and dosing equipment shall be located. Suitable staircases, walkways, platforms etc. shall be provided to have clear access to different units.

3) Quick lime (purity of 75% CaO) shall be dissolved in the slaking tanks and the resultant slurry (about 10% W/V) from the slaking tanks shall be transferred to the lime solution preparation tanks by the lime slurry transfer pumps. The lime solution dosing system shall be of re-circulating type.

4) Alum solution preparation tanks and dosing equipment shall be sized for a continuous alum dosage of 70 ppm considering the clarifiers to be operating at the maximum capacity.

5) Operating platforms shall be provided for all the structures such as Aerators, Stilling chambers, Clarifiers, Sludge chamber etc. along with step ladders and hand railings. All the sumps, tanks, reservoirs, and other water retaining structures shall be provided with approach ladders (i.e. step ladders with hand railing) from operating platforms/ground level.

6) All the metallic parts of equipment of Pre-treatment plant (PT) and effluent treatment plant (ETP) which are embedded in concrete or in contact with water shall be painted with three coats of bitumastic heavy duty paint over a coat of primer to prevent corrosion unless otherwise specified and total thickness shall be 400 microns.

7) All the other parts of the PT Plant and ETP shall be painted with one coat of primer and three coats of chlorinated rubber paint and total thickness shall be 200 microns. The concrete parts encountering water shall be painted with three (3) coats of bitumastic heavy-duty paint of 400 microns thick.

8) All the tanks shall be provided with vent, overflow, drain and sample connections. Effective capacity for chemical tanks & water retaining structures/ tanks/sumps means the capacity between the bottoms of the overflow nozzle to the top of the outlet nozzle. Outlet nozzle center line shall be kept at least 200 mm from the Invert Level of the Chemical tanks /Water retaining structures /Tanks/Sumps. A minimum free board of 300 mm shall be provided in all the water retaining structures of Pre-treatment plant and Effluent treatment plant above the maximum water level at design flow condition/overflow level.

9) Maximum operating speed of all the pumps shall be limited to 1500 rpm or less unless specified otherwise.

10) Various equipment in the PT Plant will be sized for the following minimum Chemical Dosing Requirements:

a)	Alum	70 mg/litre on 100% basis
b)	Lime	30 mg/litre on 100% basis

11) For all pumps, while calculating the pump head, 10% margin shall be considered on friction losses.

12) The maximum support length in meters for MS pipe shall be as follows

a)	Pipe dia (mm)	1200	1000	800
b)	Span (meters)	12	10	10
For pipe sizes less than 800 NB, span shall be provided as per ANSI B31.1				

2.03.00 **Gravity filter**

1) The inlet channel from clarifiers to gravity filters shall be designed considering operation of all the gravity filters including standby filters under exigency.

2) Only one filter shall be backwashed at a time. Backwashing of filters shall be done in not less than 24 hours. The velocity of water during backwashing shall not exceed 35.0 m/hr., when air scouring is employed. Air blower shall be used for air scouring of filter bed.

3) At least 50% free board shall be left over the filtering media to facilitate backwashing. The filtering medium shall be washed, screened, and hydraulically graded anthracite coal or sand having an aggregated depth not less than 1200 mm.

4) Anthracite shall have the following properties: -

Uniformity coefficient	1.6
Hardness	2.5 to 3.5 (Mho scale)
Dust content	Less than 1%
Specific gravity	1.75 (Approx.)

Anthracite shall be free from iron sulfide, clay, shale, long, thin or scale pieces

5) Sand shall have the following properties: -

Sand shall be of hard and resistant quartz or quartzite and free of clay particles, soft grains, and dirt. Effective size shall be 0.45 to 0.70 mm. Uniformity coefficient shall not be more than 1.7 or less than 1.3. Ignition loss should not exceed 0.7 per cent by weight. Soluble fraction in hydrochloric acid shall not exceed 5.0% by weight. Silica content should not be less than 90%. Wearing loss shall not exceed 3%. Specific gravity shall be in the range between 2.55 to 2.65.

Sand should be clean and well graded. Sand filter shall have a HCL solubility of less than 5% when tested in accordance with AWWA B 11.53.

3.00.00 Other design and construction features

3.01.00 **Aerator & Stilling Chamber**

The aerator shall be of stepped design and shall allow water to flow downward after spreading over inclined thin sheets and the turbulence is secured by allowing the water to pass through a series of steps and baffles. The chlorine di-oxide dosing shall be done in the stilling chamber before and after aerator by using diffusers of proven design.

3.02.00 **Clarifiers**

3.02.01 The clarifier shall be solid contact reactor type with integral variable speed impeller/ turbine to internally re-circulate water and sludge at adjustable rate to produce consistent water quality at varying hydraulic load and turbidity.

3.02.02 The Clarifiers shall be provided with following features:

1) The sludge blanket shall be suspended and maintained in the lower portion. The clarifier unit shall be circular, central feed type with concentric recirculation zone (rapid mixing),

LOW PRESSURE PIPING

TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC NO: CS-4540-001A-2

1.00.00 **LOW PRESSURE PIPING**

1.01.00 The Scope of Low Pressure (LP) piping systems for the following services shall be as defined in various tender drawings & the sub section pertaining to "Terminal points and exclusions" and shall include the following systems:

a) Circulating water piping

b) DM water normal make-up piping (condenser makeup, ECW makeup for both Steam Generator and Turbo Generator Auxiliaries & CPU regeneration plant, etc.). DM for Aux Boiler filling, FGD area, etc.

c) Condenser emergency make up and ECW tank emergency make-up for SG & TG / condensate storage and transfer system.

d) Boiler (Steam Generator) and Deaerator fill piping.

e) Equipment Cooling Water (ECW) piping including its chemical dosing for primary circuit for Steam generator and Turbo generator and their auxiliaries.

f) Auxiliary cooling water piping.

g) Complete service water piping, APH /ESP wash water piping, Drinking (potable) water piping (plant distribution, CHP area, for Colony, etc.), CW Blowdown piping (including FGD & CHP area), clarified water & HVAC piping, Raw water piping (PT plant, ash handling, Make up to Fire water Tank), R.O. reject to CHP piping, Sludge & Effluent transfer piping system.

h) Compressed air (Instrument & service air) piping system.

i) Sludge (PT Plant to Ash slurry sump) & Effluent (DM Plant to Ash slurry sump) transfer systems.

j) CPU Regeneration waste to CW Channel, Condenser Pit Clear water to CW Channel, ADV discharge to CW Channel, etc.

k) Drain & vent piping system for the piping\equipment etc. under the bidder's scope.

l) Tanks as described elsewhere in the specification for the above systems. (Including condensate storage tanks, etc.).

m) Re-circulation pipes along with valves, breakdown orifices etc., wherever required/specified elsewhere in Technical Specification.

n) Any other piping system required making the Low Pressure (LP) piping systems in the bidder's scope complete.

o) Other applicable piping systems as mentioned in Plant Water Scheme and elsewhere in Technical Specification.

1.02.00 The scope covers the following for the complete LP piping mentioned above:

a) Design, engineering, manufacturing, supply, fabrication, testing packaging, transportation to site, storage, taking delivery of Employer supplied equipment from site stores, in plant transportation, erection, cleaning, testing and commissioning of all items i.e., pipes, fittings, supports/ hangers, valves, actuators, motors, specialties,

expansion joints, strainers, moisture traps, tanks, chemical dosing system for Equipment Cooling Water System (Primary circuit), instruments, drains, vent including drain/ vent valves ,air release valves etc.

The items though not specifically mentioned or indicated here in but are needed to make the system / equipment complete shall also be furnished and treated as if included in the specification unless otherwise specifically excluded.

1.03.00 Bidder's scope of supply & works shall include but not be limited to the following:

a) Pipes, headers and manifolds, bends, elbows, returns, tees, laterals, crosses, reducers/ expanders, caps and closures, couplings, plugs, sleeves, and saddles, stubs and bosses, unions and other similar fittings, flanges, gaskets, fasteners and sealants, ring joints, backing rings, all types of valves including drain/ vent/ air release valves, 3-way valves(where applicable) with test connection for instruments/ manifolds etc. actuators, specialties, orifices, flow nozzles, etc. as per finalized single line flow diagrams and layout drawings/ isometric drawings.

b) Complete assemblies of hangers, supports anchor, guides, restraints, etc. including welded attachments, clamps, devices tie-rods, turn-buckles, springs and spring cages, shoes, rollers, trapezes etc.

c) Weather hoods for pipes crossing ceilings and walls.

d) Instrument tapping and stub connections, root valves, 3-way valves (where applicable) with test connections, drains and vent valves & expanders / reducers as required and instruments as indicated else where for instruments supplied by the Contractor.

e) Drain funnels, drip pans, moisture traps etc. wherever required shall be provided.

f) Instrument tapping, stub connections, root valves and instrument tubing up to root valves for instruments supplied by the Employer for onward connections by the Employer.

g) All supporting attachments like plates, saddles, stools, shoes, base plate, saddle plates, angles, channels, I-beams, trapeze, cantilevers, brackets, sways, braces, nuts, bolts, cleats, clamps, needed to complete the erection of piping system covered under this specification.

Anchor bolts, bed & foundation plates, pipe sleeves and Nuts to be embedded in concrete for piping where ever indicated in the drawing. All grouting and chipping work (including supply of cement, sand and stone chips) for equipment foundations, pipe supporting etc.

Reinforced concrete valve chambers wherever required for underground piping.

h) Surface preparation, priming and painting of all non-insulated above ground piping and equipment except galvanized steel piping & surfaces, stainless steel piping & surfaces, and gun metal surfaces.

Paints and varnishes, primers, thinners etc. as required for anti-corrosive protection of piping & equipment above ground.

i) Bidder shall provide anti-corrosive protection anticorrosive tape or coating wrapping on the external surfaces of pipes to all directly buried piping including galvanized carbon steel piping.

j) On the internal surface of all pipes 1000 mm and above, a coat of primer followed by a hot coat of coal tar enamel paint or coal tar epoxy paint shall be applied.

k) Excavation, preparation of bed, backfilling with compaction of soil and removal of extra-earth to designated places in case of pipes to be buried.

l) Bidder shall also design, supply, fabricate, erect, set and commission all hangers, tie-rods, turn-buckles, supports, guides, restraints, anchors, etc. as required for the, piping system. This includes the provision of all associated steel work including brackets, cradle supports, duck foots, channels, angles, etc. It is Bidder's responsibility to estimate these requirements and include them in their offer price. Whenever, straight run of the yard pipes are more than 300 meters, flexibility analysis shall be conducted by the contractor to identify the requirement of loops, type of supports etc.

m) In covered concrete trenches bidder shall supply necessary supporting materials such as stools, saddles, base plates, clamps, U-bolts, angles, clips etc.

n) Bidder shall supply all necessary drains and vents with drain & vent valves including anti-flash funnels and moisture traps for compressed air system as required for the safe and effective draining-venting of the piping systems based on the approved flow scheme / single line diagram. It is bidder's responsibility to identify the requirements of drains, vents, and supply the necessary pipe work, fittings, hangers and supports etc. for the same.

o) Bidder shall supply and install necessary matching pieces as may be needed for connection of piping systems with equipment terminals, valves and specialties.

p) Bidder shall erect all instrument impulse piping and fittings from the tap-off point of the last root valve including the root valve and instruments.

q) Bidder shall perform necessary internal machining of pipe for installing orifices, flow nozzles, straightening vanes etc.

r) The Bidder shall prepare the flow diagrams, detailed dimensional piping layout/ Isometric/ fabrication/ as built drawings of all the systems along with Cross sectional drawings, showing all supports and equipment as required.

s) In addition to submission of drawings as stipulated above bidder shall also furnish the data/ documents with respect to following:

1) Thickness calculation of large diameter buried pipes as per AWWA-M-11.
2) System design calculation of Primary closed circuit ECW and secondary circuit ACW system for flow & pressure balancing.
3) Design calculations for condensate storage tank and Drinking water tank.
4) Static Analysis for Long (more than 300 meter straight run) above ground piping wherever required.

t) Bidder's scope of supply for fabrication, erection, cleaning, testing and commissioning of the piping systems installed by him shall include the following: -

All welding consumables like welding electrodes, filler rods and wires; gases like oxygen, acetylenes, argon, carbon-dioxide, propane, backing rings etc.

Films for radiographic examination of welds.

X-ray and Gamma -ray equipment including isotopes, dye penetrants, and other required non-destructive testing materials and equipment (all to be taken back by the Bidder after completion of work).

All heating and stress relieving equipment, thermocouples asbestos blankets, cables, temperature recorders, charts heat sensitive chalks and crayons etc. (All to be taken back by bidder after completion of work).

All machinery, equipment tools and tackles as required for transportation handling, fabrication and erection (All to be taken back by Bidder after completion of work).

All equipment/ materials as required for cleaning, flushing, blowing out and hydro testing of the piping systems; these shall include but not be limited to pumps and compressors with prime movers, instruments, pipe work with supports, valves, strainers and other specialties, blanks, plugs, spool pieces, dummy plates, electrical accessories, etc. (All to be taken back by Bidder after completion of work).

All scaffolding materials and false work (To be taken back by Bidder after completion of work).

1.04.00 The Bidder shall provide Services of erection superintendent and foremen, fitters and riggers, welders, transport and crane operators and other skilled and unskilled labour.

The design engineering and providing all temporary pipe work as required for erection, cleaning, flushing, blowing out, testing and commissioning of the piping system is the responsibility of the Bidder.

The Bidder's scope shall include design, supply of required structural steel (except those which are specifically excluded), their fabrication and erection where ever required.

LOW PRESSURE PIPING (Cont.)

TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO. CS-4540-001A-2

LOW PRESSURE PIPING

1.00.00 **EQUIPMENT SIZING CRITERIA**

1.01.00 All the piping systems and equipment supplied under this package shall be designed to operate without replacement and with normal maintenance for a plant service life of 30 years, and shall withstand the operating parameter fluctuations and cycling which can be normally expected during this period.

1.02.00 For all Low Pressure piping systems covered under this specification, sizing and system design shall be to the requirements of relevant codes and standard indicated. In addition to this, requirements of any statutory code as applicable shall also be taken into consideration.

1.03.00 Inside diameters of piping shall be calculated for the flow requirements of various systems. The velocities for calculating the inside diameters shall be limited to the following:

a) **Water Application**

	Pipe Size	Water Velocity in m/sec Below 50 mm	50-150 mm	200 mm & above
(a)	Pump suction	------	1.2-1.5	1.2-1.8
(b)	Pump discharge and recirculation	1.2-1.8	1.8-2.4	2.1-2.5
(c)	Header	------	1.5-2.4	2.1-2.4

Pipe line under gravity flow shall be restricted to a flow velocity of 1 m/sec generally. Channels under gravity flow shall be sized for a maximum flow velocity of 0.6 m/sec.

WILLIAM & HAZEN formula shall be used for calculating the friction loss in piping systems with the following "C" value:

(i)	Carbon steel pipe	100
(ii)	Ductile Iron.	140
(iii)	Rubber lined steel pipe	120
(iv)	Stainless steel pipe	100

For calculating the required pump head for pump selection, at least 10% margin shall be taken over the pipe friction losses and static head shall be calculated from the minimum water level of the tank/ sump/ reservoir from which the pumps draw water.

(b) **Compressed Air Application**

Compressed air 15.0 m/sec.

1.04.00 The pipes shall be sized for the worst (i.e. maximum flow, temp. and pressure values) operating conditions.

1.05.00 Based on the inside diameter so established, minimum thickness calculation shall be made as per ANSI B 31.1 OD. Manufacturing allowance shall be added to minimum calculated thickness and next higher standard thickness of pipes shall than be selected as per ANSI B 36.10/IS-1239 Heavy grade/IS-3589/ASTM-A-53/API-5L/ANSI B36.19 as the case may be. Alternatively, manufacturers standard thickness can also be accepted subject to that such thickness shall be equal to or more than the minimum calculated thickness after considering manufacturing allowance. Selected thickness then shall be checked for vacuum loading criterion as per the guidelines given in AWWA-M-11.

1.06.00 Corrosion allowance of 1.6 mm will be added to the calculated thickness being considered (except stainless steel piping).

1.07.00 Bend thinning allowance/manufacturing allowance etc. shall be as per the requirement of the design code provision.

1.08.00 Material of construction for pipes carrying various fluids shall be as specified elsewhere.

1.09.00 Compressed air pipe work shall be adequately drained to prevent internal moisture accumulation and moisture traps shall be provided at strategic locations in the piping systems.

1.10.00 Depending upon the size and system pressure, joints in compressed air pipe work shall be screwed or flanged. The flange shall be welded with the parent pipe at shop and shall be hot dip galvanized before dispatch to site. Alternatively, the flanges on GI pipes may be screwed-on flanges also.

1.11.00 Threaded joints shall be provided with Teflon sealant tapes.

1.12.00 Following types of valves shall be used for the system/service indicated.

SYSTEM	**TYPES OF VALVES**					
	Butterfly	Gate	Globe	Check	Ball	Plug
Water	x	x	x	x	x	
Air		x	x	x	x	
Drains & vents		x	x	x		
Fuel oil (if any)		x	x	x	x	x

1.13.00 Recirculation pipes along with valves, breakdown orifices etc. shall be provided for important pumping systems as indicated in respective process and instrumentation diagrams (P&IDs). The recirculation pipe shall be sized for minimum 30%design flow of single pump operation or the recommended flow of the pump manufacturer whichever is higher.

2.00.00 **TECHNICAL SPECIFICATION**

2.01.00 **GENERAL**

Specific technical requirements of low-pressure piping, fittings, supports, valves, specialties and tanks etc. have been covered under this Sub-section. It includes details pertaining to design and material of construction for piping, fittings, valves, equipment, etc. cleaning/surface preparation application of primer and painting on over ground piping. It also

	includes detailed technical requirement of laying underground/buried piping including water proofing/anti corrosive protection. It also covers design, engineering, manufacturing, fabrication, technical details of piping, valves, specialties, piping hangers / supports, tanks etc.
2.02.00 2.02.01	**Pipes and fittings** All low pressure piping systems shall be capable of withstanding the maximum pressure in the corresponding lines at the relevant temperatures. However, the minimum thickness as specified in the following clauses and or respective codes for pipes and fittings shall be adhered to. The bidder shall furnish the pipe sizing/ thickness calculation as per the criteria mentioned above under LP piping equipment sizing criteria of this Technical Specification.
2.02.02	Piping and fittings coming under the purview of IBR shall be designed satisfying the requirements of IBR as a minimum.
2.02.03	Supporting arrangement of piping systems shall be properly designed for systems where hydraulic shocks and pressure surges may arise in the system during operation. Bidder should provide necessary protective arrangement like anchor blocks/anchor bolt etc. for the safeguard of the piping systems under above mentioned conditions. The requirement will be, however, worked out by the contractor and he will submit the detailed drawings for thrust/anchor block to the Employer. External, and internal, attachments to piping shall be designed so as not to cause flattening of pipes and excessive localized bending stresses.
2.02.04	Bends, loops, off sets, expansion or flexible joints shall be used as required in order to prevent overstressing the piping system and to provide adequate flexibility. Flexibility analysis (using software packages such as Caesar-II etc.) shall be carried out for sufficiently long piping (straight run more than 300M).
2.02.05	Wherever Bidder's piping coming under this specification, terminates at an equipments or terminal point not included in this specification, the reaction and the thermal movement imposed by bidder's piping on equipment terminal point shall be within limits to be approved by the Employer.
2.02.06	The hot lines shall be supported with flexible connections to permit axial and lateral movements. Flexibility analysis shall be carried out for pipelines which have considerable straight run as indicated above and necessary loops/ expansion joint etc. shall be provided as may be necessary depending on layout.
2.02.07	Piping and fittings shall be manufactured by an approved manufacturer of repute. They should be truly cylindrical of clear internal diameter, of uniform thickness, smooth and strong, free from dents, cracks and holes and other defects.
2.02.08	For rubber lined ERW pipes, beads shall be removed for pipe size 80 NB and above.
2.02.09	Inspection holes shall be provided at suitable locations for pipes 800 Nb and above as required for periodic observations and inspection purposes.
2.02.10	At all intersection joints, it is Contractor's responsibility to design and provide suitable reinforcements as per the applicable codes and standards.
2.02.11	For large size pipes/ducts, at high point and bends/change of direction of flow, air release valves shall be provided as dictated by the system requirement and operation philosophy & tripping conditions of pumping system. Sizing criteria for air release valves shall be generally on the basis of valve size to pipe diameter ratio of 1:8. Requirement shall be decided as per relevant code. Transient analysis /surge analysis where ever specified and required shall be conducted in order to determine the location, number and size of the Air-Release valve on certain long distance/high volume piping systems, if applicable within the scope of work of the package.

2.03.00 **Material**

2.03.01 Alternate materials offered by Bidder against those specified. shall either be equal to or superior to those specified. The responsibility for establishing equality or superiority of the alternate materials offered rests entirely with the Bidder and any standard code required for establishing the same shall be in English language.

2.03.02 No extra credit would be given to offers containing materials superior to those specified. Likewise, no extra credit would be given to offers containing pipe thickness more than specified.

2.03.03 All materials shall be new and procured directly from the manufacturers. Materials procured from traders or stockists are not acceptable.

2.03.04 All materials shall be certified by proper material test certificates. All material test certificates shall carry proper heat number or other acceptable references to enable identification of the certificate that certifies the material.

2.03.05 Material of construction for pipes carrying various fluids shall be as follows:

Sl No	Type of Fluid	Material
1.	i) Ordinary Water (Raw Water, Clarified Water, etc.) ii) Equipment cooling water including Both primary & secondary circuit (DMCW pH-corrected & ACW drain water)	IS-2062 Gr.-E-250B/ASTM A-36/ASTM A-53 type 'E' Gr. B/IS-3589 Gr. 410 /IS-1239 Heavy.
2.	i) Demineralised water, ii)Alkaline solution (ECW system chemical dosing)	Stainless Steel to ASTM A312, Gr. 304 welded for sizes 65 mm NB and above. Stainless steel to ASTM A312, Gr. 304 sch.40s seamless for sizes 50mm and below
3.	i) Drinking (potable) water ii)Compressed air (Instrument & service air)	ASTM A-53 type E Gr. B galvanized/ IS 1239 Gr heavy galvanized/IS 3589 Gr 410 galvanized. Galvanized shall be to IS- 4736 or equivalent.
4.	(Condensate) spill water	ASTM A 106 Gr. B
5.	Effluents from Neutralization pit	MSRL

2.03.06 In water lines, pipes up to 150mm Nb shall conform to ANSI B36.10/ASTM-A-53, Type-E Gr. B /IS:1239 Gr. Heavy and minimum selected thickness shall not be less than IS:1239 Grade Heavy except for demineralised water, drinking water and condensate spill lines.

2.03.07 Pipes of above 150mm Nb shall be to AWWA-C200/ANSI B 36.10/ASTM A-53/IS 3589 Gr.410. Pipe to be fabricated by the bidder shall be rolled and butt welded from plates conforming to ASTM A-53 type 'E' Gr. B/IS 2062 Gr. E-250B/ASTM-A-36. However, larger pipes, i.e. 1000mm Nb and above shall be made from plates conforming to ASTM A 36/IS 2062 Gr. E-250B and shall meet the requirements of AWWA-M-11 (for deflection & buckling criteria considering water filled pipe as well as vacuum condition that may prevail during transient/surge conditions, truck-load, rail-load and weight density for compacted soil or any other load as the case may be).

2.03.08 In demineralised water service, the pipes up to 50 Nb shall be of stainless steel ASTM A 312, Gr. 304 sch. 40 Seamless. The size for these pipes shall be to ANSI B 36.19. These shall be socket welded. The material for pipe from 65mm NB up to and including 400 NB shall be to ASTM A 312, Gr. 304 (welded). In no case the thickness of fittings shall be less than parent pipe thickness.

	Bidder/Contractor shall note that pipes offered as per a particular code shall conform to that code in all respects i.e. Dimension, tolerances, manufacturing methods, material, heat treatment, testing requirements, etc. unless otherwise mentioned elsewhere in the specification.
2.03.09	Instrument air, Plant (service) air lines and Drinking water lines shall be to ASTM A 53 type E grade B/ANSI B 36. 10/IS 3589, Gr. 410 / IS: 1239 Heavy (in case thickness calculated is more than gr. Heavy, ANSI B 36.10 Schedule numbers shall be followed) and galvanized to IS 4736 or any equivalent internationally reputed standard. The material of the pipes shall be to ASTM A 53 type 'E' Gr. B / IS: 3589, Gr. 410 / IS: 1239 Gr. Heavy. The fittings shall be of either same as parent material or malleable iron to IS-1879 (galvanized).
2.03.10	Spiral welded pipes as per API-5L/IS-3589 are also acceptable for pipe of size above 150 NB. However minimum thickness of the pipes shall be as elaborated in above clauses.
2.03.11	Condensate lines shall be to ASTM A 106 Gr. B and dimension to ANSI B 36.10 schedule "standard" as minimum to be maintained.
2.03.12	If carbon steel plates of thickness more than 12 mm are used for manufacture of pipes, fittings and other appurtenances, then the same shall be control-cooled or normalized as the case may be following the guidelines of the governing code.
2.04.00 2.04.01	**Field routed pipes:** Pipe lines of NB 50 size and below are regarded as field run piping. It is Bidder's responsibility to plan suitable layouts for these system insitu. Bidder shall prepare drawings indicating the layout of field run pipe work. These drawings shall be approved by Project Manager to the installation of the field run pipe work. Based on these approved layouts the Bidder shall prepare the BOQ of field run-pipes and submit to Employer for approval.
2.05.00 2.05.01	**Slope/Drains and Vents** Suitable slope shall be provided for all pipelines towards drain points. It is Bidder responsibility to identify the requirements of drains and vents, and supply the necessary pipe work, valves, fittings, hangers and supports etc. As per the system requirement low points in the pipelines shall be provided with suitable draining arrangement and high points shall be provided with vent connections where air or gas pockets may occur. Vent for use during hydrostatic test shall be plugged after the completion of the test. Vent shall not be less than 15mm size. Drains shall be provided at low points and at pockets in piping such that complete drainage of all systems is possible. Drain shall not be less than 15mm for line size up to 150mm, not less than 20mm up to 300mm and not less than 25mm for 350mm to 600mm pipes and not less than 50mm for 600mm and above pipes. Material for drain and vent lines shall be compatible with that of the parent pipe material.
2.05.02	Air piping shall be sloped so that any part of the system can be drained through the shut-off drain valve or drain plugs.
2.06.00	**Pipe Joints** In general all water lines 65mm NB and above, are to be joined generally by butt welding except the locations where valves/fittings are to be installed with flanged connections and 50mm and below by socket welding unless mentioned otherwise specifically. All air lines shall be of screwed connection and rubber lined pipes of flanged connections.
2.06.01	**Screwed Joints** (a) Threading of pipes shall be carried out after bending, heat treatment etc. If not possible, threading may be done prior to these operations but proper care should be taken to protect them from damage. Threads shall be to ANSI B 2.1 (taper) NPT / ANSI B1.20.1 (taper) NPT / IS: 554 unless specified otherwise. (b) Galvanized pipe shall generally be joined by screwing into sockets. The exposed threaded portion on the outside of the pipes shall be given a zinc silicate coating.

Galvanized pipes shall not be field joined by welding for protection of Galvanising Zinc layer. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing. For galvanized pipe sizes above 150 mm NB, screw & socket jointing as per ASTM-A-865 shall be employed for both pipe-to-pipe and pipe-to-fitting jointing. For pipe to fitting connection since no direct threading can be done on the fittings (supplied as per ASTM-A-234 Gr. WPB and ANSI B-16.9) necessary straight pipe lengths acting as match pieces shall be welded to the fitting at both ends and subsequently the free ends of the straight lengths shall be threaded as per ASTM A-865 for jointing with main pipe. Once welding of fittings with match pieces and threading of free ends of match pieces are over, the entire fabricated piece shall be galvanized, or in case match pipes and fittings are already galvanized before the above mentioned fabrication then suitable application of Zinc-Silicate paste adequately at the welded surface (both in side & outside) after welding, along with the nascent threaded metal portions at both free ends given the same application of Zinc Silicate paste. Alternatively, flanged jointing may be employed for pipe sizes 100 NB and above. However, the bidder shall ensure the galvanized pipe joints do not fail during hydro test.

(c) Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be reamed and all chips shall be removed. Screwed flanges shall be attached by screwing the pipe through the flange and the pipe and flange shall be refaced accurately.

(d) For pipe sizes from 350 mm NB to 550 mm NB (including 350 NB & 550 NB) the GI pipes shall be of flanged connection. However, the pipes after welding of flanges shall be completely galvanized. All the welded surfaces whether inside or outside shall be coated with zinc-silicate paste. Seal welding of flanges will be permitted only when any flange is leak-prone during hydro testing.

(e) For pipe sizes 600 mm NB and above, the GI pipes shall be of welded connection followed by application of zinc silicate coating at welded surfaces both inside and outside the pipe, except for the last blank/blind flange, or, equipment connection where application of zinc-silicate paste after welding cannot be done due to inaccessibility of the inside welded surface and where galvanic protection has been impaired due to welding of pipe-to-pipe joint. Thus the last erection joint shall be flanged joint.

2.06.02 **Welded Joints**

(a) For making up welded joints (butt weld or socket weld) the welding shall be performed by manual shielded metal arc process in accordance with the requirements specified elsewhere in the spec. Any welder employed for carrying butt welding shall be qualified as per ASME section IX for the type of joints he is going to weld. Jointing by butt weld, or socket weld shall depend upon the respective piping material specifications.

2.06.03 **Flanged Joints**

(a) Flanged connections for pipes are to be kept to the minimum and used only for connections to vessel, equipments, flanged valves and other fittings like strainer/traps/orifices etc. for ease of connection and maintenance etc. Rubber lined pipes shall be flange joined only.

(b) All flanged valves intended for installation on steel piping system, shall have their flanges drilled to ANSI B 16.5 (or equivalent) and according to the pressure class stated in their respective piping material specification.

(c) Drilling on flanges of flanged valves must correspond to the drilling of flanges on the piping system on which the valves are installed.

2.07.00 **Bends / elbows / mitre bends / Tees / Reducers & other fittings**

2.07.01 For pipe fittings such as elbows (long radius), reducers, tees, etc. the material shall be to ASTM-A-234 Gr. WPB/ASTM-105 up to 300 NB. For pipe fittings above 300 NB, the fittings may be fabricated conforming to parent pipe material. Provision of compensation pads shall be kept as per ANSI B 31.1. The fitting shall conform to the dimensional standard of ANSI B-16.9/ 16.11. Further branching in pipes for sizes 65nb and above is also acceptable (ANSI B 31.1).

However, for pipes up to 150 NB, pipe fittings may be supplied with material and dimension conforming to IS 1239 in case parent pipes also conform to IS 1239.

2.07.02 For pipe size 350Nb and above mitre bends may be used for all pipes except rubber lined pipes. However, mitre bends are also acceptable for rubber lined pipes above 1200 NB. The bend radius shall be 1½ times the nominal pipe diameter. 90 deg. bends (mitre) shall be in 4 pieces (3 cuts) and 45 deg. mitre bends shall be in 3 pieces 22½ deg. Fabrication of mitre bends shall be as detailed in BS 2633/BS534.

2.07.03 For pipes, above 1200 NB, reducer and tees shall be to dimensional standard of AWWA-C-208.

2.07.04 Stainless steel fittings shall conform to either ASTM-A-182 Gr. 304 or ASTM-A-403 Grade WP. 304 Class-S, for sizes up to and including 50 mm NB, i.e. the fittings shall be of seamless construction. However, for stainless fittings above 50 mm NB, the same shall conform to ASTM-A-403 Gr. WP 304 Class W i.e. the fittings shall be of welded construction strictly in accordance with ASTM-A-403.

2.07.07 In no case, the thickness of fittings shall be less than the thickness of parent pipe, irrespective of material of construction.

2.08.00 **Flanges**

2.08.01 Flanges shall be slip on type or weld neck type. Welding of flanges in tension is not permitted.

2.08.02 All flanges and-flanged drilling shall be to ANSI B 16.5/BS EN-1092 / AWWA C-207 of relevant pressure/temperature class. Flanges shall be fabricated from steel plates conforming to ASTM A 105/IS 2062 Gr. E-250B. However stainless steel flanges shall be fabricated from SS plates to ASTM-A-240, Gr. 304 or equivalent.

2.09.00 **Specific technical requirement of laying buried pipe with anti-corrosive treatment**

The pipe in general shall be laid with the top of the pipe minimum 1.0 (one) meter below finished general ground level.

2.09.01 **Trenching**

(a) The trench shall be cut true to the line and level and shall follow the gradient of the pipeline. The width of the trench shall be sufficient to give free working space on each side of the pipe. Trenches shall conform to IS 5822 or any international standard.

2.09.02 **Preparation and cleaning of piping**

(a) The pipeline shall be thoroughly cleaned of all rust, grease, dirt, weld scales and weld burrs etc. moisture or other foreign matter by power cleaning method such as sand or grit blasting, power tool cleaning, etc. Grease or heavy oil shall be removed by washing with a volatile solvent such as gasoline. Certain inaccessible portions of the pipeline (which otherwise not possible to be cleaned by power cleaning methods) may be scrubbed manually with a stiff wire brush and scrapped where necessary with specific permission of the Project Manager.

(b) On the internal surface for pipes 1000 Nb and above, a coat of primer followed by a hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.

2.09.03 **Coating and wrapping/ Anti corrosive Protection Coal tar tape**

a. Buried piping shall be coated and wrapped, as per specification, after completion of welded and/or flanged connections, and after completion and approval of Hydro testing. Materials to be used for coating and wrapping of underground pipelines are:

(1) Coating primer (coal tar primer)

(2) Coating enamel (coal tar enamel)

(3) Wrapping materials.

All primer/coating/wrapping materials and methods of application shall conform to IS: 10221 except asphalt/bitumen material. Materials (primer/coating/wrapping) as per AWWA-C-203 are also acceptable.

Protective coating shall consist of coal tar primer, coal tar enamel coating, glass fiber, tissue inner wrap followed by glass fiber or coal tar impregnated Kraft outer wrap or finish coat.
Number of coats and wraps, minimum thickness for each layer of application shall be as per IS-10221. Number of. Coats and wraps shall be decided based on soil corrosivity / resistivity as indicated in IS-10221. Soil data-for this purpose shall be made available.

Total thickness of completed coating and wrapping shall not be less than 4.0 mm.

b. Alternatively, the anti-corrosive protection for buried pipes can consist of anti-corrosive protection Coal-tar tapes. Material and application of tapes shall conform to IS 15337 or equivalent. These-tapes shall be applied hot over the cold coal tar primer in steps of 2mm thickness so as to cover the spiral edges of the first tape by the application of second tape. The total nominal thickness of the finished protective coating shall be 4.0 mm.

2.09.04 **Trench bed preparation and back filling**
Prior to lowering and laying pipe in any excavated trench, the bottom of the trench may require to be back filled and compacted (or as the case may be) to provide an acceptable bed for placing the pipe. Bed preparation in general shall be as per IS: 5822.

2.09.05 **laying of galvanized steel (GI) pipes**

All the joints shall be screwed with socket or flanged. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before jointing Threaded portion on either side of the socket joint shall be applied with Zinc silicate paste.

All the provisions for trenching' bed preparation' laying the pipe application of primer' coating' wrapping with tapes and back filling etc. as indicated for "laying of buried piping" and " anti-corrosive protection for buried piping" are applicable for buried galvanized steel (GI) pipes also.

2.10.00 **Cleaning and flushing**

2.10.01 All piping shall be cleaned by the Bidder before and after erection to remove grease, dirt, dust, scale and welding slag.

2.10.02 Before erection all pipe work, assemblies, sub-assemblies, fittings, and components, etc. shall be thoroughly cleaned internally and externally by blast cleaning or by power driven wire brushes and followed by air-blowing. However, for pipe sizes below 100nb the pipes

may be cleaned internally by compressed air blowing as an alternative to internal blast cleaning. The brushes shall be of the same or similar material as the metal being cleaned. Cleaning of Galvanized pipes shall be done by air blowing only.

2.10.03 After erection, all water lines shall be mass flushed with water. The cleaning velocities in water lines shall be 1.2-1.5 times the operating velocities in the pipelines.

2.10.04 All compressed air pipe work shall be cleaned by blowing compressed air.

2.11.00 **Specification for hangers and supports**

2.11.01 All supports and parts shall conform to the requirement of power piping code ANSI B 31.1 or approved equivalent.

2.11.02 The maximum spans of the supports of straight length shall not exceed the recommended values indicated in ANSI B 31.1.

2.11.03 At all sliding surfaces of supports suitable arrangement is to be provided to minimize sliding friction.

2.12.00 **Design/Construction/Material Particulars of Gate/ Globe /Check /Butterfly / Ball / Air release /Float valves / Moisture Traps.**

2.12.01 **GENERAL**

(a) All valves shall have indicators or direction clearly marked on the hand-wheel so that the valves opening/closing can be readily determined.

(b) Special attention shall be given to operating mechanism for large size valves with a view to obtaining quick and easy operation ensuring that a minimum of maintenance is required.

(c) The valves coming in vacuum lines shall be of extended gland type and/or water sealed.

(d) The actuator-operated valves shall be designed on the basis of the following:

(1) The internal parts shall be suitable to support the pressure caused by the actuators;

(2) The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.

(3) All actuator-operated valves shall be provided with hand operated gearing mechanism also.

(4) All actuators operated valves shall open/ close fully within time required by the process.

(e) Valves coming under the purview of IBR shall meet IBR requirements.

(f) All valves shall be provided with embossed name plate giving details such as tag number, type, size etc.

(g) Wherever required valves shall be provided with chain operator, extension spindles and floor stands or any other arrangement approved by employer so that they can be operated with ease from the nearest operating floor. Wherever necessary for safety

purpose locking device shall be provided. Further, necessary small platforms for facilitating easy valve operation shall be provided by the contractor wherever necessary in consultation with project manager within the bid price at no extra cost to employer

2.12.02 **VALVE BODY MATERIAL**

Valve body material for various services shall be as follows:

Valve body material for water application like Secondary circuit auxiliary cooling water of ECW system, Raw water, Ash water make-up, service water, clarified water, DM cooling water (pH corrected) , drinking water etc. shall be cast iron for sizes 65NB and above; gun-metal for sizes 50 Nb and below.

For compressed air application, valve body material shall be cast carbon steel or forged carbon steel for sizes 65 mm NB & above and Gun metal for sizes 50 NB and below.

DM water: SS body and disc along with SS internals. However for butterfly valves, Cast Iron /Ductile Iron/SG iron/carbon steel body and disc with elastomer lining are also acceptable.

Condensate: Cast Carbon Steel / Forged Carbon Steel.

2.12.03 The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. The valves shall conform to the latest editions of applicable codes and standards as mentioned elsewhere. Nothing in this specification shall be construed to relieve the Bidder of his responsibility. Valves in general shall conform to the requirements of the following standards.

Standards and Codes

AWWA-C-504	Rubber seated butterfly valves.
BS-5155/EN-593	Cast iron and steel body butterfly valves for general purpose.
IS-778	Gun-metal gate, globe and check valves for general purpose.
BS-5154	Copper alloy globe/globe stop and check and gate valves for general purpose.
IS-780	Sluice valves for water works purpose (50-300 mm size)
IS-2906	Sluice valves for water works purpose (350-1200 mm size)
IS-5150	Cast iron wedge and double disc gate for general purpose.
BS-5152	Specification for cast iron globe valves.
BS-5153	Cast iron check valves for general purpose.
IS-5312	Swing check type reflux (non-return) valves.
ANSI B 16.34	Standard for valves.
API-594	Standard for Dual-check valves.
API-600	Steel gate valves.

	ANSI-B-16.10	Valves face to face and other relevant dimension.
	API-598	Valves inspection test.

2.12.04 **End Connections**

The end connections, shall comply with the following:

Socket welding (SW) - ANSI B 16.11

Butt Welding (BW) - ANSI B 16.25.

Threaded (SC) - ANSI B 2.1

Flanged (FL) - ANSI B 16.5& AWWA-C-207 (steel flanges), ANSI B 16.1 (Cast Iron flanges).

2.13.00 **Gate/Globe/Check Valves**

(a) All cast iron body valves (gate, globe and non-return) shall have flanged end connections; (screwed ends for Ductile D.2NI body valves are not acceptable).

(b) All steel and stainless steel body valves of sizes 65 mm and above shall have flanged or butt welding ends. Valves of sizes below 65mm shall have flanged or socket welded ends. Compatibility of welding between valve body material and connecting pipe material is a pre-requisite in case of butt-welded joints.

(c) All gun metal body valves shall have screwed ends.

(d) All flanged end valves / specialties shall be furnished along with matching counter flanges, fasteners, gaskets etc. as required to complete the joints.

(e) Gate/sluice valves shall be used for isolation of flow. All gate valves shall be of the full-way type, and when in the full open position, the bore of the valve shall not be constricted by any part of the gate.

Gate valves shall be of the solid/elastic or articulated wedge disc. Gate valves shall be provided with the following accessories in addition to other standard items:

(1) Hand wheel

(2) Position indicator (for above 50 mm NB valve size)

(3) Draining arrangement wherever required.

(f) Globe valves shall be used for regulation purposes. They shall be provided with hand wheel, position indicator, draining arrangement (wherever required) and arrow indicating flow direction. Preferably, the valves shall be of the vertical stem type. Globe valves shall preferably have reduced or spherical seating and discs shall be free to revolve on the spindle.

The pressure shall preferably be under the disc of the valve. However, globe valves, with pressure over the disc shall also be accepted provided (i) no possibility exists that flow from above the disc can remove either the disc from stem or component from disc (ii) manual globe valves can easily be operated by hand. If the fluid load on the top of the disc is higher than 40-60 KN, bypass valve shall be provided which permits the downstream system to be pressurized before the globe valve is opened.

(g) Check valves shall be used for non-return service. They shall be swing check type or double door (Dual plate) check type with a permanent arrow inscription on the valve body indicating the fluid flow direction. In long distance pipes lines with possibility of surge-occurrence, dual plate check valves are preferable for its spring controlled opening /closing of flaps/doors against flow reversals. However, dual plate check valves shall not be used for sizes more than 600mm NB.

(h) For bore greater than 2" the valves must be swing check type or dual plate check type suitable for installation in all positions (vertical and horizontal);

(i) For bore smaller than or equal to 2" the valves must be of the piston type to be installed, in horizontal position.

(j) All gate and globe valves shall be provided with back seating arrangement to enable on line changing of gland packing. The valves shall be preferably outside screw & yoke type.

(k) All gate and globe valves shall be rising stem type and shall have limit switches for full OPEN and full CLOSED indication wherever required. This will include motor-operated valves also wherever required. In such cases the limit switches shall form an integral part of the valve. Stop-gap arrangement in this respect is not acceptable.

(l) All valves except those with rising stems shall be provided with continuous mechanical position indicators; rising stem valves shall have only visual indication through plastic/metallic stem cover for sizes above 50 mm nominal bore.

(m) For CI gate, globe and check valves wherever thickness of body/bonnet is not mentioned in the valves standards, thickness mentioned in IS- 1538 for fitting shall be applicable.

2.13.01 **MATERIAL OF CONSTRUCTION (GATE/GLOBE/CHECK VALVE)**

(a) The materials shall generally comply with the following:

(1) **Cast Steel Valves**

Body & bonnet	ASTM A 216 Gr. WCB/ ASTM A 105
Disc for non-return Valves	ASTM A 216 Gr. WCB/ ASTM A 105
Trim.	ASTM A 182 Gr. F6 or Equivalent

(2) **Stainless steel valves**

Body & Bonnet	SS 304
Disc	-do-
Trim.	SS 316

(3) **Cast iron valves**

Body & bonnet	BS 1452 Gr. 14/ IS-210 Gr. FG 260
Seating surfaces and rings	13% chromium steel/ 13% Chrome overlay
Disc for non-return valves	BS 1452 Gr. 14/IS-210 Gr FG 260

		Hinge pin for non-return valves	AISI 316
		Stem for gate globe valves	13% chromium steel or Equivalent
		Back seat	13 % chromium steel / 13% Chrome overlay
	(4)	**Gun Metal valves**	
		Body and bonnet	IS 318 Gr. 2/ Equivalent Standard
		Trim.	-do-

(b) Cast iron body valves shall have high alloy steel stem and seat.

(c) Material for counter flanges shall be the same as for the piping.

(d) Forged carbon steel & Forged stainless steel valves are also acceptable in place of Gun metal valves.

2.14.00 **Air Release Valve**

(a) The air release valves shall be of automatic double air valve with two orifices and two floats. The float shall not close the valve at higher air velocities. The orifice contact joint with the float shall be leak tight joint.

(b) The valve shall efficiently discharge the displaced air automatically from ducts/pipes while filling them and admit air automatically into the ducts/pipes while they are being emptied. The valve shall also automatically release trapped air from ducts/pipes during operation at the normal working pressure.

(c) Body material of automatic air release valves shall comply generally with BS 1452 Gr. 14/IS: 210 Gr. FG 260. and spindle shall conform to high tensile brass.

(d) Air release valves shall not have any integral isolation device within them. Each Air release valve shall be mounted, preceded by a separate isolation gate/ butterfly valve.

2.15.00 **Butterfly valves**

2.15.01 **Design/Construction**

(a) The valves shall be designed for the design pressure/temperature of the system on which it is installed and in accordance with AWWA-C-504, EN-593 or any other approved equivalent standard latest edition. Fabricated steel (IS: 2062 GR. E-250B) butterfly valves instead of cast iron body valves are also acceptable for size above 300 mm Nb diameter.

(b) The valves shall be suitable for installation in any position (horizontal/vertical etc.) and shall be generally of double-flanged construction. However, for sizes 600 NB and below the valves of Lugged -Wafer construction are also acceptable

(c) Valves-350Nb and above shall have pressure equalizing bypass valves, wherever system parameters warrant the same.

(d) Valves-200Nb and above shall also be provided with gear operator arrangement as a standard practice suitable for manual operation. Manual operation of valve shall be

through gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque It shall be designed to hold the valve disc in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent over travel in either direction.

Limit and torque switches (if applicable) shall be enclosed in water tight enclosures along with suitable space heaters for motor actuated valves, which may be either for On-Off operation or inching operation with position transmitter.

2.15.02 **Material of Construction (Butterfly Valves)**

Materials and other design details shall be as indicated below:

(a) **Cast Iron Butterfly Valves**

Body & Disc	ASTM A48, Gr. 40 with 2% Ni / IS: 210. Gr. FG-260, with 2% Ni / SG iron BSEN 1563, Gr EN GJS-400-15 with 2%Ni and epoxy coated
Shaft	BS 970 431 S: 291 / EN 57, or AISI-410 or AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.
Seat ring	18-8 Stainless steel
SEAL	NITRILE RUBBER

(b) **Stainless Steel Butterfly Valves**

Body & Disc	SS 304
Shaft	SS 316
Seat Rings	EPT/BUNA-N/Neoprene

(c) **Carbon steel Butterfly Valves**

Body & Disc	ASTM A 216, Gr. WCB
Shaft	SS 304
Disc & Seat Rings	EPT/BUNA-N/Neoprene

(d) **Elstomer lined Butterfly Valves**

Body & Disc	ASTM A48, Gr. 40 / IS: 210. Gr. FG-260 / SG Iron (ductile iron) IS 1865 Gr 400-15 or BSEN 1563, Gr EN GJS-400-15 / ASTM A 216, Gr. WCB with elastomer lining.
Shaft	SS 316

2.15.03 **Proof of Design Test (Type Test) for Butterfly Valves**

Proof of Design (P.O.D.) test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him, in the absence of which actual P.O.D. test shall be conducted by the bidder.

All valves that are designed and manufactured as per AWWA-C-504 / AWWA-C-516 shall be governed by the relevant clauses of P.O.D test in AWWA-C-504/AWWA-C-516. For Butterfly valves, designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. test of AWWA-C-504/AWWA-C-516.

2.16.00 **Float operated valves**

(a) Valve shall automatically control the rate of filling and will shut off when a predetermined level is reached and close to prevent over flow on pre-set maximum water level. Valve shall also open and close in direct proportion to rise or fall of water level.

(b) DESIGN AND CONSTRUCTION FEATURES
The following design and construction feature of the valve shall be the minimum acceptable.

(c) Valves shall be right-angled or globe pattern.

(d) Valves shall be balance piston type with float ball.

(e) Leather liner shall not be provided.

(f) The body and cover material shall be cast iron conforming to ASTM-A 126 Grade 'B' or IS: 210 Grade 200 or equivalent, and Float shall be of copper with epoxy painting of two (2) coats.

(g) Valves shall be suitable for flow velocities of 2 to 2.5m/sec.

(h) The valves shall have flanged connections.

2.17.00 **Tanks and Accessories**

2.17.01 The designer and manufacturer of storage tanks shall comply with and obtain approval of all currently applicable statutory regulations and safety codes in the locality where the equipment will be installed. The tanks shall conform to IS 803/IS804/IS 805/ IS 2825/ API 650/ IS 4049/ IS 4682 (part-I) and IS 4864 to 4870/ ASME B & PV code Sec.-VIII as the case may be.

2.17.02 **DESIGN AND CONSTRUCTION**

(a) Design of all vertical atmospheric storage tanks containing water, acid, alkali and other chemical shall conform to IS:803 & API 650.

(b) Design of all horizontal atmospheric storage tanks containing water, acid, alkali and other chemicals shall generally conform to IS:2825 as regards to fabrication and general construction taking care of combined bending, shear & hoop stresses developed due to supporting arrangement.

(c) Tank shall be made from mild steel plates to BS 4360/IS-2062 Gr.E-250B (or equivalent) for ordinary wafer application when it is not corrosive in nature.

(f) Tank shall be provided with suitable supporting joints. All vessels shall be provided with lifting lugs, eye bolts etc. for effective handling during erection.

(j) Tanks shall be provided with float operated level indicators / level gauges / level transmitters and level switches, as required, with complete assembly. Suitable flanged pads for level switches mounting shall also be provided. The level indicator can be top or side mounted as the case may be.

(k) In addition to inlet and outlet nozzles, the tanks shall be provided with vents, overflow, drain nozzles complete for various connections on tanks. Overflow lines from storage tanks is to be routed to the nearest surface drains. For tanks containing DM water, alkaline water or power cycle water the vent to atmosphere shall be

through carbon-di-oxide absorber vessel suitably mounted on the tank. CO2 absorber vessel shall be provided with the initial fill of chemicals.

(l) Tanks shall have suitable stairs/ladders on inside and outside of the tanks, manholes / inspection cover as required and also platform suitably located.

(m) Tank supporting arrangement as approved by Employer shall be provided with all plates/angles/joints/flats and supporting attachment including lugs, saddles, legs etc.

(o) Tank fabrication drawing and design calculations shall be approved by the Project Manager.

2.17.03 **Corrosion protection**

(a) A corrosion allowance, applicable to surface in contact with corrosive media, when required after thorough cleaning by blast cleaning preceded by wire brushing shall be taken into consideration.

(b) Manholes shall be provided for easy access into the vessels. The size shall be minimum 500 mm and will be with cover plate, nuts bolts, etc. to ensure leak tightness at the test pressure.

(c) Each tank shall be provided with drilled cleats welded to the tank for electrical grounding. Material of cleats shall be same as that of the shell.

Sl. No.	Description	Tech. Particulars
1.00	**CONDENSATE STORAGE TANKS**	
1.01	Number required	one for each unit
1.02	Capacity of each tank (Effective)	350 Cu. m (for 660MW units)
1.03	Size (Dia. & Height)/Plate Thickness	8.6mX7.2m minimum, Shell & Roof plate Thickness 8mm and Base plate thickness 10mm
1.04	Type and pressure class	Vertical, cylindrical, atmospheric
1.05	Material of construction	MS- (IS-2062 Gr. B or equivalent) as per specified code, 8mm thickness (minimum)
1.06	Location	Outdoor
1.07	Overflow, drain, vent and Sample connection (piping &valve)	required
1.08	Level Indicator	
	a) Number	One for each tank
	b) Type	Mechanical float type with dial

			type indicator (Guide wire, Float and Housing of Stainless steel - 316 Gr. construction)
	1.09	Manhole (minimum 500mm size)	Two (2)-one on shell and the other on roof
	1.10	Special Fittings	
		a) Hydraulic Seal of Overflow/Drain	Required
		b) Additional nozzle Connection	number and size to be indicated to successful Bidder
		c) Nozzle connection for Instrument/spare	Three (3) nos. for each tank
		d) CO2 Absorber for vent (not to be kept on roof of tank, but to be kept on ground level)	required
		e) Outside stair case (spiral)	required
		f) Inside Ladder	Required
		g) Draw off sump	required
		h) Root valve for level Transmitter	Root valves for two (2) nos. level transmitter for each tank Required

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2.18.00 RUBBER EXPANSION JOINTS

2.18.01 All parts of expansion joints shall be suitably designed for all stresses that may occur during continuous operation and for any additional stresses that may occur during installation and also during transient condition.

2.18.02 The expansion joints shall be single bellow rubber expansion joints. The arches of the expansion joints shall be filled with soft rubber.

2.18.03 The tube (i.e. inner cover) and the cover (outer) shall be made of natural or synthetic rubber of adequate hardness. The shore hardness shall not be less than 60 deg. A for outer and 50 deg. A for inner cover.

2.18.04 The carcass between the tube and the cover shall be made of high quality cotton duck, preferably, square woven to provide equal strength in both directions of the weave. The fabric plies shall be impregnated with age resistant rubber or synthetic compound and laminated into a unit.

2.18.05 Reinforcement, consisting of solid metal rings embedded in carcass shall be provided.

2.18.06	Expansion joints shall be complete with stretcher bolt assembly. The expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipe lines.
2.18.07	The expansion joints shall be of heavy duty construction made of high grade abrasion-resistant natural or synthetic rubber compound. The basic fabric for the' duck' shall be either a superior quality braided cotton or synthetic fiber having maximum flexibility and non-set characteristic.
2.18.08	The expansion joints shall be adequately reinforced, with solid steel rings, to meet the service conditions under which they are to operate.
2.18.09	All expansion joints shall be provided with stainless steel retaining rings for DM water application and IS 2062 Gr E-250B galvanized steel retaining rings for ordinary water for use on the inner face of the rubber flanges, to prevent any possibility of damage to the rubber when the bolts are tightened. These rings shall be split and beveled type for easy installation and replacement and shall be drilled to match the drilling on the end rubber flanges and shall be in two or more pieces.
2.18.10	The expansion joints shall have integral fabric reinforced full-face rubber flanges. The bolt on one flange shall have no eccentricity in relation to the corresponding bolt hole on the flange on the other face. The end rubber flanges shall be drilled to suit the companion pipe flanges. The flanges shall be as per ANSI B 16.5. For higher sizes, not covered under ANSI B 16.5, the same shall be as per AWWA.
2.18.11	All exposed surfaces of the expansion joint shall be given a 3 mm thick coating of neoprene. This surface shall be reasonably uniform and free from any blisters, porosity and other surface defects.
2.18.12	Each control unit shall consist of two (2) numbers of triangular stretcher bolt plates, a stretcher bolt with washers, nuts, and lock nuts. Each plate shall be drilled with three holes, two for fixing the plate on to the companion steel flange and the third for fixing the stretcher bolt.
2.18.13	Each joint shall have a permanently attached brass or stainless steel metal tag indicating the tag numbers and other salient design features.
2.18.14	Bidder to note that any metallic part which comes in contact with DM /corrosive water shall be of Stainless Steel material.
2.18.15	**Life cycle test for RE Joints of Condenser CW Inlet Outlet lines:** Life cycle test certificates shall be furnished by the bidder for each type and size of RE joints supplied by the Bidder, in the absence of which actual Life cycle test shall be conducted on one rubber expansion joint of each type and size.
2.19.00	**STRAINERS**
2.19.01	**Simplex type** The strainers shall be basket type and of simplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe lines. The strainer element shall be 20 mesh. Pressure drop across the strainers in new condition shall not exceed 1.5 MCW at full flow. Wire mesh of the strainers shall be suitably reinforced, to avoid buckling under operation. Strainer shall have screwed blow off connection fitted with a removable plug. The material of construction of various parts shall be as follows: (a) Body — IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent)

	(b)	Strainer Element	Stainless steel (AISI 316)
	(c)	End connection	Screwed up to 50 mm Nb, and Flanged above 50 mm Nb

2.19.02 **Duplex type**

(a) The strainers shall be basket type and of duplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe. The mesh of strainer element shall be commensurate with the actual service required. Pressure drop across the strainer in new condition shall not exceed 4.0 MWC at full flow.

(b) Wire mesh (if applicable) of the strainers shall be suitably reinforced. The material of construction of various parts shall be as follows.

Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS:210, Gr. FG 260 or ASTM-A-515 Gr. 75/IS-2062 Gr. E-250B and internally epoxy-painted above 50 mm NB.
Strainer element	Stainless steel (AISI 316)
End connection	Screwed up to 50mm Nb, and Flanged above 50 mm Nb. Gasket shall be of full face type

(c) The strainer will have a permanent stainless steel tag fixed on the strainer body indicating the strainer tag number and service and other salient data.

(d) The size of the strainer and the flow direction will be indicated on the strainer body casting.

(e) Thickness of the strainer element should be designed to withstand the pressure developed within the strainer due to 100% clogged condition exerting shut-off pressure on the element.

GENERAL TECHNICAL REQUIREMENT OF PUMPS

Annexure-1

HORIZONTAL CENTRIFUGAL PUMPS

1.00.00 SCOPE

General requirements in respect of design, material, constructional features, manufacture, inspection, testing the performance at the Vendor's/ Sub-Vendor's works and delivery to site erection, field testing and commissioning of Horizontal Centrifugal Pumps. The minimum technical requirements and equipment shall include, but not be limited to the following:

2.00.00 CODES AND STANDARDS

2.01.00 Design, material, construction manufacture inspection and performance testing of Horizontal Centrifugal Pumps shall comply with all currently applicable statutes, regulations, and safety codes in the locality where the equipment will be installed. The equipment supplied shall comply with the latest applicable Indian standards listed below. Other National Standards are acceptable, if they are established to be equal or superior to the Indian Standards.

2.02.00 **List of Applicable Standards**

i) IS : 1520 - Horizontal Centrifugal Pumps for clear cold fresh water.

ii) IS : 5120 - Technical requirements of roto-dynamic special purpose pumps

iii) API - 610 - Centrifugal pumps for general refinery service.

iv) IS : 5639 - Pumps Handling Chemicals & corrosion liquids.

v) IS : 5659 - Pumps for process water

vi) HIS - Hydraulic Institute Standards; USA

vii) ASTM-I-165-65 - Standards Methods for Liquid Penetration Inspection.

3.00.00 DESIGN REQUIREMENTS

3.01.00 The maximum efficiency of pumps shall be preferably within + 10% of the rated design flow indicated in data sheets.

3.02.00 Total head capacity curve shall be continuously rising from the operating point towards shut - off without any zone of instability and with a minimum shut off head of 15% more than design head.

3.03.00 Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. The head Vs capacity and BHP Vs capacity characteristics should match to ensure even load sharing and trouble-free operation throughout the range. Components of identical pumps shall be interchangeable.

3.04.00 Pumps shall run smoothly without undue noise and vibration. Peak to peak vibration limits shall be restricted to the following values during operation.

Speed	Antifriction bearing	Sleeve bearing
1500 rpm and below	75.0-micron	75.0 micron
3000 rpm	50.0-micron	65.0 micron

The noise level shall not exceed 85 dBA. Overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1M from the equipment surface.

4.00.00 DESIGN CONSTRUCTION

4.02.00 Pump casing shall have radially/axially split type construction. The casing shall be designed to withstand the maximum shut - off pressure developed by the pump at the pumping temperature. The pumps shall be capable of starting with discharge valve fully open and close condition.

4.03.00	Pump casing shall be provided with a vent connection and piping with fittings & valves Casing drain as required shall be provided complete with drain valves, piping and plugs. It shall be provided with a connection for suction and discharge pr. Gauge as standard feature.
4.04.00	**Impeller**
	Impeller shall be closed or semi-closed as specified elsewhere and designed in conformance with the detailed analysis of the liquid being handled
4.05.00	**Impeller/ Casing Wearing Rings**
	Replaceable type wearing rings shall be provided at suitable locations pumps.
4.06.00	**Shaft**
	The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed.
4.07.00	**Shaft Sleeves**
	Shaft sleeves shall be fastened to the shaft to prevent any leakage or loosening
4.08.00	**Bearings**
	The bearings offered shall be capable of taking both the radial and axial thrust. Anti-friction bearings of standard type, if provided, shall be selected for a minimum life 16,000 hours of continuous operation at maximum axial and a radial loads and rated speed.
	Bearings shall be easily accessible without disturbing the pump assembly.
4.09.00	**Stuffing Boxes / Mechanical Seals**
	Stuffing boxes of packed ring construction type or mechanical seals shall be provided wherever specified. Packed ring stuffing boxes shall be properly lubricated and sealed as per service requirements. If external gland sealing is required, it shall be done from the pump discharge. The Mech sealing face should be low frictional co-efficient & resistance to corrosion against the liquid being pumped.
4.11.00	**Pump Shaft Motor Shaft Coupling**
	The Pump and motor shaft shall be connected with a adequately sized flexible coupling of proven design with a spacer
4.12.00	**Base Plate**
	A common base plate mounting both for the pump and motor shall be furnished. The base plate shall be of fabricated steel and of rigid construction, suitable ribbed and reinforced.
4.13.00	**Assembly and Dismantling**
	Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouting base plate or alignment.
4.14.00	**Drive Motor (Prime Mover)**
	The KW rating of the drive shall be based on continuously driving the connected equipment for the conditions specified. In case, where parallel operation of the pumps is specified, the actual motor rating is to be selected considering overloading of the pump in the event of tripping of operating pumps. Continuous motor rating (at 50 deg. Cent, ambient) for pump shall be at least 10% above the maximum load demand of the driven equipment in the complete range.

Annexure-2

VERTICAL PUMPS

1.00.00 SCOPE

1.01.00 This specification covers general requirements in respect of design, construction features, manufacture, inspection, and performance at Vendor's / sub-vendor's works delivery to site, erection field testing and commissioning of Makeup Water & Raw Water Pumps. The minimum technical requirements and equipment shall include, but not be limited to the following:

2.00.00 CODES AND STANDARDS

2.01.00 The design, material, construction, manufacture, inspection, testing and performance of Vertical Pumps shall comply with all currently applicable statutes, regulations, and safety codes in the locality where the equipment will be installed. The equipment supplied shall comply with the latest applicable Standards listed below. Other national standards are acceptable, if they are established to be equal or superior to the listed standards.

2.02.00 **List of Applicable Standards**

IS: 1710 : Vertical Turbine Pumps for clear cold fresh water.

IS: 5120 : Technical requirement of rotor dynamic special purpose pumps.

HIS : Hydraulic Institute Standards U.S.A.

PTC 82 : Centrifugal pumps-power test code

API 610: Centrifugal pumps for general refinery purposes.

3.00.00 DESIGN AND PERFORMANCE REQUIREMENTS

3.01.00 The maximum efficiency point of the pumps shall preferably lie within 10% of the rated design flow.

3.02.00 Pumps of a particular category shall be identical, suitable for parallel operation and provided with interchangeable components. Head vs. capacity and BHP vs. Capacity characteristic should match to ensure even load sharing and trouble-free operation throughout the range.

3.03.00 The pumps shall have stable Head vs. Capacity characteristic continuously rising towards shut-off with the highest at shut-off and with an approximate shut-off head of 15% or more than the design head for radial flow pumps and 50% more than the design head for mixed flow/ turbine type pumps.

3.04.00 The operating range of operation of pumps shall generally be 40% to 120% of rated flow for sustained period of operation.

3.05.00 The power requirement of the pump shall be non-over loading type for mixed flow/ turbine type pumps.

3.06.00 The critical speed of the pump shall be less than 80% of the rated speed or more than 130% of the rated speed. Also, the critical speed of the pump-motor assembly shall be more than the maximum reverse run-away speed.

3.07.00 Pump shall run smoothly without undue noise and vibration. The vibration limit measured at motor end shall not exceed the limit specified in Hydraulic Institute Standards. The noise level shall not exceed 85 dBA overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1M from the equipment surface.

3.08.00 The base plate, foundation bolts, motor stool and other components shall be designed to take the full force coming on the discharge elbow under shut-off condition.

3.09.00 Water for motor cooling and thrust bearing cooling, if required, shall be tapped from the discharge of the pumps and/or fed from an over-head tank. All piping, valves, strainer,

instruments etc. required for this purpose and line shaft bearing lubrication (if required) shall be provided by the Contractor.

3.12.00 Reverse Rotation

a) The pump shall be provided with an approved mechanical device to protect reverse rotation on loss of drive motor power and failure of discharge valve to close.

b) a reverse rotation detection switch shall be provided to prevent starting of motor while rotating in reverse direction.

3.13.00 Motor Rating

The pumps shall be capable of starting with discharge valve fully closed as well as fully open conditions. Motors shall be selected to suit to the above requirements. Continuous motor rating (at 50^{O}C ambient) for all pumps shall be at least ten per cent (10%) above the maximum load demand of the driven equipment in the complete operating range (including run out condition) to take care of the system frequency/voltage variation.

Drive motors shall be connected directly to the line shaft of the pump.

4.00.00 DESIGN AND CONSTRUCTION

4.01.00 **Pump Type**

Pumps shall be of vertical shaft, single stage/multi-stage, submerged suction, complete with bowl, column & head assembly, and drive assembly. The pump design shall be of pullout/non-pull-out type as specified

4.02.00 **Discharge head**

The pump discharge shall be of above-floor type/sub- floor type. In certain cases of pump installation where expansion joint is located immediately at the pump discharge, the pump assembly will be subjected to the unbalanced hydraulic thrust. A thrust pad will be built in with the discharge head for transmitting the hydraulic thrust to external structures such that this hydraulic thrust is not transmitted to the foundation bolts for which they may not be designed.

4.03.00 **Column Pipe**

Column pipes shall be flanged and bolted and shall be complete with gaskets, nuts, and bolts.

4.04.00 **Impeller**

The impeller shall be closed, or semi-open or open as specified elsewhere.

4.05.00 **Wearing Rings**

Replaceable type wearing rings shall be provided for both casing and the impeller. For open impellers replaceable casing liners shall also be provided. The difference in hardness of the casing & impeller wearing rings shall be minimum 50 BHN.

4.06.00 **Impeller & Line Shaft**

Shaft size selected based on maximum combined shear stress must take into consideration the critical speed as per API - 610.

4.07.00 **Pump & Shaft Bearings - lubrication**

4.07.01 Adequate number of properly designed bearings shall be furnished. The type of lubrication i.e., self-water lubrication or forced water lubrication shall be provided.

4.07.02 **Self water Lubrication System**

The line shaft bearings shall be lubricated by the water being pumped. The main pump and line shaft bearings which are above minimum water level shall be of 'Thordon' type/

equivalent. For other line shaft bearings located below minimum water level, cutless rubber bearings can be used.

4.07.03 **Forced water lubrication system**

The line shaft shall be provided with shaft enclosing tube to exclude pumped water from shaft and bearings.

Lubricating water pumps shall be provided to supply lubricating water for bearings. These lubricating water pumps shall get supply from the overhead water storage tank.

4.08.00 **Thrust Bearings**

Single thrust bearing at motor top or separate thrust bearings at pump and motor shall be provided to take care of hydraulic thrust and weight of the rotating assembly. Thrust bearing shall be spherical roller type or superior, capable of absorbing axial thrust in both directions of rotation. Water required for cooling of thrust bearing shall be taken from pump discharge, wherever applicable.

The thrust bearing shall be rated for continuous operation with thrust as developed in shut-off condition with clearance between the wearing rings in worn out condition to be at least four (4) times the clearance between the wearing rings in new condition.

4.09.00 **Pump Motor Supports, Base plate etc.**

The pump and motor shall have a common support. The necessary supporting frame, base plates, mounting plates etc. as required shall be supplied under this specification.

4.10.00 **Stuffing Box**

Gland packing shall be provided at the top-of-the-line shaft. Shaft sleeves shall be provided at the stuffing box.

4.11.00 **Assembly and Dismantling**

Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouted base/sole plate or alignment.

9.00.00 **Technical Data Sheet (if not mentioned specifically elsewhere in the CW System technical specifications) of Pumps**

SN	Description	Parameters
1	Designation	As applicable
2	Total No. of Pumps	As applicable
3	No. of Working Pumps	As applicable
4	No. of Standby Pumps	
5	Guaranteed Flow & Total Head (Guaranteed)	
6	Operating Speed (Max.)	1500 rpm
7	Pumps and drives to be designed for	Outdoor duty & Continuous Operation
10	Type of Pump	Vertical Wet Pit & Non-Pull out type

Annexure-3

SUBMERSIBLE PUMPS

1.00.00 SCOPE

1.01.00 This specification covers general requirements in respect of design, material, manufacture, construction, testing & inspection at Vendor's / sub-vendor's delivery to side, of submersible pumps. The minimum technical requirements and equipment shall include, but not be limited to the following:

2.00.00 CODES AND STANDARD

The design manufacture and performance of submersible pumps shall be complied with all currently applicable statues, regulation, and safely codes in the locality where the Equipment will be installed. The Equipment shall also conform to the latest applicable Indian standards listed below/equivalent standards.

2.01.00 **List of Applicable Indian Standards**

IS: 8034 - Submersible pumps for clear cold fresh water

IS: 5120 - Technical requirement of Rotodynamic Special Purpose pumps.

3.00.00 DESIGN AND PERFORMANCE REQUIREMENTS

a) The pump shall be of single stage mono - block type with non-clog design.

b) Components of Identical pumps shall be interchangeable.

c) Pumps shall have continuously rising head characteristics.

4.00.00 MOTOR RATING

Continuous motor rating (at 50 deg. C ambient) for pumps shall be at least ten percent (10%) above the maximum load demand of the driven equipment in the complete operating range to take care of the system frequency variations.

5.00.00 FEATURES OF CONSTRUCTION

a) Pumps shall be of Submersible, wet pit type.

b) Pumps shall be able to pass through solids up to 100 mm and capable of handling wastewater which may contain, sludge, plastic solids etc.

c) Coupling device shall ensure leak proof joint between the pump and discharge elbow. This shall also enable pump to be removed from the sumps without the necessity of dismantling any nuts, bolts etc.

d) Pumps shall be portable type and capable of using in any sump as and when required. Pump shall be provided with required stool, flexible, hose chain connection etc. for easy installation, removal, and maintenance. Adequate length of chain required for lowering the pump into the sump and flexible type discharge pipe shall be provided.

e) Impeller

Enclosed impellers shall be equipped with seal rings on their hubs. In case of open impeller, the pump shall be designed to take care of the additional thrust produced.

GENERAL TECHNICAL REQUIREMENT FOR ELEVATORS, CRANES AND HOISTS

TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC NO: CS-4540-001A-2

ELEVATORS, CRANES AND HOISTS

1.00.00 **ELEVATOR**

1.01.00 **Passenger Elevators for TG Building, Service Building and Administration Building**

The Passenger elevators for TG Building, Service Building and Administration Building shall be as under.

(i) One (1) no. conventional type elevator having capacity of 13 persons for TG Building for each unit.

(ii) Two (2) nos. conventional type elevator having capacity of 13 persons for Service Building.

(iii) Two (2) nos. panoramic type elevator with five glass panels on rear side having capacity of 13 persons (884 kg.), for Administration building.

1.01.01 The scope shall include all items / accessories, service along with all electrical equipment etc. required to meet all design, installation, operation, safety, protection and other requirements of IS: 14665 (latest edition) (all parts), 'Lift' and service lifts'. This scope shall include all items / devices needed to comply with the requirements indicated elsewhere in the specification. The scope shall include but not limited to the following:

(a) 1 No. fireman's switch for each elevator.

(b) Machinery supporting Beam.

1.01.02 The location of Elevators shall be as per tender drawings enclosed with the specification.

1.01.03 Complete erection, testing and commissioning including all testing and commissioning materials, consumables and other tools and tackles required for erection.

1.01.04 To obtain necessary local administration permits / approvals and make arrangements for inspection and tests required thereby.

2.00.00 CRANE & HOIST

2.01.00 Suitable EOT Crane/HOT crane/monorail beams with hoists/chain pulley blocks of adequate capacity, to meet the erection and maintenance requirements are to be provided by the vendors for the various equipment/areas. Some of the areas/equipment not covered by TG hall EOT crane are indicated below. For balance areas/equipment, not listed herein, the requirements of Technical Specification shall be followed.

(a) Feed water heaters & deaerator.

(b) Various pumps & Heat Exchangers.

(c) Fans, motors, gear boxes etc., of Main Condenser, vacuum pumps, control fluid room etc.

(d) Auxiliary cooling water pumps and DM cooling water pumps of ECW systems and Plate heat exchangers.

(e) Central lube oil system room.

(f) Any other equipment.

The above requirement is indicative only; the requirement given in the respective chapter is to be adhered to.

GENERAL TECHNICAL REQUIREMENT FOR ELEVATORS, CRANES AND HOISTS (Cont.)

TALCHER THERMAL POWER PROJECT **STAGE-III (2X660 MW)** **EPC PACKAGE**	**TECHNICAL SPECIFICATION** **SECTION-VI, PART-B** **BID DOC. NO. CS-4540-001A-2**

SERVICE ELEVATORS, CRANE, HOIST & MONORAIL

1.00.00 SERVICE ELEVATORS

1.01.00 DESIGN CRITERIA AND OPERATIONAL SPECIFICATION

1.01.01 **Design**

Elevator shall be of conventional type for Service Building and TG building and of panoramic type with five glass panels on rear side for Administration Building. The elevator shall meet the quality of international standard. The quality of glass panel on rear should be of highest grade from safety point of view and should meet the best standard.

1.01.02 No. of floors to be served shall be as per the specification and tender drawing of the Employer. Bidders shall quote variation in price for addition/deletion of one landing level in the relevant schedule of Forms and Procedures. However, bidder shall quote for above indicated landing levels in his base offer. No of floors and landing elevations are tentative only. The final landing elevations for all buildings shall be subject to approval by the Employer after award.

1.01.03 Elevators shall be designed based on following criteria:

i)	Design/construction/installation codes.	:	Latest edition of IS: 14665 (all parts)
ii)	Load carrying capacity	:	884 kgs. (equivalent to 13 persons) for passenger elevator for service building , TG building and Administration Building.
iii)	Rated speed	:	1.0 m/sec.
iv)	Position of machine room	:	Directly above the elevator shaft.
v)	Machine room	:	Window air conditioner of minimum 2T capacity per elevator shall be provided by bidder.

1.02.00 **CONSTRUCTION**

Construction of the elevators shall specifically meet all requirements of the codes indicated and shall have following additional features:

i)	Flooring of Cabin	:	Vitrified ceramic tiles of mat finish.
ii)	Car enclosure & car panels	:	Stainless Steel
iii)	Handrails on 3 sides	:	Mirror Stainless Steel
iv)	False ceiling	:	Powder painted

v)	Car opening & Hoist way opening	:	Protected by central opening sliding Stainless Steel door
vi)	CABIN ACCESSORIES	:	The following accessories shall be provided : a) Recessed fluorescent light/LED fittings on car ceiling. b) Car control station c) Emergency stop switch. d) 5/15A, 3 pin plug socket with switch on top of lift car. e) Switches with Braille characters.

1. AUTOMATIC RESCUE DEVICE (ARD) - (BATTERY DRIVE):

   Bidder to provide a modern Advanced electronic drive system of "RESCUING Passenger Trapped in a ELEVATOR".

2. EMERGENCY SAFETY DEVICES :

   The lift shall be provided with safety Device attached to the lift car frame and placed beneath the car. The safety device shall be capable of stopping and sustaining the lift car up at governor tripping speed with full rated load in car.

3. Elevator shall have Floor announcement system & Braille switches

1.02.01 All steel embedment for fixing landing doors/indicators etc. to the Elevator well shaft and fascia plate shall be supplied by the Bidder.

1.02.02 Guide rails complete with supporting brackets for the car and counter weights. Bidder to take care of granite tiles (approx 80 kg) to be provided for cabin flooring in selecting counter weights.

1.02.03 Elevator drive machines complete with electric motor, reduction gear unit, suspension ropes, buffers for the cars and the counter weights and other drive and control mechanism. All foundation anchor bolts, sleeves, anchoring steel and any item required to complete the job satisfactorily shall be provided by the bidder. The bidder shall also provide for the grouting of anchor bolts, sleeves, anchoring steel, etc. and other anchorages

1.02.04 Any other steel works as well as all other accessories/components not specified in the specification but necessary for making the Elevator complete.

1.02.05 All building work including the supply of steel items, associated with installation of equipment in the machine room hoist way, hoist way door, frames and Elevator pit, shall form part of bidders scope of service, Bidder shall also provide the Elevator-well complete with foundation

and brick walls around the lit-well together with overhead machine room. The machine room will be provided with R.C.C. floor slab with necessary pockets for anchor bolts and slots.

1.03.00 **OPERATION**

1.03.01 Elevator shall have provisions to meet following operational requirements :

a) Selective Duplex collective, automatic operation with or without attendant through illuminated push button station located inside the lift car.

b) Door operating shall be automatic door operation and electronic door protection system for opening/closing of car and landing doors.

c) Bidder shall provide car operating panel with luminous buttons, car position indication in car (both visual and audio) combined with direction arrows, overload warning indicator, battery operated alarm bell and emergency light and fan & hands free speaker telephone set with suitable battery, charger & controls.

d) Bidder shall provide emergency indicator to indicate the location of elevator in case of elevator being stuck up between the floors through automatic flashers (both audio & visual)

e) Bidder shall provide electronic door detector (Infra red curtain type).

f) Two push buttons, one for upward movement and the other for downward movement at each intermediate landing and one push button at each terminal landing shall be provided in order to call the car. Digital hall position indicator at all floors, tell lights at all floors shall also be provided by the bidder.

g) For facilitating the movement of visually & hearing impaired persons, hall lantern and car arrival chimes shall be provided.

h) All fixtures shall be in stainless steel face plates.

i) Push buttons shall be fixed in the car for holding the doors open for any length of the time required.

j) All other safety/protection/operation interlocks as required by IS:14665 (latest edition).

1.04.00 **Elevator Electricals:**

1.04.01 **Electric motor:**

The driving motors shall conform to I.S 325 and suitable for the Variable Voltage Variable Frequency (VVVF) application. All motors shall be squirrel cage induction type, suitable for operation at 415V (+/- 10% variation) , 3 phase, 3 wire, 50HZ (+3% to -5% variation) supply. Motors shall be provided with thermal class 130 (B) or better insulation

.

1.04.02 **Controls:**

The controls shall be Variable Voltage and Variable frequency type and shall provide smooth and constant acceleration and retardation under all conditions of operation. Suitable control panel shall be provided in the machine room.

1.04.03 **Cables and wiring:**

All the cables except trailing cables shall be as per IS:1554-1 or IS-7098-I. the PVC outer sheath of these cables shall be flame retardant, low smoke (FRLS) type with the following FRLS properties.

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

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

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

The circular trailing cables shall be either in accordance with IS 4289 Part-I (Elastomer insulated) or IS-4289 Part-II (PVC insulated). The flat type trailing cables if offered shall be in accordance with IEC-60227-6.

All wiring / cabling between the equipments in the lift machine room and that between the machine room and equipments in the lift well and at the landings shall be wired in HDP conduits/ galvanized steel conduits to be supplied by the contractor. Alternatively armored cables may be used.

1.04.04 **Earthing:**

The elevator structures and all Electrical equipment, including metal conduits shall be effectively earthed with the earth conductors provided in the machine room as per IS: 3043.

DATA SHEET

i)	Type of services	:	Passenger
ii)	Load carrying capacity	:	As per specification
iv)	Rated speed		One (1) m/s
v)	Total Travel	:	TG hall- As per layout Service Building- As per layout Administrative Building- As per layout
vi)	No. of floor to be served	:	TG hall, Service Building & administrative building: - To be decided during detailed engineering.
vii)	Method of control	:	Variable voltage variable frequency (VVVF)
viii)	Position of M/c room	:	Directly above lift shaft
Ix)	Size of platform	:	As per IS14665 & manufacturer's standard latest.
x)	Size of lift well	:	-do-
xiii)	Specification code	:	As per IS:14665 (5 parts) (Latest Edition).
xiv)	Design siesmic co-efficient	:	According to the IS 1893-1977

2.00.00 **CRANE, HOIST & MONORAIL**

2.01.00 Suitable EOT Crane/HOT Crane/Monorail beams with hoists/Chain Pulley Blocks of adequate capacity, to meet the erection and maintenance requirements are to be provided by the vendor for the various areas/equipment. Some of the areas/equipment not covered by TG hall EOT cranes are indicated below. For balance areas/equipment, not listed hereinafter, the requirements of Specification shall be followed.

(a) Feed water heaters & deaerator (Applicable Hoists/Chain pully block for maintenance purpose shall be provided).

(b) Various pumps & Heat Exchangers.

(c) Condenser Water Boxes (front & rear), (Applicable If hinged type water box not envisaged)

(d) CW Butterfly Valves

(e) Vacuum Pumps

(f) Control Fluid Room

(g) Auxiliary cooling water (clarified) pumps and DM cooling water pumps of ECW systems.

(h) Central Lube Oil System room.

(i) Any other equipment.

The above requirement is indicative only, the requirement given in the respective chapter is to be adhered to.

2.02.00 The EOT cranes shall be designed as per IS-3177 (Latest edition) class -2 duty and the monorail hoists (hand operated) shall be designed to duty class 2 to IS 3832. Electrical wire rope hoist shall be designed as per IS:3938 (latest).

2.03.00 The design, manufacture inspection and testing of the crane shall comply with the requirement of latest version of IS:3177

2.04.00 The stipulations of all statutory codes like Indian Electricity Act, Indian Electricity Rules, Factory Acts, Local Municipality Act etc. shall however prevail over the specification requirements, in case any conflict arises between this specification and the statutory codes.

2.05.00 For the hoists with more than 2.0 ton lifting capacity or more than 10.0 M lift, motor operated hoist block for both long travel and lift shall be provided. Other hoist blocks shall be of hand operated type for both travel and lift. However, all monorails coming out of the building shall be provided with electric hoist block, irrespective of load and lift.

For hand operated hoists, the hoists shall be suitable for operation from floor level. Hand chain shall be provided for long travel of trolley and the Hoisting mechanism.

The operator shall be able to control the movement of the monorail hoist with the help of floor operated pendant. The creep speed for vertical movement shall also be provided as per the system requirement.

MANDATORY SPARES

1.00.00 **SPARES**

The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spares is given below:-

1.01.00 **MANDATORY SPARES**

(a) The list of mandatory spares considered essential by the Employer is indicated in this chapter. The bidder shall indicate the prices for each and every item in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in the Bid Forms and Price Schedules. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.

(b) The Employer reserves the right to buy any or all the mandatory spares parts.

(c) The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes.

(d) All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments.

(e) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.

1.02.00 **RECOMMENDED SPARES**

(a) In addition to the spare parts mentioned above, the contractor shall also provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and total prices in relevant schedule of the Bid Form and Price Schedules. This list shall take into consideration the mandatory spares specified in this Section-VI, Part-A and should be independent of the list of the mandatory spares. The Employer reserves the right to buy any or all of the recommended spares. The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment.

(b) Price of recommended spars will not be used for evaluation of the bids. The price of these spares will remain valid upto 6 months after placement of Notification of Award for the main equipment. However, the Contractor shall be liable to provide necessary justification for the quoted prices for these spares as desired by the Employer.

1.03.00	**START-UP & COMMISSIONING SPARES** Start-up and commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used till the plant is handed over to the employer shall come under this category. The Contractor shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipments are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Contractor.
1.04.00	The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares and recommended spares and indicate these in the relevant schedules of the Bid Form and Price Schedules. The general requirements pertaining to the supply of these spars is given below.
2.00.00	The Contractor shall indicate the service expectancy period for the spares parts (both mandatory and recommended) under normal operating conditions before replacement is necessary.
3.00.00	All spares supplied under this contract shall be strictly inter changeable with the parts for which they are intended for replacements. 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 with desecrator packs as necessary.
4.00.00	All the spares (both recommended and mandatory) shall be manufactured alongwith the main equipment components as a continuous operation as per same specification and quality plan.
5.00.00	The contractor will provide Employer with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the Employer to identify and finalise order for recommended spares.
6.00.00	Each spares part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spares part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.
7.00.00	All cases, containers or other packages are to be opened for such examination as may be considered necessary by the Employer.
8.00.00	The contractor will provide the Employer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/components/equipments covered under the contract and will further ensure with his vendors that the Employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.

9.00.00	The Contractor shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship.
10.00.00	In addition to the recommended spares listed by the contractor, if the employer further identifies certain particular items of spares, the contractor shall submit the prices and delivery quotation for such spares within 30 days of receipt of such request with a validity period of 6 months for consideration by the Employer and placement of order for additional spares if the Employer so desires.
11.00.00	The Contractor shall guarantee the long term availability of spares to the Employer for the full life of the equipment covered under the contract. The Contractor shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, he shall give the Employer atleast 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his sub contractors, Contractor will provide the Employers, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/ procurement of such items.
12.00.00	Material Codification The bidder to provide datasheets/ assembly drawings of the manufacturer/ any other relevant document showing Bill of Material(s), Make, Model Number, Part Number etc. through which mandatory spares to be supplied can be uniquely identified. This would facilitate the Employer to assign a unique code to each of the mandatory spare as brought out in GCC. The bidder shall extend all necessary assistance in this regard.

General Technical requirements mentioned below shall be generally taken care by Bidder for supervision of the erection and commissioning activities.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	PRE-COMMISSIONING ACTIVITIES, COMMISSIONING OF FACILITIES AND INITIAL OPERATIONS
1.00.00	**GENERAL**
1.01.00	The pre-commissioning and commissioning activities including Guarantee tests, checks and initial operations of the equipment furnished and installed by the Contractor shall be the responsibility of the Contractor as detailed in relevant clauses in Technical Specification. The Contractor shall provide, in addition, test instruments, calibrating devices, etc. and labour required for successful performance of these operations. If it is anticipated that the above test may prolong for a long time, the Contractor's workmen required for the above test shall always be present at Site during such operations.
1.02.00	It shall be the responsibility of the Contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and initial operation of the equipment systems which are installed by him. The Contractor shall also be responsible for flushing & initial filling of all oils & lubricants required for the equipment furnished and installed by him so as to make such equipment ready for operation. The Contractor shall be responsible for supplying such flushing oil and other lubricants unless otherwise specified elsewhere in these specifications & documents.
1.03.00	The Contractor upon completion of installation of equipments and systems, shall conduct pre-commissioning and commissioning activities, to make the facilities ready for sustained safe, reliable and efficient operation. All pre-commissioning/commissioning activities considered essential for such readiness of the facilities including those mutually agreed and included in the Contractors quality assurance program as well as those indicated in clauses elsewhere in the technical specifications shall be performed by the Contractor.
2.00.00	**TESTING / COMMISSIONING PROCEDURES** The contractor shall submit his testing / commissioning check lists and procedures for various equipments / systems covered under the contract at least 18 months before the actual commissioning of the equipments / systems for review and approval of employer. The testing / commissioning procedures are to be of a standard format in order to maintain consistency of presentation, content and reporting. The list of commissioning check lists and procedures to be submitted and their content details shall be agreed upon during preaward discussions. An indicative list of Testing / Commissioning procedures/schedules and Standard Checklists and the details regarding the contents of testing/commissioning are enclosed as annexure at the end of this sub-section of section-VI, Part B. The actual list of such equipments / systems shall depend on the equipments / systems being supplied by the contractor. i) Annexure-I : Standard Checklist of items ii) Annexure-II : Testing / Commissioning Procedure/schedules iii) Annexure-III : Commissioning procedures requiring approval of Employer. iv) Annexure – IV : Demonstration/Acceptance test procedures during Commissioning/Initial operation v) Annexure – V : Brief write up on Contents of Testing / Commissioning Procedures Procedure/schedules shall be approved by the employer.

3.00.00 **PRECOMMISSIONING & COMMISSIONING ACTIVITIES**

3.01.00 **General**

The pre-commissioning activities including some of the important checks & tests for certain major equipment/ systems (as a minimum) are described below, although it is the Contractor's responsibility to draw up a detailed sequential & systematic list of checks / tests and various activities / procedures connected with pre-commissioning of the complete facilities with all systems, sub-systems and equipment supplied and installed by him and get the same approved by the Employer.

3.02.00 **PRE-COMMISSIONING ACTIVITIES/TESTS:**

Steam Generator

3.02.01 **Hydraulic Testing of Pressure Parts**

On completion of installation of the Steam Generator pressure parts and high pressure boiler external piping & non boiler external piping a hydraulic test in accordance with the requirements of the Indian Boiler Regulations, shall be performed by the Contractor. However, making use of valves/control valves supplied by others and installed on the contractor's piping system during hydraulic testing shall be subjected to the acceptance of respective valve supplier otherwise hydraulic cap/blanking arrangement as required shall be used. The procedure adopted for hydraulic test and preservation shall have the prior approval of the Employer. The detailed schemes and procedure for carrying out hydraulic testing shall be prepared and furnished by the contractor and it shall be discussed and finalized during detailed engineering stage. The water for hydraulic test shall be made alkaline by addition of suitable chemicals. After the test, the Steam Generator and high pressure external piping shall be suitably drained and preserved.

All blank flanges, removable plugs, temporary valves, pipes & fittings, spools, other accessories and services required for carrying out hydraulic testing of boiler external pipings & non boiler external pipings and boiler & its pressure parts shall be furnished by the Contractor. The pressurization equipment including water piping and any chemicals for preservation, needed for the above test shall also be furnished by the Contractor. Any defect noticed during the testing shall be rectified and the unit shall be retested by the Contractor.

In the case of branch connections/ tap-off piping (in others scope) from contractor's scope of piping are not ready or not erected at the time of hydrostatic testing of piping in contractor's scope, then the contractor to supply/use necessary blanking arrangement as required at these tap-off /branch connections. The hydraulic test shall be considered successful only on certification to that effect by the concerned inspecting authority as per the provision of the IBR and the Project Manager.

3.02.02 **Air & Gas Tightness Test**

After completion of installation of furnace tubes and/or inner skin casing wherever applicable ducts and air heaters, and before commencement of application of thermal insulation a test shall be performed on the Steam Generator by the contractor to prove or to establish the tightness of the erected equipments from the outlet of FD fan through Steam Generator to the stack. Such test shall be done, as far as possible, with all mountings like soot blowers etc. installed in position. The procedure adopted for such tests shall have the prior approval of the Employer. Normally physical leak detection method by pressurizing the section under test by running FD Fan / PA Fan / Temporary blower, as the case may be, is adopted. The contractor may adopt any other better method of testing.

All equipments including any temporary blanking, if required, for the above test shall be provided by the Contractor.

The Contractor's air and gas tightness test procedure shall be such that it shall enable conductance of air/gas tightness test on the ducts in segmented manner (as and when these duct segments are ready), so that these duct segments can be immediately released for application of insulation after their air/gas tightness tests. Contractor shall made all necessary arrangement for conducting tests in this manner. Any blanking etc. on the duct side required for testing of duct segments shall be provided by Contractor. Contractor shall bring fan / blower (s) of adequate size / capacity and other necessary instruments so that these tests can be conducted without necessity of FD / PA fans. The above equipment shall be brought to site by the Contractor on temporary basis and shall be taken back after successful completion of air / gas tightness test.

3.02.03 **Chemical Cleaning of Pressure Parts**

The Contractor shall perform thorough and efficient cleaning operations of all the internal parts of the boiler, like economiser, water wall / evaporator, separator, feed water line, piping, start-up recirculation lines and associated piping and all other pressure parts and associated high pressure piping covered under these specifications (except those portions which are to be steam blown).

The cleaning operation shall consist of De-mineralised (DM) water flushing, the chemical cleaning using acids like hydrofluoric acid or as recommended by the manufacturer, DM water rinsing, DM water flushing, nitrogen capping etc. Complete chemical cleaning procedure, the scheme and layout including parameters of the pumps, size of tanks, materials of construction, the rate of consumption and total requirements of steam and water for such cleaning process shall have the approval of the Employer.

The Contractor shall furnish all labour, materials such as the required chemicals and other consumables, all equipment such as acid/chemical transfer and acid/chemical circulating pumps complete with drive motors, acid storage and acid/chemical mixing tanks, all temporary piping, valves and specialities and local instruments for pressure, temperature and flow measurements and any other items needed to carry out the process. All equipment required for chemical cleaning of Steam Generator shall be supplied by the contractor.

The Contractor shall take care to dispose off the used chemicals and the effluents from the cleaning operations, after neutralisation, meeting all the statutory regulations and in a manner acceptable to the Project Manager and which would comply with the norms of the State Pollution Control Board. This includes construction of suitable neutralization pit, channels, disposal equipments etc.

The Contractor shall specifically make all necessary arrangements for prevention of any fire accidents, explosions etc. during the performance of the chemical cleaning operations.
The Contractor shall ensure that during the cleaning process the procedure adopted shall be such as to consume minimum demineralized water.

The cleaning procedure shall include final flushing and draining of the boiler under a nitrogen gas cap and/or filling the boiler with inhibited water or any other proven procedure recommended by the manufacturer for the preservation of the boiler which is acceptable to the Employer. The Contractor shall furnish a detailed procedure for boiler preservation during detailed engineering for Employer's approval.

All equipment needed for such preservation including the nitrogen cylinders, interconnecting piping and any regulating equipment for N2 cap and other preservatives shall be provided by the Contractor for the Steam Generator and the same shall also become the property of the Employer after completion of the chemical cleaning.

The Contractor shall provide adequate safety and protective equipment for all his employees and ensure that they are worn at all times of danger. Specialized treatment equipment (such as required for first aid when using hydrofluoric acid/chemical) must be provided at the place of handling acid/chemical. An acid/chemical cleaning report and log of each cleaning must be provided by the Contractor to the Employer, immediately after the cleaning operation.

Dry Preservation of non-drainable portion during shutdown to be provided.

3.02.04 **Steam Blowing**

Steam blowing of complete Superheaters, Reheaters and various boiler external piping and non boiler external piping shall be carried out by the Contractor as per requirements/scope of work (indicated in Part-A & Part-B, Section-VI) of this specification. Temporary materials as required for steam blowing of these piping systems shall be supplied by the contractor.

Steam blowing of contractor's scope of piping systems shall be performed without valves/control valves supplied in steam blowing circuit otherwise valve supplier's acceptance to include these valves for steam blowing operation is to be submitted by the contractor. Based on the above the Contractor shall give recommended procedures, method of blowing and scheme for steam blowing indicating clearly additional system, if any, to be cleaned by steam blowing and furnish data/ write-up/ layouts/ drawings to that effect to the Employer for approval.

The Contractor shall furnish his recommendations regarding use of various test equipments and instruments and termination/acceptance criteria for steam blowing, which in any case shall meet the steam turbine-generator requirements.

The systems which should be ready and operational before steam blowing shall be made ready/operational by the Contractor by the scheduled date for starting of steam blowing.

For equipments/components installed on high pressure external piping, such as various thermo-wells, flow meter, control valves, HP/LP Bypass valves etc., the Contractor shall comply with guidelines to be followed during steam blowing, with respect to removal / blanking / replacement of such items their internals etc. by spool pieces as given by the respective manufacturer/sub-contractor.

Supply of all such spools (as above) and/or blanks, temporary piping and supports etc. as required, cutting / welding / edge preparation and rewelding required for blanking, temporary piping connection and/or for replacements by spool pieces shall be the responsibility of the Contractor. After steam blowing removal of spool pieces & temporary piping and reinstallation of various components, shall also be the responsibility of the Contractor.

In the case of branch connections/ tap-off piping are not ready or not erected at the time of steam blowing operation then the contractor to supply/use necessary blanking arrangement as required at these tap-off / branch connections.

It will be the responsibility of the Contractor to operate the Steam Generator and its accessories equipment to generate adequate steam at the parameter and quality in line with the requirements of steam blowing procedure. The Contractor shall make adequate provisions for temporary enhancement of fuel oil firing capacity of the steam generators by changing oil gun tips etc. as may be required so as to be able to conduct complete steam blowing operation by oil firing alone. All necessary precautions to avoid fires and cold end corrosion of Air preheater, during such oil firing at enhanced SG loads, shall be taken by the Contractor.

The Contractor shall ensure successful and timely completion of steam blowing of all systems and will render all help/services as required including:

(i) Services of test/operating personnel/supervisors.

(ii) Extending all cooperation during erection, pre-commissioning of plant and equipment to be made ready and operational before starting steam blowing.

(iii) Extending all cooperation for interface engineering of equipments/components of temporary system required for steam blowing operation.

(iv) Contractor's engineers shall be available for all coordination meetings arranged by the Employer for finalizing the details of temporary system for steam blowing.

For the steam blowing operation, steam conditions like pressure, temperature etc. at the Steam Generator outlet shall be so selected that a minimum cleaning ratio/ disturbance factor of more than 1.4 is achieved. A cycle of heating, cooling and blowing/ purging, is to be repeated to ensure thorough cleaning of the interior of the pipes/ tubes etc. The final indication of cleanliness shall be demonstrated by purging through target plates positioned at the discharge point.

3.02.05 **SCR SYSTEM**

Complete pre-commissioning work including tests of facilities such as pressure drop test of SCR system and all other tests as mutually agreed in the Contractor's quality assurance program as well as those identified in the specification.

3.02.06 **ESP**

Complete pre-commissioning work including tests of facilities such as air and gas tightness tests of ESP, pressure drop test of ESP, gas distribution test of ESPs etc. and all other tests as mutually agreed in the Contractor's quality assurance program as well as those identified in the specification.

3.02.07 **FGD System**

3.02.07.01 **Air and Gas Tightness Test**

After completion of installation of Booster fans (if required), ducts & absorber, and before commencement of application of thermal insulation a test shall be performed on the FGD system by the contractor to prove or to establish the tightness of the erected equipments. The procedure adopted for such tests shall have the prior approval of the Employer. Normally physical leak detection method by pressurizing the section under test by running Temporary blower is adopted. The contractor may adopt any other better method of testing.

All equipments including any temporary blanking, if required, for the above test shall be provided by the Contractor.

The Contractor's air and gas tightness test procedure shall be such that it shall enable conductance of air/gas tightness test on the ducts in segmented manner (as and when these duct segments are ready), so that these duct segments can be immediately released for application of insulation after their gas tightness tests. Contractor shall made all necessary arrangement for conducting tests in this manner. Any blanking etc. on the duct side required for testing of duct segments shall be provided by Contractor. Contractor shall bring fan / blower (s) of adequate size / capacity and other necessary instruments so that these tests can be conducted. The above equipment shall be brought to site by the Contractor on

temporary basis and shall be taken back after successful completion of air / gas tightness test.

3.02.07.02 All pre-commissioning tests & activities as indicated in Annexure-I, II & III and elsewhere in the technical specification shall be performed by the Contractor.

3.02.08 Any other pre-commissioning activity such as floating of safety valves etc. as considered essential for readiness of facilities for commencement of commissioning activities shall also be undertaken by the Contractor.

3.03.00 **Demonstration/Acceptance tests during Commissioning/Initial Operation**

The following tests shall be demonstrated during commissioning for which the bidder has to furnish the procedure and get the approval of the employer:

3.03.01 Unit Load Ramp rate capability test: Demonstration of ± 3% per minute ramp rate for 50% to 100% load range and minimum ± 1% per minute below 50% load to minimum boiler once through load, maintaining the parameters within prescribed limits as defined in closed loop control system requirements (Refer Functional Guarantee Chapter).

3.03.02 **Start-up, Loading, Unloading and Shutdown Capabilities (For Turbine Generator)**

(i) **Unit Start Up**

Start-up time (upto full load), and loading capabilities for the Turbine Generator together for cold start conditions (greater than 36 hours shutdown), warm start conditions (between 8 and 36 hours shutdown) and hot start conditions (less than 8 hours shutdown) as indicated by the Contractor in the offer and accepted by the EMPLOYER shall be demonstrated, ensuring that the various turbine operational parameters like vibration, absolute and differential expansion, eccentricity and steam-metal temperature mismatch etc. are within design limits.

(ii) **Sudden Total Loss of External Load**

On occasions, the steam turbine generator unit may experience sudden total loss of all external load. Under these conditions, the steam turbine generator unit shall not trip but shall continue to be in operation under the control of its speed governor to supply power for the plant auxiliary load with HP-LP bypass in operation while staying within the agreed limits of steam to metal temperature mismatch, exhaust hood temperature, absolute and differential expansion, vibration and eccentricity. The same shall be demonstrated. Further, the provisions of Part-B, Section-VI, shall also be complied with.

(iii) **Steam Metal Temperature Mismatch Limitation**

The steam-metal temperature differential for cold, warm and hot start up, loading / unloading and shutdown conditions shall be within the permissible limits indicated by the Bidder in the offer and accepted by the Employer.

3.03.03 **Turbine Generator Set Capability**

The steam turbine generator unit shall be capable of delivering at generator terminals the output as indicated by the BIDDER in the heat balances submitted along with his bid, under the following condition.

(a) Maximum continuous output at generator terminals corresponding to both strings of HP heaters out of service, under rated steam conditions, at condenser pressure of

89 mmHg(Abs) and 3% make-up & Aux. Steam requirement tapped from CRH, generating not less than the rated output OR output corresponding to design BMCR heat duty, whichever is less without overstressing turbine components.

NOTE: While conducting the tests of (a) above the condenser pressure measurement shall be done at 300mm above the top row of condenser tubes .

3.03.04 **Turbine Auxiliaries**

(i) **H.P./L.P. Bypass Capabilities**

The HP & LP Bypass system should satisfy the following functional requirements under automatic interlock action. It should come into operation automatically under the following conditions:

(a) Generator circuit breaker opening.

(b) HP - IP stop valves closing due to turbine tripping.

(c) Sudden reduction in demand to house load.

Under all these conditions, while passing the required steam flows as per the relevant heat balances, the condenser should be able to swallow the entire steam without increasing the exhaust hood temperature and condenser pressure beyond the maximum permissible value indicated by the BIDDER in his offer and accepted by the EMPLOYER. The same shall be demonstrated.

(ii) **Steam Condensing Plant for main turbine**

(a) Temperature of condensate, at outlet of condenser, shall not be less than saturation temperature corresponding to the condenser pressure at all loads.

(b) Oxygen content in condensate, at condensate collection tank outlet, shall not exceed 0.015 CC per litre over the entire load range and shall be determined according to calorimetric Indigo - Carmine method.

(c) Air leakage in the condenser under full load condition shall not exceed more than 50% of design value taken for sizing the condenser air evacuation system.

(d) When one half of the condenser is isolated, condenser shall be capable of taking at least 60% T.G. load under EMCR conditions.

(e) The capacity of each vacuum pump in free dry air under standard conditions at a condenser pressure of 25.4 mm Hg (abs) and sub cooled to 4.17 deg.C below the temperature corresponding to absolute suction pressure shall not be less than specified elsewhere. Correction curves for establishing the capacity at site conditions shall also be furnished.

(f) The air and vapour mixture from air cooling zone of condenser shall be 4.17 deg.C below the saturation temperature corresponding to 25.4 mm Hg (abs) suction pressure. Correction curves for establishing the same at site conditions shall also be furnished.

(iii) **Feed water heaters & Deaerator**

(a) TTD's and DCA's of feed water heaters in line with 660 MW TMCR heat balance shall be demonstrated.

(b) Dissolved O_2 content in Deaerator effluent at deaerator outlet without chemical dosing at all loads, not to exceed 0.005 CC/ litre determined as per ASTM-D-5543-09 or Indigo Carmine method.

(c) Difference between saturation temperature of steam entering the deaerator and temperature of feed water leaving deaerator.

(iv) **Condensate Extraction Pumps**

The vibration, noise level and parallel operation of any two of the three pumps shall be demonstrated.

(v) **Drip Pumps (if envisaged)**

The vibration and noise level shall be demonstrated.

(vi) **Boiler feed pumps**

(a) The vibration, noise level and parallel operation of any two of the three pumps shall be demonstrated as per specification requirements.

(b) Cold start up / hot start up of the unit using TDBFP with motive steam from auxiliary steam header.

(vii) **Turbine hall and other EOT Crane**:

Over load test, travel & hoist speed checks etc., shall be demonstrated as per IS: 3177 (latest edition).

3.03.05 **Balance Pumps, Blowers, Fans, Compressors and rotating equipment.**

a) The vibration, noise level and parallel operation, wherever applicable, of the pumps, blowers, fans, compressors and rotating equipment shall be demonstrated.

b) Pumps, blowers, fans, compressors and rotating equipment shall be capable of delivering flow and head corresponding to design point as specified.

3.03.06 **Balancing of Coal/Primary air flow**

Contractor shall balance the primary air as well as coal flows in the pulverised fuel pipes such that the minimum PF and PA flow imbalance in the PF pipes from each coal pulveriser does not exceed 5% of average flows.

The above balancing shall be checked by the Contractor by carrying out both clean air test and dirty air test (using dirty pitot tubes).

3.03.07 **Demonstration of boiler operation, rate of change of load and sudden load change withstand capability**

Refer Sub section-A-02 and A-03 ,Part-B (Mechanical), Section VI of Technical Specification.

3.03.08 **Steam Temperature Imbalance**

The Contractor shall demonstrate that at SH and RH outlets (in case of more than one outlet) the temperature imbalance between the outlets does not exceed 10 deg C under all loads including transients.

3.03.09 **No fuel oil support shall be required above 40% BMCR**

Contractor shall demonstrate that oil support for flame stabilization shall not be required beyond 40% of BMCR load when firing the coals from the range identified. The Contractor shall demonstrate that with any combination of mills/ adjacent mills in service (to Employer's choice) the Steam Generator does not require any oil firing for stable and efficient boiler operation at and above 40% BMCR loads.

3.03.10 **Capabilities of all drives**

After completion of installation of drives, contractor shall demonstrate the capability of all drives as specified elsewhere in Section VI Part B of Technical Specifications.

3.03.11 **Margin on Fans**

After completion of installation of fan drives, Fans, inlet and outlet ducting, measuring equipments etc. contractor shall demonstrate the margin on seal air fans, primary fans, Forced draft fans and induced draft fans as specified elsewhere in Section VI Part B of Technical Specifications.

3.03.12 **Cold Air Velocity Test (CAVT)**

A CAVT shall be conducted on each Steam Generator during commissioning before its initial operation to establish the average cold air velocity and the velocity distribution at minimum three predetermined sections (Employer's Choice) of steam generator. The data obtained from the CAVT will be used to compute the actual flue gas velocities as well as their distribution at the test sections during actual operation by correlating the CAVT data with the test/computed data from Thermal Performance Test as per Clauses 1.03.04 (iii) sub section-IV, Section-VI- Part-A. Should the CAVT results after this correlation with TPT data indicate actual localized high flue gas velocity zones/ mal-distribution of gas flow and/or flue gas laning, suitably designed stainless steel screens at required SG cross sections shall be provided by the Contractor to bring the deviation of the localized gas velocity within ± 20% of average gas velocity specified. Through this test the Contractor shall also demonstrate the compliance with the specification requirements regarding the maximum allowable flue gas velocities at various sections of the Steam Generator, refer sub-sectdion-A-03, Part-B of Technical Specifications.

The detailed CAVT procedure shall be to Employer's approved. The Contractor shall submit a detailed CAVT report and the computations of actual velocities after correlating CAVT data with TPT data to the Employer for approval.

3.03.13 **Capabilities of firing of 30% imported coal**

Contractor shall demonstrate the capability of Steam generator and its auxiliaries to operate at rated parameters safely and on sustained basis at TMCR load while firing range of Indian coal(s) as specified in Table-1(A), Annexure-IV-2 ,sub section-IB ,Part-A of Section-VI blended with imported coal up o 30% by weight specified in Table-4, Annexure-IV-4, sub section-IB ,Part-A, Section-VI. Such demonstration shall be for 72 hours of continuous operation

3.03.13 a)	Performance characteristic of fans (PA/FD/ID fan capacity, head developed, etc.)
3.03.14	Passenger & good elevators for steam generator – overload tests, travel and hoist speed checks.
3.03.15	ESP Air in Leakage Contractor shall demonstrate that ESP air in leakage shall be limited to 1% of the total gas flow under guarantee point condition.
3.03.16	Pressure Drop Across ESP Contractor shall demonstrate that the maximum flue gas pressure drop across the ESP under specified guarantee point condition shall not exceed 20 mmwc.
3.03.17	FGD System (i) Performance characteristics of fans (capacity, head developed, etc.) and margins on fans in case Booster Fan, as specified in Part-B of technical specification, is provided by the Contractor. (ii) Capabilities of all drives (Refer Part B of Technical Specifications) (iii) Passenger cum Goods Elevator for FGD absorber & Limestone Grinding Building: Over load tests, travel and hoist speed checks.
3.03.18	Unit startup/shutdown demonstration as per combined startup curves for cold, warm and hot conditions.
3.03.19	**Fire Detection and Protection System** a) Following shall be demonstrated at Site: i) Vibration & Noise level of fire water pumps. ii) Performance test of each of systems such as Hydrant, HVW Spray, MVW Spray, Foam Injection system, Inert gas extinguishing system, fire detection and alarm system, Fire extinguishers and Fire monitors as per the design parameters/ standards/TAC. iii) Parallel Operation, vibration & noise level of the fire water pumps and diesel engines. b) All tests as required by the TAC.
3.04.00	**Pre-commissioning & Commissioning activities requiring approval of the employer:** (a) Hydraulic Test for STG integral piping, heat exchangers, condenser tubes & condenser, equipment cooling water system pipes and associated equipment etc. shall be done. The hydraulic test of other piping system as per statutory requirement and specified elsewhere shall also be carried out. All equipment needed for the tests shall be furnished by the Contractor. (b) Oil flushing of lube oil system, control & jacking oil system, etc. for turbines shall be done. Entire flushing oil requirement & refilling with fresh oil and other consumables along with flushing equipment shall be met by the Contractor.

(c) High Pressure/Low Pressure (HP/LP) bypass tests, vacuum tightness test as per approved procedures shall be done by the Contractor after arranging & lining up of all the necessary equipment by him.

(d) Steam blowing & chemical cleaning, as applicable of integral piping of the turbo-generator, Low pressure piping, Power cycle piping & other piping in the scope of the Contractor shall be done by the Contractor.

(e) Steam blowing & chemical cleaning, as applicable of integral piping of CEP sets & other piping in the scope of the Contractor shall be done by the Contractor.

(f) All tests and activities pertaining to the CEP and its drive as per manufacturer's recommendations and as given in the chapter and covered in the specification.

(g) Steam blowing & chemical cleaning, as applicable of integral piping of Drip Pump sets & other piping (if applicable) shall be done by the Contractor.

(h) All tests and activities pertaining to the Drip Pump and its drive (if applicable) as per manufacturer's recommendations and as given in the chapter and covered in the specification.

(i) Steam blowing & chemical cleaning, as applicable of integral piping of the Heaters & other components shall be done by the Contractor.

(j) All tests and activities pertaining to the Heater as per manufacturer's recommendations and as given in the chapter and covered in the specification.

(k) Oil flushing of lube oil system, control & jacking oil system, for BFP sets shall be done. Entire flushing oil requirement & refilling with fresh oil and other consumables along with flushing equipment shall be met by the Contractor.

(l) Steam blowing & chemical cleaning, as applicable of integral piping of BFP sets & other piping shall be done by the Contractor.

(m) All tests and activities pertaining to the BFP and its drive as per manufacturer's recommendations and as given in the chapter and covered in the specification.

(n) Hydraulic Test for all low and high pressure piping, equipment cooling water system pipes and associated equipment etc. shall be done as per statutory requirement and specified elsewhere shall be carried out. All equipment needed for the tests shall be furnished by the Contractor.

(o) All tests and activities pertaining to the Generator and Excitation as per manufacturer's recommendations and covered in the specification.

(p) All tests and activities pertaining to the Generator Auxiliaries viz Primary water system, Seal oil system, Gas system etc., as per manufacturer's recommendations and covered in the specification.

(q) Any other pre-commissioning checks/ tests and activities as described below and also those mutually agreed between the Contractor & the Employer shall be undertaken.

3.05.00 **COMMISSIONING OF FACILITIES**

General

Upon completion of pre-commissioning activities/test the Contractor shall initiate commissioning of facilities. During commissioning the Contractor shall carryout system checking and reliability trials on various parts of the facilities.

Contractor shall carry out these checks/tests at site to prove to the Employer that each equipment of the supply complies with requirements stipulated and is installed in accordance with requirements specified. Before the plant is put into initial operation the Contractor shall be required to conduct test to demonstrate to the Employer that each item of the plant is capable of correctly performing the functions for which it was specified and its performance, parameters etc. are as per the specified/approved values. These tests may be conducted concurrently with those required under commissioning sequence.

The Contractor shall finalize the protocol of check lists, after erection of the system and equipment, as per International Codes/Standard with the Employer.

The Contractor shall furnish requisite no. of copies of procedures and list of start up, pre-commissioning, commissioning and initial operation tests for Employer's approval.

The Contractor shall also demonstrate the performance of all C&I equipment, the tests on main equipment or prior to that as the case may be.

Other tests shall be conducted, if required by the Employer, to establish that the plant equipments are in accordance with requirements of the specifications.

3.05.01 The Commissioning tests/checks shall specifically include but will not be limited to following:

(a) Checks on the operation of all controls of isolating gas and air dampers.

(b) Checks on operation of all fans and all rotating equipment to ascertain level of noise and vibration.

(c) Test running of all pumps.

(d) Checks on operation of all air heaters and adjustment of seals, if necessary when each heater is upto its working temperature.

(e) Checks on operation of all soot blowers and retraction gear and the sequences control.

(f) Check run on the Pulverised Fuel (P.F.) Mills including clean air flow test.

(g) Standard commissioning tests and procedures as per Contractor's practice for Steam Generator, SCR System, FGD System and other equipment / auxiliaries.

(h) Checks on operation of all individual control loops in the Steam Generator control loops in the Steam Generator control system including SCR & FGD System.

(i) Checks on inter-relation between each control loop in the Steam Generator control system including SCR & FGD system. Checks on inter-relation between each control loop in the turbine generator control system.

(j) Checks on correct functioning of the Burner Management System (BMS).

(k) Calibration tests of orifice, flow nozzles, instruments and control equipment to the extent included in these specifications.

(l) Tests on Control & Instrumentation (C&I) Equipments:

3.05.02 **LIST OF TEST / ACTIVITIES TO BE PERFORMED ON TG & AUXILIARY (but not limited to folowing)**

A) COMMISSIONING TESTS/CHECKS

1. Test running of all pumps
2. Condenser vacuum test, feed water heater operational tests for establishing correct cascaded flow, heater water levels etc. & checking of all parameters as per approved heat balance diagrams.
3. Test for HP/LP bypass valves operation & their control system.
4. Test for operation of governing control system for turbines.
5. Standard commissioning tests and procedures as per Contractor's practice for steam turbine generator and other equipment / auxiliaries within the Contractor's scope of work.
6. Checks on operation of all individual control loops in the turbine generator control system.
7. Checks on correct functioning of the Turbine Protection System (TPS), Turbine Supervisory Control System (TSCS) for main turbine, Automatic Turbine Run-up System (ATRS), Automatic Testing of Turbine (ATT).
8. Standard commissioning tests and procedures as per Contractor's practice for CEP and other equipment / auxiliaries within the Contractor's scope of work.
9. Checks on operation of all individual control loops in the CEP control system.
10. Standard commissioning tests and procedures as per Contractor’s practice for Drip Pump (if applicable) and other equipment / auxiliaries within the Contractor’s scope of work.
11. Checks on operation of all individual control loops in the Drip Pump control (if applicable) system.
12. Feed water heater operational test for establishing correct cascaded flow, heater water levels and checking of all parameters as per approved heat balance diagram.
13. standard commissioning tests and procedures as per contractor’s practice for heaters and de-aerator and other equipment/auxiliaries within the contractor’s scope of work.
14. Checks on operation of all individual control loops in the heater and deaerator control system.
15. Test for operation of governing control system for BFP turbines.
16. Standard commissioning tests and procedures as per Contractor's practice for BFP and other equipment / auxiliaries within the Contractor's scope of work.
17. Checks on operation of all individual control loops in the BFP control system.
18. Checks on correct functioning of the BFP Turbine for Turbine Protection System (TPS), Turbine Supervisory Control System (TSCS) for main turbine, Automatic Turbine Run-up System (ATRS), Automatic Testing of Turbine (ATT).
19. Calibration tests of orifice, flow nozzles, instruments and control equipment to the extent included in these specifications.
20. Checks on operation of all rotating equipments to ascertain level of noise and vibration

	21. Checks on operation of all static equipments to ascertain level of noise and vibration 22. Standard commissioning tests and procedures as per manufacturer's practice for Generator, Excitation and its auxiliaries within the Contractor's scope of work.
3.06.00	**Balance of Plant equipment & systems** All pre-commissioning tests &activities as required for successful running of the equipment or as mentioned in the technical specification elsewhere shall be performed by the contractor.
4.00.00	**INITIAL OPERATION** Upon completion of system checking/tests and as a part of commissioning of facilities, complete plant/facilities shall be put on initial operation for a period of thirty (30) days or 720 hours as stipulated in General Technical Requirements.
5.00.00	The Contractor shall conduct all the commissioning tests and undertake commissioning activities pertaining to all other auxiliaries and equipments including all Electrical & C&I equipment/systems not specifically brought out above but are within the scope of work and facilities being supplied & installed by the Contractor and follow the guidelines indicated above or elsewhere in these technical specifications (Section-VI).
6.00.00	The Contractor shall conduct the comprehensive guarantee tests on the Steam Generator in co-ordination with the Steam Generator to establish the functional guarantee values at stipulated conditions as per Sub-section-IV, Part-A, Section-VI.
7.00.00	The Contractor shall conduct all the commissioning tests and undertake commissioning activities pertaining to all other auxiliaries and equipments including all Electrical & C&I equipment/systems not specifically brought out above but are within the scope of work and facilities being supplied & installed by the Contractor and follow the guidelines indicated above or elsewhere in these technical specifications (Section-VI).
8.00.00	**COMMISSIONING SPARES**
8.01.00	It will be the responsibility of the Contractor to provide all commissioning spares including consumable spares required for initial operation till the Completion of Facilities. The Contractor shall furnish a list of all commissioning spares within 60 days from the date of Notification of Award and such list shall be reviewed by the Employer and mutually agreed to. However, such review and agreement will not absolve the Contractor of his responsibilities to supply all commissioning spares so that initial operation do not suffer for want of commissioning spares. All commissioning spares shall be deemed to be included in the scope of the Contract at no extra cost to the Employer.
8.02.00	These spare will be received and stored by the Contractor at least 3 months prior to the schedule date of commencement of initial operation of the respective equipment and utilized as and when required. The unutilized spares and replaced parts, if any, at the end of successful completion of guarantee tests shall be the property of the Contractor and he will be allowed to take these parts back at his own cost with the permission of Employer.

ANNEXURE-I

STANDARD CHECKLIST

This is an indicative list of items. The actual list shall depend on the Equipment / System being supplied by the contractor.

MECHANICAL

VALVES

1. Manually Operated Valve
2. Electrically Operated Valve
3. Pneumatically Actuated Valve
4. Hydraulically Actuated Valve
5. Safety Valve
6. Electromatic Relief Valve
7. Steam Trap
8. Non Return Valve (including Hydraulic/ Pneumatic QCNRVS)
9. Control Valve
10. Relief Valve
11. Differential Pressure Regulating Valve
12. One spare EOTV for steam blowing

TANKS & PRESSURE VESSELS

1. Tanks (metal) up to 20 M^3
2. Tanks (Large Storage)
3. Pressure Vessel (Below 17 bars)
4. Air Receiver
5. Pressure Vessel – Access Door

PUMPS

1. Pump-Low Pressure Centrifugal (Motor driven)
2. Pump-Up to 350HP
3. Pump-Sump installation
4. Gear Pump/Screw pump

PIPE WORK SYSTEM

1. Steam services
2. Water services
3. Oil / Fire Resistant fluid system
4. Air services (Compressor)
5. High pressure services
6. Constant load support

7. Spring supports
8. PF Coal
9. Hangers and other Supports

STRAINER AND FILTER

1. Strainer / Filter Basket Type
2. Strainer Rotary (Low Pressure)
3. Filter & Strainers Centrifugal Separators
4. Filter & Strainer Y-Type
5. Filter & Strainer (Plate Type)
6. Purifier
7. Filter – Compressed Air Line

HEAT EXCHANGER

1. Heat Exchanger (General)
2. Heat Exchanger – Oil / Water
3. Rotary Air Heater

FANS & COMPRESSORS

1. Fans –Non-Pressure Lubricated
2. Fans – Axial Flow pressure Lubricated
3. Compressors-General

DAMPERS & GATES

1. Manually Operated Damper
2. Pneumatically Operated Damper
3. Electrically Operated Damper
4. Manually Operated Gates
5. Pneumatically Operated Gate
6. Electrically Operated Gate

DUCT WORK

1. Boiler Flue Ducting
2. Expansion Joints
3. Observation & Access Door

CRANES AND ELEVATORS

1. Auxiliary Overhead Crane
2. Travel Support Structure for Crane
3. Long Travel & Cross Traverse Motion of Crane
4. Main Aux. Hoist Motion (Crane)
5. Crane Electric Hoist

POWER TRNAMISSION

1. Power Transmission Gear Box
2. Bearings
3. Fluid Couplings

BOILER & AUX.SYSTEM

1. Soot Blower Long Retractable
2. Wall Deslagger/Soot Blower
3. Bottom Ash Hopper
4. Fly Ash Hopper
5. Lubricator –Compressed Air Lines
6. Wind Box Assembly
7. Mixer / Stirrer
8. Compressed Air Breathing Apparatus
9. Oil Burner
10. Ignitors
11. Scanner
12. Manual Lubricators
13. Air Motor
14. Driers-Non Regenerative /Regenerative
15. Coal Bunker

ELELCTRICAL

1. D.C. Motor
2. HV Squirrel Cage Induction Motor
3. 415 V Squirrel Cage Induction Motor
4. Motor Operated Actuators
5. Soot Blower (Deslagger)
6. Soot Blower (Long Retractable)
7. Soot Blower (Air Heater)
8. Aux. Control and Relay Panel Desk

CONTROL & INSTRUMENTATION

1. Conductivity Measuring Equipment Including Test Procedures
2. pH Analyser Including Test procedure
3. Level Switch (Float Actuated)
4. Level Switch (Displacer Actuated)
5. Transmitter (Float Operated Pneumatic Output including Testing procedures
6. Level indicator (Float/Pulley Type)

7. Local Temperature Indicator Including Test Procedure
8. Resistance Thermometer Element Including Test procedure
9. Thermocouple Element and Connecting Cable
10. Thermocouple and Resistance Thermometer Convertor/Transmitter Including Test Procedures
11. Temperature Switch Including Test Procedure
12. Cold Junction Boxes
13. 0_2Analyser
14. 0_2 in Hydrogen including Test procedures
15. Pressure and Vacuum Switch Including Test procedures
16. Differential Pressure Transmitter including Test Procedures
17. Differential pressure switch including Test procedures
18. Flow indicator (Variable Area)
19. Orifice plate
20. Flow Switch
21. Nozzle
22. Flow indicator (Float Operated) Including Test Procedure
23. Venturi (Fluid)
24. Flow Switch (Magnetic Type)
25. Limit Switches
26. Position Measurement & Indication Including Test procedures
27. Vibration Measurement
28. Digital Indicator
29. Moving Coil Indicator Including Test Procedures
30. Recorder Including Test procedure
31. Flame Scanner
32. Electrical Auto Manual Control Station
33. Push Button Module
34. Test Procedure for Electronic Modules of DDCMIS
35. Thermo Control Valve
36. Test procedure for Adjustment of Modulating Controller-PID Term
37. Test Procedure Indicating Controller-Electrical Input & Pneumatic Output

ANNEXURE-II

COMMISSIONING PROCEDURES

Following is an indicative list of equipments / systems for which Testing / Commissioning procedures are to be submitted. The actual list will depend on the equipment / system being supplied by the Contractor.

S. No	DESCRIPTION
1.	ID Fan
2.	FD Fan
3.	PA Fan
4.	Air Heater
5.	Scanner Air Fans
6.	Fuel Firing System
7.	Milling System
8.	Soot Blower System
9.	Aux. Steam System
10.	Mill Reject Handling System
11.	HP Bypass System
12.	S.A.D.C. and its control
13.	Boiler Chemical Analysis Equipment
14.	SH / RH Spray system
15.	Chemical Dosing System
16.	Boiler Air and Gas System -Interlock Operation

ANNEXURE-III

COMMISSIONING PROCEDURES REQUIRING APPROVAL OF EMPLOYER

S.NO.	DESCRIPTION
1.	Boiler Hydraulic Test and Preservation
2.	Boiler Chemical Cleaning
3.	Air and Gas Tightness Test of Furnace, Ducts etc.
4.	Steam Blowing of Boiler including Interconnecting Pipe Lines of Boiler, Turbine, Aux. Steam Header and Steam Supply lines.
5.	Steam Blowing and Oil Flushing of Fuel Oil System
6.	Clean Air Flow Test of Coal Pipes
7.	Oil Flushing of Lub Oil System of Rotary Equipments
8.	Cold Air Velocity Test
9.	Flushing of HP Bypass system oil lines

ANNEXURE-IV

Demonstration/Acceptance tests during Commissioning/Initial Operation

The following tests shall be demonstrated during commissioning for which the bidder has to furnish the procedure and get the approval of the employer:

1. Balance Pumps, Blowers, Fans, Compressors and rotating equipment.
2. Balancing of Coal/Primary air flow
3. Demonstration of boiler operation, rate of change of load and sudden load change withstand capability
4. Steam Temperature Imbalance
5. No fuel oil support shall be required above 40% BMCR
6. Capability of all drives
7. Margin on Fans
8. Cold Air Velocity Test (CAVT)

-ANNEXURE-V

BRIEF WRITE UP ON THE CONTENTS OF TESTING / COMMISSIONING PROCEDURE

Testing / Commissioning Procedure is required to be of a standard format in order to maintain consistency of presentation, content and reporting. These should contain the following sections to make the document a self contained one.

1. Plant Details / Design data
2. Objective
3. Proposal
4. Services Required
5. Safety Precautions
6. Emergency Procedures
7. State of the Plant (Status in respect of erection completion of Mech, Elect and C&I items)
8. Method
9. Completion / Acceptance Criteria
10. Appendix
    - Result
    - Log sheet
    - Drawing etc.

e-Learning Package For Effluent Treatment Plant

e-Learning Package:

e-learning packages shall be supplied for the equipment / system for the complete Pre Treatment Plant along with associated electrical and C&I system.

1. The objective of the e-Learning package consisting of courses for erection, commissioning, operation and maintenance of equipment / system as specified above is to facilitate the employees to have first hand information / requirement with respect to above activities for the supplied equipment / system .

2. The bidder shall submit e-learning courses each for erection, commissioning, operation and maintenance of each of the equipment / system supplied as above.

    a. The erection course(s) should include instructions on pre-checks, prerequisites, erection strategy, erection procedure etc.
    b. The commissioning course(s) should include instructions on pre-commissioning, commissioning, initial operation etc.
    c. The operation course(s) should include instructions on the permissive, interlocks, physical check ups, start up, shutdown and protections etc.
    d. The maintenance course(s) should include instructions on predictive, preventive, breakdown and overhauling.

    Depth of coverage of above courses shall be as specified for **"Instruction Manuals"** in General Technical Requirement Part-C, Section-VI of technical specification. A literature on caution / safety while handling equipment / system for the above modules shall follow the description of the said equipment /system.

3. The e-Learning packages on equipment / system shall be installed by the vendor and shall be successfully test run in the presence of EIC or representative before acceptance by NTPC. The vendor will also give the master copy in form of Flash Drive/CD/DVD. The respective module for erection & commissioning shall be delivered and successfully test run at least three months before the scheduled start of the corresponding activity at site. The respective module for operation & maintenance shall be delivered and successfully test run at least three months before scheduled first synchronization of first unit.

4. e-Learning course broad requirements:

a. The courses shall be web based and mobile based Application type. It shall run on all possible versions of web browser like Internet Explorer, Google Chrome, Firefox etc. on Laptop/Desktop and shall be Smartphone/Tablet/Mobile responsive. The Mobile responsive courses shall run on Android, Windows Mobile, Blackberry, iOS etc.

b. The courses shall support liquid/fluid page layout so that the entire screen gets adjusted to PC, Laptop, Smartphone/Mobile, Tablet and any other display devices.

c. Course content text shall be in English language and be associated with a voiceover in English language with Indian accent.

d. Courses shall be SCORM (Sharable Content Object Reference Model) compliant, version 1.2 which is compatible with LMS at PMI.

e. Each course shall have every physical and functional detail of the equipment / system supplied.

f. Each of the e-Learning course shall be based on multiple web pages and mobile pages with multiple modules.

g. There shall be option for self-assessment test after every course. In case the user doesn't opt for self assessment test the user shall be able to go to the next course. There shall be no restriction in no. of times for repeating the assessments. All correct answers along with the answers marked by the users shall be displayed at the end of test/quiz.

h. If Java and Flash, as applicable are not available in the system to run the package, then there shall be a prompt message for updation of the same.

i. Each course shall have a self-running interactive content with navigation buttons containing forward, backward, pause, bookmark and menu options in the course window.

j. The course shall contain chapter titled 'Introduction/overview' that explains the purpose of the course.

k. The course content shall contain descriptive text shall be factual, specific, terse, clearly worded, and simply illustrative, so that the user can understand it.

l. The system shall provide the user with the ability to select the information with a Cursor.

m. The course menu should contain table of content linked to concerned pages. The user shall be given the capability to access all of the functions available on the system through a menu system. This shall consist of active buttons, which shall control a hierarchy of pull down/pop up menus. Menu shall appear quickly and exist only while a selection is being made. The user shall be given the capability to position the cursor or pointer on the menu item and use pointer device such as mouse to activate the function.

n. Every course shall contain the 3D design/drawing/exploded view/360^0 turn around view of the equipment/system, textual description of the equipment/system and its functionality with video (as applicable), animation and audio.

o. The users shall be able to control audio sound level associated with the courses.

p. Drawings / text in the courses shall be scalable (Zoom In/ Out).

q. The user shall have the capability to record a **bookmark** to mark displayed information for later recall, whenever he accesses the same course next time.

Notes:

1. e-learning Package of an equipment / system shall include e-learning courses for each of erection, commissioning, operation and maintenance of that equipment / system.
2. e-learning courses on erection, commissioning, operation and maintenance of an equipment / system shall include e-learning lessons/chapters/modules (as required) for erection, commissioning, operation and maintenance respectively of that equipment / system.
3. The vendor shall get the approval of one sample course from EIC before proceeding for further courses.

VOLUME – III

SECTION – III

LIST OF DOCUMENTS TO BE SUBMITTED ALONG WITH BID

Bidder to furnish following documents/information along with the bid (For Electrical and C&I Please Refer the Respective Section of the Specification).

- Deviation if any strictly in the enclosed Schedule of deviation with cost of withdrawal only with mention of specification clause for which deviation is being asked. (Stamped & Signed). In case of No Technical Deviation, bidder to furnish the same format stating "No Deviation w.r.t. technical Specification" duly Stamped & Signed.
- Compliance certificate. (Stamped & Signed)
- Schedule of Declaration. (Stamped & Signed)
- Un Price Schedule duly filled in. (Stamped & Signed)

Any other documents submitted by bidder except as asked in the bid's specification shall not be evaluated & considered as null & void.

NOTES:

1) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the works 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.

2) All drawings/documents shall be approved by BHEL/Customer during detailed engineering stage. Successful Bidder shall comply with the comments of the customer/BHEL without any price & delivery implication.

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnishing same with the offer:

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
2. QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.
3. QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.
4. All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
5. There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.
6. The offered materials shall be either equivalent or superior to those specified. Also, for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.
7. The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL and Customer).
8. All sub vendors shall be subject to BHEL/CUSTOMER approval.
9. Any special tools & tackles, if required, shall be in bidder's scope.
10. Performance guarantee test parameters shall stand valid till the satisfactory completion of Performance guarantee test and its acceptance by BHEL and Customer.

PRE-BID CLARIFICATION SCHEDULE

All clarification from the Technical Specification shall be filled in by the BIDDER clause by clause in this format only.

VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION

SCHEDULE OF DECLARATION

I …… certify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated …….. and there is no deviation to the specification.

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Bidders Company Name ……

Authorized Representative's
Signature ……

Name ……

Bidder's Name ……

The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated.

SCHEDULE OF DEVIATIONS WITH COST OF WITHDRAWAL

PROJECT:- 2X660 MW TALCHER THERMAL POWER PROJECT STAGE-III

EFFLUENT TREATMENT PLANT

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

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

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

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

NOTES:

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