NTPC 1x500 MW FIROZ GANDHI UNCHAHAR THERMAL POWER PLANT

TECHNICAL SPECIFICATION

FOR CONDENSER ON LOAD TUBE CLEANING SYSTEMS (COLTCS).

Specification No. : PE-TS- 401-165-N002 (REV. 0)

VOLUME -IIB

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
PPEI BLDG., SEC-16A, PLOT NO. 25
NOIDA – 201301 (UP)

1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

1.1 **Volume -I CONDITIONS OF CONTRACT**

This consists of four parts as below:

Volume - I A : This part contains instructions to bidders for making bids to BHEL.

Volume - I B : This part contains general commercial conditions of the tender and include provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.

Volume - I C : This part contains special conditions of contract.

Volume - I D : This part contains commercial conditions for erection and commissioning site work, as applicable.

1.2 **Volume - II TECHNICAL SPECIFICATIONS**

Technical requirements are stipulated in Volume II which comprises of :

Volume - II A : General Technical Conditions

Volume - II B : Technical specification including drawings, if any

1.2.1 Volume - II B:

This volume is sub-divided into following sections:

Section - A : This section outlines the scope of enquiry.

Section - B : This section provides “Project Information”

Section - C : This section indicates technical requirements specific to the contract, not covered in Section-D.

Section - D : This section comprises of standard technical specifications of equipments complete with data sheet A, B & C.
Data sheet-A specifies data and other requirements pertaining to the equipment.
Data sheet - B specifies data to be filled by the bidder (Data Sheet B is contained in Volume - III)
Data sheet - C indicates data documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).

1.2.2 **Volume - III TECHNICAL SCHEDULES**

1.0 This volume contains technical schedules and Data Sheets - B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per instructions given in Document No.PES-100-901 in Volume-III.

2.0 The requirements mentioned in Section C/Data Sheets-A of Section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section -D.

INDEX

SECTION - A
SCOPE OF ENQUIRY

1.00.0 **SCOPE**

This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works properly packed for delivery of the items as follows:

1.01.0 **Condenser On Load Tube Cleaning Systems :**

Condenser On Load Tube Cleaning Systems (COLTCS) complete with all accessories as per the requirements specified in different sections of this specification for:

- **NTPC 1X500 MW FG UTPP.**

The bidder's scope also includes installation checks, commissioning, trial runs & PG Testing at site of COLTCS.

1.01.0 **The bids shall be evaluated as per NIT.**

2.00.00 **GENERAL TECHNICAL INSTRUCTIONS:**

2.01.00 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 standard of design, engineering and workmanship, and shall be capable of performing the required duties in a manner acceptable to Engineer/ Owner, who will interpret the meaning of drawing and specifications, and shall be entitled to reject any component or material, which in his judgement is not in full accordance herewith.

2.0.2.00 The omission of specific reference to any component/ accessory necessary for the proper performance of the equipment's shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of the equipment's at quoted prices.

2.03.00 In case of any deviation from this Technical specification (Vol. IIB) and General Technical Conditions (Vol. IIC), the same shall be indicated in the schedule of deviations enclosed in Volume-III, Part-A. In the absence of duly filled schedules it will be assumed that the bid strictly conforms to the specification.

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

2.05.00 The equipment's covered under this specification shall not be despatched unless the same have been finally inspected, accepted and shipping release issued by BHEL/ Customer

2.06.00 Un-priced copy of price bid shall be furnished along with the technical bid.

SECTION – B

PROJECT INFORMATION

Annexure-IB

CLAUSE NO.	PROJECT INFORMATION 11748

1.00.00 **BACKGROUND**

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

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

1.01.00 **LOCATION AND APPROACH**

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

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

1.02.00 **LAND REQUIREMENT**

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

1.03.00 **WATER**

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

1.04.00 **COAL AVAILABILITY AND TRANSPORTATION**

1.04.01 **Coal Availability**

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

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

1.04.02 **Coal Transportation**

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

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

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

1.05.00 **CAPACITY & POWER EVACUATION**

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

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

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

1.06.00 **METEOROLOGICAL DATA**

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

1.07.00 **PLANT WATER SCHEME**

The Plant water scheme is described below.

1.07.01 **Source of Water**

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

1.07.02 **Water Requirement**

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

1.07.03 **Raw Water System**

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

1.07.04 The quality of Raw water and Clarified water is enclosed with this sub-section

1.08.00 **Criteria for Wind Resistant Design of Structures and Equipment**

All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given in Sub-Section- D-01, Part-B, Section-VI, i.e. Technical Specification for Civil and Structural Works.

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

All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in Sub-Section- D-01, Part-B, Section-VI, i.e. Technical Specification for Civil and Structural Works.

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DESIGN RAW WATER ANALYSIS

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

DESIGN CLARIFIED WATER ANALYSIS FOR DM PLANT

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

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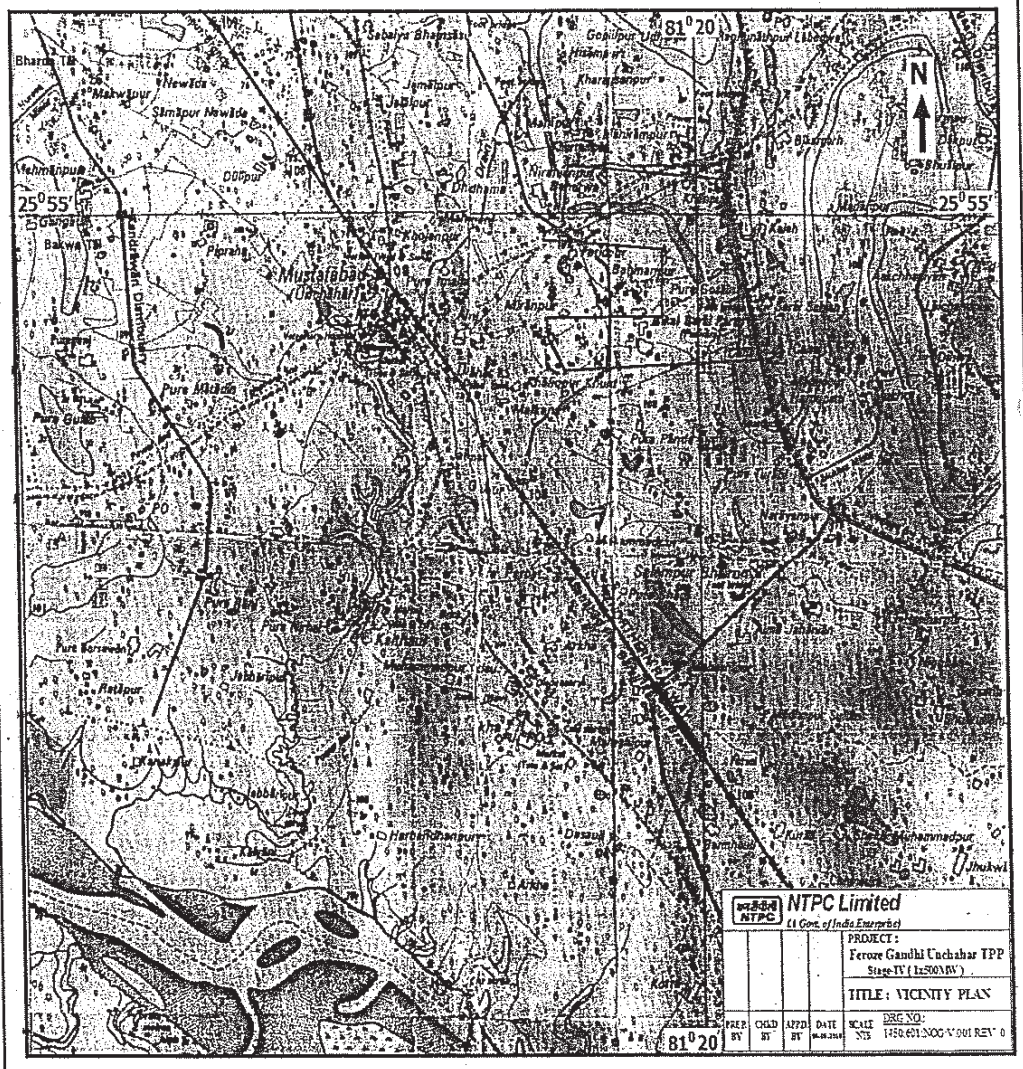
VICINITY PLAN

ANNEXURE- I



ANNEXURE-II-1 (PAGE 1 OF 2)

TABLE – 1 COAL CHARACTERISTICS

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

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

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ANNEXURE-II-2 (PAGE 1 OF 2)

FUEL OIL CHARACTERISTICS

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

ANNEXURE-II-2 (PAGE 2 OF 2)

LIGHT DIESEL OIL CHARACTERISTICS

AS PER IS 1460-2000

Characteristics		LDO
1.	Pour Point (max)	21 °C & 12°C for Summer and Winter respectively
2.	Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.7
3.	Sediment percent by mass (max)	0.10
4.	Total sulphur percent by mass (max)	1.8
5.	Ash percentage by mass (max)	0.02
6.	Carbon residue (Rans bottom) percent by pass (max.)	1.50
7.	Acidity inorganic	Nil
8.	Flash point (Min.) - Pensky Martens	66 deg.C
9.	Copper strip corrosion for 3 hours at 100°C	Not worse than No. 2
10.	Water content, % by volume (max)	0.25

NTPC BHEL POWER PROJECTS PRIVATE LIMITED NBPPL

CLIMATOLOGICAL TABLE

ANNEXURE-III
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जलवायवी सारणी
CLIMATOLOGICAL TABLE

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

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

AIR TEMPERATURE (वायु तापमान)

	Station level pressure (स्टेशन का सतह दाब) hPa	Mean: Dry bulb (शुष्क बल्ब) °C	Mean: Wet bulb (नम बल्ब) °C	Mean: Daily max (दैनिक अधिक तम) °C	Mean: Daily min (दैनिक न्यूनतम) °C	Mean: Highest in the month (मास में उच्चतम) °C	Mean: Lowest in the month (मास में निम्नतम) °C	Extremes: Highest (उच्चतम) °C	Extremes: Date and year (दिनांक और वर्ष)	Extremes: Lowest (निम्नतम) °C	Extremes: Date and year (दिनांक और वर्ष)
I	1006.2	12.5	10.6	23.0	6.7	27.9	4.5	31.1	29 1934	2.0	07 1972
II	1003.1	20.6	15.0								
I	1003.8	16.0	12.5	27.2	11.2	32.4	6.1	30.1	27 1896	1.1	02 1905
II	1000.6	24.8	16.5								
I	1000.8	23.0	16.0	33.6	16.5	39.0	10.9	42.5	30 1873	7.2	02 1900
II	996.9	31.4	18.6								
I	996.5	30.2	19.1	39.4	22.5	43.5	17.3	45.1	29 1979 ©	12.7	01 1966
II	992.3	37.3	20.5								
I	991.0	33.5	22.2	42.3	25.7	49.9	22.5	47.3	20 1966	17.2	11 1924
II	987.4	40.1	22.0								
I	988.0	32.8	25.3	40.1	28.5	45.2	24.0	48.8	09 1979	19.4	21 1930
II	984.2	37.3	25.6								
I	988.0	29.2	26.4	34.1	26.4	39.3	23.5	45.6	01 1901	22.0	22 1975
II	985.0	31.5	27.0								
I	989.7	28.3	26.3	32.7	25.7	38.5	23.6	42.7	03 1972	21.1	23 1953
II	986.5	30.2	26.9								
I	993.0	28.2	25.5	33.2	24.7	38.2	22.3	39.6	11 1900	16.3	22 1912
II	990.0	30.4	26.1								
I	1000.0	25.8	21.8	33.1	20.5	35.8	15.9	40.6	03 1898	11.7	31 1898
II	996.7	29.7	22.9								
I	1004.0	19.0	15.8	29.7	13.8	32.7	9.6	35.9	07 1965	5.6	30 1941
II	1001.4	25.2	18.4								
I	1006.6	14.0	11.7	24.0	9.3	28.4	5.3	31.1	02 1946	-0.7	26 1961
II	1003.8	20.7	15.6								
Annual I	997.6	24.5	19.4	32.8	19.5	48.1	3.0	48.8		-0.7	
Annual II	994.0	29.9	21.3								
Years I	30	30	30	30	30	30	30	100		100	
Years II	30	30	30								

HUMIDITY, CLOUD AMOUNT, RAINFALL (वर्षा), WIND

	Relative humidity (सापेक्ष आर्द्रता) %	Vapour pressure (वाष्प दाब) hPa	All clouds (समस्त मेघ) Oktas of sky	Low clouds (निम्न मेघ) Oktas of sky	Monthly total (मासिक योग) mm	No. of rainy days (वर्षा के दिनों की संख्या)	Total in wettest month with year mm	Total in driest month with year mm	Heaviest fall in 24 hours mm	Date and year	Mean wind speed (माध्य पवन गति) Km/h
I	78	11.3	2.1	0.7	19.2	1.6	126.0 1900	0.0	70.9	24 1900	3.4
II	53	12.7	2.0	0.5							
I	66	11.9	1.7	0.6	15.6	1.4	103.8 1920	0.0	51.3	11 1898	4.1
II	40	12.1	1.9	0.6							
I	46	12.6	1.8	0.4	9.2	0.9	81.0 1944	0.0	35.5	11 1978	4.8
II	26	10.6	2.0	0.5							
I	32	13.1	1.5	0.2	5.7	0.5	43.7 1933	0.0	26.8	01 1985	6.9
II	18	10.6	1.9	0.5							
I	38	17.4	1.4	0.6	9.9	0.7	62.3 1971	0.0	54.0	18 1971	7.0
II	20	13.6	1.5	0.6							
I	55	25.9	3.8	1.4	95.4	4.4	526.5 1916	0.0	176.0	23 1916	8.0
II	41	23.2	4.2	2.1							
I	80	32.1	6.4	3.6	300.1	12.8	702.1 1925	26.2 1918	229.4	15 1963	7.4
II	71	32.0	6.5	3.7							
I	85	32.5	6.6	3.9	307.6	14.4	914.7 1953	53.3 1903	335.3	20 1953	6.2
II	77	32.7	6.8	3.8							
I	80	30.4	4.8	2.8	189.8	8.7	781.5 1970	0.5 1907	266.2	04 1938	5.7
II	71	30.4	5.0	2.9							
I	69	23.1	1.9	0.8	40.1	2.2	576.8 1894	0.0	163.3	04 1894	3.4
II	55	22.5	2.8	1.0							
I	65	15.0	1.3	0.2	11.7	0.5	110.1 1956	0.0	96.0	01 1956	2.4
II	49	15.8	1.4	0.3							
I	75	12.1	1.8	0.3	3.4	0.5	60.3 1985	0.0	54.6	11 1986	2.6
II	50	13.8	1.7	0.3							
Annual I	64	19.8	2.9	1.3	1017.7	40.8	1935.5	410.5	335.3		* 6.1
Annual II	48	19.2	3.1	1.4			1894	1968			
Years I	30	30	30	21	29	29	99	99	99		24
Years II	30	30	30	21							

CLIMATOLOGICAL TABLE

ANNEXURE-III
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जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्टेशन : इलाहाबाद
STATION : Allahabad

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

पवन / WIND — पवन की गति के साथ दिनों की संख्या (कि. मी. प्र. घं.) / No. OF DAYS WITH WIND SPEED (Km. p. h.); पवन की दिशा के दिनों की संख्या का प्रतिशत / PERCENTAGE No. OF DAYS WIND FROM

माह MONTH		वर्षण 0.3 मि.मि.या अधिक PPT 0.3mm or more	ओले HAIL	गर्जन THUNDER	कुहरा FOG	धूल भरी आंधी DUST STORM	चंड वात SQUALL	62 या अधिक 62 or more	20-61	1-19	0	N	NE	E	SE	S	SW	W	NW	CALM
जनवरी JAN	I	3.0	0.2	1.3	4.6	0.1	0.1	0	0	19	12	2	5	9	4	5	10	25	3	31
	II							0	0	18	13	8	11	8	2	0	1	21	16	35
फरवरी FEB	I	2.8	0.1	2.3	1.3	0.0	0.2	0	0	19	9	4	4	6	4	4	10	28	6	28
	II							0	1	22	5	0	9	5	1	2	2	31	26	16
मार्च MAR	I	1.7	0.0	2.9	0.1	0.4	0.7	0	1	25	5	4	4	8	5	8	19	30	7	15
	II							0	2	26	3	12	6	3	1	1	2	29	38	8
अप्रैल APR	I	1.0	0.1	2.3	0.0	0.9	0.4	0	2	24	4	2	6	10	6	8	16	32	10	11
	II							0	4	24	2	13	8	3	1	1	2	26	45	2
मई MAY	I	1.3	0.0	2.7	0.0	1.5	0.5	0	2	24	5	8	10	19	8	6	9	27	9	11
	II							0	3	26	2	18	15	5	1	2	3	18	30	2
जून JUN	I	6.5	0.0	8.0	0.0	2.7	1.1	0	4	23	3	3	11	21	0	5	12	25	9	0
	II							0	5	24	1	12	19	14	3	3	6	18	21	4
जुलाई JUL	I	16.8	0.0	12.0	0.0	0.2	0.4	0	3	25	3	2	8	23	6	10	17	21	4	9
	II							0	2	25	4	5	12	10	6	8	13	20	8	10
अगस्त AUG	I	18.2	0.0	12.0	0.0	0.5	0.4	0	2	25	4	2	9	23	7	7	12	19	6	15
	II							0	1	26	5	7	14	17	4	6	9	23	8	13
सितम्बर SEP	I	11.5	0.0	8.4	0.1	0.0	0.6	0	2	24	4	4	9	20	0	6	11	23	7	14
	II							0	1	22	7	10	13	16	3	2	8	17	15	18
अक्तूबर OCT	I	3.5	0.0	2.7	0.4	0.1	0.2	0	0	20	11	3	7	10	8	8	10	20	6	32
	II							0	1	14	16	11	9	7	1	0	2	7	14	49
नवम्बर NOV	I	0.8	0.0	0.2	0.4	0.0	0.0	0	0	15	15	2	3	3	3	3	11	28	5	42
	II							0	0	10	20	9	4	2	0	0	0	8	12	65
दिसम्बर DEC	I	0.9	0.0	0.4	3.7	0.0	0.0	0	0	17	14	1	2	6	2	3	13	29	3	42
	II							0	0	10	21	0	8	4	0	0	0	12	9	63
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I	68.0	0.4	55.2	10.5	6.4	4.6	0	16	260	69	3	6	13	5	6	14	28	6	21
	II							0	20	246	99	10	11	8	2	2	4	19	21	20
वर्षों की सं. NUMBER OF YEARS	I	26						24				30								
	II							24				30								

मेघ / CLOUD — मेघ मात्रा (सभी मेघ) सहित दिनों की संख्या - अष्टमांश / No. OF DAYS WITH CLOUD AMOUNT (ALL CLOUDS) OKTAS; निम्न स्तरी मेघ मात्रा सहित दिनों की संख्या - अष्टमांश / No. OF DAYS WITH LOW CLOUD AMOUNT OKTAS

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

माह MONTH		All 0	All T-2	All 3-5	All 6-7	All 8	Low 0	Low T-2	Low 3-5	Low 6-7	Low 8	कुहरा FOG 8	UP TO 1 Km (1 कि.मी. तक)	1-4 Kms	4-10 Kms	10-20 Kms	OVER 20 Kms
जनवरी JAN	I	16	5	4	3	3	26	2	2	1	1	0	1.8	12.7	14.8	0.5	1.2
	II	15	7	4	4	1	24	4	2	1	0	0	0.1	2.0	26.9	2.0	0.0
फरवरी FEB	I	16	4	4	3	1	23	2	2	1	0	0	0.6	0.3	20.7	0.4	0.0
	II	15	5	4	3	1	22	3	2	1	0	0	0.0	1.3	20.3	5.2	1.2
मार्च MAR	I	18	6	5	3	1	26	3	2	0	0	0	0.0	2.0	27.0	2.0	0.0
	II	14	6	5	5	1	25	4	2	0	0	0	0.0	1.3	21.0	0.7	0.0
अप्रैल APR	I	18	5	4	3	0	27	2	1	0	0	0	0.0	3.0	24.7	2.3	0.0
	II	15	6	5	3	1	23	6	2	0	0	0	0.0	1.9	22.6	5.0	0.6
मई MAY	I	18	6	4	3	0	26	3	2	0	0	0	0.0	3.7	22.5	3.6	1.2
	II	9	10	6	4	2	20	6	5	0	0	0	0.1	3.6	23.8	3.5	0.0
जून JUN	I	7	5	7	7	4	15	7	5	2	1	0	0.1	2.2	24.7	3.0	0.0
	II	0	4	10	11	5	10	9	10	1	0	0	0.3	3.1	23.1	3.5	0.0
जुलाई JUL	I	0	2	6	13	11	5	7	11	7	1	0	0.0	0.9	24.5	5.6	0.0
	II	0	1	5	16	9	1	7	17	5	1	0	0.2	1.8	22.1	0.9	0.0
अगस्त AUG	I	0	1	4	15	11	4	5	12	9	1	0	0.0	1.3	23.1	6.4	0.2
	II	1	0	5	16	8	1	7	17	5	1	0	0.0	0.9	19.6	10.4	0.1
सितम्बर SEP	I	4	4	6	10	6	9	6	8	6	1	0	0.0	0.8	21.7	7.3	0.2
	II	2	4	8	11	5	3	10	12	4	1	0	0.0	0.8	17.5	10.6	1.1
अक्तूबर OCT	I	16	6	4	3	2	24	3	3	1	0	0	0.0	1.2	23.7	6.1	0.0
	II	12	9	5	3	2	16	10	4	1	0	0	0.0	0.2	21.2	8.9	0.7
नवम्बर NOV	I	19	5	3	2	1	28	1	1	0	0	0	0.0	7.6	21.5	0.9	0.0
	II	17	7	0	2	1	27	2	1	0	0	0	0.0	1.3	26.5	2.2	0.0
दिसम्बर DEC	I	19	5	3	3	1	29	1	1	0	0	0	1.3	15.7	13.0	0.1	0.0
	II	16	7	4	3	1	28	2	1	0	0	0	0.0	2.9	25.0	2.2	0.0
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	I	149	54	53	68	41	241	42	50	27	5	0	3.8	57.4	282.0	38.2	2.8
	II	118	68	64	61	38	200	69	75	18	3	0	0.7	21.1	270.4	69.1	3.7
वर्षों की सं. NUMBER OF YEARS	I	27					27						27				
	II	27					27						27				

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SECTION – C

SPECIFIC REQUIREMENTS

SECTION C1 : CONDENSER ONLOAD TUBE CLEANING SYSTEMS

SECTION C2 : ELECTRICAL SYSTEMS

SECTION C3 : C&I SYSTEMS

SECTION C1

CONDENSER ONLOAD TUBE CLEANING SYSTEMS

(MECHANICAL DETAILS)

1.0 GENERAL

The Condenser On load Tube Cleaning Systems (COLTCS) complete with all accessories shall conform to the standard technical specifications (Section-D) and Data Sheet-A enclosed herewith. In addition the requirements of this section C shall also be complied with. However, wherever the details given in Section-D and Data Sheet-A are different, the requirements of Data Sheet-A shall prevail. Similarly in the event of contradictions between Section-C & Section-D/ Data Sheet-A, Section-C shall prevail.

Section C consists of 3 parts viz. Sec. C1, C2 and C3 for Mechanical, Electrical and C&I respectively, the requirements of all 3 sections shall be complied with.

2.0 DESCRIPTION OF EQUIPMENTS :

2.1 **Condenser on load tube cleaning systems (COLTCS) :**

The condenser on load tube cleaning system (COLTCS) is intended to prevent formation of various forms of fouling and scaling in the condenser tubes. The cooling water system is of closed circuit type with cooling towers or open circuit type as specified. The water analysis is indicated in project information in section B.

3.0 SCOPE OF SUPPLY UNDER THE SPECIFICATION IN THE BIDDER'S SCOPE FOR COLTCS.

3.1 The scope of supply for COLTCS covered under this specification is as under.

The size, MOC's and other particulars of the equipments for various projects are detailed in Data Sheet A annexed with Section – D of the specification.

SL.NO.	PROJECT	COLTCS
1.	1X500 MW FGUTPP	2 SETS

3.2 **SCOPE OF SUPPLY IN THE BIDDER'S SCOPE FOR COLTCS:**

3.2.1 Each set of COLTCS for each projects shall comprise of following :

a) One No. Ball Separator at Condenser CW outlet pipe.
b) One No. Ball recirculation pump with drive motor.
c) One No. Ball collector.

d) One No. Manual ball sorter (Bucket type sorter with sieves to manually sort out the undersized balls by shaking the sieved bucket manually) for each set of COLTCS.

e) Differential pressure measuring system for ball separator. DP measuring system shall comprise of 2 nos. DPT +1 no. DPG for each COLTCS. Instrument shall be with *Remote seal* arrangement. Stubs for DPT and DPG shall be independent.

f) Ball monitoring system comprising of an independent balls recirculation monitor and an independent balls oversize monitor. If bidder is not manufacturing Ball over size monitor then they can offer other alternatives like automatic ball sorter etc.

g) Length of Ball separator, Scope of Counter Flange, Nuts and bolts shall be as per Annexure- I of section C1.
Thickness of body flange and counter flange shall be as per Drg no PE-DG-999-141-MO17 enclosed at enclosures at Annexure-II.

h) Complete Pipe work, including interconnection piping, flanges/counter flanges for valves & pipes, bends, fittings, distributors, nozzles and support installation materials shall be in Bidder's scope. Bidder shall finalize the pipework to suit the layout at contract stage in such a way that no site welding is required for his pipework otherwise the same shall be carried out by bidder at site.

i) The Electrical and C&I item / accessory as specified in succeeding clause/ respective sections herein.

j) Power and Control cables between starter panel (switch gear) and various drives in bidder's scope of supply.

k) Starter Panel (switch gear panel) shall be as follows:

a) 2 Sets of COLTCS shall have one Common Starter Panel (switch gear panel) for DCS based control system.

Switch Gear Panel should have suitable arrangement like Bus Coupler for providing redundancy to incoming supply feeder (1 working + 1 supply feeder).

l) Control cables between field instruments and Control panel.

m) All the field instruments stipulated in this specification shall be in Bidder's scope.

n) Commissioning balls and other commissioning spares on "As required basis".

o) Set of mandatory spares as indicated in Data Sheet A.

p) Supporting arrangement complete with saddle support (as required as per layout), foundation plates, anchor bolts, nuts, sleeves, inserts, all installation materials, fixing bolts, clamps and other accessories etc. for complete equipment supplied under this package.

q) Finish paints for touch up painting of equipment after erection at site, in sealed containers.

r) Set of special tools and tackles (if required) for maintenance and erection of the equipment supplied.

s) Various drawings, data test reports/ certificates instruction manuals for erection operation and maintenance etc. as specified in Data Sheet-C. and cables schedule indicating BOQ for power & control cables.

t) Panels & Instruments: Scope and Type as specified in C&I section wherever required.

Any item not specified but required to make COLTCS a complete package shall also be in bidder's scope.

4.0 SCOPE OF SERVICES INCLUDED IN THE BIDDER'S SCOPE :

The bidder's scope also includes following services at site, for scope under this specification for COLTCS for respective projects

a) Installation checks (Erection in BHEL's scope).
b) Commissioning of equipment.
c) Trial run for requisite period
d) Performance Testing.

The trial run of equipment shall be generally conducted immediately after commissioning while PG testing shall be conducted at a later date. These activities for different units shall be timed separately.

The no. of visits may be suitably assessed by bidders as per their experience with site stay periods on as required basis.

In the event of order number of visits as follows shall be made as a minimum with charges included in the bidder's base price itself.

- **For drawings/documents approval**
  In the event of order all drawings / documents in soft as well as hard copy shall be submitted as per NIT.

  Further on receipt of Customer comments, if required bidder's engineer shall visit BHEL/ Customer alongwith soft copy to resolve all issues and incorporate comments in the soft copy for across the table finalisation and Category-I approval.

- **Site Visits :**

  i. No. of site visits for combined activities of erection checks and commissioning for COLTCS as applicable shall be one per unit - for both sets of equipments of one unit. Time duration for erection and commissioning shall be "on as required basis" with equipments run for trial operation thereafter for requisite period to demonstrate satisfactory operation.

  However the no. of visits may be suitably assessed by bidders as per their experience with site stay periods on as required basis.

  ii. Bidder shall demonstrate guarantees including balls recovery, life of balls, pressure drops, etc. at site during subsequent visit for COLTCS of each unit.

  iii. For trouble shooting on "as required basis".

5.0 EXCLUSIONS :

The following are excluded from the bidder's scope .

5.1 Civil foundation works required for installation
5.2 Erection of Equipment at site.

6.0 DESIGN CONSTRUCTION :

In addition to the requirements of Section-D the following shall also be complied with for packages/ projects under scope of this specification:

6.1 For COLTCS - Layout Piping Arrangement Drg. is enclosed in the specifications at Annexure-III.

6.2 Thickness of body flange and counter flange of COLTCS shall be as per Drg no PE-DG-999-141-MO17 enclosed at enclosures at Annexure-II.

6.3 The materials of construction specified in Data Sheet-A are minimum requirements and materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty which shall be subject to purchaser's approval during detailed engineering in the event of order.

6.4 Housing/ body of COLTCS shall be designed and manufactured as per the applicable codes for pressure vessels and to take care of force and moments as enclosed in the specification. However in no case thickness of housing/ body shall be less than connecting pipe thickness as specified in Data Sheet-A of COLTCS.

6.5 Adequate provision for future installation of Cathodic Protection for COLTCS (Sacrificial type) shall be kept by the bidder in the equipment.

6.6 Any flow straightner for streamlining the CW flow in balls collecting strainer if required shall be supplied by the bidder along with mounting arrangement and the fixing details.

6.7 Velocity in the pipe work shall be less than 1.5 m/ sec for pump suction and less than 2.5 m/ sec. in other pipe work. All valves upto 150 NB shall be ball valves. For higher sizes, gate/ globe/ B.F. valves shall be provided. All instrument valves shall be needle valves.

7.0 Performance Guarantee and Testing :

The Tube Cleaning Systems shall be guaranteed to meet the performance requirements specified in Section-D and also for trouble free operation after commissioning. Schedule of performance guarantees (enclosed in Volume III) duly filled and signed shall be furnished with the bid.

The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Consultant/Customer. If the guarantee period specified in the Commercial Specification is higher, same shall prevail.

8.0 Performance Guarantee and Bid Evaluation criteria for Condenser on Load Tube Cleaning System.

8.1 **Condenser On Load Tube Cleaning Systems.**

8.1.1a Performance Parameters to be guaranteed by bidders for COLTCS-under penalty (Liquidated damages) shall be as under :

i) Pressure drop in ball separator in clean condition (test to be conducted along with commissioning of COLTCS).

The cl. No. 8.1.2 in subsequent paragraphs shall be referred regarding liquidated damages.

8.1.1b Performance Parameters to be guaranteed by bidders for COLTCS-under demonstration category under compulsory corrections shall be as under:

ii) Percentage recovery of balls (min. 90% recovery for 3 weeks with 8 hrs operation of COLTCS per day)

iii) Life of Sponge Rubber Ball (Min. 3 weeks with 8 hrs operation of COLTCS per day**).**

For demonstrating the parameters at sl. No. (ii) & (iii) above, the COLTCS system shall be operated 24 hrs per day for one week.

Any deviation to above balls life and percentage recovery will not be accepted.

In case the successful bidder fails to demonstrate any of these parameters he shall carry out modifications at his own cost, to purchaser's approval.
In case bidder fails to demonstrate above parameters to purchaser's satisfaction even after modification carried by him at site, the purchaser has the right to reject the equipment out rightly.

8.1.1 Bidder to note that bids shall be evaluated on account of pressure drop across ball collecting strainer (in clean condition) and liquidated damages on account of not meeting the same during PG test shall be in accordance with following:

A) Bid Evaluation Criteria & Liquidated Damages:

The bids received shall be evaluated for Pressure drop across balls collecting strainers:

- The permissible limit of pressure drop across balls collecting strainers in clean condition shall be 0.15 MWC.

- If the pressure drops quoted are higher than above limit, the bids shall be technically loaded @ Rate as mentioned in Data Sheet-A on pro-rata basis for respective projects per **0.05 MWC** pressure drop across each balls collecting strainer.
- However no advantage shall be given for pressure drops quoted less than above permissible limit.
- The maximum acceptable limit for pressure drop across balls collecting strainer shall be (with technical loadings) 0.2 MWC.
  The bids will be technically rejected for pressure drops quoted higher than above maximum limit.
- The guaranteed pressure drops shall be demonstrated at site by bidder and if found higher shall be subject to LD @ twice the bid evaluation factor as above.

9.0 SPARES :

9.1 **Recommended Spares :**

Bidder to submit the list of recommended spares (along with prices) as per NIT required for three (3) years of reliable operation and maintenance of COLTCS for BHEL reference purpose only.

The recommended spares shall not be considered for evaluation and ordering purpose.

9.2 **Mandatory Spares**

Mandatory Spares shall be as per Data Sheet-A or annexure enclosed with data sheet A.

10.0 **Quality Plan**

Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ Customer approval and 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. Charges for 3rd party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself. Witness for all the test identified under agency “C” & “N” in Quality plan shall be by third party.

If BHEL or BHEL customer decides to witness the tests along with third party, the cost of travel of BHEL or BHEL customer shall be borne by BHEL or BHEL customer themselves.

10.0 DELIVERY & DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE :

a. Delivery of Equipment for each project shall be as per NIT.

b. Drawings submission schedule shall be as per NIT/as advised by Project Group.

11.0 The makes of various bought out items shall be subjected to purchaser's approval in the event of order.

12.0 It is mandatory for the bidders to submit along with the bid the deviations if any whether major or minor in the schedule of deviations only. ***In the absence of deviations listed in the schedule of deviations the offer shall be deemed to be in full conformity with the specification "non-withstanding" anything else stated elsewhere in bidder's offer, data sheets etc. The implied/ indirect deviations in data sheets etc. Shall not be binding on the purchaser.***

13.0 The following documents shall be furnished by the bidder with his offer :

- Compliance certificate duly signed and stamped (Enclosed at Schedules).
- Guarantee schedule duly signed and stamped (Enclosed at Schedules).

- GA drawings of following with empty/ filled-ups.
  - Balls Collecting Strainers (as applicable).
  - Balls recirculating Skids.
  - Other equipments considered necessary for Layout/ Civil.

- Electrical Load Data (Enclosed at Vol. III of Specification)
- Schedule of Deviation (Enclosed at Schedules).

The bidder to note that load requirement furnished and finalised during tender stage shall only be provided by BHEL and any changes or additional requirement of Electrical load by bidder during contract stage shall be provided by BHEL with cost repercussions to the bidder.

NOTE: Apart from above, no other drawing/ document/ data sheet etc. shall be submitted along with the offer. If any drawing/ document etc. is submitted with the offer, same shall be considered as for ‘Reference’ purpose only and shall not be reviewed/ commented upon and any deviation, exclusion to scope, etc. taken in documents but not highlighted in the deviation schedule shall not be taken cognizance of.

ANNEXURE- I

COLTCS

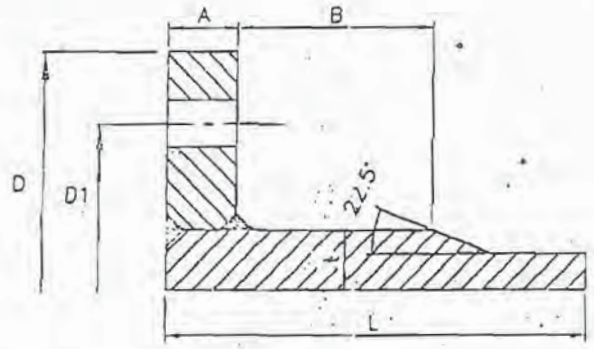
SL.NO.	Projects	Size (NB)	Length of Ball Seperator (Including Counter Flange)	Scope of Counter Flange	Scope of all Gaskets, nuts and bolts.
1	1X500 MW FG UTPP	2200 NB	3010 mm	In Bidder's Scope	In Bidder's Scope

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

DRAWING NO. PE-DG-999-141-M017

ANNEXURE-I)



NOTES:-

Flange thicknesses listed are for Design pressure=5Kg/cm²(g) and Flange dimensions as given in the table. Final thickness of the flange is to be checked for actual OD/Bolting PCD/Neck dimensions.

PIPE SIZE	PIPE THK.	FLANGE OD 'D'	Bolt PCD 'D1'	WELD NECK FLANGE				SLIP-ON FLANGE THICKNESS
				FLANGE THK. 'A'	NECK THK. 't'	NECK Length 'D'	Appx. Total Length 'L'	
1200	10-12	1465	1380	40	24	70	200	90
1400	14	1675	1590	50	24	70	200	100
1600	14	1915	1920	60	32	80	220	110
1800	14-16	2115	2020	70	32	90	250	120
2200	18	2550	2420	80	36	100	300	140
2300	20			90	38	110	325	150
2500	20			90	38	110	325	150
2700	20			90	38	110	325	150

DRAWING FOR BALL SEPARATOR COUNTER FLANGE

REV.	DATE	ALTD	CHD	APPD

JOB NO. 999

STATUS -

DISTRIBUTION

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
PPEI, NOIDA

DEPT CODE		NAME	SIGN	DATE
	DRN	PM		25.06.07
	DSGN	PM		25.06.07
	CHD	SPV		25.06.07
	APPD	SM		25.06.07

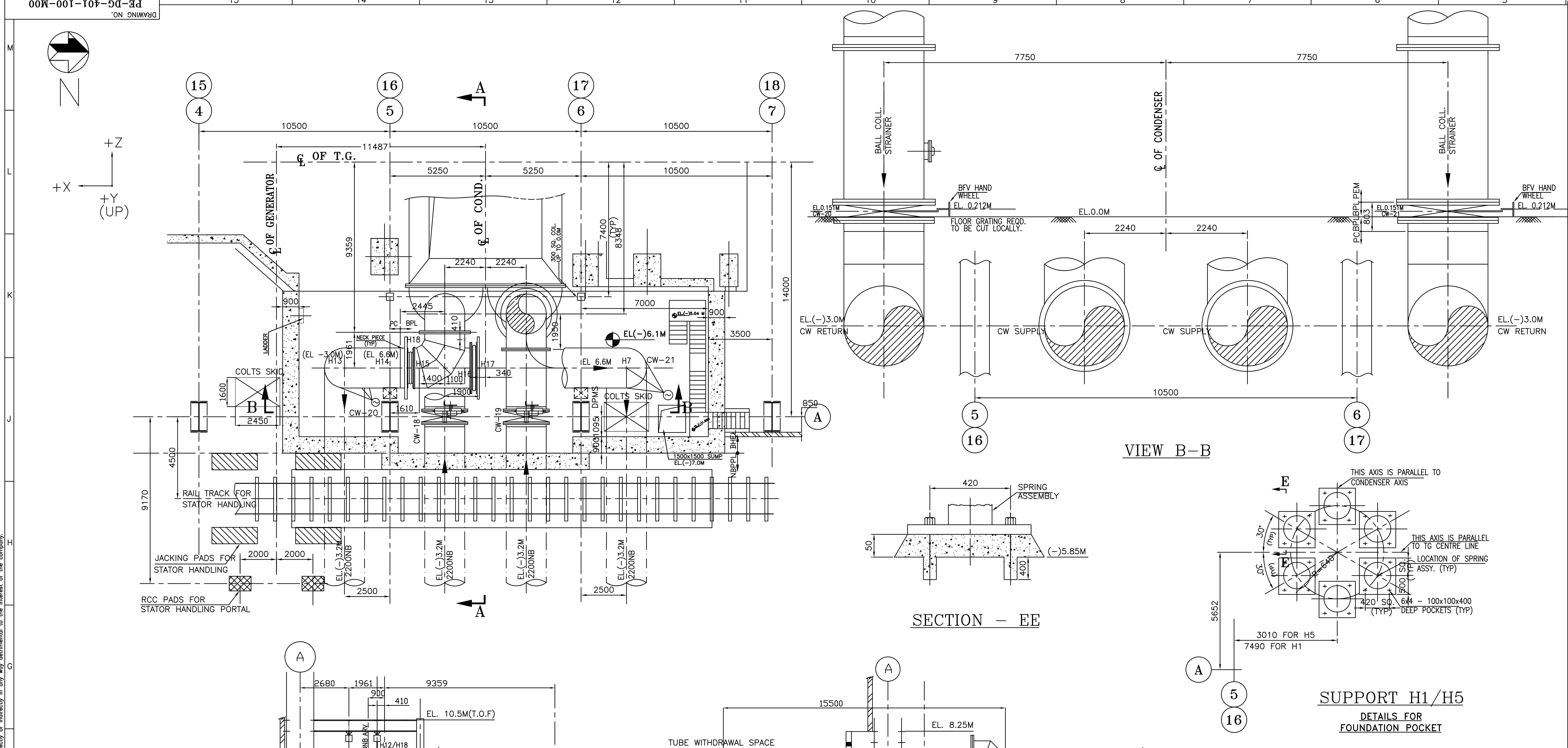
TITLE
COUNTER FLANGE DETAILS

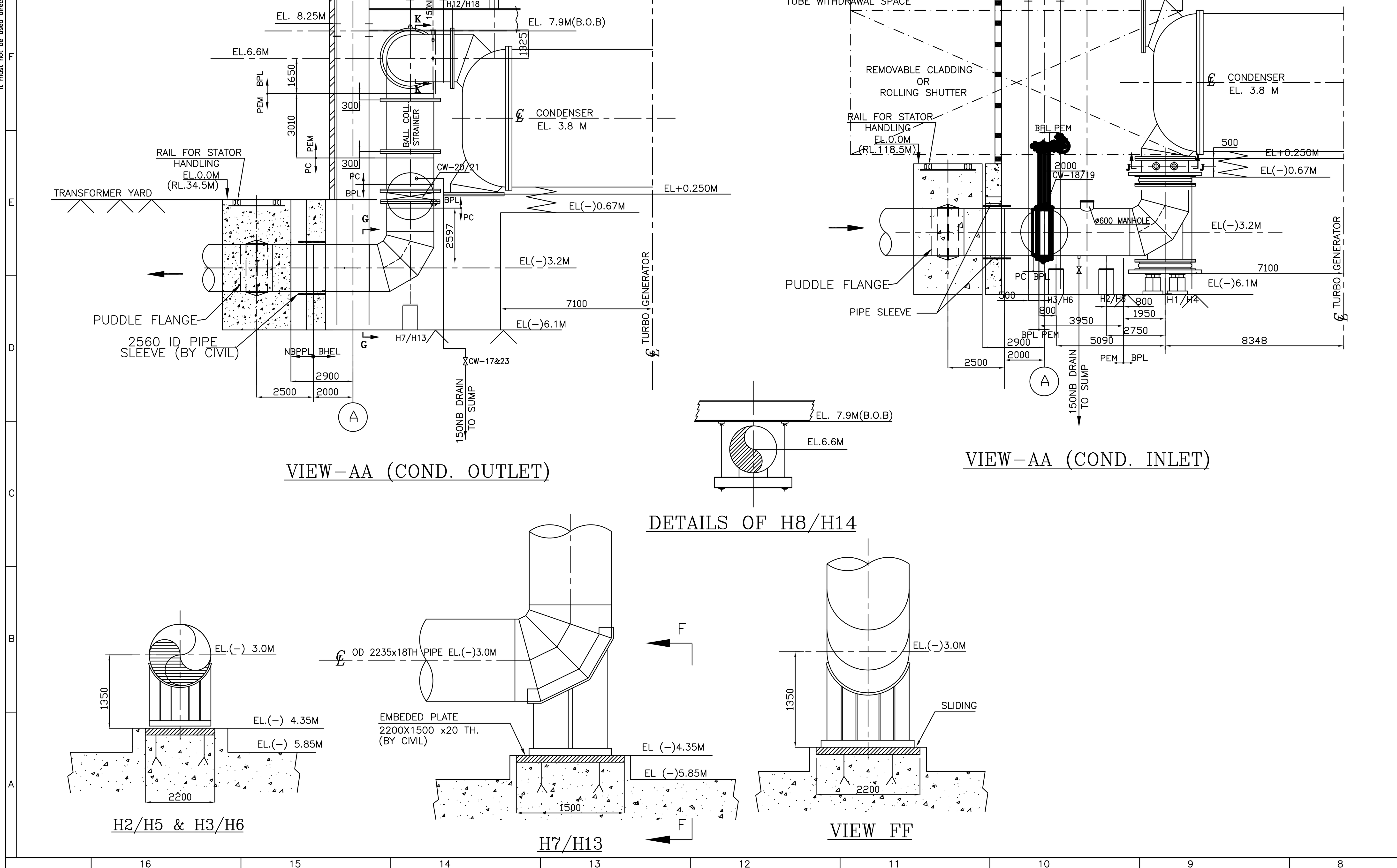
DRAWING NO.
PE-DG-999-141-M017

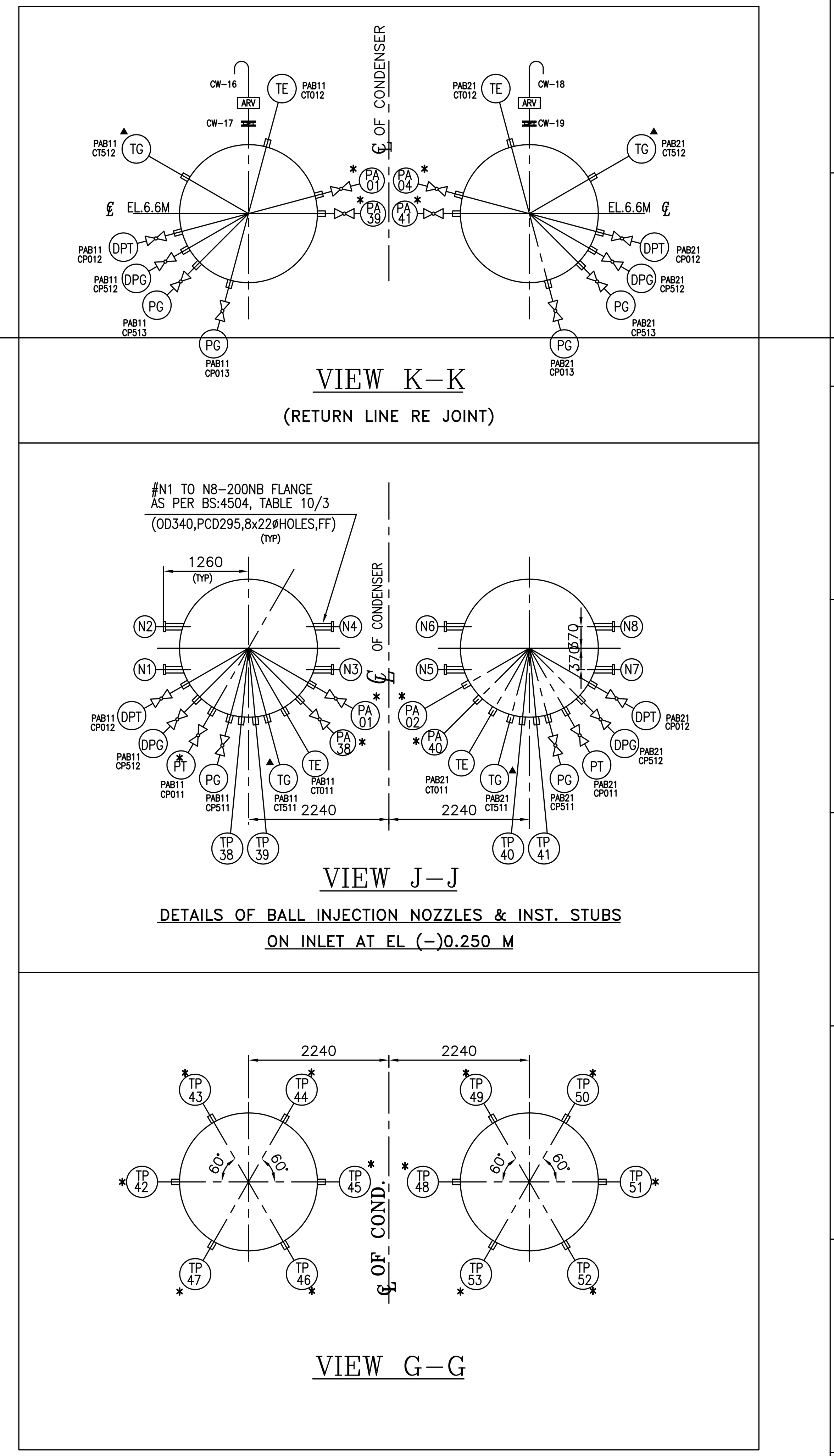
SHEET 01 OF 01 REV 00

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM







LOAD DETAILS:–

SL. No.	HANGER/ SUPPORT No.	LOAD(TONNE) Fx	Fy	Fz	MOMENTS(T–m) Mx	My	Mz
1.	H–1, H–4		–21				
2.	H–2, H–5		–32				
3.	H–3, H–6		–22				
4.	H–7, H–13		–65				
5.	H–8, H–14		–22				
6.	H–9, H–15		–3				
7.	H–10, H–16		–4				
8.	H–11, H–17		–14				
9.	H–12, H–18		–3				

(+)X=>TS to GS; (+)Y=>Vertically Upwards; (+)Z=>"A" Row to "B" Row

NOTES:–

1. Forces and Moments on Anchors are for piping from R.E. joint upto Anchor.
2. The effect of further piping (beyond Anchor) including pressure thrust, buried piping resistance and thermal movements is to be taken care while calculating the total load on Anchor.

NOTES:–

1) ALL DIMENSIONS ARE IN MM AND ELEVATIONS IN METRES UNLESS STATED OTHER WISE.
2) ALL ELEVATIONS ARE MARKED w.r.t. T.G. HALL FINISHED FLOOR LEVEL AS +0.0M WHICH CORRESPONDS TO RL +107.0M.
3) DESIGN PARAMETERS : PRESSURE : 5 kg /sq.cm (g) & 0.1 kg/sq.cm. (a) TEMPRATURE : 60°C HYD. TEST PRESSURE : 7.5 kg/sq.cm.
4) PIPE SPECIFICATION: 2235 OD x 18 THK. ROLLED & WELDED TO IS:3589 FROM IS : 2062 Gr.B PLATES.
5) ALL 2200NB BENDS ARE OF MITRE TYPE WITH RADIUS = 1650 mm
6) INSTRUMENTS MARKED WITH * MARK ARE FOR PERFORMANCE GUARANTEE TEST.
7) MATING FLANGES FOR BFVs(FOR INLET VALVE, ONE SIDE ONLY), AND BALL COLLECTING STRAINERS ARE WITH NECK PIECES AND SHALL BE SUPPLIED WITH RESPECTIVE EQUIPMENT.
8) DEBRIS FILTER(LENGTH–3950) SHALL ACCOMODATE OPENING FOR ATTENDING BFV SEAL (DIM. BEING 900) AS SHOWN IN DRG.
9) DEBRIS FILTER FLANGE DIMENSIONS TO BE MATCHED WITH BFV AND IS TO BE SUPPLIED WITHOUT COUNTER FLANGES.

REF. DRGS. :–

1) P & ID CW AND ACW SYSTEM : DRG. NO. PE–DG–401–165–N001 (PEM)
2) PG TEST INSTRUMENTATION SCHEME ; DRG. NO. PE–DG–401–100–NXXX (PEM)
3) CONDENSER ASSY. (G.A.) ; DRG. NO. 0–160–10–70044–C204 (2–SHEETS) (HWR)
4) ARRGT. OF ø2200 B.F. VALVE (CW INLET) ; XXXXXXXXXX
5) ARRGT. OF ø2200 B.F. VALVE (CW OUTLET) ; XXXXXXXXXX
6) G.A. OF R.E. JOINT ; DRG. NO. XXXXXXXXXX
7) INSTRUMENT STUB DETAIL (PRES/TEMP). : DRG. NO. PE–DG–401–100–IXXX
8) G.A. OF BALL SEPARATOR : DRG. NO. PE–V2–401–165–NXXX (PEM–VENDOR)

NTPC DRG. No.
NBPPL DRG. No.
PROJECT: FEROZE GANDHI UNCHAHAR THERMAL POWER PROJECT STAGE–IV 1X500MW
OWNER: NTPC Limited (A GOVERNMENT OF INDIA ENTERPRISE)
EPC VENDOR: NTPC BHEL Power Projects Private Limited (A Joint Venture Company of NTPC & BHEL) Y.S.R. Puram, Village Mannavaram, Sri Kalahasti Mandal, Distt. Chittoor - 517620 (A.P.)
GBTGM: BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NEW DELHI

JOB NO.	401
STATUS	CONTRACT
DISTRIBUTION	
TO	
No. OF	

REV.	DATE	ALTD	CHD	APPD

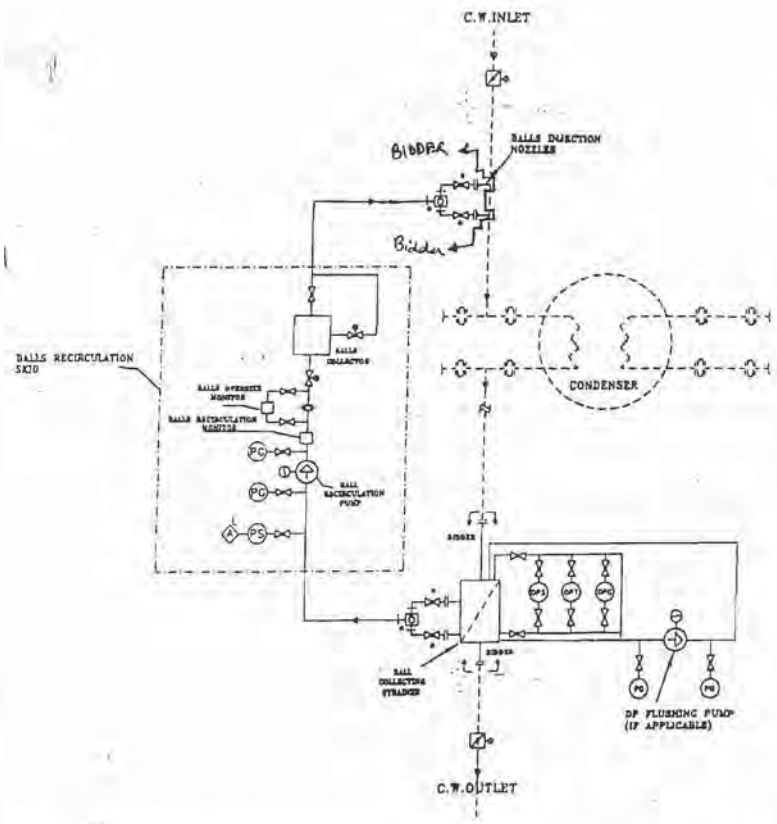
DEPT	CODE	NAME	SIGN	DATE
M	DRN	AJAY SHARMA		18.10.2001
	DESN	MUKESH		18.10.2001
	CHD	RM		18.10.2001
	APPD	SK.ANAND		18.10.2001

TITLE: CW PIPING LAYOUT INSIDE TG HALL

DEPT. SCALE:1:100 DRAWING NO. PE–DG–401–100–M00 SHEET 1 OF 1 REV.0

FORMAT SIZE A0

ELECTRONIC FILE NAME: 100_MOORO



NOTE:-

1. SCHEMATIC SHOWN IS TYPICAL FOR ONE HALF OF CONDENSER, SHALL BE IDENTICAL FOR THE CONDENSER SECOND HALF.

2. BIDDER'S SCOPE OF SUPPLY INCLUDES :
   a) BALL RECIRCULATING SKID COMPLETE WITH BALLS COLLECTOR, BOM, BRM, VALVES, INSTRUMENTS ETC.
   b) COUNTERFLANGES FOR BALL SEPARATORS.
   c) INJECTION NOZZLES WITH FLANGES/ COUNTER FLANGES.
   d) ALL VALVES IN COTCS (*) INCLUDING THEIR COUNTERFLANGES, NUTS, BOLTS, GASKETS.
   e) COUNTERFLANGES WITH NUTS, BOLTS & GASKETS FOR ALL TERMINAL POINTS.
   f) SIGHT FLOW INDICATORS (*) OR ANY OTHER SPECIAL FITTING/EQUIPMENT COMING ON COTCS PIPEWORK.

3. SCOPE OF SUPPLY

PURCHSER'S | BIDDER'S

TYPICAL FLOW DIAGRAM FOR ON LOAD TUBE CLEANING SYSTEM

SECTION C2

CONDENSER ONLOAD TUBE CLEANING SYSTEMS

(ELECTRICAL DETAILS)

ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: COLTCS (CIVIL IN BHEL SCOPE)

PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	NBPPL	NBPPL	1. 415 V AC/240 V AC supply shall be provided by NBPPL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract including power supply equipment (battery charger etc) required for the PLC/control panel (as applicable) for the system supplied by vendor. 2. Interposing relays (RE 302 of Jyoti make or equivalent), if required for PLC and microprocessor based systems, shall be provided by NBPPL in MCCs. Requirement of these relays shall be furnished by vendor during detailed engineering stage.
2	Local Push Button Station (for motors)	NBPPL	NBPPL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in NBPPL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	 NBPPL NBPPL NBPPL	 NBPPL Vendor NBPPL	1. Sizes and quantity of cables required shall be informed by vendor at contract stage (based on inputs provided by NBPPL). Finalisation of cable sizes shall be done by NBPPL. Vendor shall provide lugs & glands accordingly. 2. Laying of cables by NBPPL except for cabling in vendor scope. 3. Termination at NBPPL equipment terminals by NBPPL L. 4. Termination at Vendor equipment terminals by Vendor.
4	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	Vendor	
5	Cable trays, accessories & cable trays supporting system	NBPPL	NBPPL	
6	Cable glands and lugs for equipments supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power cables 3. Solder less crimping type heavy duty copper lugs for control cables.
7	Conduit and conduit accessories for cabling between equipments supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537. Makes of conduits shall be subject to customer/ NBPPL approval at contract stage.
8	Lighting	NBPPL	NBPPL	
9	Equipment grounding & lightning protection	NBPPL	NBPPL	
10	Below grade grounding	NBPPL	NBPPL	

ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: COLTCS (CIVIL IN BHEL SCOPE)

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
11	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ NBPPL approval at contract stage.
12	Mandatory spares	Vendor	-	Vendor to quote as per specification.
13	Recommended O & M spares, E & C spares, erection & maintenance tools & tackle.	Vendor	-	As per specification
14	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
15	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for C & I systems for vendor supplied equipment shall be furnished during detail engineering by vendor in soft copies in the NBPPL cable schedule format.
16	Equipment layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipments requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Electrical equipment layout drawing shall be to NBPPL approval.
17	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of NBPPL/customer after award of contract.
2. All QPs shall be subject to approval of BHL/customer after award of contract without any commercial implication.
3. For skid mounted system, 2 nos. (1W+1S) supply of 415 V, 3 phase AC shall be provided by NBPPL. Complete electrical distribution for the skid including changeover between feeder/starters/LCP/inter-locks/protection devices / any other supply etc. shall be in bidder's scope.

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

1.0	Design ambient temperature	:	50 ^{o}C
2.0	Maximum acceptable kW rating of LV motor	:	≤200KW
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Degree Of Protection (Indoor/Outdoor)	:	IP54/IP55
5.0	Type of Cooling	:	TEFC/CACA/TETV
6.0	Details of supply system		
	a) Rated voltage (with variation)	:	415V ± 10%
	b) Rated frequency (with variation)	:	50 Hz (Variation: +3% TO –5%)
	c) Combined voltage & freq. variation	:	10%
	d) System fault level at rated voltage	:	45 kA for 1 sec
	e) Short time rating for terminal boxes		
	o 110kW & Above (Breaker controlled)	:	45 kA for 1 sec
	o Below 110kW (SFU+ Contactor controlled)	:	45 KA for 0.20 sec.
	f) LV System grounding	:	Solidly
7.0	Class of insulation	:	Class ‘F’, with temp rise limited to class B. (Refer clause 5.00.00 of Motors)
8.0	Minimum voltage for starting (As percentage of rated voltage)	:	85% of rated voltage
9.0	Power cables data	:	Shall be given during Detailed engg.
10.0	Earth Conductor Size & Material	:	Shall be given during Detailed engg.
11.0	Space heater supply	:	240 V, 1Φ , 50 Hz
12.0	Rating up to which Single phase motor	:	Acceptable below 0.20 kW
13.0	Tests	:	As per Customer motor spec. (enclosed)
14.0	Energy efficient/ Flame proof motor	:	As per Customer spec. requirement

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

1.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:**

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

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

Refer "Electrical Scope between NBPPL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

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

a) A copy of this sheet "Electrical equipment Specification for COLTCS" and sheet "Electrical Scope between NBPPL and Vendor" with bidder's signature and company stamp.
b) List of Erection and Commissioning spares.
c) List of Erection & Maintenance tools & tackles.
d) Electrical load requirement

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 List of enclosures :

a) Electrical scope between NTPC & vendor.
b) Technical specification, datasheets & quality plans for 415V Electric motors.
c) Technical Specification, datasheets & quality plans for LT power & control cables.
d) Technical Specification, datasheets & quality plans for cabling, earthing & lightning protection.
e) Electrical Load data format.

SECTION C3

CONDENSER ONLOAD TUBE CLEANING SYSTEMS

(C&I DETAILS)

1 X 500 MW FGUTPP

COLTCS

BIDDER'S SCOPE FOR C&I

1. GENERAL

The Contractor shall provide complete Instrumentation for control, monitoring and operation of entire Condenser On load Tube Cleaning System. The requirements given below are to be read in conjunction with detailed Technical specification enclosed in the specification. Further in case of any discrepancy in the requirement within the same section noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre- bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per interpretation of customer shall prevail without any commercial implication.

Further Bidder shall also include in his proposal and shall furnish all equipment, devices and services which may not be specifically stated in the specification but are needed for completeness of the equipment/systems furnished by the Bidder and for meeting the intent and requirements of the specification.
In addition to requirements specified under this Section-C, all C&I systems/ sub-systems/ equipment/ devices shall also meet other requirements stipulated under other Sub-sections/ parts/ sections of specification.

The make/model of various instruments/items/systems shall be as per NTPC/NBPPL approved vendor list. No commercial and delivery implication in this regard shall be acceptable.

In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.

2. CONTROL SYSTEM

a) The controls for Condenser On load Tube Cleaning System shall be realized in DDCMIS based control system (Owner's scope).

b) Contractor shall furnish Instrument Schedule, I/O list, Drive list, Cable Schedule, Cable interconnection, JB grouping, Annunciation list, SOE list, List of Instruments/devices for HART in BHEL approved format. Also reusable database format like MS Excel, MS Access etc. of these documents shall also be provided by Contractor in BHEL approved format. Soft copy of the formats shall be provided to the successful bidder.

c) Interface of MCC,HT SWGR, field instruments, Actuators etc. with DDCMIS based control system shall be as per Drive Control Philosophy enclosed in Sub Section- Control System, C&I Specification, Section-D of technical specification.

3. MEASURING INSTRUMENTS

Primary instruments like Microprocessor based transmitters, pressure, diff. Pressure switches & gauges for :

a) Complete Condenser On load Tube Cleaning System package as per tender PID as of minimum.

b) Integral to equipment which are not indicated in the tender drawings, but are required for control, monitoring and operation of the equipment / plant systems for which no P&IDs are enclosed, all the instruments shall be provided to meet the actual system requirements and meeting redundancy and other requirements specified under technical specifications subject to Employer's approval.

c) For Binary and analog inputs required in major equipment protection, triple-sensing devices shall be provided. Binary and analog inputs, which are, required for protection of more than one equipment as well as protection signals for important auxiliaries and HT Drives (fed by a supply feeder of ratings 3.3 kV onwards) etc., triple sensing devices shall be provided.

d) For other critical binary and analog inputs required for protection and interlock purpose of other equipment (e.g. those interlocks which may result in loss of generation, non-availability of a major equipment etc.), triple sensors shall be provided.

e) Temperature elements (if applicable), electronic transmitters etc. are to be provided for all the cases.

f) Temperature transmitters (if applicable), are to be provided by the contractor for all the temperature elements in the scope of the contractor. Compensating Cables, JB/rack & other erection hardware shall also be in scope of contractor.

g) Rail mounted/ Rack mounted (Dual input Field mounted temperature transmitters)/ Field Bus Compatible temperature transmitters for temperature elements (for all the temperature elements being procured by the contractor) are to be provided (if applicable), by the contractor as per the followings.

   i. Contractor shall provide atleast one dual input transmitter for temperature measurements being used in trip/protection/major interlock of Turbine Generator and Major auxiliaries. Eg when three/two temperature measurement points are being used to for monitoring one bearing temperature, both elements

of one duplex temperature element is to be connected to one dual input temperature transmitter.

ii. Remaining temperature transmitter are to be Single Input DIN rail mounting type.

iii. Head mounted transmitters may be provided for temperature elements which are located in accessible areas as decided during detailed engineering.

h) All the instruments shall be terminated upto JBs by Contractor. JBs shall be in Contractor's scope.

i) Instrument installation and accessories required for the same shall be in Contractor's scope and shall be as per the instrument installation diagrams enclosed in the specification.

j) Detailed specification of instruments, JB, Control panel etc. & Instrument Stub details, Instrument installation diagrams shall be as defined in Sub Section- Measuring Instruments, C&I Specification, Section-D of technical specification.

k) Generally electronic transmitter shall be provided for the process measurements that are in the scope of the bidder. However the use of process actuated switches are also acceptable if it is a standard and proven practice of the bidder.

4. INSTRUMENTATION CABLES & CONTROL CABLES

Scope of Instrumentation cables(Screened Control Cables) & Control cables shall be as per Electrical Cable scope matrix in Electrical portion of specification.

5. ELECTRICAL ACTUATORS

Electrical Actuators with Integral starter shall be provided for all on/off and inching type valves in main plant and offsite areas along with necessary interface units for linking to Control System as applicable as detailed out in Sub Section- Electric Actuator, C&I Specification, Section-D of Technical Specification.

6. TYPE TEST REQUIREMENT

The type tests to be conducted for C&I systems & equipments shall be as detailed out in Sub Section- CNI TYPE TEST, Section-D of technical Specification.

7. QUALITY ASSURANCE

Contractor shall perform tests of C&I items/instruments/systems as per Sub-Section- Quality Assurance for C&I, Section-D of the technical specification.

8. DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT

Documents to be submitted after award of Contract shall be as defined in Sub Section- C&I Documents to be submitted after Award of Contract, C&I Specification, Section-D of technical specification.

SECTION – D

STANDARD TECHNICAL SPECIFICATION

SECTION D1 : CONDENSER ONLOAD TUBE CLEANING SYSTEM

SECTION D2 : ELECTRICAL SYSTEMS

SECTION D3 : C&I SYSTEM

SECTION D1

STANDARD TECHNICAL SPECIFICATION FOR CONDENSER ONLOAD TUBE CLEANING SYSTEMS

1.00.00 **GENERAL**

This specification covers the design, performance and operational requirements, configuration and constructional features, manufacture, assembly, inspection and testing at the manufacturer's and/or his sub-contractor's works and painting for delivery of condenser on-load tube cleaning system (sponge rubber balls type) complete with all accessories as specified hereinafter. Each half of the condenser shall be provided with an independent tube cleaning system.

2.00.00 **CODES AND STANDARDS**

2.01.00 The design, materials, manufacture, inspection and testing of the condenser on-load tube cleaning system complete with all accessories, shall comply with the requirements of the latest versions of the following appropriate codes and standards.

2.01.01 IS/BS/DIN/US Standards regarding pressure vessels, pumps, piping, flanges and others as necessary.

2.01.02 IS/BS/DIN/ASTM Standards for materials specification and testing procedures.

2.01.03 IS/BS/DIN/AWWA Standards for valves and the testing.

2.02.00 In case of any conflict between the above codes/standards and this specification, the later shall prevail and in case of any further conflict in the matter, the interpretation of the specification by the Engineer shall be final and binding.

3.00.00 **DESIGN AND CONSTRUCTION**

3.01.00 General Requirements

3.01.01 Unless otherwise necessary, manufacturer's standard and proven models of the tube cleaning system shall be supplied.

3.01.02 The tube cleaning system shall be capable of safe, continuous and trouble-free operation for removal of fouling and scaling materials from condenser tubes. Vibration, noise, mechanical stresses shall be kept within allowable limits specified by relevant codes/standards. In design, due attention shall be given to ease of maintenance, repair and cleaning.

3.01.03 Suitable Corrosion allowance shall be provided whenever necessary. Adequate provision for future installation of cathodic protection shall be provided.

3.01.04 The tube cleaning system shall consist of ball separator at condenser outlet, recirculating pump, ball collector, differential pressure measuring system for ball separator, ball monitoring system, cleaning balls, piping valves, distributors, injection nozzles, instrumentations, control panel, interconnecting cables and others as necessary. The configuration of the tube cleaning system shall be as described in section C and / or as per the scheme enclosed.

3.02.00 **Performance Requirements.**

3.02.01 The tube cleaning system with all accessories shall be designed and guaranteed to meet the following requirements :

The tube cleaning system shall perform satisfactorily under the flow and pressure drop conditions (in the condenser) specified in Data Sheet - A and shall be capable of removing the various forms of fouling and scaling from condenser tubes.

3.02.02 The ball separator at the condenser outlet, shall be designed such that the pressure drop across the ball separator under clean conditions shall not be more than that specified in Data Sheet - A. The performance of the ball separator shall be continuous with minimum number of backwashing operations.

3.02.03 The power consumption by ball recirculation pump during various operations shall be minimum possible.

The quantity of cleaning balls worn out and / or lost, shall be minimum possible.

3.03.00 **Operational Requirements**.

The tube cleaning system and other accessories shall be designed for the following operation modes :

3.03.01 Complete automatic start-up of tube cleaning system initiated by pressing the push button (manual command).

3.03.02 Complete automatic shut-down of tube cleaning system with ball collection, effected by the following :

- Push button (manual command).
- Adjustable timer (after a defined cleaning period).
- Ball monitoring system (when the number of oversized balls falls below a set value).

3.03.02 Complete automatic backwashing of ball separator with ball collection, effected by the following :

- Differential pressure measuring system at a pre-determined differential across the ball separating strainer/ screen.
- Adjustable timer
- Push button

3.03.04 Complete automatic emergency backwashing of ball separator with alarm indication, effected by differential pressure measuring system.

3.03.05 Manual operation for start-up, shut-down with ball collection backwashing of ball separator, flushing of differential pressure measuring system etc., in case of failure of control system.

3..04.00 **Ball Separator**

3.04.01 Ball separator body shall be of rigid construction and shall be designed and manufactured as per the applicable codes for pressure vessels. It shall house the ball separating screen / strainer and shall have flanged inlet, outlet, ball extraction opening and pressure measuring tappings etc. Body shall be designed and manufactured as per the applicable codes for pressure vessels and to take care of forces and moments as enclosed in the specification. However in no case thickness of housing/body shall be less than the connecting pipe thickness as specified in data sheet A

3.04.02 The ball separator shall be provided with manhole with bolted cover and sight glass to observe its internals.

3.04.03 If specified in Data Sheet -A, ball separator body shall be Epoxy lined.

3.04.04 The ball seperating screen / strainer shall be designed for the maximum differential pressure across the separator and shall be securely mounted in the body. Screen / strainer shaft shall be sized adequately considering the overloading of screens / strainer due to debris accumulation.

3.04.05 The ball separating strainers / screens shall have electric actuators for swivelling to allow for their backwashing. Also suitable handwheels shall be provided to enable manual swivelling of strainers / screens.

3.05.00 **Ball Recirculating Pump**

3.05.01 The ball recirculating pump shall be horizontal centrifugal type. The casing shall be designed to withstand 1.5 times the shut-off pressure or twice the operating pressure, whichever is higher.

3.05.02 The impeller shall be non-clog type and shall be contoured suitably to avoid damage to the cleaning balls. The impeller shall be secured suitably to the shaft and shall be retained against circumferential movement by keys, pins or lock rings. Loctite compound shall be applied after tightening of locknuts to prevent dislocation of impeller.

3.05.03 Replaceable type wearing ring shall be provided to prevent damage to the casing and impeller.

3.05.04 Pumps shall be provided with mechanical seals to the extent feasible. If Gland packing is provided it should be of good quality to be provided to prevent leakage of water from pump glands.

3.05.05 Shaft size selected shall take into Consideration the critical speed which shall be away from the operating speed as recommended in applicable codes / standards. Renewable type fine finished shaft sleeves shall be integral with water thrower plates at the end and the length must extend beyond the outer faces of gland packing so as to distinguish between the leakage between shaft and the shaft sleeve and that past the seals / glands.

3.05.06 Bearings of adequate design shall be provided for taking the entire pump load arising from all probable conditions of continuous operation through its range of operation. The bearings shall be designed on the basis of 20,000 working hours minimum for the load corresponding to the duty point. Proper lubricating element does not contaminate the liquid being pumped. Bearings shall be easily accessible without disturbing the pump assembly

3.05.07 Stuffing box of suitable design to permit replacement of packing without removing any part other than the gland shall be provided. The stuffing boxes shall be sealed / cooled by the fluid being pumped.

3.05.08 Pumps shall be of self-lubricated, self - sealed and self-cooled type. All pipework, fitters etc., for sealing, cooling and lubricating purpose shall be supplied and no external cooling/lubricating/sealing water will be supplied. Pump capacity shall take into account the cooling/lubricating/sealing water requirement.

3.05.09 All rotating components shall be statically and dynamically balanced.

3.05.10 The pump shall be designed such that pump impellers and other accessories of the pump, are not damaged due to flow reversal.

3.05.11 The pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the head Vs. flow characteristic curve over a range or 40% of rated flow to 120 -130 % of rated flow.

3.05.12 The pump shall preferably be non-overloading type. The total head Vs. capacity curve shall be continuously rising from the maximum flow point towards shut-off without any zone of instability.

3.05.13 The pump shall run smoothly without undue noise and vibration. Peak to peak vibration limits and noise level shall be within the acceptable values of applicable codes/standards.

3.05.14 The pump and motor shafts shall be connected through a pin and rubber bush flexible type of couplings. Suitable coupling guards shall be provided for the couplings.

3.05.15 The pump shall be capable of being started with discharge valve fully opened. Motor rating shall be adequate for this condition. The output KW rating of the pump drive motor shall not be less than the larger of the following :

a) Maximum power input to the pump over the entire range for maximum flow to shut-off condition.
b) 125% of power input to the pump at duty point corresponding to 103% of the rated speed.

3.06.00 **Ball Collector**

3.06.01 The body of the ball collector shall be designed to withstand 2.0 times the operating pressure or 1.5 times the recirculating pump shut-off pressure, whichever is higher.

The ball collector shall be designed and manufactured as per the applicable codes for pressure vessels.

3.06.02 Ball collector shall be provided with an inspection window/sight glass for visual inspection of the cleaning balls.

3.06.03 Ball collector shall be provided with suitable ports with covers for ball feeding and removal.

3.06.04 The ball collector shall be provided with vent and drain connections with isolating valves.

3.06.05 Provision shall be made in the ball collector for separating the undersized balls and ball collector shall have a separate chamber for collecting the undersized balls.

3.06.06 If specified in Data Sheet -A, ball collector body shall be lined with suitable resilient material.

3.06.07 The differential pressure measuring system shall be provided with D.P. transmitter ,DPS & DPGof remote seal arrangement.

3.07.00 **Differential Pressure Measuring System.**

3.07.01 The ball separator shall be provided with a measuring system for differential pressure across the ball separating strainer/screen, to check debris accumulation and to initiate ball catching and backwashing operations. This shall consist of a differential pressure switch/transmitter for automatic backwashing operation, a differential pressure guage for manual observation with adequate number of tappings with isolating valves.

3.07.02 The contacts for differential pressure switch/transmitter and for differential pressure guage shall be independent so that in the event of failure of one, the other is available.

3.07.03 The differential pressure measuring system shall be with remote seal arrangement .

3.08.00 **Ball Monitoring System**

3.08.01 Ball monitoring system shall be provided for continuously monitoring the quantity and size of the cleaning balls in circulation. The monitoring system shall perform the following functions :

a) Continuously counting the oversize balls in circulation and giving an alarm calling for investigation of ball losses, when the number of oversize circulating balls falls below a set valve.

b) Continuously measuring the size of the balls in circulation and initiating the shut-down of the tube cleaning system with alarm calling-for replacement of balls when the number of oversized balls falls below a set valve.

c) Bidder's if not manufacturing ball oversized monitor,can supply automatic ball sorter in lieu of same for automatic sorting of the undersized balls.

3.08.02 The monitoring system shall be of proven and reliable design and shall be complete with necessary transducers, amplifiers, transmission lines, power cables and electronic processor etc.

3.08.03 The electronic processor of the ball monitoring system shall be housed in the control panel and shall consist the following : -

a) Indicators for
- required basic ball charge.
- recirculating ball quantity.
- oversized ball quantity.

b) Time counters for
- total cleaning system operating hours.
- cleaning system operating hours with sufficient number of oversized balls.

c) Recorder for ball consumption.

3.08.04 The ball monitoring system shall have provisions for self-testing and self-calibration.

3.09.00 **Cleaning Balls**

3.09.01 The sponge rubber cleaning balls shall be slightly oversized to the internal diameter of condenser tubes and should be able to remove all fouling and scaling deposits in the condenser tubes.

3.09.02 The specific gravity of the cleaning balls shall be such that good distribution of balls across the tube sheet and cleaning of all tubes are ensured.

3.09.03 The composition of the cleaning balls shall be based on natural rubber and shall be suitable for temperature upto 100°C. Hardness of the cleaning balls shall be compatible to tube material and corrosion/fouling behaviour. If cleaning balls consist of abrasive coated balls, the abrasive material shall also be compatible for use with the tube material.

3.09.04 Calculations and basis for selection of cleaning balls circulation quantity, type, size, hardness, cleaning frequency etc., shall be furnished during contract stage.

3.10.00 **Piping, Valves, Distributors and Injection Nozzles.**

3.10.01 Interconnecting piping, valves, injection nozzles and other fittings shall be designed to withstand 2.0 times the operating pressure or 1.5 times the pump shut-off pressure whichever is higher.

3.10.02 Interconnecting piping shall be sized and routed optimally. Velocity in the pipe work shall be less than 1.5 m/s for pump suction and less than 2.2 m/s in other pipe work.

3.10.03 Necessary isolation valves, vent and drain valves for various equipments shall be provided. Valves shall conform to appropriate standards. Valves provided in ball transport piping shall be ball type. Gland packing of all valve shall be of superior quality to avoid leakage. All valves upto 150 Nb shall be ball valves. For higher sizes ,

gate / globe /B.F. valves shall be provided. All instrument valves shall be needle valves.

3,10.04 Adequate number of ball injection nozzles shall be provided for proper distribution of cleaning balls in condenser inlet. Ball injection nozzles shall be flanged type and shall have two sets of flanges, one for connecting to ball transport pipe and other for connecting to the stub on condenser inlet pipe for ease of removal during repairs or checking.

3.10.05 Distributors (if applicable) with sight glass shall be provided wherever ball transport piping branching out or joining together for proper guidance of cleaning balls.

3.10.6 Type of valves shall be ball valves, no diaphragm type valve shall be used.

3.11.00 **Actuators**

3.11.00 Tube cleaning system shall be provided with actuators wherever necessary for various automatic operations. The actuators shall be electric motor operated and shall meet the requirements of the enclosed specification. The actuator shall be provided with auxiliary handwheel for manual operation in the event of control system failure.

3.12.00 **Electric Motors**

The drive motors for recirculating pump and differential pressure measuring system flushing pump shall conform to the requirements of the enclosed specification.

3.13.00 **Instrumentation and Control System.**

3.13.01 Complete instrumentation and control system for automatic operation of tube cleaning system, protection, interlocking, indication / annunciation of differential pressure and other malfunctions etc., shall be provided. This shall consist of adequate operational hardware, local control panel (As applicable) and interconnecting control and power cabling between the control panel and various equipments in the tube cleaning system.

3.13.02 The control panel shall house all necessary instruments, indicating / annunciation lamps, alarms, differential pressure indicator, timer, function selection switches, ball monitoring system processor, relays, protection and interlocking systems, start / stop push button etc., and shall be complete with internal wiring. The control panel shall meet the requirements of the enclosed specification.

3.13.03 Pressure guages shall be provided at recirculating pump suction and discharge. All instrumentation shall be of reputed make and shall meet the requirements of the enclosed specifications.

3.14.00 **Other Accessories.**

3.14.01 Counter flanges, complete with gaskets, bolts and nuts etc., shall be supplied for ball separator inlet, outlet connections and all other terminal points Fabrication, dimensions and drilling of the flanges shall conform to the codes/standards specified in

Data Sheet-A / Section -C.

3.14.02 Ball recirculating pump, ball collector with interconnecting piping and valves, shall be mounted on a frame. For fixing the frame, necessary foundation plates, bolts, nuts etc. shall be provided.

3.14.03 Suitable lifting arrangement shall be provided for various equipments of the tube cleaning system, for handling during erection and maintenance.

3.15.00 **Materials of Construction**

Materials of various equipments in the tube cleaning system shall be corrosion resistant and consistant with the fluid handled. However, material specification for various components shall be equal to or superior to those specified in Data Sheet-A.

4.00.00 **PAINTING**

4.01.00 The surface preparation of the various equipments / components of the tube cleaning system shall be done as per the standard mentioned in Data Sheet - A and shall include the following :

a) Removal of oil, grease, dirt and swarf etc.

b) Removal of rust and scale etc.

c) Sand blasting / shot blasting.

4.02.00 All internal surfaces of the various equipments / components of the tube cleaning system, which are subjected to immersion or water spray and which are not made of stainless steel or other corrosion resistant materials after surface preparation, shall be coated with epoxy paint of approved make and quality over a coat of zinc chromite primer, unless otherwise specified in Data Sheet - A.

4.03.00 The external surfaces of the various equipments / components of the tube cleaning system after surface preparation, shall be coated with synthetic enamel paint of approved make and quality over two coats of red oxide primer, unless otherwise specified in Data Sheet -A.

5.00.00 **SHOP INSPECTION AND TESTS**

5.01.01 **General**

5.01.01 Manufacturer shall conduct all tests and stage inspections as per the approved

quality plan to ensure that the various equipments and other accessories of the tube cleaning system shall conform to the requirements of this specification and of the applicable codes / standards.

5.01.02 All materials used for manufacture /fabrication of the various equipments of the tube cleaning system shall be of tested quality. Relevant test certificates for chemical analysis, mechanical tests and heat treatment shall be made available before the final shop inspection. In case the relevant test certificates are not available, the manufacturer shall arrange to carry out the necessary tests as per the approved quality plan and applicable codes at his cost for which samples shall be identified by BHEL's representative.

5.01.03 All shop tests shall be conducted as per approved quality plan and test certificates / reports for the same shall be furnished to BHEL for approval.

5.01.04 Qualification of welding procedures and welders shall be as per ASME B&PV code, Section - IX / applicable codes.

5.2.00 **Ball Separator**

5.02.01 Chemical analysis, mechanical tests shall be carried out on materials used for body, strainer / screen, strainer / screen shaft and other appurtenances as per the applicable material specification standards.

5.02.02 All butt welded joints shall be subjected to radiographic/ ultrasonic testing as per applicable codes. However, all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.

5.02.03 Strainer / screen shaft shall be subjected to ultrasonic test as per ASTM-A388 for subsurface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1.

5.03.00 **Ball Recirculating Pump**

5.03.01 Chemical analysis, mechanical tests shall be carried out on materials used for casing, impeller, shaft, sleeves, wear rings etc., as per the applicable material specification standards.

5.03.02 The casting used for pump casing and impeller shall be sound, clean and free from porosity, blow holes, hard spots, cold shuts, distortion and other harmful defects. All accessible surfaces of the impeller shall be subjected to penetrant test as per ASTM-E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1. No welding or repairs shall be carried out without prior permission of BHEL.

5.03.03 Pump shaft and sleeves shall be subjected to ultrasonic test as per ASTM - A388 for sub-surface defects and penetrant test after finish machining as per ASTM-E165 for surface defects.

5.03.04 Wear rings shall be subjected to penetrant test as per ASTM-E165.

5.03.05 Pump impellers and rotor assembly shall be statically and dynamically balanced as

per ISO-1940

5.04.00 **Ball Collector**

5.04.01 Chemical analysis, mechanical tests shall be carried out on materials used for body and other appurtenances / accessories as per the applicable material specification standards.

5.04.02 All but welded joints shall be subjected to radiographic / ultrasonic testing as per applicable codes. However, all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.

5.05.00 **Piping, Valves, Distributors, and Injection Nozzles.**

5.05.01 Chemical analysis, mechanical tests shall be carried out for materials used for piping, fittings, valves, distributors and injection nozzles.

5.05.02 All welded joints of distributors & injection nozzles shall be subjected to penetrant test as per ASTM-E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1.

5.05.03 Inspection and testing of valves including leakage test shall be carried out as per the requirements of the applicable standards. Valve stem and ball shall be subjected to penetrant test as per ASTM-E165.

5.05.04 All materials for various nozzles, stubs, gaskets, nuts, bolts etc. shall be of tested quality and correlating test certificates for chemical and mechanical properties shall be furnished.

5.06.00 **Rubber Lining (as applicable)**

Rubber lining shall be subjected to surface crack test, 100% spark and hardness tests and shall be checked for layer thickness, defects etc.

5.07.00 **Flanges**

5.07.01 Chemical and mechanical test certificates shall be furnished for flange materials.

5.07.02 In case of fabricated flanges, all the welds shall be subjected to 100% radiography as per ASME B&PV code, Section VIII, Division 1.

5.07.03 In case of forged flanges, ultrasonic testing shall be carried out as per ASTM-A 388.

5.07.04 If the thickness of the plate used for flanges is 40mm or more, the same shall be checked ultrasonically as per ASTM-A435 to demonstrate the absence of lamination and lack of fusion etc.

5.07.05 Flanges shall be checked for edge preparation, fit up and satisfactory working with matching parts.

5.08.00 **Dimensional Checks.**

Dimensional checks for various equipments/components of the tube cleaning system shall be carried out as per assembly drawing approved by BHEL. Alignment and fit up of movable parts shall be checked.

5.09.00 **Hydrostatic Test**

Hydrostatic test shall be conducted on various assemblies / equipments / components of the tube cleaning system at a pressure of 1.5 times and design pressure. The duration of the test shall be minimum 30 minutes.

5.10.00 **Leakage Test**

Leakage test shall be conducted at the design pressure on all assemblies of the tube cleaning system to demonstrate that the assemblies are leak tight and no water seepage shall take place at various nozzles and valve connections.

5.11.00 **Performance Test on Recirculating Pump**

Performance test on recirculating pump with drive motor shall be conducted as per BS-599 / ASME PTC 8.0. Performance curves i.e., discharge flow Vs head, discharge flow Vs power consumption and discharge flow Vs efficiency shall be plotted and acceptance norms shall be as per BS-599 / ASME PTC 8.0. Vibration and noise shall be measure and acceptance norms shall be as per Hydraulic Institute (USA) standard.

5.12.00 **Functional Tests**

Various assembles / equipments / components of the tube cleaning system shall be subjected to functional tests and the following shall be checked.

5.12.01 Smooth and free operation of all movable parts.

5.12.02 Interlock and sequential operation.

5.12.03 Satisfactory operations of ball monitoring system.

5.12.04 Satisfactory operations of actuators torque switches, limit switches etc.

6.00.00 **TESTING AT SITE**

After completion of installation at site, the tube cleaning system will be tested to check that the tube cleaning system performance meets the requirements of this specification. Rectification of all defects shall have to be done by the supplier at no extra cost to the owner / purchaser. However, the owner / purchaser reserves the right to reject the equipments / parts not meeting the requirement if the deficiency still persists.

7.0.0 Performance Guarantee and Bid Evaluation criteria for Condenser on Load Tube Cleaning System.

The Tube Cleaning Systems shall be guaranteed to meet the performance requirements specified in Section-D , Data Sheet A and Guarantee schedule and also for trouble free operation after commissioning. Schedule of performance guarantees (enclosed in Volume III) duly filled and signed shall be furnished with the bid.

The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Customer. If the guarantee period specified in the Commercial Specification is higher, same shall prevail.

7.01.00 Performance Parameters to be guaranteed by bidders shall be as under :

i) Pressure drop in ball separator in clean condition viz. after back washing.

ii) Percentage recovery of balls (min. 95% recovery)

iii) Life of Sponge Rubber Ball (Min. 4 weeks)

7.02.00 Bidder to note that bids shall be evaluated on account of pressure drop across ball collecting strainer (in clean condition) and liquidated damages on account of not meeting the same during PG test shall be in accordance with following :

A) Bid Evaluation Criteria & Liquidated Damages:

The bids received shall be evaluated for Pressure drop across balls collecting strainers :

- The permissible limit of pressure drop across balls collecting strainers in clean condition shall be 0.15 MWC.
- If the pressure drops quoted are higher than above limit, the bids shall be technically loaded @ indicated in Data Sheet A .
- However no advantage shall be given for pressure drops quoted less than above permissible limit.
- The maximum acceptable limit for pressure drop across balls collecting strainer shall be (with technical loadings) 0.2 MWC.

The bids will be technically rejected for pressure drops quoted higher than above maximum limit.

- The guaranteed pressure drops shall be demonstrated at site by bidder and if found higher shall be subject to LD @ twice the bid evaluation factor as above.

7.03.00 **OtherGuaranteed Parameters to be demonstrated at site**

i) Life of sponge rubber balls shall be minimum 4 weeks.
ii) Percentage recovery of balls shall be minimum 95%.

Any deviation to above balls life and percentage recovery will not be accepted.

Bidder to indicate the life of sponge rubber ball and nos. of balls lost during 1000 hours of plant operation in the Guarantee schedule and shall demonstrate same at site.

In case the successful bidder fails to demonstrate any of these parameters he shall carry out modifications at his own cost, to purchasers approval.

In case bidder fails to demonstrate above parameters to purchaser's satisfaction even after modification carried by him at site, the purchaser has the right to reject the equipment out rightly.

8.00.00 **QUALITY ASSURANCE & QUALITY PLAN**

8.01.00 The tube cleaning system and other accessories to be supplied, shall have assured quality and workmanship.

8.02.00 Typical quality plans are enclosed herewith this specification for bidder's guidance. The bidder shall furnish his own quality plan based on materials, equipments and components of the tube cleaning system being offered.

9.00.00 **NAME PLATE AND TAG NUMBERS**

9.01.00 Ball separator, recirculating pump, ball collector shall be provided with a permanently attached brass or stainless steel plate indicating the following details :-

a) Design and maximum flow rates.
b) Design and test pressures.
c) Design temperature.
d) Empty and operating weights.

9.02.00 Each valve in the tube cleaning system shall be provided with a name plate indicating the following :-

a) Service.
b) Design and test pressures.
c) Maximum flow and flow direction.
d) Size.
e) Tag Number.

Tag Numbers will be indicated on the drawings submitted for approval during contractstage.

9.03.00 Each motor shall be provided with a name plate indicating the following details :

a) Supply conditions.
b) KW Rating.
c) Make.

10.00.00 **DRAWING, DATA & INFORMATION TO BE SUBMITTED AFTER THE AWARD OF CONTRACT.**

The drawings, data and other documents as required in Data Sheet-C shall be furnished after the award of contract.

1.00.00 **DRAWING, DATA & INFORMATION TO BE SUBMITTED AFTER THE AWARD OF CONTRACT**.

After the award of contract, the following drawings, data and information is to be submitted for review / approval of BHEL as per the distribution schedule given in Section - C.

1.01.00 Within 2 (two) weeks of the date of LOI, the following shall be submitted,

1.01.01 Data sheet (s) - B.

1.01.02 Final versions of the following drawings to enable BHEL to finalise the layout and to design foundations and structures :-

a) General arrangement / installation drawings of ball separator, ball recirculating unit, control panel each complete with all accessories, incorporating the principal dimensions and weights of equipment offered, size and location of various nozzle connection, supporting arrangement (wherever applicable) and scope of supply etc.

b) Foundation arrangement drawings (wherever applicable) showing load data on supports, size and location of anchor bolts etc.

c) General arrangement drawing indicating the layout of the equipments and interconnecting piping with pipe supports.

1.01.03 Bar chart and inspection schedule.

1.02.00 Within the stipulated time period as per Vendor's drawing /document list, the following shall be submitted.

1.02.01 Cross Sectional/ detailed drawing of ball separator, recirculating pump, ball collector, differential pressure measuring system, ball monitoring system distributors, injection nozzles actuators, motors, control panel etc, indicating bill of quantities and materials of construction.

1.02.02 Final versions of calculations and basis for selection of cleaning balls circulation quantity, type, size, hardness, cleaning frequency etc.

12.2.03 Flow and control logic diagrams for various operations of the tube cleaning system.

1.02.04 Detailed schedule of valves indicating Tag numbers, type, make size, pressure and temperature ratings, materials etc.

1.02.05 Detailed schedule of instruments indicating tag numbers, type, make, materials , of construction, range and accuracy etc.

1.2.6 Detailed schedule of piping and fittings indicating sizes, materials, maximum working pressure and temperatures etc.

1.02.07 Control panel layout and list of instruments provided on control panel.

1.02.08 List of annunciations, protections and interlocks provided.

1.02.09 Detailed drawings of flanges.

1.02.10 Ball recirculating pump performance characteristic curves.

1.02.11 Write-up and instruction manuals for erection, operation and maintenance.

1.02.12 Storage instructions.

1.02.13 Vendor to send 3 sets of final documents (O&M manual, GA drg, P&ID) direct to site under intimation to PEM.

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Manufacturer's Name & Address	STANDARD QUALITY PLAN		BHEL Doc No.: PE- V1 -XXX- 165-N008
	INDEX	Vendor Q.P. NO.	PROJECT:
		PACKAGE : COLTCS	CUSTOMER:
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		Page 01 of 15	CONSULTANT:
			P.O. No.

SL. NO.	DESCRIPTION	PAGE NO.
1	BALL SEPARATOR	2 TO 5
	WORM GEAR	6
	ACTUATORS	6
2	BALL RECIRCULATION SKID	7
	BALL VESSEL	7,8
	BALL INJECTION NOZZLE	8
	BALL RECIRCULATING PUMP	9
	BALL VALVE	10
	RECIRCULATING PUMP MOTOR	11
3	V - PIECE	11
4	BALL OVERSIZE MONITOR	12
5	PRESSURE GAUGE,DP GAUGE,DP SWITCH & DP TRANSMITTER	13
6	CLEANING BALLS	13
7	ALL COMPONENT & EQUIPMENT	13
8	STARTER PANEL	14
9	FASTENERS	15

Note :Items not included in quality plan to be inspected as per approved data sheet/drawings

ANNEXURES

DRY RUN TEST PROCEDURE FOR BALL SEPERATOR
HYDRO STATIC TEST PROCEDURE
LEAK TIGHTNESS TEST PROCEDURE
PACKING PROCEDURE

LEGEND
* Records indentified with "STAR" shall be essentially included by contractor in QA Documentation.
** M :Manufacturer / Manufacturer's Sub-contractor
C Contractor | O Owner
Indicate "P" - Perform, "W" - Witness and "V" - Verification

Manufacturer / Sub-Contractor	Contractor	Reviewed By	Name & Sign. Of approving authority & Seal
Signature			

		Manufacturer's Name & Address			STANDARD QUALITY PLAN				BHEL Doc No.:		PE- V1 -XXX- 165-N008		
							Vendor Q.P. NO:		PROJECT:				
		P.O. No.			Item : Ball Separator		PACKAGE : COLTCS		CUSTOMER:				
							Date :		PURCHASER:				
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Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency M	C	O	Remarks
1	2	3	4	5	6	7	8	9	D*	**	10		11
		Surface defects on machined area	Critical	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V	
		Sub-surface defects	Critical	Ultrasonic test	100%	ASME SA745	ASME SA745	Inspection report	*	P	V	V	
[e]	Screen ribs	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample / heat	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / Lab test report/Raw material flow sheet	*	P	V	V	
		Corrosion Resistance	Major	IGC	One/Heat	ASTM A 923	ASTM A 923	Test Report/Lab test report	*	P	V	V	
		Surface Defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Inspection report/ Raw material Flow sheet	-	P	V	V	
[f]	Ball Extraction Nozzle Pipe [Duplex Stainless Steel]	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample / cast/heat/ batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / Lab test report/Raw material flow sheet	*	P	V	V	
		Surface Defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Inspection report/ Raw material Flow sheet	-	P	V	V	
		Leak Tightness	Major	Hydrostatic Test	100%	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's Test Certificate	*	P	V	V	
1.2.0	**Inprocess Quality Control**												
1.2.1	Welding procedure specification	Correctness	Critical	Scrutiny	100%	ASME Sec.IX	ASME Sec.IX	QW 482 of ASME Sec.IX	*	P	V	V	
1.2.2	Welding procedure qualification	Weld soundness	Critical	Physical test	100%	ASME Sec.IX	ASME Sec.IX	QW 483 of ASME Sec.IX	*	P	V	V	Welding procedure already approved by BHEL/LRQA/GL/DNV/TUV shall be employed for this job.
1.2.3	Welder performance qualification	Weld soundness	Critical	Radiography	100%	ASME Sec.IX	ASME Sec.IX	QW 484 of ASME Sec.IX	*	P	V	V	Welders already qualified by BHEL/LRQA/GL/DNV/TUV shall be employed for this job.
1.2.4	Fit-up of butt weld	Alignment and dimensions	Major	Template, visual	100%	Manufacturing Drawing	ASME Sec VIII Div.1	Log book		P	W/V	-	BHEL to witness > 20mm thick butt joint
1.2.5	Fit-up of shell flange and nozzle assembly to shell	Orientation, alignment and dimensions	Major	Template, visual	100%	Manufacturing Drawing	ASME Sec VIII Div.1	Log book		P	-	-	

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			Vendor Q.P. NO:	PROJECT:
	P.O. No.	Item : Ball Separator	PACKAGE : COLTCS	CUSTOMER:
			Date :	PURCHASER:
			Page 04 of 15	CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	D*	Agency M **	Agency C	Agency O	Remarks
1	2	3	4	5	6	7	8	9			10		11
1.2.6	Weld quality for Pressure Parts												
	[a] Root run	Surface defects	Major	Penetrant test / Visual	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Operation Process Sheet	–	P	V	V	
1.2.7	[a] Completed butt welds	1.Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V	
		2.Sub-surface defects	Critical	Radiography test	10% of total weld length & 100% T Joints	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 4 / UW 52	Radiographs & inspection report	*	P	V	V	RT films will be reviewed by BHEL
	[b] Completed fillet welds	Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V	
1.2.8	Fabricated Shell (Prior to sand blasting)	1.Dimensions, Orientation	Major	Measurement by visual	100%	Manufacturing Drawing	Manufacturing Drawing	Inspection report	*	P	V	V	
		2. Hydro test	Critical	Hydrostatic Pr. @ 1.5 times design pr. (positive) Duration 30 minutes	100%	ASME Sec.VIII Div.1	No Leakage	Inspection report	*	P	W	V	
1.2.9	Picking and Passivation	Protection Layer	Major	Visual	100%	IS : 10117	IS : 10117	Log Book	–	P	–	–	
1.2.10	Final tests (completed equipments) - After assembly	1.Dimensions, orientation, workmanship & finish	Major	Measurement by visual	100%	G.A drawing	G.A drawing	Inspection report	*	P	W	W	
		2.Leak tightness for assembly	Critical	Leak Tightness @ design pr. (positive) Duration 30 minutes	100%	ASME Sec.VIII Div.1	No Leakage	Inspection report	*	P	W	W	
		3.Dry function test for Ball Separator	Critical	Operational test	100%	Approved procedure	Approved procedure	Inspection report	*	P	W	W	

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							Vendor Q.P. NO:		PROJECT:					
		P.O. No.			Item : Ball Separator		PACKAGE : COLTCS		CUSTOMER:					
							Date :		PURCHASER:					
							Page 05 of 15		CONSULTANT:					
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record			Agency			Remarks
										M	C	O		
1	2	3	4	5	6	7	8	9	D*	**	10			11
1.3.0	Rubber Lining for ball Seperator Shell, V-Piece & skid IC Pipe.													
1.3.1	Rubber formulation	Tensile elongation and hardness	Major	Physical test	One per lot	Manufacturer's procedure	BS 6374/Equivalent	Manufacturer's test certificate		P	V	V		
		Polymer Identification	Major	Flame test	One per lot	For Semi Ebonite	For Semi Ebonite	Inspection report	*	P	V	V		
						Ebonite Polymer catches fire; catches fire and On removal from fire it continues to burn	Ebonite Polymer catches fire; catches fire and On removal from fire it continues to burn							
		% Change in weight after 24 hrs immersion in sea water at 70 degrees	Major	Immersion test (bleeding test)	One per lot	ASTM D 471	+ / - 1 %	Inspection report	*	P	V	V		
1.3.2	Surface preparation of items to be lined	Free from rust , scale, dust and grease	Major	Visual	100%	SA 2.5	SA 2.5	Manufacturer"s Internal inspection		P	-			
1.3.3	Vulcanising	Temperature, Pressure and time	Major	Process monitoring	100%	Manufacturer's procedure	Manufacturer's procedure	Process Procedure		P	-	-		
1.3.4	Vulcanised rubber lined items	a) Chip test	Major	Chip test	One per lot	Approved drawing and BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V		
		b)Adhesion, Visual defects, thickness and hardness	Major	Measurement,visual inspection	100% visual. Thickness0hardness at random	Approved drawing and BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V		
		c)Spark test for Pin holes at 5 kv/mm	Major	Spark test for Pin holes	100%	Approved drawing and BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V		
			LEGEND											
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Signature								Reviewed By					Name & Sign. Of approving authority & Seal	

		Manufacturer's Name & Address			STANDARD QUALITY PLAN				BHEL Doc No.:				PE- V1 -XXX- 165-N008	
		P.O. No.			Item : WORM GEAR & ACTUATORS		Vendor Q.P. NO:		PROJECT:					
							PACKAGE : COLTCS		CUSTOMER:					
							Date :		PURCHASER:					
							Page 06 of 15		CONSULTANT:					
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record			Agency			Remarks
										M	C	O		
1	2	3	4	5	6	7	8	9	D*	**	10			11
1.4.0	Complete Unit of Worm gear	Reduction Ratio	Critical	Functional Test	100%	Approved Data Sheet	Approved Data Sheet	Manufacturer test certificate	*	P	V	V		
		Angle of Rotation												
		Input Torque												
		Output Torque												
		Degree of protection	Critical	Water & Dust ingress tests	Type test	Approved Data Sheet	Approved Data Sheet	Type test certificate	*	V	V	V		
1.5.0	Actuators	Routine Test	Major	Electrical test	100%	Supplier catalogue	Supplier catalogue / ADS	Manufacturer TC	*	V	V	V	Review of TCs	
		Make, Range, Model	Major	Visual	100%	Supplier catalogue	Supplier catalogue / ADS	Inspection Report	-	P	-	-		
		Assembly check alongwith ball valves	Major	Visual	100%									
		Functional check alongwith settings/auxiliary contacts	Major	Visual	100%									
		Note. ADS - APPROVED DATA SHEET												
			LEGEND											
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			C : Contractor		O . Owner									
Manufacturer / Sub-Contractor		Contractor	Indicate "P" - Perform, "W" - Witness and "V" - Verification											
Signature								Reviewed By					Name & Sign. Of approving authority & Seal	

	Manufacturer's Name & Address				STANDARD QUALITY PLAN				BHEL Doc No.:			PE- V1 -XXX- 165-N008
							Vendor Q.P. NO:		PROJECT:			
	P.O. No.				Item : Ball Recirculation Skid & Ball Vessel		PACKAGE : COLTCS		CUSTOMER:			
							Date :		PURCHASER:			
							Page 07 of 15		CONSULTANT:			

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	D*	Agency M **	Agency C	Agency O	Remarks
1	2	3	4	5	6	7	8	9	D*	**	10		11
2.0.0	**Complete Skid**												
	Recirculating Skid with ball vessel and ball oversize monitor	Completeness, Correctness, Orientation, Dimensions	Major	Visual & Measurement	100%	Approved Drawing	Approved Drawing	Inspection report	*	P	V	V	
	Ball Vessel												
2.1.0	**Raw Material**												
[a]	Housing Shell, Nozzle flanges and dished end	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample/heat	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Surface defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill TC/Inspection report	*	P	V	V	
		Sub-surface defects	Major	Ultrasonic test	100%	ASME SA 435	ASME SA 435	Inspection report	–	P	V	V	Plates > 20mm Thk only (UT - Full Volume)
2.2.0	**Inprocess Quality Control**												
2.2.1	Welding procedure specification	Correctness	Critical	Scrutiny	100%	ASME Sec.IX	ASME Sec.IX	QW 482 of ASME Sec.IX	*	P	V	V	
2.2.2	Welding procedure qualification	Weld soundness	Critical	Physical test	100%	ASME Sec.IX	ASME Sec.IX	QW 483 of ASME Sec.IX	*	P	V	V	Welding procedure already approved by BHEL/LRQA/GL/DNV/TUV shall be employed for this job.
2.2.3	Welder performance qualification	Weld soundness	Critical	Radiography	100%	ASME Sec.IX	ASME Sec.IX	QW 484 of ASME Sec.IX	*	P	V	V	Welders already qualified by BHEL/LRQA/GL/DNV/TUV shall be employed for this job.
2.2.4	Dished end for ball vessel	Dimensions	Major	Template	100%	Manufacturing Drawing	ASME Sec VIII Div.1	Inspection report	–	P	V	V	
		Surface defects	Critical	Penetrant test	100%	ASME Sec VIII Div.1	ASME Sec VIII Div.1 Appendix 8	Inspection report	–	P	V	V	

LEGEND

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C : Contractor   O : Owner

Indicate "P" - Perform, "W" - Witness and "V" - Verification

Manufacturer / Sub-Contractor Signature	Contractor	Reviewed By	Name & Sign. Of approving authority & Seal

	BHEL	Manufacturer's Name & Address			STANDARD QUALITY PLAN		Vendor Q.P. NO:		BHEL Doc No.:				PE- V1 -XXX- 165-N008
		P.O. No.			Item : Ball Vessel & Ball Injection Pipe		PACKAGE : COLTCS		PROJECT:				
							Date :		CUSTOMER:				
							Page 08 of 15		PURCHASER:				
									CONSULTANT:				
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record			Agency		Remarks
										M	C	O	
1	2	3	4	5	6	7	8	9	D*	**	10		11
2.2.5	Fit-up of butt weld	Alignment and dimensions	Major	Measurement	100%	Manufacturing Drawing	ASME Sec VIII Div.1	Log book	–	P	W/V	–	BHEL to witness >20mm thick butt joint.
2.2.6	Fit-up of shell flange and nozzle assembly to shell	Orientation, alignment and dimensions	Major	Template, visual	100%	Manufacturing Drawing	ASME Sec VIII Div.1	Log book	–	P	–	–	
2.2.7	**Weld quality for Pressure Parts**												
	[a] Root run	Surface defects	Major	Penetrant test / Visual	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Operation Process Sheet	★	P	V	V	
2.2.8	[a] Completed butt welds	1.Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	★	P	V	V	
		2.Sub-surface defects	Critical	Radiography test	10% of total weld length & 100% T Joints	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 4 / UW 52	Radiographs and inspection report	★	P	V	V	RT films will be reviewed by BHEL
	[b] Completed fillet welds	Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	★	P	V	V	
2.2.9	Fabricated Shell	1.Dimensions, Orientation	Major	Measurement	100%	Manufacturing Drawing	Manufacturing Drawing	Inspection report	★	P	V	V	
		2. Hydro test for Ball Vessel	Critical	Hydrostatic Pr. @ 1.5 times design pr. (positive) (Duration 30 minutes)	100%	ASME Sec.VIII Div.1	No leakage	Inspection report	★	P	W	V	Hydrostatic test shall be conducted along with Recirculating skd Assly for Ball Vessel.
2.2.10	Pickling and Passivation	Protection Layer	Major	Visual	100%	IS . 10117	IS : 10117	Log Book		P	–	–	
2.2.11	**Ball injection Pipe**	Chemical & Physical properties	Major	Chemical & mechanical tests	One sample/heat	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	★	P	V	V	
		Surface defects	Minor	Visual	100%	Approved drg/ Data sheet	Approved drg/ Data sheet	MTC / Inspection report	–	P	V	V	
		Leak Tightness	Major	Hydrostatic test	100%	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's Test Certificate	★	P	V	V	
			LEGEND										
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			C : Contractor		O Owner								
Manufacturer / Sub-Contractor		Contractor	Indicate : "P" - Perform, "W" - Witness and "V" - Verification										
Signature								Reviewed By			Name & Sign. Of approving authority & Seal		

	BHEL	Manufacturer's Name & Address			STANDARD QUALITY PLAN		Vendor Q.P. NO:		BHEL Doc No.:		PE- V1 -XXX- 165-N008			
		P.O. No.			Item : RECIRCULATING PUMP		PACKAGE : COLTCS		PROJECT:					
							Date :		CUSTOMER:					
							Page 9 of 15		PURCHASER:					
									CONSULTANT:					
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency				Remarks
										M	C	O		
1	2	3	4	5	6	7	8	9	D*	**	10			11
2.3.0	Raw material control													
2.3.1	Casng	Chemical,Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / Heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's Test Certificate	*	P	V	V		
		Surface defects	Minor	Visual	100%	Approved drg/ Data sheet	Approved drg/ Data sheet	MTC / Inspection report	–	P	V	V		
2.3.2	Impeller, Sleeve	Physical.and Chemical properties	Major	Physical and Chemical analysis	One Sample/Cast / Heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's Test Certificate	*	P	V	V		
2.3.3	Shaft	Physical.and Chemical properties	Major	Physical and Chemical analysis	One Sample/Cast / Heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's Test Certificate	*	P	V	V		
		Sub-Surface defects	Major	Ultrasonic Test	100%	ASME SA 745	ASME SA 745	MTC / Inspection report	*	P	V	V	Only for shaft >= 50mm	
2.3.4	In-process control													
2.3.5	Casing	Leak tightness	Critical	Hydro.test @ 1.5times design pr. (positive) (Duration 30 minutes)	100%	Manufacturing Standard	No Leakage	Inspection report	*	P	V	V		
2.3.6	Shaft	Surface defects	Critical	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V		
2.3.7	Impeller	Residual static, dynamic unbalance	Major	Static,dynamic balancing	100%	ISO:1940	ISO:1940, Gr 6.3	Inspection report	*	P	V	V		
2.3.8	All components	Workmanship, finish and dimensions	Major	Measurement, visual examination	100%	Manufacturing drawing	Manufacturing drawing	Log book / job card	–	P	–	–		
2.3.9	Assembly, control, final inspection / test													
	Performance Test	a) Q Vs. Head, Q Vs. Pumps efficiency / overall efficiency, Q Vs. Power, Vibration and Noise	Critical	Performance test	100%	Approved curve, approved data sheet, IS:5120	Approved data sheet	Inspection report, plotted curves	*	P	V	V		
		b) Dimensions, workmanship and finish	Major	Measurement, visual	100%	Data sheet	Data sheet							
		c) Noise level	Major	–	–	–	85 db at 1 meter distance							
2.3.10	Complete pump	Completeness, correctness, cleanliness	Major	Visual examination	100%	Approved data sheet / Mfg. Drg.	Approved data sheet / Mfg. Drg.	Check list / inspection report	*	P	V	V		
			LEGEND											
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Manufacturer / Sub-Contractor		Contractor	Indicate "P" - Perform, "W" - Witness and "V" - Verification											
Signature								Reviewed By					Name & Sign. Of approving authority & Seal	

	Manufacturer's Name & Address	STANDARD QUALITY PLAN	BHEL Doc No.: PE- V1 -XXX- 165-N008
		Vendor Q.P. NO:	PROJECT:
	P.O. No.	Item : BALL VALVES / PACKAGE : COLTCS	CUSTOMER:
		Date :	PURCHASER:
		Page 10of 15	CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	D*	Agency ** M	C	O	Remarks
1	2	3	4	5	6	7	8	9	D*	**	10		11
2.4.0	**Ball valves**												
2.4.1	**Materials**												
	Body and Tail end pieces	Chemical,Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's T.C.	*	P	V	V	
2.4.2	Ball	Chemical,Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's T.C.	*	P	V	V	
2.4.3	Stem	Chemical,Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's T.C.	*	P	V	V	
2.4.4	**In-process Inspection**												
2.4.5	Machining of body, end, pieces, ball	Dimension	Major	Measurement	100%	Approved drg/Data sheet	Approved drg/Data sheet	Log book	–	P	V	V	
2.4.6	Ball	a) Surface defects	Critical	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V	
		b) Hardness	Major	Hardness testing	Random	Approved drg/Data sheet	Approved drg/Data sheet	Inspection report	*	P	V	V	
2.4.7	**Assembly**	a) Dimensions	Major	Measurement	100%	EN ISO 17292	EN ISO 17292	Manufacturer's T.C.	*	P	V	V	
		b) Opening / Closing	Major	Operation	100%	—	As per approved data sheet	–	–	P	V	V	Test at works for opening / closing time of actuator operated valves.
2.4.8	**Testing**												
	[a] Body	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2/API 598/Appd data sheet	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[b] Seat test	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2/API 598/Appd data sheet	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[c] Seat	Leakage	Critical	Air test	100%	EN 12266-1&2/API 598/Appd data sheet	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	

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Manufacturer / Sub-Contractor Signature	Contractor	Reviewed By	Name & Sign. Of approving authority & Seal

		Manufacturer's Name & Address			STANDARD QUALITY PLAN				BHEL Doc No.:				PE- V1 -XXX- 165-N008
		P.O. No.			Item : RECIRCULATING PUMP MOTOR		PACKAGE : COLTCS		PROJECT:				CUSTOMER:
					V PIECE		Date :		PURCHASER:				
							Page 11 of 15		CONSULTANT:				
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks
										M	C	O	
1	2	3	4	5	6	7	8	9	D*	**	10		11
2.5.0	Motor	Routine test, No Load test & IR	Major	Electrical test	100% test	IS 325	IS:325	Manufacturer test certificate	*	P	V	V	Review of supplier TC
		Make , Rating	Major	Verification	100%	Appd drg/Data sheet	Appd drg/Data sheet	Inspection report	*	V	V	V	
		Degree of Protection	Critical	Verification	Type test	IP 55	IP 55	Manufacturer's test Certificate	*	V	V	V	
3.1.0	V - Piece												
	Raw material inspection	Chemical & Physical properties	Major	Chemical & mechanical tests	One sample/heat	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
	In process inspection	b) Surface defects	Major	Visual	100%	Approved drg/ Data sheet	Approved drg/ Data sheet	MTC / Inspection report	*	P	V	V	
		c)Sub-surface defects	Critical	Radiography test	10% of total butt weld length	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 4	Radiographs and inspection report	*	P	V	V	
		d) Hydro Static Test	Critical	Hydrostatic Pr. @ 1.5 times design pr. (positive) (Duration 30 minutes)	100%	ASME Sec.VIII Div.1	No leakage	Inspection report	*	P	V	V	

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Manufacturer / Sub-Contractor	Contractor	Reviewed By	Name & Sign. Of approving authority & Seal
Signature			

		Manufacturer's Name & Address			STANDARD QUALITY PLAN				BHEL Doc No.:				PE- V1 -XXX- 165-N008	
							Vendor Q.P. NO:		PROJECT:					
		P.O. No.			Item : Ball Monitoring System (Ball Oversize Monitor)		PACKAGE : COLTCS		CUSTOMER:					
							Date :		PURCHASER:					
							Page 12 of 15		CONSULTANT:					
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record			Agency			Remarks
										M	C	O		
1	2	3	4	5	6	7	8	9	D*	**	10			11
4.1.0	**Raw Material** Housing shell, Flanges	Chemical properties	Major	Chemical Analysis	One sample/heat	Approved drg/Data sheet	Approved drg/Data sheet	Mill test Certificate / lab test report/raw material flow sheet	*	P	V	V	if fabricated type	
		Physical properties	Major	Physical test	One sample / cast/heat/ batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill test Certificate / lab test report/raw material flow sheet	*	P	V	V		
		Surface defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate/Inspection report	*	P	V	V		
		Sub-surface defects	Major	Ultrasonic test	100%	ASME SA 435	ASME SA 435	Mill Test Certificate	*	P	V	V	Plates > 20mm Thk only (UT - Full Volume)	
4.2.0	**Inprocess Quality Control**													
4.2.1	Welding procedure specification	Correctness	Critical	Scrutiny	100%	ASME Sec.IX	ASME Sec.IX	QW 482 of ASME Sec.IX	*	P	V	V		
4.2.2	Welding procedure qualification	Weld soundness	Critical	Physical test	100%	ASME Sec.IX	ASME Sec.IX	QW 483 of ASME Sec.IX	*	P	V	V	Welding procedure already approved by BHEL/LRQA/GL/DNV/TUV shall be employed for this job.	
4.2.3	Welder performance qualification	Weld soundness	Critical	Radiography	100%	ASME Sec.IX	ASME Sec.IX	QW 484 of ASME Sec.IX	*	P	V	V	Welders already qualified by BHEL/LRQA/GL/DNV/TUV shall be employed for this job.	
4.2.4	Fabricated Shell	1.Surface defects (fillet welds)	Major	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V		
		2.Dimensions, Orientation	Major	Measurement by visual	100%	Approved doc./ Data sheet	Approved documents / Data sheets	Inspection report	*	P	V	V		
		3. Hydro test	Critical	Hydrostatic Pr. @ 1.5 times design pr. (positive) (Duration 30 minutes)	100%	ASME Sec.VIII Div.1	No leakage	Inspection report	*	P	W	V	Hydrostatic test shall be conducted alongwith Recirculating skid assembly	
		4. Functional Test	Major	Functional	100%	Approved procedure	Approved procedure	–	–	P	V	V	Functional test to be done at site	

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Manufacturer / Sub-Contractor	Contractor	Reviewed By	Name & Sign. Of approving authority & Seal
Signature			

		Manufacturer's Name & Address			STANDARD QUALITY PLAN				BHEL Doc No.:				PE- V1 -XXX- 165-N008	
							Vendor Q.P. NO:		PROJECT:					
					Item : Pressure Gauge, DP Gauge, DP Switch, DP Transmitter		PACKAGE : COLTCS		CUSTOMER:					
		P.O. No.					Date :		PURCHASER:					
									CONSULTANT:					
					Cleaning Balls									
					All components & Equipments		Page 13 of 15		PACKAGE : COLTCS					
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks	
										M	C	O		
1	2	3	4	5	6	7	8	9	D*	**	10		11	
5.0.0	In process quality control	Make, Range and Model	Critical	Visual	100%	Approved Data Sheet	Approved Data Sheet	Manufacturer test certificate	*	P	V	V		
		Calibration	Critical	Calibration test	100%	Approved Data Sheet	Approved Data Sheet	Manufacturer test certificate	*	V	V	V		
		Degree of Protection	Critical	-	Type Test Certificate	Approved Data Sheet	Approved Data Sheet	Manufacturer test certificate	*	V	V	V	For Pressure guage, DP Guage, DP Switch	
6.0.0	Cleaning Balls													
	– Normal balls – Abrasive balls	Dimensions	Critical	Measurement	Random	Approved Data Sheet	Approved Data Sheet	Manufacturer's test certificate	*	P	V	V	Quantity and type of balls to be checked with datasheets	
		Type Size												
7.0.0	All Components / Equipments	Painting Dry film thickness and visual	Major	Measurement	Random	Painting schedule	Painting schedule	Inspection report	*	P	V	V		
		Packing	Major	Measurement	100%	MFG. Procedure	MFG. Procedure	Inspection report	*	P	V	-		

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Manufacturer / Sub-Contractor	Contractor		Reviewed By	Name & Sign. Of approving authority & Seal
Signature				

		Manufacturer's Name & Address			STANDARD QUALITY PLAN					BHEL Doc No.:			PE- V1 -XXX- 165-N008
					Item : Starter Panel		Vendor Q.P. NO:			PROJECT:			
							PACKAGE : COLTCS			CUSTOMER:			
		P.O. No.					Date :			PURCHASER:			
							Page 14 of 15			CONSULTANT:			
Sl. No.	**Component / Operation**	**Characteristics Checked**	**Class**	**Type of Check**	**Quantum of Check**	**Reference Documents**	**Acceptance Norms**	**Format of Record**		**Agency**			**Remarks**
										M	**C**	**O**	
1	2	3	4	5	6	7	8	9		**	10		11
8.0.0	**Starter panel**												
08.1.0	**Incoming Material**												
08.1.1	Fabricated & Painted Panel	Dimension	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	–	P	--	--	
		Panel G.A.	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	–	P	--	--	
		Paint colour	Major	Visual	100%	Approved Drgs.	Approved Drgs.	Inspection report	–	P	--	--	
		Paint thickness	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	–	P	--	--	
		Paint Shade, Adhesion	Major	Visual	Sample	Approved Drgs.	Approved Drgs.	Inspection report	–	P	--	--	
08.1.2	Wire	Size / Colour / Rating / Surface Defects	Major	Visual / Dimension	Sample	IS 694	Specification / drawings	Inspection report	–	P	--	--	ISI Marked wire
08.1.3	Panel Mounting	Make, Functional, Type & Rating	Major	Visual / Electrical	100%	Approved BOM	Approved BOM	---		P	V	V	
08.2.0	**In Process Inspection**												
10.2.1	Name Plate, Component Mounting, Etc.	Workmanship, Finish, Correctness	Major	Visual	100%	Approved Drgs.	Approved drawings	Inspection report	–	P	--	--	
08.2.2	Electrical Wiring of Panels	Continuity, Colour of wires, Bunching and Grouping	Major	Visual	100%	Mounting Drawing	Approved drawings	Inspection report	–	P	--	--	
08.2.3	Ferruling of Cables	Start & End	Major	Visual	100%	Manufacturer's drawing	Manufacturer's drawing	Inspection report	–	P	--	--	
08.3.0	**Final Inspection**									P	--	--	
08.3.1	Workmanship, Finish & Paint shade / Thickness	Visual	Major	Visual	100%	G.A Drawing	Approved drgs.	Inspection report	*	P	W	V	
08.3.2	Overall Dimension, G.A of starter panel	Measurement	Major	Visual	100%	G.A Drawing	Approved drgs.	Test Certificate	–	P	W	V	
08.3.3	Component Identification	Visual	Major	Visual	100%	G.A Drawing	Approved drgs.	Inspection report	–	P	W	V	
08.3.4	Degree of Protection	Ingress Protection IP55	Critical	Environmental	Verification	Approved drgs.	IS 2147	Inspection Report		P	V	V	for enclosure
08.3.5	IR - HV - IR	Electrical	Critical	Electrical	100%	Approved Procedure	Approved Pocedure	Inspection report	–	P	V	V	
08.3.6	Functional & Continuity	Functional	Major	Functional	100%	Appd Drawing	Appd Drawing	Inspection report	*	P	W	W	

LEGEND

* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.
** M : Manufacturer/ Sub-contractor
C : BHEL   O Owner
Indicate : "P" - Perform, "W" - Witness and "V" - Verification

Manufacturer / Sub-Contractor Signature	Contractor	Name & Sign. Of approving authority & Seal

Manufacturer's Name & Address	STANDARD QUALITY PLAN	BHEL Doc No.: PE- V1 -XXX- 165-N008
P.O. No.	Item : FASTENERS	Vendor Q.P. NO:	PROJECT:
		PACKAGE : COLTCS	CUSTOMER:
		Date :	PURCHASER:
		Page 15 of 15	CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	D*	Agency ** M	Agency C	Agency O	Remarks
1	2	3	4	5	6	7	8	9	D*	**	10		11
9.1.0	Internal Fasteners (Duplex Steel)	Chemical & Physical properties	Major	Chemical & Mechanical analyses	1 Per heat/HT Batch	Approved drg/Data sheet	Approved drg/Data sheet	Mfr TC / Lab report	*	P	V	V	
		Visual & workmanship finish	Major	Visual	Sample	Approved drg/Data sheet	Approved drg/Data sheet		–	P	V	V	
		Dimensions	Major	Measurement	Sample	Approved drg/Data sheet	Approved drg/Data sheet		–	P	V	V	
9.2.0	Main Fasterners	Visual	Major	Visual	Sample	Approved drg/Data sheet	Approved drg/Data sheet	Inspection report / Mfr TC	*	P	V	V	
		Dimensions	Major	Measurement	Sample	Approved drg/Data sheet	Approved drg/Data sheet	Inspection report / Mfr TC	*	P	V	V	
		Chemical & Physical properties	–	Chemical & Physical test a) Tensile b) Yield c) Elongation d) Proof load	1 sample per heat	Approved drg/Data sheet	Approved drg/Data sheet	Mfr TC/Lab report	*	P	V	V	

LEGEND
* Records indentified with "STAR" shall be essentially included by contractor in QA Documentation.
** M :Manufacturer / Manufacturer's Sub-contractor
C . Contractor | O . Owner
Indicate "P" - Perform, "W" - Witness and "V" - Verification

Manufacturer / Sub-Contractor Signature	Contractor	Reviewed By	Name & Sign. Of approving authority & Seal

1	**GENERAL**		
1.1	Nos. of tube cleaning systems sets required for station	NOS.	Two (02) Nos. for 1x500 MW unit viz. One independent set for each half of condenser
1.2	Liquid handled		*Clarified Water as per Analysis* Attached along with project information in section B.
1.3	Size of COLTCS	Nb	*2200 NB*
2.0	**DESIGN**		
2.1	Operating pressure at Condenser inlet flange	kg/cm2 (g)	Approx 1.5 to 2.0
2.2	Design Pressure for ball separator	kg/cm2 (g)	5.0 kg/cm² (g) & vacuum 0.1 kg/cm² (abs)
2.3	Design Mechanical Temperature	Deg. C	60
2.4	Condenser Details		
	a) Type of condenser		*Double pass*
	b) No. of Condenser sections	Nos.	2 (Two)
	c) No. of passes per condenser section (viz. condenser half)	Nos.	2 (Two)
	d) No. of tubes per condenser	Nos.	24398
	• Top two rows		376
	• Remaining		24022
	e) Tube Dia. OD x Thickness		
	• Top two rows	mm x mm	31.75 x 0.889
	• Remaining	mm x mm	31.75 x 0.7112
	f) Length of tubes between ends.	mm	*13700*
	g) Tube material		*SS: ASTM A 249 TP 304*
	h) Pressure drop across condenser - At Normal flow (between Inlet and Outlet flanges of condenser)	MWC	*4.05 MWC* *(However the actual value can vary +/-10% of the design value)*
2.5	CW flow rate through each ball separator		
	- Normal	cu.m/hr	27150
	- Maximum	cu.m/hr	35295
2.6	Design differential pressure for ball separator strainer/screen	$Kg/cm^2(g)$	0.2

2.7	Pressure drop across ball separator i.e. between inlet & outlet flanges in clean condition at normal flow.	MWC	0.15
2.8	Pressure drop across ball separator in choked condition when strainer backwashing starts	MWC	Not to exceed 0.30
2.9	No. of balls required for COLTCS per condenser section	Nos.	Minimum 10% of number of condenser tubes
3	**CONNECTING PIPE DETAILS**		
3.1	Condenser inlet pipe		
	a) Material		*Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589*
	b) O.D. X Thickness	mm x mm	*2235 X 18*
3.2	Condenser outlet pipe		
	a) Material	CS	*Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589*
	b) O.D. X Thickness	mm x mm	*2235 X 18*
3.3	Manhole		Yes, 600 NB size
4.0	**MATERIALS OF CONSTRUCTION**		
4.1	BALL SEPARATOR		
	a) Body / housing		Carbon Steel to IS -2062 Gr.B. with epoxy painted inside (with minimum housing thickness same as connecting pipe thickness)
	b) Screen / Strainer		SS-316
	c) Strainer shaft		SS-316
	e) Internal Hardware including nuts, bolts , etc.		SS-316
	f) Site Glass provision		Yes
4.2	BALL RECIRCULATING PUMP		Non Clog type
	a) Casing		CI to IS 210 FG 260
	b) Impeller		SS-316
	c) Shaft		SS-304
4.3	**BALL COLLECTOR**		
	a) Body / housing		Carbon steel-IS 2062 Gr. B with epoxy painted inside
	b) Screen / Strainer		SS-316
	c) Site Glass Provision		Yes

4.4	Differential pressure measuring system		SS-316
4.5	Injection nozzle		SS-316
4.6	Valves		
4.6.1	Check Valves (All sizes)		For size 50 NB and below – Piston type For sizes 65 NB and above-Swing check type or dual plate type.
	a) Body & Bonnet		CI, IS-210 Gr. FG 260 / BS 1452 Gr. 14, Flanged Ends
	b) Seating Surface and rings		13 % Chromium Steel
	c) Disc for Check Valve		CI, IS-210 Gr. FG 260 / BS 1452 Gr. 14
	d) Hing Pin		AISI 316
	e) Backseat		13 % Chromium Steel
4.6.2	Gate/ Globe Valves 50 Nb & Below		
	Body, Bonnet & Trim		IS 318 Gr. 2 /Eq
4.6.4	BF/Gate Valves (65 NB & above)		
	a) Body & Disc		ASTM A48, Gr. 40 with 2% Ni / IS 210 Gr. FG 260 with 2% Ni and epoxy painted.
	b) Shaft		BS 970 431 S: 291 / EN 57, **or** AISI-410 **or** AWWA-permitted shaft material equivalent to EN-57/AISI-410 or better.
	c) Seal		Nitrile rubber
	d) Sealing, Retaining segment & internals		18 – 8 SS
	e) Bearings		Sleeve type Self lubricated
	f) Companion Flange		IS 2062, Gr. B
	C) Ball valves i) Body ii) Ball iii) Stem		 SA 351 CF8M SA 351 CF8M SS 316
4.7	Interconnecting Piping		By Bidder

	Material		a) Upto 150NB - Carbon steel ERW, IS:1239 (Heavy Grade) b) Greater than 150NB – CS to IS 2062 Gr. B, rolled & butt welded, conforming to IS 3589
5	**COUNTER FLANGES for Ball Separator**		
	a) Flanges		Carbon Steel to IS 2062 Gr. B or eq for thickness, drilling etc refer Annexure II in section C1 (In Bidder's scope)
	b) Fasteners		A 193 & A 194 (In Bidder's scope).
	c) Gaskets		Min 4 mm thick rubber (In Bidder's scope).
6	**OTHER COUNTER FLANGES (for interconnecting piping)**		In Bidder's scope
6.1	MATERIALS		
	a) Flanges		Carbon Steel to IS 2062 Gr. B
	b) Fasteners		A 193 & A 194
	c) Gaskets		Min 4 mm thick rubber
7.0	Material of Other components not specified above		Suitable for intended duty and shall be subject to Purchasers approval during detailed engg. In the event of order.
8.0	**PAINTING: EXTERNAL SURFACE**		
	a) Surface preparation (Externally & internally)		Shall be cleaned by sand blasting or power tool cleaning
	b) Primer		Two coats of red oxide (Zn Chromate Phosphate) primer confirming to IS-2074/IS-1274 or equivalent
	c) Intermediate		One coat of Synthetic enamel paint confirming to IS-2932 or equivalent
	d) Final paint		Two coat of Synthetic enamel paint confirming to IS-2932 or equivalent to achieve Total DFT of 150 microns minimum including primer.
9.0	Adequate provision for future installation of cathodic protection (Sacrificial type anodic protection by Purchaser)		YES
10.0	Flow straightner for streamlining the CW flow in ball collecting strainer		If required as per bidder's design – the same to be incorporated by bidder in its constructional feature.
11.0	Performance Guarantee & Bid Evaluation		
11.1	Performance Parameters to be Guaranteed		
	❖ Pressure drop in ball separator in clean condition		As per Guarantee schedule of bidder

	❖ Percentage recovery of balls		Min. 90 % recovery
	❖ Life of sponge Rubber Balls		Min. 3 weeks
11.2	Bid evaluation Criteria & Liquidated damages		As per clause no 8.00.00 of Section C1
11.3	Bid evaluation rate		INR 652000 per 0.05 MWC pr. drop across each balls collecting strainer
11.4	Liquidated damages		Twice the bid evaluation rate
12.0	The tube cleaning system shall be designed for following operation modes		
	a) Automatic start up initiated by push button		YES
	b) Automatic shutdown with ball collection effected by : i. Push button ii. Adjustable timer iii. Ball monitoring system		YES
	c) Automatic backwashing of ball seperator with ball collection effected by : a. Push button b. Adjustable timer c. Diff. Pressure measuring system		YES
	d) Automatic emergency backwashing of ball seperator effected by diff. Pressure measuring system		YES
	e) Automatic ball sorting initiated by push button		YES
	f) Provision for manual operation of complete tube cleaning system in case of control system failure		YES
	g) Whether the contacts for DPG, DPS and DPT are independent		YES
	h) Timer for Backwashing		YES
	i) Whether the ball monitoring system is designed to perform the following functions : i. Continuously counting the balls in circulation and giving an alarm calling for investigation of ball losses when the number of balls falls below a set value ii. Continuously measuring the size of the balls in circulation and initiating the shutdown of the tube cleaning system with alarm calling for replacement of balls when the no. of oversized balls falls below a set value		YES

	j) Whether the electronic processor of the ball monitoring system is provided with the following : i. Indicators for required basic ball charge ii. Indicators for recirculating ball quantity iii. Indicators for oversized ball quantity iv. Time counters for total cleaning system operating hours v. Time counters for cleaning system operating hours with sufficient no. of oversized balls vi. Recorders for ball consumption		YES
	k) Whether provision for self-testing and self-calibration are made		YES
13.0	Mandatory Spares to be supplied under this specification.		NIL
14.0	Documents enclosed for bidder's reference		
	❖ Water Analysis		Indicated in project information in Section B.
	❖ GA of CW piping in TG hall		Attached as per Annexure-III

SECTION D2

STANDARD TECHNICAL SPECIFICATION FOR ELECTRICAL SYSTEMS

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

1.0 INTENT OF SPECIFIATION

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

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

2.0 CODES AND STANDARDS

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

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

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

3.0 DESIGN REQUIREMENTS

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

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

3.3 Starting Requirements

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

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

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

3.3.3 The following frequency of starts shall apply

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

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

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

3.4 **Running Requirements**

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

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

3.5 **Stress During bus Transfer**

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

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

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

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

4.0 **CONSTRUCTIONAL FEATURES**

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

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

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

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

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

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

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

4.7 **Terminals and Terminal Boxes**

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

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

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

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

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

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

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

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

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

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

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

4.9 **General**

4.9.1 Motors provided for similar drives shall be interchangeable.

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

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

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

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

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

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

5.0 **INSPECTION AND TESTING**

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

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

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

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

6.0 **DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT**

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

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

SUB-SECTION – B-09

MOTORS

1.00.00 GENERAL REQUIREMENTS

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

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

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

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

1.05.00 The auxiliary AC voltage supply arrangement shall have 11kV, 3.3 kV and 415V systems. It shall be designed to limit voltage variations as given below under worst operating condition :

(a) 11kV, 3.3 kV +/- 6%

(b) 415/240V +/- 10%

1.06.00 The voltage level for motors shall be as follows :-

a) Upto 0.2KW : Single phase 240V AC / 3 phase 415V AC

b) Above 0.2KW and upto 200KW : 3 phase 415V AC

c) Above 200KW and upto 1500 KW: 3.3 kV

d) Above 1500 KW : 11 kV

Voltage rating for special purpose motors viz. screw compressors and those with VFD shall be as per manufacturer standard.

For CHP conveyor's motor above 160KW rating 3.3KV, three phase AC supply is to be used. However all the motors on the Stacker/ Reclaimer machine shall be on 415V AC only.

1.07.00 Fault level shall be limited to 40kA RMS for 1 second for 11kV & 3.3 kV system and 45 kA RMS 1 second for 415V system. 415V system shall be solidly grounded and 220 VDC system shall be isolated type.

1.08.00 Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.

1.09.00 The responsibility of coordination with electrical agencies and obtaining all necessary clearances shall be of the contractor.

1.10.00 Degree of Protection

Degree of protection for various enclosures as per IS:4691, IEC60034-05 shall be as follows :-

i)	Indoor motors	-	IP 54
ii)	Outdoor motors	-	IP 55
iii)	Cable box-indoor area	-	IP 54
iv)	Cable box-Outdoor area	-	IP 55

2.00.00 CODES AND STANDARDS

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

3.00.00 TYPE

3.01.00 **AC Motors:**

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

b) Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature), shall be Energy Efficient motors, Efficiency class-Eff 1, conforming to IS 12615 or high efficiency (IE2) as per IEC:60034-30

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

3.02.00 DC Motors Shunt wound.

4.00.00 RATING

(a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.

(b) Whenever the basis for motor ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings

shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.

(c) For BFP motor the starting MVA shall be restricted to 58 MVA.

5.00.00 TEMPERATURE RISE

Air cooled motors

70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.

Water cooled

80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.

41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class Y wet wound Boiler circulation pump motor.

6.00.00 OPERATIONAL REQUIREMENTS

6.01.00 **Starting Time**

6.01.01 For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.

6.01.02 For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.

6.01.03 For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.

6.01.04 Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.

6.02.00 **Torque Requirements**

6.02.01 Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.

6.02.02 Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.

6.03.00 **Starting voltage requirement**

a) 85% below 110 KW
b) 80% from 110 KW to 200 KW
c) 85% above 200 KW to 1000 KW
d) 80% from 1001 KW to 4000 KW
e) 75% > 4000 KW

7.00.00 DESIGN AND CONSTRUCTIONAL FEATURES

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

7.02.00 All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). CW motors can be screen protected drip proof (SPDP) type. Motors located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below

(a)	Fuel oil area	:	Group – IIB
(b)	Hydrogen generation plant area	:	Group - IIC (or Group-I, Div-II as per NEC)

7.03.00 Winding and Insulation

(a)	Type	:	Non-hygroscopic, oil resistant, flame resistant
(b)	Starting duty	:	Two hot starts in succession, with motor initially at normal running temperature. However the conveyor motor shall be suitable for 3 consecutive hot starts.
(c)	11kV & 3.3 kV AC motors	:	Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Presure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15
(d)	240VAC, 415V AC & 220V DC motors	:	Thermal Class(B) or better

7.04.00 Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.

7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.
7.06.00	Noise level for all the motors shall be limited to 85dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.
7.08.00	Motor body shall have two earthing points on opposite sides.
7.09.00	HT motors can be offered with either elastimould termination or dust tight phase separated double walled (metallic as well as insulated barrier) cable boxes. In case elastimould terminations are offered, then protective cover and trifurcating sleeves shall also be provided. In case cable box is offered, then Employer shall provide termination kit. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided in case of cable boxes.
7.10.00	The spacing between gland plate & centre of terminal stud shall be as per Table-I.
7.11.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.
7.12.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.
7.13.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.
7.14.00	11kV and 3.3 kV motor Terminal Box shall be suitable for fault level of 750MVA for 0.12 sec and 250 MVA for 0.12 sec respectively. Elastimould termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.
7.15.00	The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP Motor.

	(a) Upto 110KW : 11.0 (For AOP motor it shall be 8.0) (b) Above 110KW & upto 1500KW : 10.0 (c) Above 1500KW & upto 4000KW : 9.0 (d) Above 4000KW : 6 to 6.5
9.00.00	CW Motor shall be desigined with minimum power factor of 0.8 at design point.
10.00.00	**TYPE TEST**
10.01.00	**HT MOTORS**
10.01.01	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII-(BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.
10.01.02	The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.
10.01.03	In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the owner for waival of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The owner reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.
10.01.04	Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED"and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this

contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.

10.01.05 **LIST OF TYPE TESTS TO BE CONDUCTED**

The following type tests shall be conducted on each type and rating of HT motor

(a) No load saturation and loss curves upto approximately 115% of rated voltage

(b) Measurement of noise at no load.

(c) Momentary excess torque test (subject to test bed constraint).

(d) Full load test(subject to test bed constraint)

(e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.

(f) Lightning Impulse withstand test on the sample coil shall be as per IEC-60034, part-15

(g) Surge-withstand test on interturn insulation shall be as per clause no. 5.1.2 of IEC 60034, part-15

10.01.06 **LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED**

The following type test reports shall be submitted for each type and rating of HT motor

(a) Degree of protection test for the enclosure followed by IR, HV and no load run test.

(b) Terminal box-fault level withstand test for each type of terminal box of HT motors only.

10.02.00 **LT Motors**

10.02.01 LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last *ten* years from the date of bid opening.

	These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
10.02.02	However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.
10.02.03	**LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED** **The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only** 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip . 5. Temperature rise test . 6. Momentary excess torque test. 7. High voltage test . 8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section) 10. Test for degree of protection and 11. Overspeed test.
10.03.00	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
10.04.00	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet.

TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

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

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

PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:

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

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

	TITLE	SPECIFICATION NO.
	MOTOR	**VOLUME II B**
		SECTION D
	DATA SHEET - C	**REV NO. 00 DATE 07.01.14**
		SHEET 1 **OF** 2

S. No.	Description	Data to be filled by successful bidder
A.	**General**	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
B.	**Design and Performance Data**	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a Voltage	
6	b Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	**Constructional Features**	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	**Characteristic curves/ drawings** (To be enclosed for motors of rating ≥ 55KW)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

MOTORS

INDUCTION MOTOR & SYNCHRONOUS MACHINE

TESTS/CHECKS / TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating/TC/General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing (WPS/PQR)	Heat Treatment
Plates for stator frame,end shield, spider etc.	Y	Y	Y	Y					Y
Shaft	Y	Y	Y	Y	Y	Y			Y
Magnetic Material	Y	Y	Y	Y	Y		Y		
Rotor Copper/Aluminium	Y	Y	Y	Y		Y	Y		Y
Stator copper	Y	Y	Y	Y			Y		Y
SC Ring	Y	Y	Y	Y	Y	Y	Y	Y	Y
Insulating Material	Y		Y	Y			Y		
Tubes for Cooler	Y	Y	Y	Y	Y				Y
Sleeve Bearing	Y	Y	Y	Y	Y				Y
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y	
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y	
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y				Y
Wound stator	Y	Y					Y	Y	
Wound Exciter	Y	Y					Y	Y	
Rotor complete	Y	Y					Y		
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y		
Accessories, RTD, BTD,CT, Brushes, Diodes, Space heater, antifriction bearing, cable glands, lugs, gaskets etc.	Y	Y	Y						
Motor (IS 325 / 4722/ 9283)	Y	Y	Y						

INDUCTION MOTOR & SYNCHRONOUS MACHINE (Contd.)

TESTS/CHECKS / ITEMS/COMPONENTS	Magnetic Characteristics	Hydrualic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	All tests as per IS-325/IS-4722 / 9283	Vibration	Over speed	Tan delta, shaft voltage & polarisation index test
Plates for stator frame, end shield, spider etc.									
Shaft									
Magnetic Material	Y		Y						
Rotor Copper/Aluminium									
Stator copper			Y						
SC Ring									
Insulating Material			Y						
Tubes for Cooler		Y							
Sleeve Bearing		Y							
Stator/Rotor, Exciter Coils									
Castings, stator frame, terminal box and bearing housing etc.									
Fabrication & machining of stator, rotor, terminal box									
Wound stator									
Wound Exciter									
Rotor complete				Y	Y				
Exciter, Stator, Rotor, Terminal Box assembly									
Accessories, RTD, BTD,CT, Brushes, Diodes, Space heater, antifriction bearing, cable glands, lugs, gaskets etc.									
Motor (IS 325 / 4722 / 9283)						Y	Y	Y	Y1

Note :

1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed alongwith relevant supporting documents during QP finalisation. However QP approval is not envisaged for LT motors upto 50 KW.
2. Makes of all major bought out items shall be subject to Employer's approval.

Y1 = for HT Motor / Machines only.

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

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

NOTES:

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

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

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

Legends for Inspection agency

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

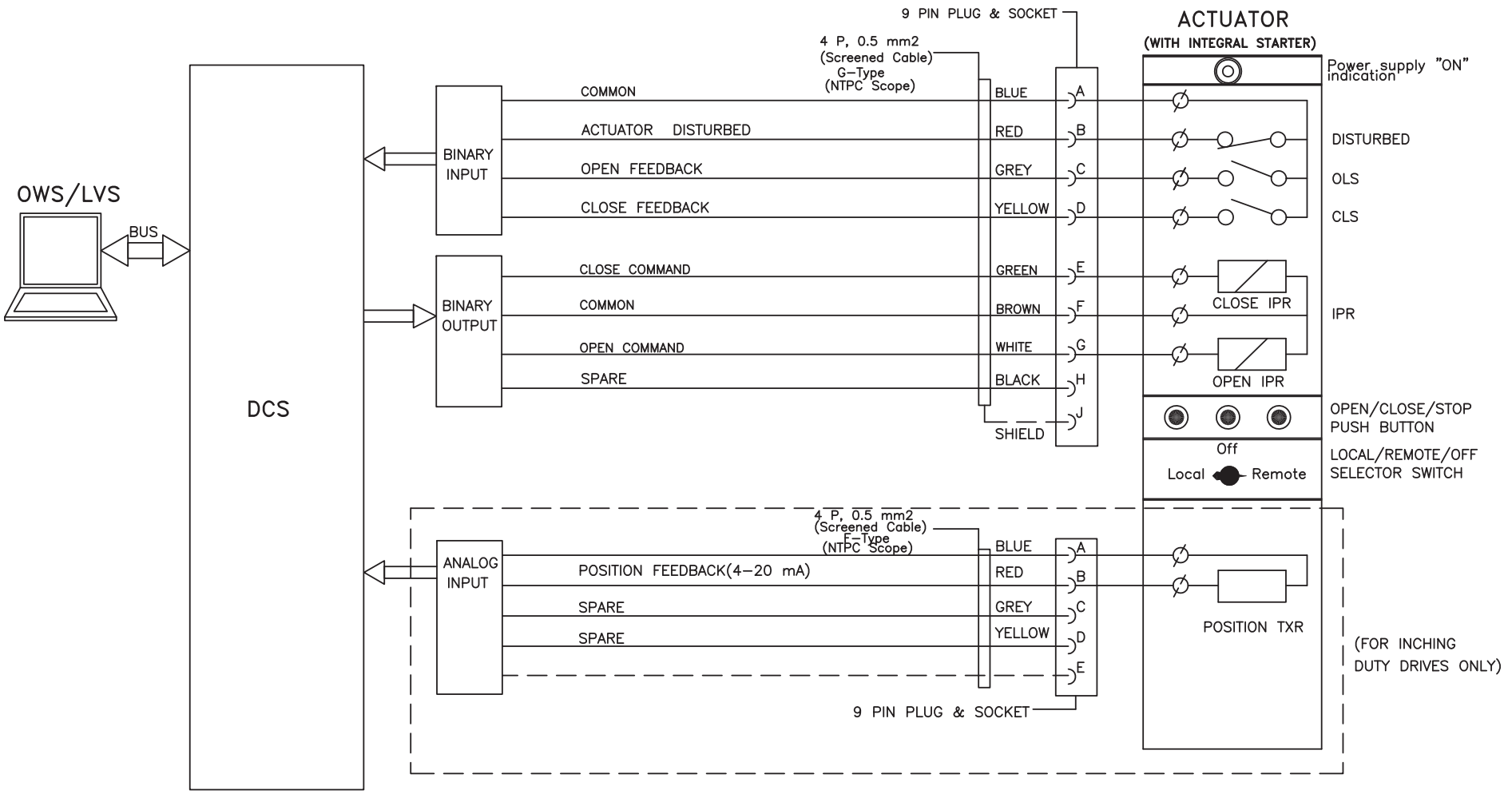
P. PERFORM
W. WITNESS
V. VERIFY

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

SUB-SECTION

CONTROL SYSTEM

DCS INTERFACE FOR BIDIRECTIONAL DRIVE(WITH INTEGRAL STARTER)

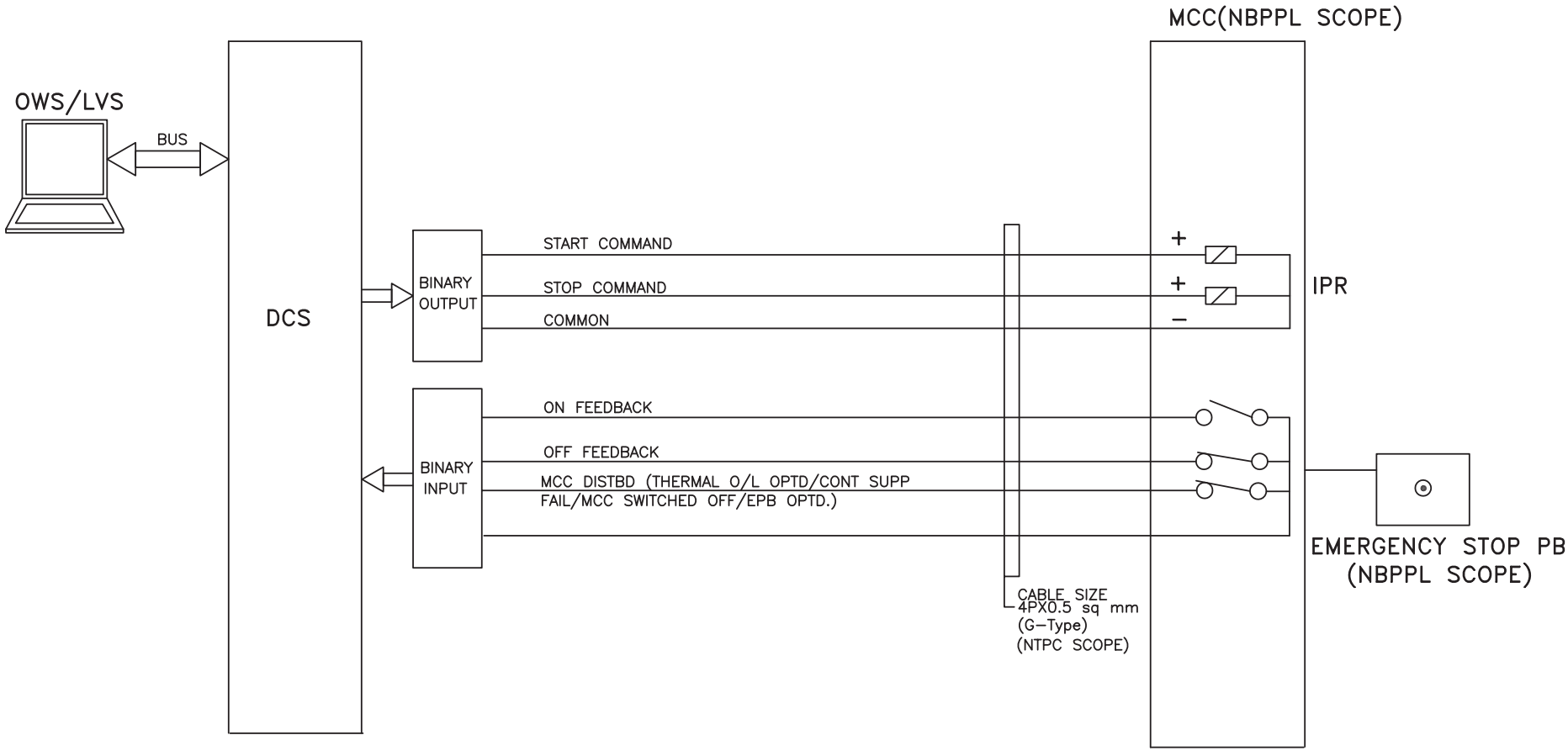


NOTE:

1. DISTURBED= Loss of Power supply (1 Phase/3 Phase),
   Loss of control supply, Motor thermostat trip,
   Thermal over load relay trip,
   Local/Off/Remote Sel. switch in local or off mode.
   Stop PB optd.

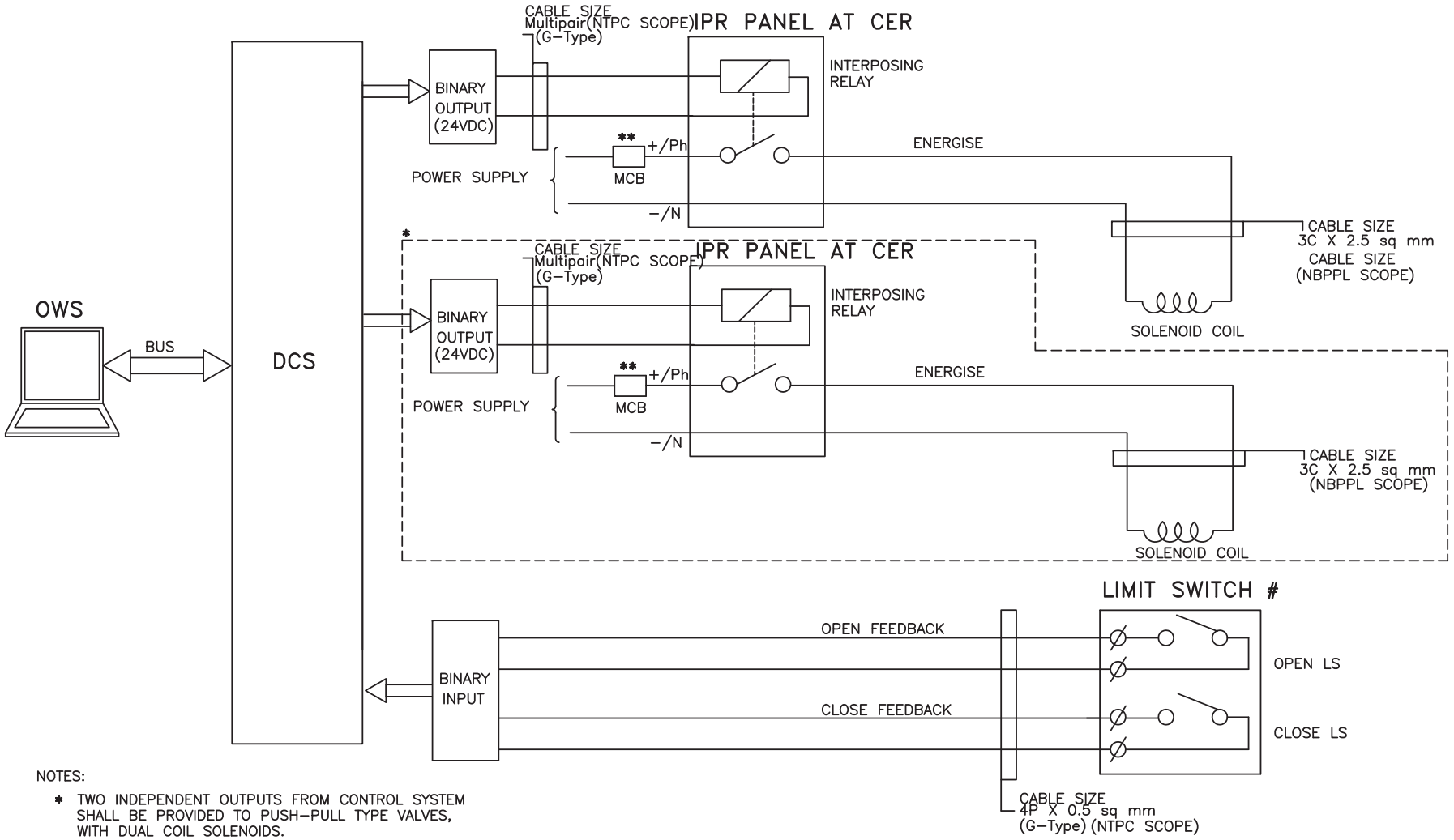
BHEL	NTPC LIMITED FEROZ GANDHI UNCHAHAR THERMAL POWER PLANT(1 X 500 MW)	DRG.NO. PE–DM–401–145–I002 DATE 05.03.2014
	TITLE DCS INTERFACE FOR BIDIRECTIONAL DRIVE	REV.NO. 00 SHT 7 OF 13

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE (CONTACTOR CONTROLLED)



BHEL	NTPC LIMITED FEROZ GANDHI UNCHAHAR THERMAL POWER PLANT(1 X 500 MW)	DRG.NO.	PE−DM−401−145−I002
		DATE	05.03.2014
	TITLE DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE	REV.NO.	00
		SHT	8 OF 13

DCS INTERFACE FOR SOLENOID DRIVE
(24V DC/240V AC)



NOTES:

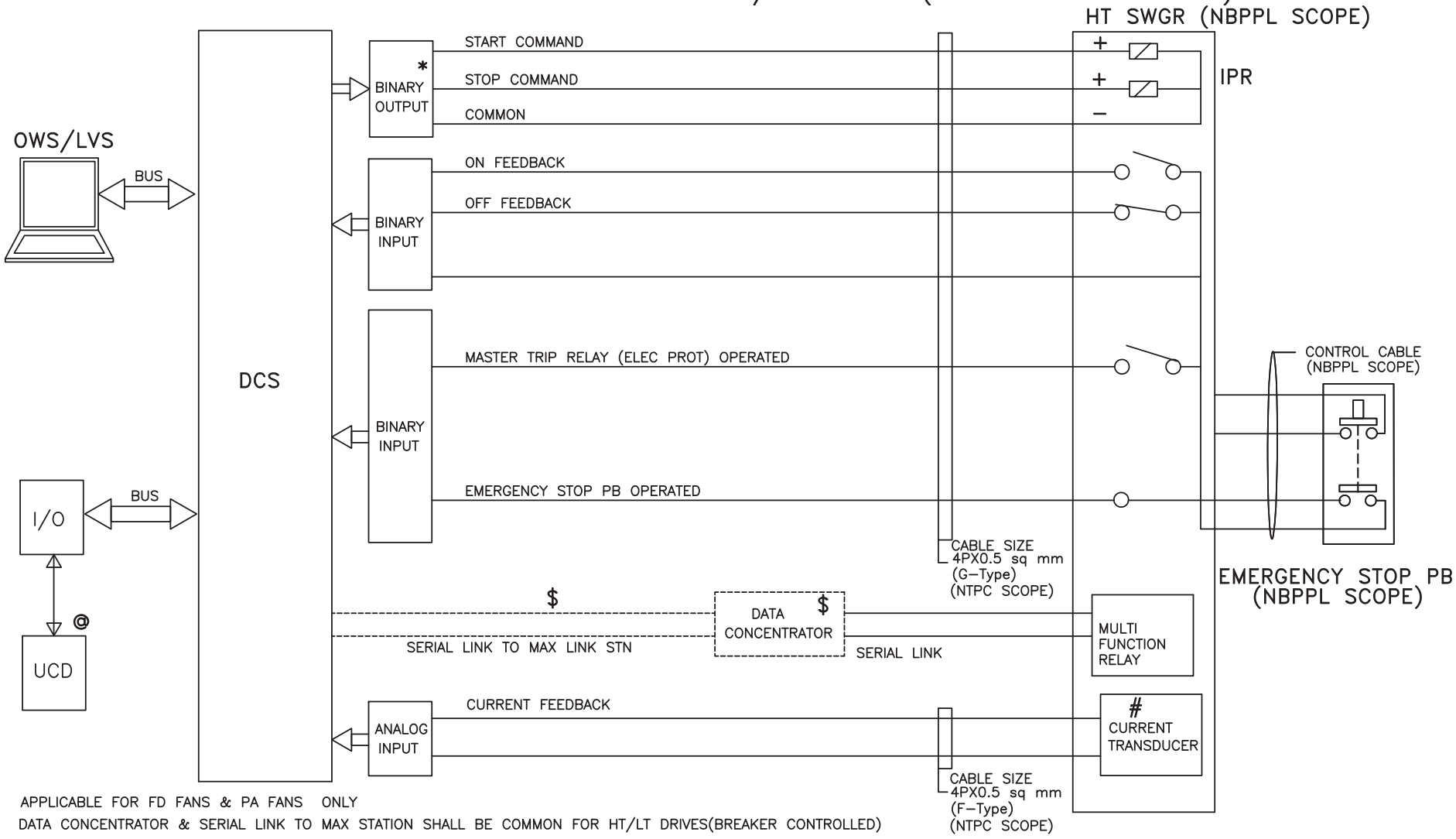
* TWO INDEPENDENT OUTPUTS FROM CONTROL SYSTEM SHALL BE PROVIDED TO PUSH-PULL TYPE VALVES, WITH DUAL COIL SOLENOIDS.

** MCB SHALL BE PROVIDED FOR EACH SOLENOID

\# FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.

BHEL	NTPC LIMITED	DRG.NO.	PE-DM-401-145-I002
	FEROZ GANDHI UNCHAHAR THERMAL POWER PLANT(1 X 500 MW)	DATE	05.03.2014
	TITLE: DCS INTERFACE FOR SOLENOID DRIVE	REV.NO.	00
		SHT	9 OF 13

DCS INTERFACE FOR UNIDIRECTIONAL HT DRIVE/ LT DRIVE (BREAKER CONTROLLED)



\# APPLICABLE FOR FD FANS & PA FANS ONLY

$ DATA CONCENTRATOR & SERIAL LINK TO MAX STATION SHALL BE COMMON FOR HT/LT DRIVES(BREAKER CONTROLLED)

@ APPLICABLE TO SELECTED DRIVES ONLY.

* REDUNDANCY SHALL BE PROVIDED AS PER CLAUSE 1.01.00, NOTE 12, CONTRACT QUANTITIES FOR DDCMIS, APPENDIX–I TO PART–A OF TECHNICAL SPECIFICATION.

NOTE: 1. EXACT NO. OF PORTS/ LINKS BETWEEN NUMERICAL RELAYS & MAX LINK STATION SHALL BE AS PER THE APPROVED SWGR & DATA CONCENTRATOR DRAWINGS.
2. OVER LOAD ALARM, RELAY FAULT, SWGR AVAILABLE & SWGR DISTURBED SIGNALS ALONG WITH OTHER INFORMATION SHALL FLOW THROUGH SOFT LINK

NTPC LIMITED	DRG.NO.	PE–DM–401–145–I002
FEROZ GANDHI UNCHAHAR THERMAL POWER PLANT(1 X 500 MW)	DATE	05.03.2014
TITLE: DCS INTERFACE FOR UNIDIRECTIONAL HT DRIVE	REV.NO.	00
	SHT	10 OF 13

SUB-SECTION

MEASURING INSTRUMENTS

CLAUSE NO.	TECHNICAL REQUIREMENTS
1.00.00	**MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)**
1.01.00	Measuring instruments/equipment and subsystems offered by the Bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Refer Sub-section Basic Design Criteria. Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance and shall comply with the acceptable international standards and shall be subject to Employer's approval.
1.02.00	Every panel-mounted instrument requiring power supply shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.
1.03.00	All transmitters, sensors, and switches for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance as well as for operator and management information (including all computation) of equipment in the system under the scope of specification shall be provided as ~~indicated in the APPENDIX I TO PART A OF TECHNICAL SPECIFICATIONS/~~ tender drawings. Estimated system parameters & instrument ranges etc. are indicated in the I & C device list. The exact value shall be provided by Employer during detailed engineering. The Contractor shall furnish all Instrumentation / Control equipment & accessories under this specification as per technical specification, ranges, makes & model as approved by the Employer during detailed engineering.
1.04.00	The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. 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. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.
1.05.00	~~The quantity of secondary instruments etc. to be provided by Contractor is listed in Appendix I to Part A of Technical Specifications.~~
2.00.00	**SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, D.P., FLOW AND LEVEL**
	ELECTRONIC TRANSMITTERS

Sl.No.	Features	Essential/Minimum Requirements
1.	Type of Transmitter	Microprocessor based 2 wire type, Hart protocol compatible.

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	2.	Accuracy	± 0.1% of calibrated span (minimum) (upto turn down ratio of 10:1)
	3.	Output signal range	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol)
	4.	Turn down ratio	10:1 for vacuum/very low pressure applications. 5:1 for very high pressure application. 30:1 for other applications.
	5.	Stability	± 0.1% of calibrated span for six months for Ranges up to and including70 Kg/cm². ± 0.25% of calibrated span for six months for Ranges more than 70 Kg/cm² (g).
	6.	Zero and span drift	+/- 0.015% per deg.C at max span. +/-0.11% per deg.C at min. Span.
	7.	Load impedance	500 ohm (min.)
	8.	Housing	Weather proof as per IP-55 with durable corrosion resistant coating.
	9.	Over Pressure	150% of max. Operating pressure
	10.	Connection (Electrical)	Plug and socket type
	11.	Process connection	1/2 inch NPT (F)
	12.	Span and Zero	Continuous, tamper proof, Remote as well as adjustability manual from instrument with zero suppression and elevation facility.
	13.	Accessories	-Diaphragm seal, pulsation dampeners, syphon etc. as required by service and operating condition. -2 valve manifold for absolute & Gauge pressure transmitters, 3-valve manifold for vacuum pressure transmitters & where DP transmitters are being used for pressure measurement and 5 valve manifold for DP/Level/Flow applicable. -For hazardous area, explosions proof enclosure as described in NEC article 500.

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC

14.	Diagnostics	Self Indicating feature
15.	Power supply	24V DC ± 10%.
16.	Adjustment/calibration/maintenance	From hand held calibrator/centralized PC based system (as applicable).

Notes

For air/flue gas applications, DP type transmitters shall be provided for pressure measurement.

LVDT type is not acceptable.

Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

2.01.00 **GUIDED WAVE RADAR TYPE LEVEL TRANSMITTER**

Guided wave radar type level transmitters shall be provided for level measurements of the vessel under vacuum or low pressure applications.

Type	Guided wave Radar
Principle	TDR (Time domain reflectometry)
Probe Type& Material	Coaxial, SS316/316L. If required, probe shall be suitable for overfill prevention.
Signal o/p	4-20mA with HART signal suitable for overfill prevention.
Display	Integral
Power supply	24 VDC
Accuracy	5mm
Electromagnetic compatibility	Shall meet EN 61326-1 (1997) and AmdtA1, class A equipment/EN 50081-2 & EN 5008 1-2 & EN 50082-2
Mounting	External cage mounting

The transmitters shall be provided with IP-55 protection class with durable corrosion resistant coating.

CLAUSE NO.	MEASURING INSTRUMENTS (C-03)	एनटीपीसी NTPC

The transmitter shall provide suitable 4-20mA dc output signal for control and indication/recording. Converters if necessary shall be provided to generate the 4-20mA signal.

A local indicator of fuel oil flow shall also be provided. The instrument shall be calibrated in Tons/hr.

Suitable strainer shall be provided before the transmitter for the protection of oval wheel meters against foreign matter contained in the fuel oil.

The exact model no. and type of material being used, etc., shall be subject to Employer's approval during detailed engineering without any price repercussion to Employer.

15.00.00 PROCESS ACTUATED SWITCHES

FEATURES	ESSENTIAL / MINIMUM REQUIREMENTS		
	Pressure/ Draft Switches/ DP Switches	Temperature switches	Level switches
Sensing Element	Piston actuated for high pressure and diaphragm or bellows for low pr./ vacuum	Vapor pressure sensing, liquid filled bellow type with SS bulb and capillary (10 m minimum)	Capacitance types for oil and dirty medium, water, condensate application. Float type switches for applications as decided by Employer during detailed engineering. Capacitance/ Conductivity/ Ultrasonic type for acid and alkali application. Radio-frequency/ Ultrasonic type for ash hopper, ash slurry application.
Material	316 SS	Bulb 316 SS/ capillary 304 SS	316 SS
End connection	½ inch NPT (F)	½ inch NPT (F)	Manufacturer standard
Over range proof pressure	150% of max. design pr.	-	150% of max. design pressure

CLAUSE NO.	MEASURING INSTRUMENTS (C-03)	एनटीपीसी NTPC

Repeatability	±0.5% of full range		
No. of contacts	2 No.+2NC. SPDT snap action dry contact		
Rating of contacts	60 V DC, 6 VA (or more if required by DDCMIS)		
Elect. Connection	Plug in socket.		
Set point/ dead band adjustment	Provided over full range.		
Enclosure	Weather and dust proof as per IP-55		
Accessories	Siphon, snubber, chemical seal, pulsation dampeners as required by process	Thermo well of 316 SS and packing glands	All mounting accessories
Mounting	Suitable for enclosure/ rack mounting or direct mounting	Suitable for rack mounting or direct mounting	-
Power Supply (wherever required)	24 V DC, to be arranged by Contractor except for Ash Level Switches, where the same shall be as per Contractor's Standard practice.		

Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

CLAUSE NO.	MEASURING INSTRUMENTS (C-03)	एनटीपीसी NTPC

16.00.00 **SPECIFICATIONS FOR PR. GAUGE, D.P. GAUGE, TEMP. GAUGE AND LEVEL GAUGE.**

Sl. No	FEATURES	ESSENTIAL/MINIMUM REQUIREMENTS		
		Pr. Gauge/ DP Gauge/ Draught gauges	Temperature Gauge	Level Gauge
1	Sensing Element and material	Bourdon for high pressure, Diaphragm/Bellow for low pr. Of 316 SS	Mercury in steel for below 450°C and inert gas actuated for above 450°C of SS bulb and capillary.	Tempered * toughened Borosilicate gauge glass steel armoured reflex or transparent type.
2	Body material	Die-cast aluminium	Die-cast aluminium	Forged carbon steel/304 SS
3	Dial size	150mm	150 mm	Tubular covering entire range
4	End connection	1/2 inch NPT (M)	3/4" NPT (M)	Process connection as per ASME PTC and drain/vent 15 NB
5	Accuracy	±1% of span	± 1% of span	± 2%
6	Scale	Linear, 270° arc graduated in metric units	Linear, 270° arc graduated in °C	Linear vertical
7	Range selection	Cover 125% of max. of scale	Cover 125% of max. of scale	Cover 125% of max. of scale
8	Over range test	Test pr. for the assembly shall be1.5 to the max. Design pr. at 38°C.		
9	Housing	Weather and dust proof as per IP-55	Weather and dust proof as per IP-55	CS/304 SS leak proof
10	Zero/span adjustment	Provided	Provided	--
11	Identification	Engraved with service legend or laminated phenolic name plate		

CLAUSE NO.	MEASURING INSTRUMENTS (C-03)			
	12	Accessories	Blow out disc, siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve	SS Thermowell	Gasket for all KEL-F shield * for transparent type vent and drain valves of Steel/SS as per CS/Alloy process Requirement.
	13	Material of Bourdon/ movement	316 SS / 304 SS	316 SS / 304 SS	

Notes:-

*Bicolour type level gauges will be provided for applications involving steam and water except for condensate and feed water services.

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.

Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

17.00.00 G Related Special Measuring Instrument

17.01.00 **ANALYSER INSTRUMENTS:**

Common Requirements

1	Output signals Analog	4-20 mA DC
	Binary	2 NO + 2 NC for high alarm
2.	Zero & span Adjustment	Available
3.	Ambient temp.	50°C
4.	Indication	Digital
5.	Enclosure Type/Material	Weather & Dust proof (IP 55) Die cast Aluminium/SS
6.	Type of Electronics	Microprocessor based

CLAUSE NO.	TECHNICAL REQUIREMENTS

instrumentation cable shields at same potential. This shall be completed prior to system tests. All the cables etc. required for grounding of all equipments supplied under this package are to be supplied by the Bidder.

9.07.00 The Contractor shall take full care while laying / installing cables as recommended by cable manufacturers regarding pulling tensions and cable bends. Cables damaged in any way during installation shall be replaced at the expense of the Contractor.

10.00.00 FIELD MOUNTED LOCAL JUNCTION BOXES

(i)	No. of ways	12/24/36/48/64/72/96/128 with 20% spares terminals.
(ii)	Material and Thickness	4mm thick Fiberglass Reinforced Polyester (FRP).
(iii)	Type	Screwed at all four corners for door. Door gasket shall be of synthetic rubber.
(iv)	Mounting clamps and accessories	Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands required for erection shall be of SS, included in Bidders scope of supply.
(v)	Type of terminal blocks	Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm^2. A M6 earthing stud shall be provided.
(vi)	Protection Class	IP: 55 minimum for indoor & IP-65 minimum for outdoor applications.
(vii)	Grounding	To be provided.
(viii)	Color	To be decided during detailed engineering & subject to Employer's approval.

11.00.00 CONDUITS

11.01.00 Conduits shall be generally used for interconnecting cables from field instruments to Local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS: 9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant lead coated steel, water leak, fire and rust proof *for the following areas:-*

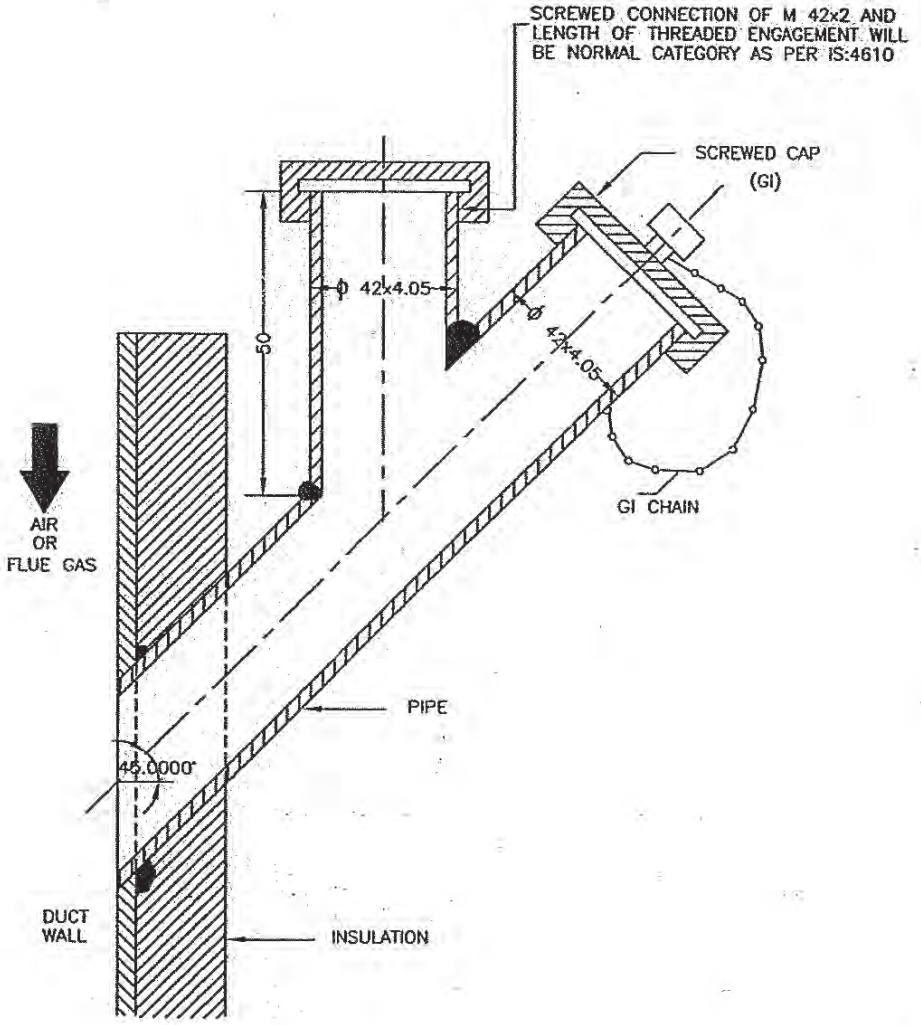
(i) Mills,

(ii) Drum,

(iii) Main Steam, RH steam

09944

PRESS. MEASUREMENT



NOTES:-

1. THIS TYPE OF PRESSURE CONNECTON SHALL BE PROVIDED FOR PRESSURE MEASUREMENTS IN AIR AND FLUE GAS DUCT/FURNACE.
2. DIMENSIONS ARE INDICATIVE ONLY.

FOR TENDER PURPOSE ONLY

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE
A	FIRST ISSUE										

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NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

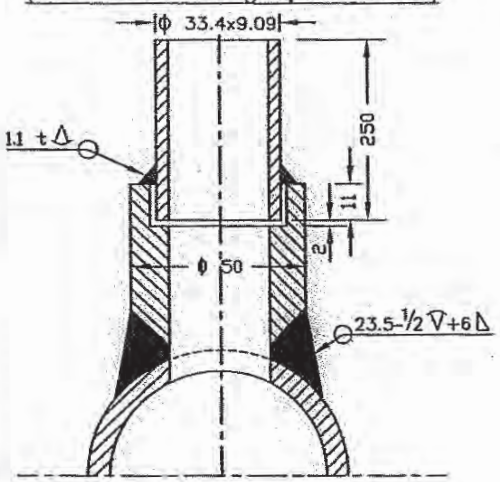
PROJECT: TYPICALTHERMAL POWER PROJECT (STATION C&I PACKAGE)

TITLE: INSTRUMENT SOURCE CONNECTION DETAILS

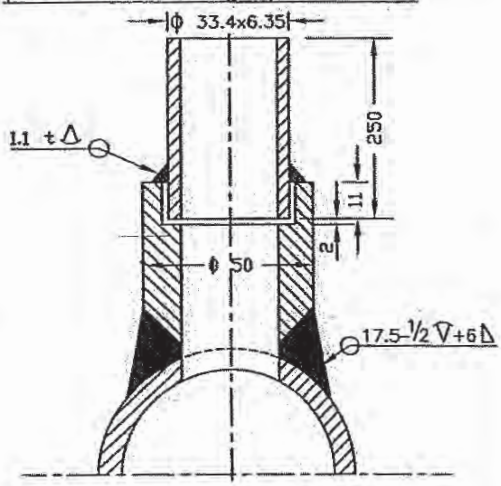
SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-405-POI-A-035 Sh-3 Of 14	A

PRESSURE MEASUREMENT

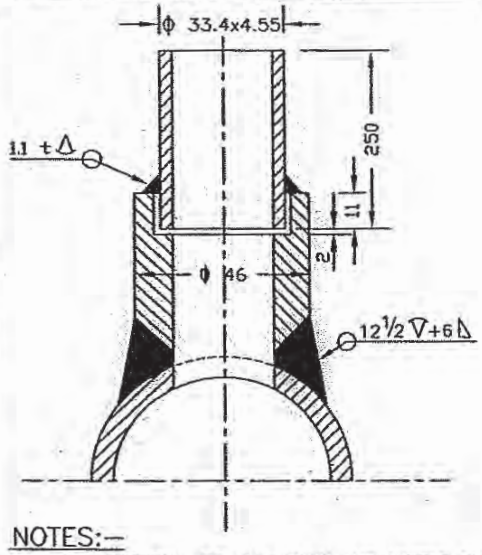
(SYSTEM PR.>40Kg/Sq Cm CL 9000)



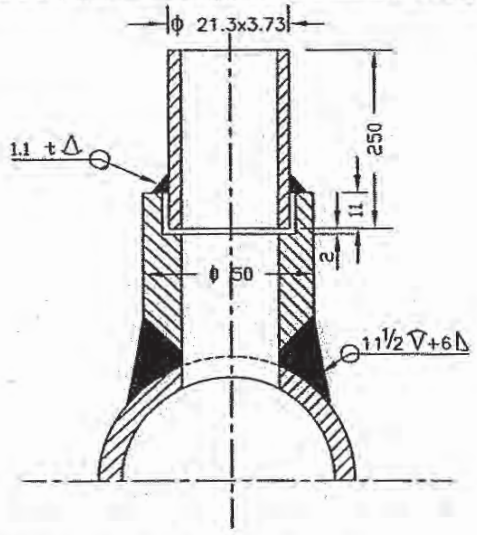
(SYSTEM PR.>40Kg/Sq Cm CL 6000)



(SYSTEM PR. <40Kg/Sq cm Nb 25 CL 3000)



(SYSTEM PR. <40Kg/Sq cm Nb 15 CL 3000)



NOTES:—

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFIRM TO ANSI B 16.11.
2. THE LENGTH OF THE NIPPLE SHOULD BE 250mm.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1" GLOBE VALVE OF MATERIAL AS PER ANSI B 16.1.
4. TWO ISOLATED VALVES ARE TO BE USED FOR PRESSURE = >40 Kg/Cm2 & TEMP.= >280°C.
5. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY (1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.
6. ORIENTATION OF TAP WILL BE VARY WITH TYPE OF PROCESS FLUID AND NATURE OF RUN OF THE PIPE.
7. ACTIVITIES TO BE COMPLETED AT THE SHOP, WELD THE COUPLING (OR BOSS) ON THE PIPE AND DRILL PRESSURE CONNECTION HOLE (SAME AS I D OF NIPPLE) IN THE PIPE IN ALLIGNMENT WITH HOLE IN THE COUPLING.
8. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.

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REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE
A	FIRST ISSUE										

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ENGINEERING DIVISION

PROJECT: TYPICALTHERMAL POWER PROJECT (STATION C&I PACKAGE)

TITLE: INSTRUMENT SOURCE CONNECTION DETAILS

SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-405-POI-A-035 Sh-2 Of 14	A

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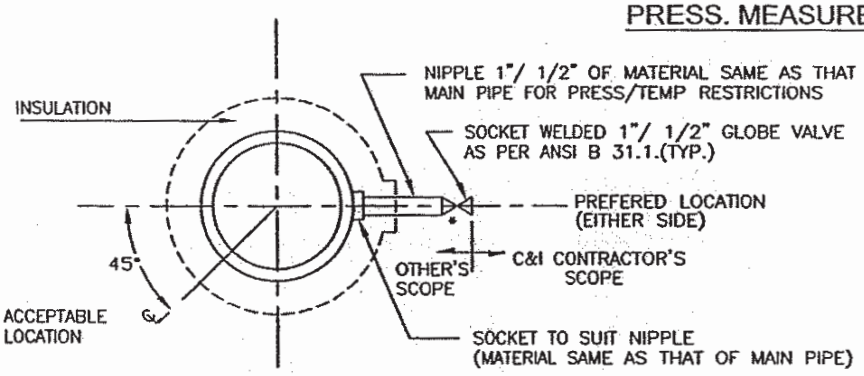
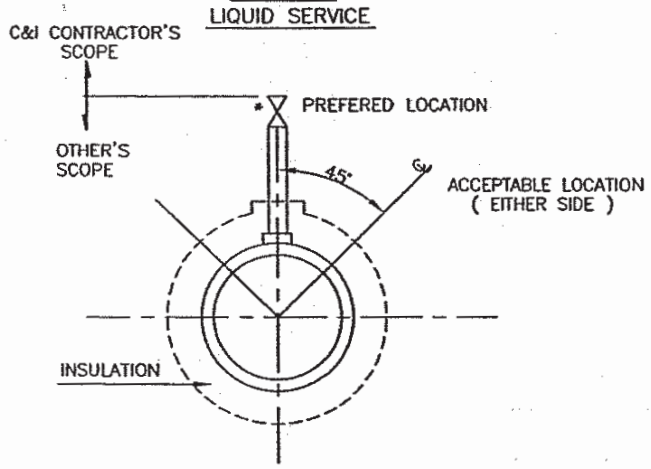
PRESS. MEASUREMENT

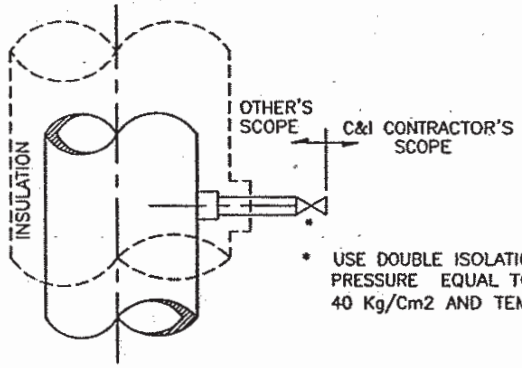


ELEVATION
LIQUID SERVICE



ELEVATION
STEAM SERVICE

PRESSURE CONNECTION ON HORIZONTAL PIPE



ELEVATION
LIQUID OR STEAM SERVICE

PRESSURE CONNECTIONS ON VERTICAL PIPES

FOR TENDER PURPOSE ONLY

A	FIRST ISSUE														
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE				
					CLEARED BY										

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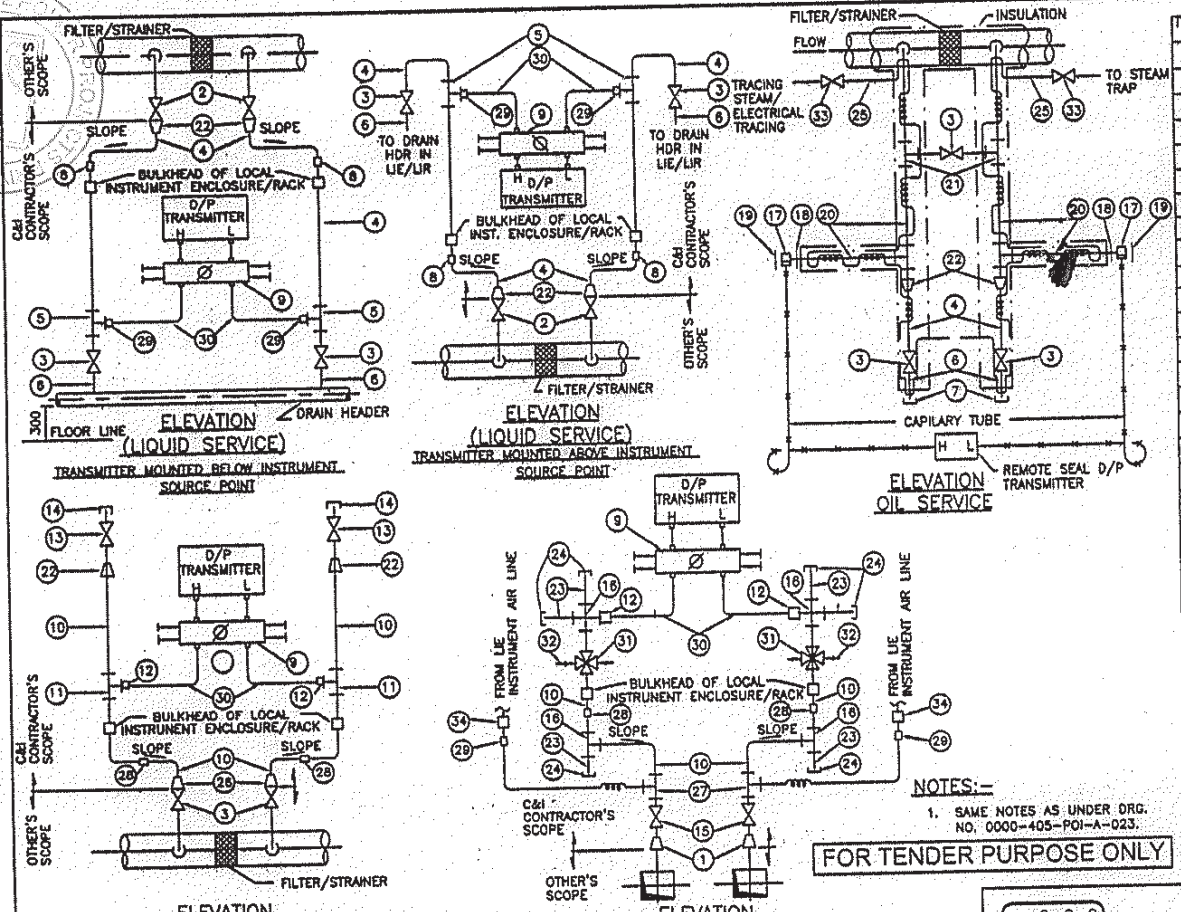
ENGINEERING DIVISION

PROJECT	TYPICALTHERMAL POWER PROJECT (STATION C&I PACKAGE)			
TITLE	INSTRUMENT SOURCE CONNECTION DETAILS			
SIZE A4	SCALE N.T.S.	DRG. NO. 0000-405-POI-A-035 Sh-1 Of 14	REV. NO. A	



NOTES:-

1. SAME NOTES AS UNDER DRG. NO. 0000-405-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) CS NIPPLE.
7.	1/2" NPT (F) CS CAP.
8.	1/2" PIPE x 1/2" PIPE UNION.
9.	5 VALVE MANIFOLD (FOR DETAIL REFER DRAWING NO.0000-405-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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NTPC LIMITED
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ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT (STATION C&I PACKAGE)

TITLE: INSTRUMENT INSTALLATION DIAGRAM
DIFF. PRESS.MEASUREMENT (LIQUID, OIL, AIR/GAS SERVICE)

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	CLEARED BY: M	E	C	C&I	ARCH.	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
A	FIRST ISSUE										26.04.06	A3	N.T.S.	0000-405-POI-A-030	A

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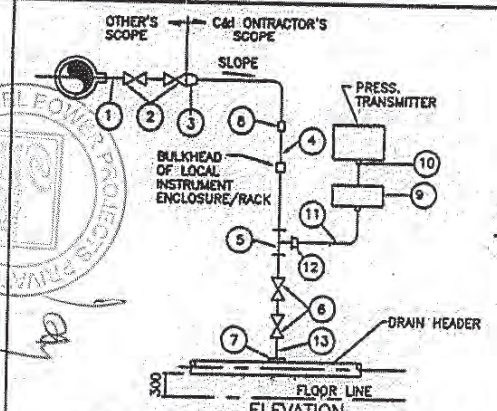
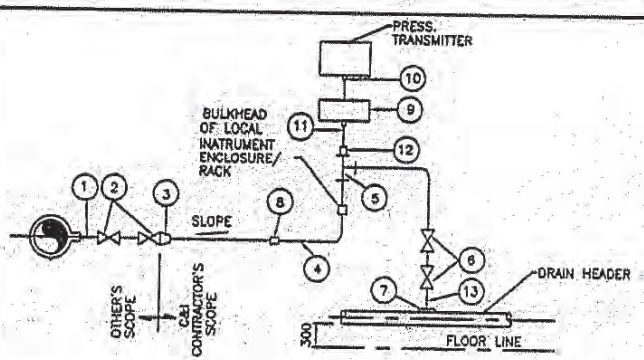


ELEVATION

TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT



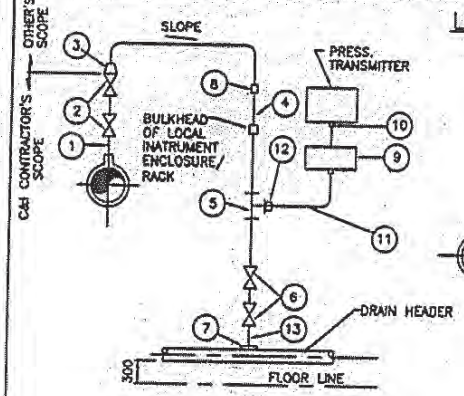
ELEVATION

TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

LIQUID PRESSURE MEASUREMENT

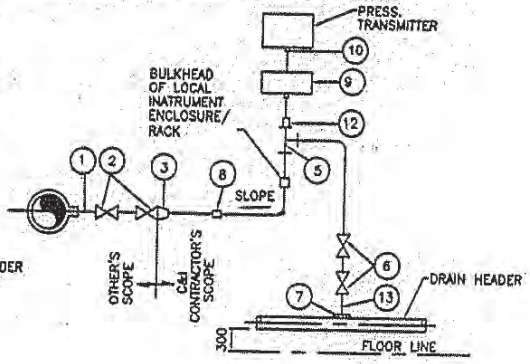
LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1/2" / 3/4"/1" NPS SCH. 80/160/XXS/P91 NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	3/4"/1" SW GLOBE VALVE.
3.	3/4"/1" TO 1/2" REDUCING INSERT
4.	1/2" NPS PIPE
5.	1/2" SW EQUAL TEE
6.	1/2"SW GLOBE VALVE
7.	1/2"NPS SCH. 80/160 SWx1/2"CS/AS COUPLER
8.	1/2" PIPE UNION
9.	2/3 VALVE MANIFOLD (FOR DETAIL SEE DRAWING NO.0000-405-POI-A-023.
10.	SUITABLE ADAPTER
11.	SS TUBE
12.	1/2" PIPE x 1/2"TUBE UNION
13.	1/2"NPS SCH. 80/160 SWx1/2" NPT(M) CS/AS NIPPLE



ELEVATION

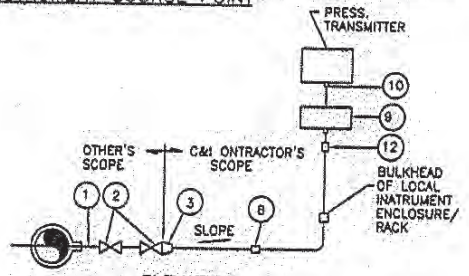
TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT



ELEVATION

TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

STEAM PRESSURE MEASUREMENT



ELEVATION

VACCUM PRESSURE MEASUREMENT

NOTES:-

1. SAME NOTES UNDER DRG. NO. 0000-405-POI-A-023.
2. FOR VACUUM APPLICATION OTHER PORT OF TRANSMITTER SHALL BE KEPT OPEN TO ATMOSPHERE.

FOR TENDER PURPOSE ONLY

एन टी पी सी लिमिटेड
NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT (STATION C&I PACKAGE)

TITLE: INSTRUMENT INSTALLATION DIAGRAM (PRESSURE MEASUREMENT USING PRESS /DP TRANSMITTERS STEAM/LIQUID VACUUM)

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										28.04.06

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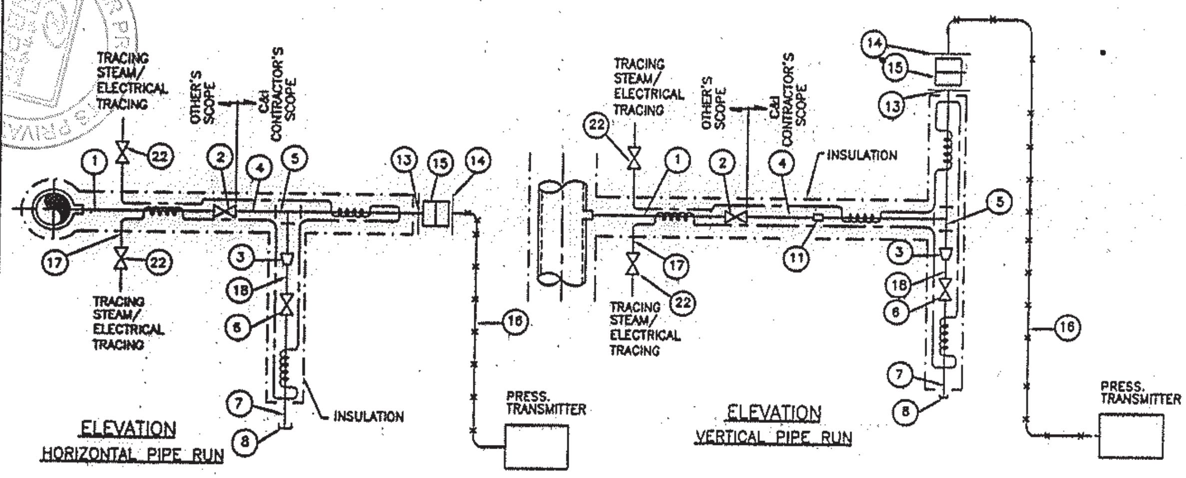
SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-405-POI-A-025	A



HEAVY FUEL PRESS. MEASUREMENT USING WAFER TYPE TRANSMITTER WITH REMOTE SEAL

NOTES:-
1. SAME NOTES AS UNDER DRG. NO.0000-405-POI-A-023.
1. FOR LFO STEAM TRACING NOT APPLICABLE.

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1" NPS SCH 40/80 (AS PER PROCESS REQUIREMENT) NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE
2.	1" SW GLOBE VALVE
3.	1" x 1/2" SW REDUCING INSERT
4.	1" NPS SCH 40/80 CS PIPE
5.	1"SW EQUAL TEE
6.	1/2" SW GLOBE VALVE
7.	1/2" NPS SCH 40/80 SW x 1/2"NPT (M) CS NIPPLE
8.	1/2" NPT (F) CS CAP.
9.	–
10.	–
11.	1/2" PIPE UNION
12.	–
13.	2½" BLIND 300lbs RF ANSI FLANGE DRILLED & TAPPED FOR 1" NPT PIPE
14.	2½" MATCHING BLIND FLANGE
15.	WAFER ELEMENT FOR USE WITH 2 1/2" ANSI RF FLANGE
16.	SPECIAL LIQUID FILLED 300 SS POLYTHINE JACKETED CAPILLARY TUBE OF PRESSURE TRANSMITTER.
17.	1/4" CHROME MOLY STEEL PIPE.
18.	1/2" NPS SCH. 40/80 CS PIPE.
19.	–
20.	–
21.	–
22	1/4" SW 316 SS ISOLATION VALVE.

FOR TENDER PURPOSE ONLY

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NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT (STATION C&I PACKAGE)

TITLE: INSTRUMENT INSTALLATION DIAGRAM (PRESSURE TRANSMITTER FUEL OIL)

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										28.04.06

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-405-POI-A-024	A

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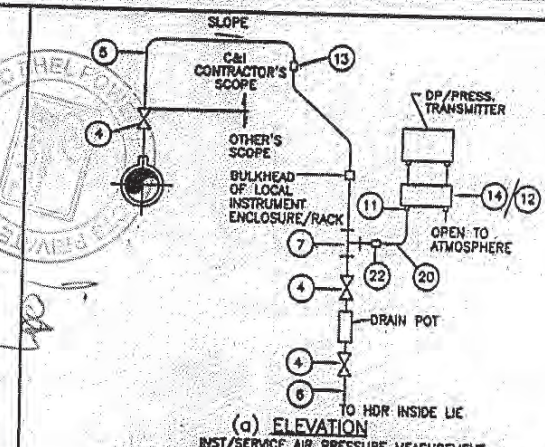
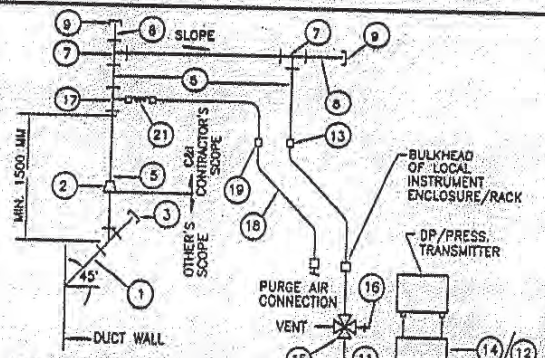
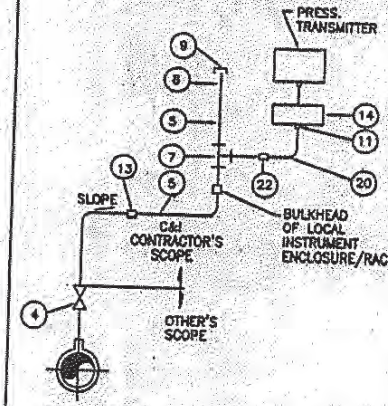


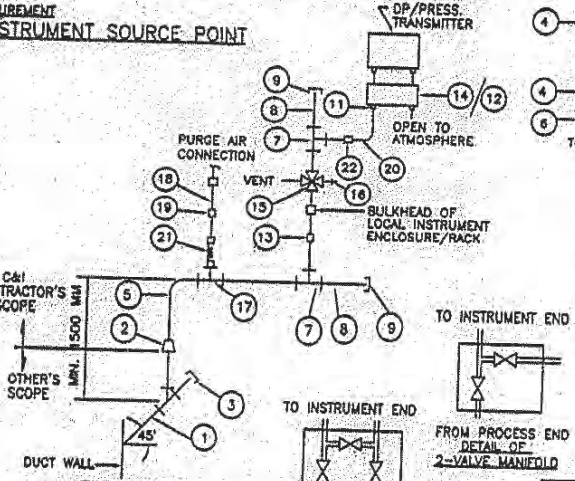
(a) ELEVATION
INST/SERVICE AIR PRESSURE MEASUREMENT
TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT



(b) ELEVATION
DIRTY AIR/FLUE GAS PRESSURE MEASUREMENT



ELEVATION
INST/SERVICE AIR PRESSURE MEASUREMENT



ELEVATION
DIRTY AIR/FLUE GAS PRESSURE MEASUREMENT
TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	42 X 405 MM M.S. BLACK PIPE
2.	M42x2 TO 3/4" REDUCING INSERT
3.	M42x2(F) M.S.CAP
4.	3/4" SW GLOBE VALVE/GATE VALVE
5.	3/4" NPS PIPE
6.	3/4" NPS SW 3/4" NPT(M) CS/AS NIPPLE
7.	3/4" SW EQUAL TEE
8.	3/4" NPS SCH 80 CARBON/ALLOY STEEL NIPPLE
9.	3/4" NPT(F) CS/AS CAP
10.	3/4" SW CS/AS EQUAL CROSS
11.	1/2" TUBE ADOPTER
12.	3 VALVE MANIFOLD
13.	3/4" PIPE UNION
14.	2 VALVE MANIFOLD
15.	3/4" SW 4 WAY VALVE
16.	QUICK DISCONECT FITTING
17.	3/4"SWx1/2"SW BRANCH TEE
18.	1/2" NB SEAMLESS GI PIPE
19.	1/2" NPT (F) GI FITTING
20.	SS TUBE
21.	FLEXIBLE HOSE WITH ONE END SOCKET WELDED (PIPE SIDE) & OTHER END WITH SUITABLE FITTINGS.
22.	3/4" x 1/2" S.S. TUBE UNION

NOTES:-

1. SEE NOTES UNDER DRG. NO.0000-405-POI-A-022.
2. IMPULSE LINE DRAIN CONNECTIONS SHALL BE DONE AS PER TECHNICAL SPECIFICATIONS
3. THE SLOPE IN THE HORIZONTAL OF THE IMPULSE PIPE SHALL BE APPROX. 50 mm/mtr.
4. THE [redacted] ORIENTATION OF THE TRANSMITTERS WITH RESPECT TO VALVE MANIFOLDS ETC. TO BE FINALISED DURING DETAILED ENGINEERING KEEPING IN VIEW THE MANUFACTURER'S RECOMMENDATIONS.
5. COMMON INSTRUMENT AIR HEADER (1"NB) USING REDUNDANT AIR FILTER REGULATORS WILL BE MADE IN EACH TRANSMITTER ENCLOSURE REQUIRING PURGE AIR. PURGE AIR FOR EACH INSTRUMENT LINE SHALL BE TAPPED FROM THIS HEADER USING INDIVIDUAL PURGE ROTAMETERS AS SHOWN IN DRG. NO. 0000-405-POI-A-034 TYPICALLY.

FOR TENDER PURPOSE ONLY

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										26.04.06

CLEARED BY

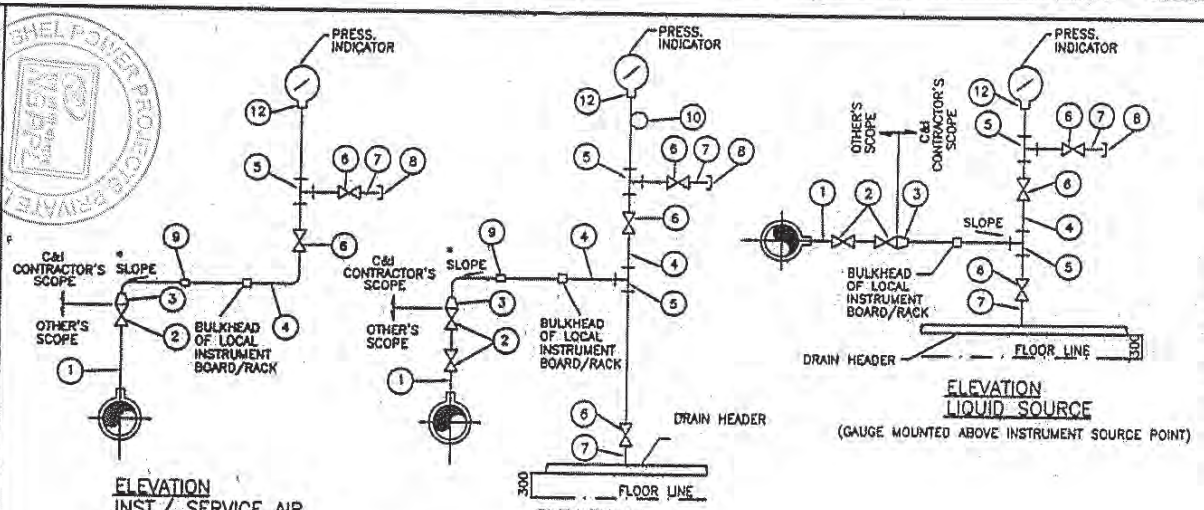
एन टी पी सी लिमिटेड
NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT (STATION C&I PACKAGE)

TITLE: INSTRUMENT INSTALLATION DIAGRAM (PRESSURE MEASUREMENT USING PRESS / DP TRANSMITTERS (INST./SERVICE, DIRTY AIR/FLUE GAS)

SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-405-POI-A-023	A

62660

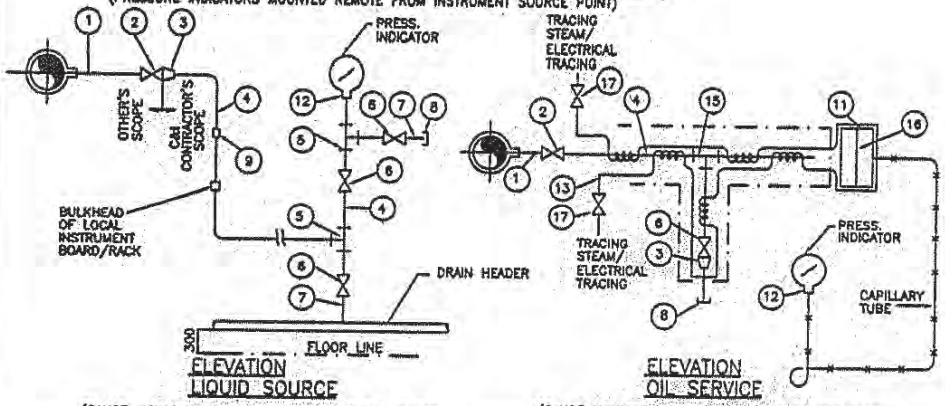


ELEVATION
INST./ SERVICE AIR

ELEVATION
STEAM SERVICE

ELEVATION
LIQUID SOURCE

(PRESSURE INDICATORS MOUNTED REMOTE FROM 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) CS CAP.
9.	1/2" / 3/4" PIPE UNION.
10.	6" SS SYPHON
11.	1/2" BLIND 3001bs 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. 40 MM / METRE.

FOR TENDER PURPOSE ONLY

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N T P C LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT (STATION C&I PACKAGE)

TITLE: INSTRUMENT INSTALLATION DIAGRAM (FOR PRESSURE GAUGE)

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										26.04.06

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-405-POI-A-022	A

82660

SUB-SECTION

CABLING PHILOSOPHY

~~SPCIFICATION OF POWER SUPPLY CABLES~~

~~Refer Annexure to this Sub-section.~~

INSTRUMENTATION CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY

The cable interconnection philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field mounted Group Junction Boxes (JBs) at strategic locations (where large concentration of signals are available, e.g. valves limit & torque switches, switchgear) is done and consequently cable with higher number of pairs are extensively used. The details of termination to be followed are mentioned in the given Table A.

TABLE A: CABLE TERMINATION TO BE FOLLOWED

Application		Type Of Termination		Type Of Cable
FROM (A)	TO (B)	END A	END B	
Valves/dampers drives (Integral Junction box)	Marshalling / Marshalling – cum Termination Cubicle / local group JB	Plug in connector	Post mount cage clamp type.	G
Transmitters, Process Actuated switches mounted in LIE/LIR	Integral Junction box of LIE/LIR	Plug in connector	Cage clamp (Rail mount) type.	F,G
RTD heads	Local junction box	Plug in connector	Cage clamp (Rail mount) type.	F
Thermocouple	Local junction box / CJC box (if applicable)	Plug in connector	Cage clamp (Rail mount) type.	A, B, C*
Other Field mounted Instrument	Local JB / Group JB	Plug in connector	Cage clamp (Rail mount) type.	F,G
RTD	Temperature transmitter	Plug in connector	Screwed, Cage clamp type	F

CLAUSE NO.	TECHNICAL REQUIREMENTS

Application		Type Of Termination		Type Of Cable
FROM (A)	TO (B)	END A	END B	
Thermocouple	Temperature transmitter	Plug in connector	Screwed, Cage clamp type	A, B, C*
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/ MCC/SWGR	Group JB	Cage clamp (Rail mount) type.	Cage clamp (Rail mount) type.	F,G
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/ Group JB / MCC/SWGR	Marshalling / Marshalling – cum Termination Cubicle	Cage clamp (Rail mount) type.	Cage clamp (Post mounted) type.	F,G
Marshalling cubicle/ Termination Cabinet	Electronic system cabinet	Cage clamp (Post mounted) type.	Plug-in connector / other system as per Mfr.'s Standard	Internal wiring
Marshalling/ Termination System Cabinets	UCD mounted equipments	Cage clamp (Post mounted) type.	Plug in connector / Cage clamp type (rail mounted).	F,G (with plug-in connect or at one end)
DDCMIS/PLC cabinets	PC, Printers etc.	Plug in connector	Plug in connector	Mfr.'s Standar d

Notes
1. Normally 10% spare cores shall be provided when the numbers of pairs of cables are more than four pairs, except for pre-fabricated cables which shall be as per manufacturer's standard.
2. For analog signals, individual pair shielding & overall shielding & for Binary signals, only overall shielding of instrumentation cables shall be provided.
3. Also refer drg. X-405-POI-A-021.
4. *For high temperature applications only.

CLAUSE NO.	TECHNICAL REQUIREMENTS
6.00.00	**TERMINAL BLOCKS**
6.01.00	All terminal blocks shall be rail mounted/post mounted, cage clamp type with high quality non-flammable insulating material of melamine suitable for working temperature of 105 deg. C. The terminal blocks in field mounted junction boxes, temperature transmitters, instrument enclosures/racks, etc., shall be suitable for cage clamp connections. The terminal blocks in Control Equipment Room logic/termination/marshalling cubicles shall be suitable for post mounted cage clamp connection at the field input end. The terminal blocks for DDCMIS input/output connections from/to SWGR/MCC, Actuators with Integral Starter (for coupling relays and check back signals of 11 kV and 3.3 kV auxiliaries, LT drives/valves & dampers/solenoids, CT & VT, etc.) shall be provided with built in test and disconnect facilities complete with plug, slide clamp, test socket etc. The exact type of terminal blocks to be provided by the Bidder and the technical details of the same including width etc. shall be subject to Employer's approval.
6.02.00	All the terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, partitions, small partitions, test plug bolts and test plug (as specified above for SWGR connections) transparent covers, support brackets, distance sleeves, warning label, marking, etc.
6.03.00	The marking on terminal strips shall correspond to the terminal numbering on wiring diagrams. At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc. All terminal blocks shall be numbered for identification and grouped according to the function. Engraved labels shall be provided on the terminal blocks.
6.04.00	For terminating each process actuated switches, drive actuators, control valves, Thermocouple,RTD, etc. in Local Junction Boxes, etc, refer Drg no. 0000-999-POI-A-065.
6.05.00	The terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks and between terminal blocks and junction box walls.
6.06.00	For ensuring proper connections, Bidder shall provide suitable accessories, along with insulation sleeves. The exact connecting accessory shall be finalised as per application during detail engineering stage subject to Employer's approval without any cost repercussions.
6.07.00	Internal wiring in factory pre-wired electronic equipment cabinets may be installed according to the Bidder's standard as to wire size and method of termination or internal equipment. Terminal blocks for connection of external circuits into factory prewired electronic equipment cabinets shall meet all the requirements as specified above.
7.00.00	**INTERNAL PANELS/ SYSTEM CABINETS WIRING**
7.01.00	Internal panel/cabinet wiring shall be of multi-stranded copper conductor with FRLS PVC insulation without shield and outer sheath meeting the requirements of VDE 0815.

-08269

SUB-SECTION

ELECRICAL ACTUATORS WITH INTEGRAL STARTERS

1.00.00	**ELECTRIC ACTUATORS WITH INTEGRAL STARTERS** 08270
1.01.00	**TYPE:**
1.01.01	The actuators shall have integral starters along with over load relays with built in SPP (Single Phasing Preventer). A 415, 3 phase 3 wire power supply shall be given to the actuator from vendor's/employer's switch board as applicable through a switch fuse unit. Control voltage of the motor starter shall be 110 V AC / 24 V DC, derived suitably from 415V power supply.
1.01.02	In case supplier's standard control voltage for Open/Close contactors is 110V AC, the same is acceptable if suitable Opto Isolation circuit is provided with coupling relays for 24 V DC command inputs.
1.02.00	**INTERFACES:**
1.02.01	Open/Close command termination logic with position & torque Limit Switches, positioner circuit shall be suitably built in the PCB inside the actuator. (a) *For Binary Drive (both ON-OFF and INCHING type) :- Open/Close command* & status thereof and disturbance monitoring signal (common contact for Overload, Thermostat, control supply failure, L/R selector switch at local & other protections operated) shall be provided. Interface with the control system shall be through hardware signal only. Inter posing relays provided (with coil burden 2.5 VA) in the actuator shall be energized to initiate opening and closing, by 24V DC signal from the external control system. (b) For Modulating Drive:- the command to actuator shall be in form of 4-20mA signal. The necessary positioning circuit and motor protection shall be provided (c) Open/close command termination logic shall be suitably built inside actuator.
1.03.00	**RATING :** (a) Supply Voltage & frequency: 415V +/- 10%, 3 Phase, 3 Wire 50HZ +/-5%. (b) Sizing:- For 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 regulating service 150 starts per hour or required cycles, whichever is higher.

1.04.00 **CONSTRUCTION:** 08271

(a) Enclosure:

Totally enclosed weatherproof minimum IP-55 degree of protection.

(b) Gear Train :

Metal (Fibre gears are not acceptable) self-locking to prevent drift under torque switch (where ever applicable) spring pressure when motor is de-energised.

(c) Manual Wheel:

Shall disengage automatically during motor operation.

1.05.00 **MOTOR :**

(a) Type :

Squirrel cage induction motor suitable for Direct On Line (DOL)starting.

(b) Enclosure:

Totally enclosed, self ventilated IP-55 degree of protection.

(c) Insulation

Class B or better. Temperature rise 70 Deg C. over 50 Deg C ambient

(d) Bearings:

Double shielded, grease lubricated antifriction.

(e) Earth Terminals:

Two

(f) Protection:

Single Phasing Protection, Over heating protection through Thermostat and wrong phase sequence protection shall be provided over and above other protection features standard to bidder's design Suitable means shall be provided to diagnose the type of fault locally.

1.06.00 **POSITION/TORQUE SWITCHES:**

1.06.01 Four nos. (2 each in open and close position) position limit switches and two nos. (one in open and other in close direction) torque switches each having two nos. NO

and two nos. NC contacts shall be provided. A single shaft shall actuate all contacts of limit switches at each position.

Limit switch and disturbance signals shall be available to DCS even when the power supply to the actuators is not available.

Torque switches shall be bypassed in both the end positions with the other end Limit switches.

Limit switches

Limit switches shall be Silver plated with high conductivity and non –corrosive type. Contact rating shall be sufficient to meet the requirement of Control System subject to a minimum of 60 V, 6 VA rating. Protection class shall be IP-55.

1.07.00 **LOCAL OPERATION:**

1.07.01 It shall be possible to operate the actuator locally also. Lockable local/remote selection shall be provided on the actuator.

1.08.00 **POSITION INDICATOR :**

1.08.01 To be provided for 0 to 100% travel.

1.09.00 **POSITION TRANSMITTER (FOR MODULATING/INCHING TYPE) :**

1.09.01 As required. Suitable for stabilized 4-20 mA signal, 2 wire inductive type, 24 volts DC operated.

1.10.00 **WIRING :**

1.10.01 Suitable voltage grade copper wire.

1.11.00 **TERMINAL BOX :**

(i) 9 pin plug and socket (1 no. per actuator to suit 4 pair 0.5 sq.mm. copper overall shielded (16 mm OD), instrumentation cable) suitably mounted in the starter box itself to terminate open/close command and status feedback signals with external control systems.

(ii) Additional one number 9 pin plug and socket (to suit 4 pair 0.5 sq.mm copper (16 mm OD) individual and overall shielded instrumentation cable) suitably mounted in the starter box itself for actuators with 4-20 mA position transmitters.

(iii) Necessary glands for power cables shall be provided.

1.12.00	**TERMINAL BLOCK :**
1.12.01	650V grade. For power cables.
1.13.00	**SPACE HEATER :**
1.13.01	Space heater of suitable rating. The supply shall be derived from the main power supply available in the actuator.
~~1.14.00~~	~~**TYPICAL WIRING DIAGRAM :**~~
~~1.14.01~~	~~Refer Tender Drawing No. 0000-999-POI-A-063.~~

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.: PE-ID-401-145-I902	
		VOLUME II B	
		SECTION D	
		REV. NO. 00	DATE: 25.03.14
		SHEET 2 OF 5	

Data Sheet A & B

		DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL*	* PROJECT	1 X 500 MW FGUTPP	
	OFFER REFERENCE		
	* TAG NO. SERVICE		
	* DUTY	☐ ON / OFF ☐ INCHING	
	* LINE SIZE (inlet/outlet): MATERIAL		
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY	
	* OPENING / CLOSING TIME		
	* WORKING PRESSURE		
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%	
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY	
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY	
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY	
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IP:55	
	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 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. **FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.**	
HANDWHEEL	* REQUIRED	■ YES ☐ NO	
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED	
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.		
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY	
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY	
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR SUITABLE FOR DOL STARTING	
	ACTUATOR APPLICABLE WIRING DIAGRAM	■ ENCLOSED (BIDDER TO CONFIRM) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ■ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram	
	COLOUR SHADE	■ BLUE (RAL 5012) ☐	
	PAINT TYPE **(## Refer Notes)**	■ENAMEL ☐ EPOXY ☐	
	SHAFT RPM	BIDDER TO SPECIFY	
	OLR SET VALUE	BIDDER TO SPECIFY	
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY	
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY	
	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC	
	@ CONTROL VOLTAGE REQUIREMENT	110V AC/ 24VDC TO BE DERIVED SUITABLY FROM 415V POWER SUPPLY	

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.: PE-ID-401-145-I902	
		VOLUME II B	
		SECTION D	
		REV. NO. 00	DATE: 25.03.14
		SHEET 3 OF 5	

Data Sheet A & B

		DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
	@ ENCLOSURE CLASS OF MOTOR	TOTALLY ENCLOSED, SELF VENTILATED IP-55 DOP	
	@ INSULATION CLASS	CLASS B OR BETTER, TEMPERATURE RISE 70 DEG C OVER 50 DEG C AMBIENT	
	@ WINDING TEMP PROTECTION	■ THERMOSTAT (3 Nos.,1 IN EACH PHASE)	
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED	
INTEGRAL STARTER	INTEGRAL STARTER	■ REQUIRED ☐ NOT REQUIRED	
	TYPE OF SWITCHING DEVICE	■ CONTACTORS ☐ THYRISTORS	
	TYPE	■ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)	
	IF SMART		
	a) SERIAL LINK INTERFACE	☐ INTEGRAL ☐ FIELD MOUNTED	
	b) SERIAL LINK PROTOCOL	☐ FOUNDATION FIELD-BUS ☐ PROFI-BUS ☐ DEVICE NET ☐.....	
	c) SERIAL LINK MEDIA	☐ TWISTED PAIR Cu-CBL ☐ CO-AXIAL Cu-CBL ☐ OFC	
	d) HAND HELD PROGRAMMER	☐ REQUIRED ☐ NOT REQUIRED	
	e) TYPE OF HAND HELD PROGRAMMER	☐ BLUETOOTH ☐ INFRARED ☐.....	
	f) MASTER STATION	☐ REQUIRED ☐ NOT REQUIRED	
	g) MASTER STN INTRFACE WITH DCS	☐ MODBUS ☐ TCP/IP	
	h) DETAILS OF SPECIAL CABLE	☐ ENCLOSED ☐ NOT REQUIRED	
	STEP DOWN CONT. TRANSFORMER	■ REQUIRED	
	OPEN / CLOSE PB	■ REQUIRED ☐ NOT REQUIRED	
	STOP PB	■ REQUIRED ☐ NOT REQUIRED	
	INDICATING LAMPS	■ REQUIRED ☐ NOT REQUIRED	
	LOCAL REMOTE S/S	■REQUIRED ☐ NOT REQUIRED	
	STATUS CONTACTS FOR MONITORING	■ REQUIRED ☐ NOT REQUIRED	
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY)	
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	■ INTERPOSING RELAY ☐ OPTO COUPLER ☐ EITHER	
	QUANTITY	■ 2 NOs. ☐ 3 NOs.	
	DRIVING VOLTAGE	■ 20.5 – 24V DC ☐ _____V DC	
	DRIVING CURRENT	■ 125mA MAX ☐ _____mA MAX	
	LOAD RESISTANCE	■ > 192 ohms - <25 k ohms ☐ > _____ohms - < _____ohms	
TORQUE SWITCH (Not Applicable for Smart Actuator) **($$ Refer Notes)**	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN / CLOSE	■1 No. ☐2Nos. / ■1 No. ☐2Nos	
	CONTACT TYPE	2 NO + 2 NC	
	RATING	5A 240V AC AND 0.5A 220V DC	
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE	
	ACCURACY	+3% OF SET VALUE	
LIMIT SWITCH (Not Applicable for Smart Actuator) **($$ Refer Notes)**	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN : INT : CLOSE	☐1 No ■2 Nos. / 2 Nos. (ADJ.) / ☐1 No. ■2Nos.	
	CONTACT TYPE	2 NO + 2 NC	
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC	

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.: PE-ID-401-145-I902	
		VOLUME II B	
		SECTION D	
		REV. NO. 00	DATE: 25.03.14
		SHEET 4 OF 5	

Data Sheet A & B

		DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	■ REQUIRED ☐ NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ■ ELECTRONIC (2 WIRE) CONTACTLESS	
	SUPPLY	■ 24V DC ☐	
	OUTPUT	■ 4-20mA	
	ACCURACY	± 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON INTEGRAL)	N.A	
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY	
	@ RATING		
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED	
	ENCL CLASS ACTUATOR/MOTOR T.B.	@☐ IP 68 @■IP 55	
	@ EARTHING TERMINAL	REQUIRED TWO	
	PLUG & SOCKET(9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	■ REQUIRED ☐ NOT REQUIRED ■ 2 NOS. ☐ ----------	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:--TO BE PROVIDED DURING DETAILED ENGINEERING	
	@ SPACE HEATER CABLE GLAND	SIZE:----- TO BE PROVIDED DURING DETAILED ENGINEERING	
	OTHER CONTROL CABLE GLANDS-1	☐ 1No. for BFV of CW PUMP	
	OTHER CONTROL CABLE GLANDS-2	QUANTITY & SIZE : TO BE PROVIDED DURING DETAILED ENGINEERING	
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.

NOTES:

1. **SCOPE**: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
2. **CODES & STANDARDS**: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATION STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
   IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION.THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
6. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.

$$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.

EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.

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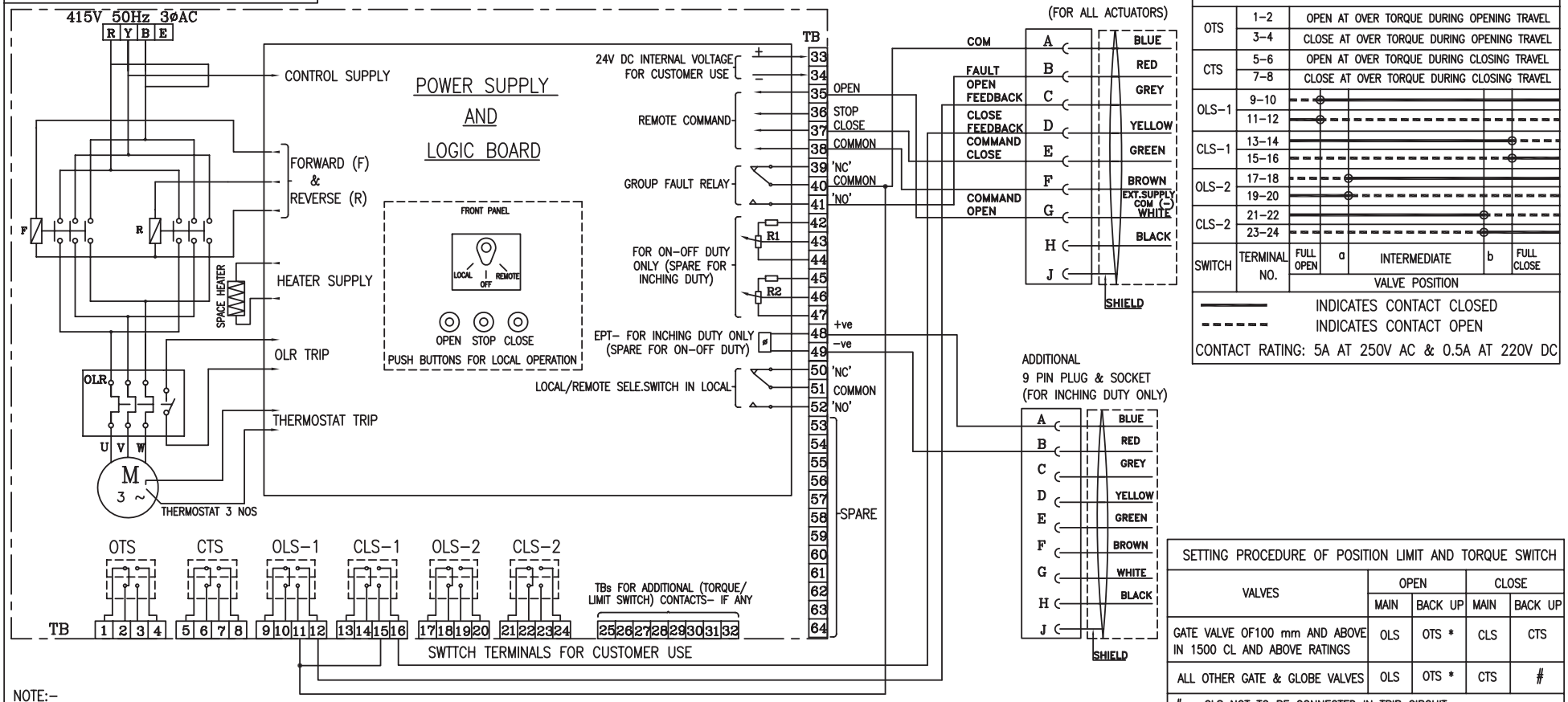
	PREPARED BY	CHECKED BY	APPROVED BY	VENDOR COMPANY SEAL
NAME	ANUJ WADHWA	AMIT TYAGI	BHARAT SINGH	NAME
SIGNATURE				SIGNATURE
DATE	25.03.2014	25.03.2014	25.03.2014	DATE

NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @= TO BE FILLED BY ES

ALL DIMENSIONS ARE IN MILLIMETRES. FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP.

DRAWING NO. 3-V-MISC-24283



CONTACT DEVELOPMENT DIAGRAM

OTS	1–2	OPEN AT OVER TORQUE DURING OPENING TRAVEL
	3–4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL
CTS	5–6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL
	7–8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL
OLS–1	9–10	
	11–12	
CLS–1	13–14	
	15–16	
OLS–2	17–18	
	19–20	
CLS–2	21–22	
	23–24	

SWITCH TERMINAL NO. — FULL OPEN | a | INTERMEDIATE | b | FULL CLOSE — VALVE POSITION

INDICATES CONTACT CLOSED

INDICATES CONTACT OPEN

CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CTS	#

\# – CLS NOT TO BE CONNECTED IN TRIP CIRCUIT

* – BYPASS OTS FOR INITIAL 5% OF TRAVEL(FOR GATE VALVES ONLY)

NOTE:–

1. ALL TORQUE AND LIMIT SWITCHES (OTS,CTS,OLS1&2, CLS1&2) ARE WITH 2NO+2NC CONTACTS '1NO+1NC' IS TERMINATED IN TBS 1–24, REMAINING CONTACTS ARE FOR INTERNAL USE. ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25–32
2. CTS – TORQUE SWITCHES FOR CW ROTATION (CLOSE)
3. OTS – TORQUE SWITCHES FOR CCW ROTATION (OPEN)
4. OLS–1, OLS–2 – LIMITSWITCHES FOR POSITION OPEN
5. CLS–1, CLS–2 – LIMITSWITCHES FOR POSITION CLOSE
6. EPT – ELECTRONIC POSITION TRAMSMITTER (CONTACTLESS TYPE, FOR INCHING DUTY)
7. R1–R2–POTENTIOMETER 2 x 100 OHMS (FOR ON–OFF DUTY)
8. FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
9. M – MOTOR 3ø 415V 50 Hz AC SUPPLY
10. TORQUE SWITCH BYPASS WITH LIMITSWITCH BOTH ON OPEN & CLOSE DIRECTION TO BE DONE INTERNALLY.

REV	DATE	ALTERED
		CHD & APPD

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS FOR NTPC PROJECTS (DRAWN FOR INTERMEDIATE POSITION OF VALVES)

BHARAT HEAVY ELECTRICALS LTD.,
UNIT: HIGH PRESSURE BOILER PLANT.
TIRUCHIRAPALLI–620014.
365–121

	NAME	SIGN	DATE	NO.OF VAR.
DRN	N.P.ESWAR	N.P	17.03.05	–
CHD	D.DINAKARAN	D.D	17.03.05	
APPD	K.ARUNACHALAM	K.A	17.03.05	

DEPT	SCALE	WEIGHT (KG).	REFERENCE INFORMATIONS	NO. OF ITEMS
VL	NTS	–		–
CODE –				

TITLE: WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET FOR NTPC PROJECTS

CARD CODE: U 01

DRAWING NO.: 3–V–MISC–24283

REV: 0

Size A3

Annexure C&I-1 to S.No. 04 of Amendment

12430

SUB–SECTION

TYPE TESTS REQUIRMENTS

NTPC BHEL POWER PROJECTS PRIVATE LIMITED ★ NBPPL

TYPE TEST REQUIREMENTS

1.00.00 **TYPE TEST REQUIREMENTS** 12431

1.01.00 General Requirements

1.01.01 The Contractor shall furnish the type test reports of all type tests as per relevant standards and codes as well as other specific tests indicated in this specification. A list of such tests are given for various equipment in table titled 'TYPE TEST REQUIREMENT FOR C&I SYSTEMS' at the end of this chapter and under the item Special Requirement for Solid State Equipments/Systems. For the balance equipment instrument, type tests may be conducted as per manufactures standard or if required by relevant standard.

(a) Out of the tests listed, the Bidder/ sub-vendor/ manufacturer is required to conduct certain type tests specifically for this contract (and witnessed by Employer or his authorized representative) even if the same had been conducted earlier, as clearly indicated subsequently against such tests.

(b) For the rest, submission of type test results and certificate shall be acceptable provided.

i. The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment. (For control valves, this shall be same size, type & design).

ii. There has been no change in the components from the offered equipment & tested equipment.

iii. The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening.

(c) 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.

1.01.02 As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by the main Bidder or his authorized representative and the balance have to be approved by the Employer.

1.01.03 The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.

1.01.04 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.

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1.01.05 The Bidder shall indicate in the relevant BPS schedule, the cost of the type test for each item only for which type tests are to be conducted specifically for this project. The cost shall only be payable after conduction of the respective type test in presence of authorize representative of Employer. If a test is waived off, then the cost shall not be payable.

2.00.00 SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS

2.01.00 The minimum type test reports, over and above the requirements of above clause, which are to be submitted for each of the major C&I systems shall be as indicated below:

i) Surge Withstand Capability (SWC) for Solid State Equipments/ Systems

All solid state systems/ equipments shall be able to withstand the electrical noise and surges as encountered in actual service conditions and inherent in a power plant. All the solid state systems/ equipments shall be provided with all required protections that needs the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Hence, all front end cards which receive external signals like Analog input & output modules, Binary input & output modules etc. including power supply, data highway, data links shall be provided with protections that meets the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Complete details of the features incorporated in electronics systems to meet this requirement, the relevant tests carried out, the test certificates etc. shall be submitted along with the proposal. As an alternative to above, suitable class of EN 61000-4-12 which is equivalent to ANSI 37.90.1/ IEEE-472 may also be adopted for SWC test.

ii) Dry Heat test as per IEC-68-2-2 or equivalent.

iii) Damp Heat test as per IEC-68-2-3 or equivalent.

iv) Vibration test as per IEC-68-2-6 or equivalent.

v) Electrostatic discharge tests as per EN 61000-4-2 or equivalent.

vi) Radio frequency immunity test as per EN 61000-4-6 or equivalent.

vii) Electromagnetic Field immunity as per EN 61000-4-3 or equivalent.

Test listed at item no. v, vi, vii, above are applicable for electronic cards only as defined under item (i) above.

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC

3.00.00 **TYPE TEST REQUIREMENT FOR C&I SYSTEMS**

Sl. No	Item	Test Requirement	Standard	Test To Be Specifically Conducted	NTPC's Approval Req. On Test Certificate
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6
1	Elect. Metering instruments	As per standard (col 4)	IS-1248	No	Yes
2	Transducers	As per standard (col 4)	IEC-60688,IS12 784	No	Yes
3	Thermocouple	Degree of protection test	IS-13947	No	No
4	RTD	As per standard (col 4)	IEC-60751	No	No
5	Electronic transmitter	As per standard (col 4)	BS-6447 / IEC-60770	No	Yes
6	E/P converter	As per standard (col 4)	Mfr. standard	No	Yes
7	Dust emission monitor	Degree of protection test	IS-13947	No	Yes
8	Instrumentation Cables Twisted & Shielded*				
	-Conductor	Resistance test	VDE-0815	No	Yes
		Diameter test	IS-10810	No	Yes
		Tin Coating test (Persul-phate test)	IS-8130	No	Yes
	-Insulation	Loss of mass	VDE 0472	No	Yes
		Ageing in air ovens**	VDE 0472	No	Yes

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC

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

2.0 In case the Contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract free of cost to the Owner and submit the reports for approval.

**These tests shall be carried out as per VDE0207 Part 6 & ASTMD-2116 for TEFLON insulated & outer sheathed cables

***Applicable for armoured cables only

9 DC Power Supply System (Applicable for each model and rating)

Degree of protection test	IS-13947	Yes	Yes
Short circuit current capability	Approved procedure	Yes	Yes
Voltage Proof Test	UL 950,IEC950	Yes	Yes
Burn In test	Approved procedure	Yes	Yes
Efficiency	Approved procedure	Yes	Yes
Audible Noise Test	Approved procedure	Yes	Yes
Fuse Clearing Capability	Approved procedure	Yes	Yes
Total harmonic content	Approved procedure/CIGRE's	Yes	Yes
Radio Frequency interference	IEC-CISPR22, IEC-61000-	Yes	Yes

BHEL POWER PROJECTS PRIVATE LIMITED & NTPC LIMITED

			approved procedure		
18	CJC Box	Degree Of protection test	IS-13947	No	Yes
19	Junction Box	Degree Of protection Test	IS-13947	No	Yes
20	OPC Data Access Server, Data Exchange Server & Historical Data Access Server	OPC Compliance Testing		No	Yes (Self certification is also acceptable)
	Conductivity Type Level Switch	Degree of protection test	IS-2147	No	No
	Local Gauges	Degree of protection test	IS-2147	No	No
	Process actuated Switches	Degree of protection test	IS-2147	No	No
	Control Valves	CV test	ISA 75.02	No	Yes
	PLCs	As per standard (Col 4)	IEC 1131	No	No
	Flow Nozzle Orifice plates	Calibration	ASME PTC BS 1042	Yes	Yes

The contractor shall submit for Employers approval the reports of all the type test as per latest IS-10918 carried out within last five years from the date of Bid opening and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The complete type test reports shall be for any rating of Battery in a particular group based on plate dimensions being manufactured by supplier.

Note:

Type Tests are to be conducted only for the items, which are being supplied as a part of this Package.

SUB-SECTION

QUALITY ASSURANCE

CLAUSE NO.	QUALITY ASSURANCE & TESTING	एनटीपीसी NTPC

MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)

TESTS / ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (if applicable)(R)	Hydro Test(R)	Material Test certificate ®
1. PR Gauge (IS-3624)	Y	Y	Y	Y	Y				
2. Temp. Gauge (BS-5235)	Y	Y	Y	Y	Y				
3. Pr./D.P.Switch (BS-6134)	Y	Y	Y	Y	Y	Y			
4. Electronic Transmitter (BS-6447 / IEC-60770)	Y	Y	Y	Y	Y	Y			
5. Temp. Switch	Y	Y	Y	Y	Y	Y			
6. Recorder (IS-9319/ANSI C-39.4)	Y	Y	Y	Y	Y	Y			
7. Vertical indicators	Y	Y	Y	Y		Y			
8. Digital Indicators	Y	Y	Y	Y		Y			
9. Integrators	Y	Y	Y	Y					
10. Electrical Metering Instrument (IS-1248)	Y	Y	Y	Y	Y	Y			
11. Transducer (IEC-688)	Y	Y	Y	Y	Y	Y			
12. Thermocouples (ANSI-MC-96.1)	Y	Y	Y	Y	Y	Y			
13. RTD (IEC-751)	Y	Y	Y	Y	Y	Y			
14. Thermowell	Y		Y				Y	Y	Y

R-Routine Test A- Acceptance Test Y – Test applicable

: Note: **1) Detailed procedure of Environmental stress screening test shall be as per Quality Assurance Programme in General Technical Conditions**

2) 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.

TESTS / ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection	Calibration (R)	Requirement as per standard (R)	WPS approval (A)	Non-destructive testing (R)	Calculation for accuracy (R)	Insulation Resistance (R)	IBR Certification as applicable (R)	Hydro test (R)	Material test certificate (A)
15. Cold junction compensation box	Y	Y	Y	Y					Y			
16. Orifice plate (BS-1042)	Y	Y	Y	Y *	Y	Y **	Y **			Y	Y **	Y
17. Flow nozzle (BS-1042)	Y	Y	Y	Y *	Y	Y	Y			Y	Y	Y
18. Impact head type element	Y	Y	Y					Y				Y
19. Level transmitter/float type switch	Y	Y	Y	Y					Y	Y	Y	Y
20. Flue Gas analyser	Y	Y	Y	Y								
21. Dust emission monitors	Y	Y	Y	Y								
*Calibration to be carried out on one flow element of each type and size if calibration carried out as type test same shall not be repeated.												
** If applicable												

R-Routine Test A- Acceptance Test Y – Test applicable

Note: 1) Detailed procedure of Environmental stress screening test shall be as per Quality Assurance Programme in General Technical Conditions

2) 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.

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SUB-SECTION – E-52

PROCESS CONNECTION AND PIPING

Process Control & Piping

TESTS / ITEMS	Visual ®	GA, BOM, Layout of component & construction feature®	Dimension ®	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	Y	Y	Y			
Local instruments racks	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y			
Junction Box	Y	Y	Y	Y*		Y		Y	Y								
Gauge Board	Y	Y	Y	Y		Y		Y		Y			Y	Y			
Impulse pipes and tubes	Y		Y		Y			Y							Y		
Socket weld fittings ANSI B-16.11	Y		Y					Y							Y		Y
Compression fittings	Y		Y					Y						Y	Y	Y	
Instrument valves & Valve manifolds	Y		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.

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SUB-SECTION – E-57

ELECTRICAL ACTUATORS WITH INTEGRAL STARTERS

CLAUSE NO.	QUALITY ASSURANCE	एनटीपीसी NTPC

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 ®	Grease leakage ®	Local/ Remote (Open-Stop-Close) Operation® Safety check (Single phasing, Phase correction, Tripping etc.) (A)
ELECTRICAL ACTUATOR WITH INTEGRAL STARTER(IS_9334)													
Motor	Y	Y	Y	Y	Y								
Final Testing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions

2) 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.

®- Routine Test (A) - Acceptance Test Y - Test applicable