TELANGANA STATE POWER GENERATION CORPORATION LIMITED (TSGENCO)

5X800 MW YADADRI THERMAL POWER STATION

TECHNICAL SPECIFICATION
FOR
CONDENSATE POLISHING UNIT

SPECIFICATION NO.: PE-TS-417-155A-A001

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

	TITLE: 5X800 MW YADADRI THERMAL POWER STATION	SPECIFICATION NO. PE-TS-417-155A-A001	
	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT		
		REV. NO. 00	DATE :

CONTENTS

	TITLE : **5X800 MW YADADRI THERMAL POWER STATION**	SPECIFICATION NO. PE-TS-417-155A-A001	
		SECTION :	
	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	**SUB-SECTION:**	
		REV. NO. 00	DATE :

PROJECT INFORMATION

YADADRI THERMAL POWER STATION

PROJECT INFORMATION

1	Name of the Project	YADADRI Thermal Power Station
2	Station Capacity	5X800 MW (Coal based)
3	Owner	Telangana State Power Generation Corporation Limited (**TSGENCO**)
4	Site Location	Site is located 7 km from the NH5.
5	Latitude	*16° 42*'20.40 N
6	Longitude	79° 34'41.56 E
7	Nearest Town	30 Km Miryalaguda
8	Nearest Railway Station	6.5 Km Damercherla
9	Nearest Airport	130 Kms (Vijayawada)
10	**Site Conditions**	
	Ambient Temperature	
	Daily minimum (average)	10°C
	Daily maximum (average)	47°C
	Design Ambient Temperature	50°C
	Ambient temperature (performance)	38°C
	Relative Humidity for design / efficiency	48-84 %
	Annual rainfall, mm	600 mm
	Plant Elevation above MSL	85 m above MSL

TELANGANA STATE POWER GENERATION CORPORATION LIMITED

From
Chief Engineer/Civil/ Thermal
TSGENCO, Vidyut Soudha,
Hyderabad – 500082

To
The Dy.General Manager,
M/s.BHEL Camp Office,
Vidyut Soudha,
Khairtabad,
Hyderabad – 500082

Lr.No.CE/C/Thermal/KTPSD/E1/F.YTPS-M/s.BHEL/D.No. 247 /2015-16,Dt. 19.08.2015

Sir,

Sub:- YTPS – 5x800MW- Wind load & Seismic zone details - Reg

Ref: email: dated.11.08.2015 from M/s.BHEL.

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With reference to the email cited, the details of wind load & seismic zone pertaining to proposed Yadradri Thermal Power Station (5x800MW) are herewith furnished for taking further action.

Wind load		Seismic zone	
Wind Speed	Terrain category	Seismic zone	Type of soil
44m/Sec	Category-2	Zone-III as per IS 1893:2002	Type of soil may be confirmed at your end after conducting soil investigation in the plant area.

Yours faithfully,

19/8/2015

CHIEF ENGINEER/CIVIL/THERMAL

Copy to the:
Chief Engineer/TPC/TSGENCO/Vidyut Soudha/Hyderabad.
A.S to Director/Projects/ TSGENCO/Vidyut Soudha/Hyderabad
M/s.DESEIN Private Limited, 102, First floor, My Home Sarovar Plaza, Secretariat Road, Hyderabad-500063.

जलवायवी सारणी
CLIMATOLOGICAL TABLE

BACK

स्टेशन : नलगोंदा
STATION : Nalgonda

अक्षांश LAT. 17°03' देशांतर LONG. 79°16'

समुद्री तल माध्य से ऊंचाई HEIGHT ABOVE M.S.L. 227 मीटर METRES

प्रक्षणों पर आधारित BASED ON OBSERVATIONS 1975-2000

माह / MONTH	स्टेशन का सतह दाब / STATION LEVEL PRESSURE	वायु तापमान / AIR TEMPERATURE										आर्द्रता / HUMIDITY		मेघ की मात्रा / CLOUD AMOUNTS		वर्षा / RAINFALL						
		माध्य / MEAN						चरम / EXTREMES														
		शुष्क बल्ब DRY BULB	नम बल्ब WET BULB	दैनिक अधिक नम DAILY MAX	दैनिक न्यून तम DAILY MIN	माह में उच्चतम HIGHEST IN THE MONTH	माह में निम्नतम LOWEST IN THE MONTH	उच्चतम HIGHEST	दिनांक और वर्ष DATE AND YEAR	निम्नतम LOWEST	दिनांक और वर्ष DATE AND YEAR	सापेक्ष आर्द्रता RELATIVE HUMIDITY	वाष्प दाब VAPOUR PRESSURE	समस्त मेघ ALL CLOUDS	निम्न मेघ LOW CLOUDS	मासिक योग MONTHLY TOTAL	वर्षा के दिनोंकी संख्या NO. OF RAINY DAYS	वर्षसहित सबसे नम महीने का योग TOTAL IN WETTEST MONTH WITH YEAR	वर्षसहित शुष्कतम महीने का योग TOTAL IN DRIEST MONTH WITH YEAR	24 घंटोंकी सबसे भारी वर्षा HEAVIEST FALL IN 24 HOURS	दिनांक और वर्ष DATE AND YEAR	माध्य पवन गति MEAN WIND SPEED
	एच.पी.ए hPa	डि. से °C	डि. से °C	डि. से °C	डि. से °C	डि. से °C	डि. से °C	डि. से °C		डि. से °C		प्रतिशत %	एच.पी.ए hPa	आकाश के अष्ठमाश Oktas of sky		मि.मि. mm		मि.मि. mm	मि.मि. mm	मि.मि. mm		कि.मी. प्र. घं. Kmph
जनवरी I JAN II	989.9	21.3	19.3	30.8	18.4	33.8	16.1	36.0	17 1998	14.4	7 1992	82	21.2	2.0	1.8	13.5	0.4	155.7 1978	0.0	55.4	11 1978	
फरवरी I FEB II	988.0	23.6	21.5	33.5	20.7	36.5	18.0	39.0	26 1980	15.4	5 1988	82	24.1	3.0	2.5	7.2	0.5	14.0 1999	0.0	49.2	20 2000	
मार्च I MAR II	985.8	26.2	23.7	37.3	22.8	40.9	19.9	42.0	14 1983			80	27.4	1.7	1.4	6.5	0.4	88.5 1981	0.0	43.6	13 1981	
अप्रैल I APR II	983.6	29.2	25.5	39.6	25.5	43.0	22.4	44.5	30 1991	14.6	15 1987	73	29.7	2.1	2.0	17.6	1.0	65.6 1981	0.0	40.6	24 1981	
मई I MAY II	980.8	31.9	26.3	41.2	28.2	44.8	23.5	46.1	26 1984			63	29.7	2.7	2.5	27.0	1.4	94.3 1991	0.0	49.0	5 1981	
जून I JUN II	978.2	29.8	25.7	37.6	27.2	42.6	23.4	46.3	2 1998	21.8	12 1991	71	29.9	5.1	4.4	65.9	3.5	48.2 2000	0.0	81.7	12 1991	
जुलाई I JUL II	978.8	27.7	24.7	33.9	25.5	37.3	23.2	39.2	7 1992	22.0	2 1992	77	28.6	6.3	5.8	124.6	6.0	176.7 1977	36.8 1979	99.2	24 1977	
अगस्त I AUG II	979.6	27.1	24.3	32.8	25.0	35.4	22.8	37.5	25 1979	22.0	2 1981	78	28.2	6.1	6.0	133.0	6.7	189.0 1998	33.2 1979	88.2	14 1977	
सितम्बर I SEP II	982.0	27.4	24.4	33.6	24.9	36.4	22.8	38.5	23 1987	21.6	8 1989	77	28.3	4.9	4.2	145.5	5.8	393.1 1991	20.3 1984	152.2	21 1991	
अक्तूबर I OCT II	985.3	26.6	23.8	33.1	23.7	36.2	21.4	36.5	1 1987	19.2	28 1980	78	27.2	4.0	3.7	104.3	3.8	333.1 1981	4.2 1984	109.2	6 1987	
नवम्बर I NOV II	987.9	24.2	21.0	31.1	21.2	33.5	17.9	35.5	7 1996	14.6	27 1981	75	22.6	3.2	2.6	48.1	2.8	66.8 1991	1.1 1981	163.5	4 1987	
दिसम्बर I DEC II	990.3	21.7	18.6	30.0	18.6	32.2	15.7			12.6	16 1993	73	19.4	2.7	2.3	3.8	0.3	3.1 1987	0.0	3.1	10 1987	
वार्षिक योग या माध्य I ANNUAL TOTAL OR MEAN II	983.9	26.7	23.4	34.8	23.7	44.3	15.9	46.3	2	12.6	16	75	26.6	3.7	3.2	696.8	32.5	631.7	631.7	163.5	4	
								6	1998	12	1993							1982	1982	11	1987	
वर्षोंकी सं I NUMBER OF YEARS II	19	19	19	19	19	21	22	19		19		19	19	18	17	20	20	16	16	23		

जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्टेशन : नलगोंदा
STAION : Nalgonda

माह / MONTH	मौसम परिघटना के साथ दिनों की संख्या — वर्षण 0.3 मि.मि.या अधिक	ओले	गर्जन	कुहरा	धूल भरी आंधी	चंड वात
	WEATHER PHENOMENA — No. OF DAYS WITH — PFT 0.3 mm Or more	HAIL	THUNDER	FOG	DUST STORM	SQU ALL
जनवरी JAN	0.5	0.0	0.0	0.0	0.0	0.0
फरवरी FEB	0.6	0.0	0.0	0.0	0.0	0.0
मार्च MAR	0.7	0.0	0.1	0.0	0.0	0.0
अप्रैल APR	1.1	0.0	0.0	0.0	0.0	0.0
मई MAY	1.8	0.0	0.0	0.0	0.0	0.0
जून JUN	4.5	0.0	0.0	0.0	0.0	0.0
जुलाई JUL	7.1	0.0	0.1	0.0	0.0	0.0
अगस्त AUG	7.7	0.0	0.0	0.0	0.0	0.0
सितम्बर SEP	6.6	0.0	0.0	0.0	0.0	0.0
अक्तूबर OCT	3.9	0.0	0.0	0.0	0.0	0.0
नवम्बर NOV	3.3	0.0	0.0	0.0	0.0	0.0
दिसम्बर DEC	0.4	0.0	0.0	0.0	0.0	0.0
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	33.3	0.0	0.1	0.0	0.0	0.0
वर्षों की सं NUMBER OF YEARS	22					

माह / MONTH	पवन की गती के साथ दिनों की संख्या (कि. मी. प्र. घं.) — 62 या अधिक	20-61	1-19	0
	WIND — No. OF DAYS WITH WIND SPEED (Km. p. h.) — 62 Or more	20-61	1-19	0
जनवरी JAN	0	0	29	2
	0	0	31	0
फरवरी FEB	0	0	28	0
	0	0	28	0
मार्च MAR	0	1	30	0
	0	1	30	0
अप्रैल APR	0	0	29	1
	0	0	30	0
मई MAY	0	0	31	0
	0	0	31	0
जून JUN	0	1	29	0
	0	1	29	0
जुलाई JUL	0	1	30	0
	0	0	31	0
अगस्त AUG	0	1	30	0
	0	0	31	0
सितम्बर SEP	0	0	29	1
	0	0	29	1
अक्तूबर OCT	0	0	29	2
	0	0	30	1
नवम्बर NOV	0	0	26	4
	0	0	28	2
दिसम्बर DEC	0	0	29	2
	0	0	30	1
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	1	5	346	13
	1	3	355	6
	22			

माह / MONTH	पवन की दिशा के दिनों की संख्या का प्रतिशत — उ	उपू	पू	दपू	द	दप	प	उप	शांत
	WIND — PERCENTAGE No. OF DAYS WIND FROM — N	NE	E	SE	S	SW	W	NW	CALM
जनवरी JAN	0	30	3	39	3	4	0	11	10
	0	29	10	51	3	1	0	4	2
फरवरी FEB	1	26	1	55	3	5	0	7	2
	1	19	7	64	3	2	0	2	2
मार्च MAR	1	25	1	55	3	5	0	9	1
	2	12	5	69	1	4	0	5	2
अप्रैल APR	0	20	1	46	4	18	0	8	3
	1	11	2	65	3	8	0	8	2
मई MAY	1	14	0	27	3	21	3	30	1
	1	20	2	29	2	19	2	24	1
जून JUN	1	2	0	6	0	36	8	47	0
	2	5	0	7	0	43	6	35	2
जुलाई JUL	1	1	0	1	0	43	10	44	0
	0	3	0	3	0	40	9	43	2
अगस्त AUG	1	1	0	2	0	32	8	55	1
	2	4	0	2	0	26	8	57	1
सितम्बर SEP	1	6	0	11	1	29	4	42	6
	4	17	1	10	0	25	6	31	6
अक्तूबर OCT	1	29	4	16	1	15	2	23	9
	2	37	6	26	1	7	2	12	7
नवम्बर NOV	3	33	7	18	2	4	0	19	14
	2	38	11	24	2	6	1	8	8
दिसम्बर DEC	3	46	3	22	1	2	1	14	8
	1	55	7	28	1	1	0	3	4
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	1	19	2	24	2	18	3	26	5
	1	21	4	33	1	15	3	19	3
	22								

माह / MONTH	मेघ मात्रा (सभी मेघ) सहित दिनों की संख्या - अष्ठमांश — 0	ले-2	3-5	6-7	8
	CLOUD — No. OF DAYS WITH CLOUD AMOUNT (ALL CLOUDS) OKTAS — 0	T-2	3-5	6-7	8
जनवरी JAN	25	0	2	1	3
	25	2	3	0	1
फरवरी FEB	18	1	3	2	4
	22	1	4	1	0
मार्च MAR	23	2	3	1	2
	26	1	2	1	1
अप्रैल APR	20	2	4	2	2
	21	1	5	2	1
मई MAY	19	2	5	2	3
	6	2	18	3	2
जून JUN	5	1	5	4	15
	2	1	4	4	19
जुलाई JUL	2	1	3	5	20
	1	0	3	4	23
अगस्त AUG	2	1	5	3	20
	0	0	1	2	28
सितम्बर SEP	4	1	6	4	15
	1	0	2	3	24
अक्तूबर OCT	18	1	5	2	5
	22	1	3	2	3
नवम्बर NOV	16	1	4	3	6
	20	1	3	2	4
दिसम्बर DEC	21	1	4	1	4
	23	2	3	1	2
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	205	13	48	29	70
	238	14	39	26	48
	21				

माह / MONTH	निम्न स्तरी मेघ मात्रा सहित दिनों की संख्या - अष्ठमांश — 0	ले-2	3-5	6-7	8	कुहरा 8
	No. OF DAYS WITH LOW CLOUD AMOUNT OKTAS — 0	T-2	3-5	6-7	8	FOG 8
जनवरी JAN	25	0	2	1	3	0
	27	1	2	0	1	0
फरवरी FEB	21	1	2	1	3	0
	24	1	3	0	0	0
मार्च MAR	25	1	3	1	1	0
	27	1	2	1	0	0
अप्रैल APR	21	1	4	2	2	0
	22	1	4	2	1	0
मई MAY	21	2	4	1	3	0
	20	2	5	2	2	0
जून JUN	7	1	4	3	15	0
	3	1	5	4	17	0
जुलाई JUL	4	1	2	3	21	0
	1	1	3	4	22	0
अगस्त AUG	3	1	4	2	21	0
	1	0	1	2	27	0
सितम्बर SEP	5	1	4	3	17	0
	2	0	2	2	24	0
अक्तूबर OCT	21	0	3	2	5	0
	23	1	3	1	3	0
नवम्बर NOV	21	1	2	2	4	0
	22	1	2	2	3	0
दिसम्बर DEC	23	1	3	1	3	0
	24	2	2	1	2	0
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	238	11	37	22	57	0
	257	14	34	20	40	0
	21					

माह / MONTH	दृश्यता सहित दिनों की संख्या — 1 कि.मी. तक	1-4 कि.मी.	4-10 कि.मी.	10-20 कि.मी.	20 कि.मी. से अधिक
	VISIBILITY — No. OF DAYS WITH VISIBILITY — UP TO 1 Km.	1-4 Kms.	4-10 Kms.	10-20 Kms.	OVER 20 Kms.
जनवरी JAN	0.6	6.7	21.3	2.3	0.1
	0.0	1.8	3.1	24.1	1.9
फरवरी FEB	0.1	7.8	18.0	1.7	0.5
	0.0	0.4	4.2	21.2	2.2
मार्च MAR	0.0	3.8	24.1	2.9	0.3
	0.0	0.3	4.4	24.2	2.1
अप्रैल APR	0.0	3.0	21.5	4.3	1.1
	0.0	0.4	3.8	24.3	1.5
मई MAY	0.0	3.1	22.5	3.4	1.9
	0.0	0.6	3.6	24.4	2.4
जून JUN	0.0	4.7	20.2	3.1	2.0
	0.0	1.1	5.2	21.4	2.3
जुलाई JUL	0.0	4.3	23.1	1.9	1.6
	0.0	1.7	4.7	22.4	2.2
अगस्त AUG	0.0	4.1	22.8	2.5	1.6
	0.0	2.8	3.9	22.7	1.6
सितम्बर SEP	0.0	3.2	20.9	3.6	2.3
	0.0	1.3	4.5	22.2	2.1
अक्तूबर OCT	0.1	3.7	22.4	3.8	1.1
	0.1	1.5	3.9	23.6	2.0
नवम्बर NOV	0.0	8.8	17.8	2.9	0.4
	0.1	3.7	5.3	17.6	3.4
दिसम्बर DEC	0.1	6.8	20.8	3.3	0.0
	0.0	4.6	3.3	21.9	1.1
वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN	0.8	60.1	255.4	35.6	13.0
	0.1	20.1	49.9	269.9	25.0
	22				

Analysis of Raw water

Table-1A

S.No.	CONSTITUENTS	As	CONTENT
1.	Calcium	$CaCO_3$	94.9 ppm
2.	Magnesium	$CaCO_3$	74.1 ppm
3.	Sodium	$CaCO_3$	184.4 ppm
4.	Potassium	$CaCO_3$	1.1 ppm
5.	Iron in Soln.	Fe	Nil
	TOTAL CATIONS	**$CaCO_3$**	**354.5 ppm**
6.	Bicarbonate	$CaCO_3$	150.9 ppm
7.	Sulphate	$CaCO_3$	58.3 ppm
8.	Chloride	$CaCO_3$	140.5 ppm
9.	Nitrate	$CaCO_3$	3.5 ppm
10.	Phosphate	$CaCO_3$	Nil
11.	Fluoride	$CaCO_3$	1.3 ppm
	TOTAL ANIONS	**$CaCO_3$**	**354.5 ppm**
12.	Reactive Silica	SiO_2	14.1 ppm
13.	Colloidal Silica	SiO_2	Nil
14.	Total Silica	SiO_2	14.1 ppm
15.	Nitrites	NO_2	Nil
16.	Total Hardness	$CaCO_3$	169 ppm
17.	Temperature		25 °C
18.	Total Suspended Solid		14 ppm
19.	Total Dissolved Solids		500 ppm
20.	Conductivity at 25°C		790 µS/cm
21.	pH value at 25°C	-	8.0
22.	Turbidity		0.9 NTU
23.	Colour	Pt.Co	< 5
24.	Residual Cl_2		0.0 ppm
25.	TOC		9.5 ppm
26.	BOD_3 at 27°C		4 ppm
27.	COD		30 ppm
28.	Dissolved Oxygen		5.8 ppm
29.	Oil & Grease		<1 ppm

Note:

1) Other parameters not indicated in above list has been considered as nil.
2) The above raw water analysis is considered based on Water analysis provided by Customer vide meeting dt.05.03.2019

Analysis of Clarified water

Table-1B

S.No.	CONSTITUENTS	As	CONTENT
1.	Calcium	$CaCO_3$	121.9 ppm
2.	Magnesium	$CaCO_3$	74.1 ppm
3.	Sodium	$CaCO_3$	184.4 ppm
4.	Potassium	$CaCO_3$	1.1 ppm
5.	Iron in Soln.	Fe	Nil
	TOTAL CATIONS	**$CaCO_3$**	**381.5 ppm**
6.	Bicarbonate	$CaCO_3$	134.8 ppm
7.	Sulphate	$CaCO_3$	80.9 ppm
8.	Chloride	$CaCO_3$	161.0 ppm
9.	Nitrate	$CaCO_3$	3.5 ppm
10.	Phosphate	$CaCO_3$	Nil
11.	Fluoride	$CaCO_3$	1.3 ppm
	TOTAL ANIONS	**$CaCO_3$**	**381.5 ppm**
12.	Reactive Silica	SiO_2	14.1 ppm
13.	Colloidal Silica	SiO_2	Nil
14.	Total Silica	SiO_2	14.1 ppm
15.	Nitrites	NO_2	Nil
16.	Total Hardness	$CaCO_3$	196 ppm
17.	Total Suspended Solid		15 ppm
18.	pH value at 25°C	-	8.0
19.	Turbidity		15 NTU

Note:

3) For the purpose of Design inlet analysis to DM plant, the following have been considered on the Raw water analysis and above clarified water analysis has been arrived.
   i) Chlorine dosing rate of 5ppm in PT plant
   ii) Alum dosing rate of 50ppm in PT plant
   iii) Lime dosing rate of 20ppm in PT plant
   iv) Poly electrolyte (PE) dosing rate of 1ppm in PT plant
4) Other parameters not indicated in above list has been considered as nil.

SECTION – I
SPECIFIC TECHNICAL REQUIREMENTS
SUB-SECTION IA - Specific Technical Requirements (Mech.)
SUB-SECTION IB - Specific Technical Requirements (Electrical)
SUB-SECTION IC - Specific Technical Requirements (C & I)

SECTION – I

SUB-SECTION – IA-SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

1.0 GENERAL

This specification is intended to cover design, engineering, manufacture, supply, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance / special tools & tackles, mandatory spares alongwith spares for erection as required, startup and commissioning spares as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in site transportation, assembly, erection & commissioning, final painting at site, minor civil work, trial run at site, preparation and submission of drawing /documents including "As Built" drawings and O & M manuals, layout drawings in 2D & 3D (As applicable) and carrying out performance guarantee /Functional / Demonstration tests at site (As applicable) & equipment /system guarantee/Aux. Guaranteed power consumption etc. inclusive of all prevailing taxes, duties and other levies and handover in flawless condition of the package specified above for above mentioned project to the end customer complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification no. **PE-TS-417-155A-A001** for condensate polishing unit package of **5X800 MW YADADRI THERMAL POWER STATION.**

The Condensate Polishing Units (5 sets) with a common external regeneration system (2sets) and associated accessories shall conform to the technical specification **(**PE-TS-417-155A-A001) for **CONDENSATE POLISHING UNIT** of **5X800 MW YADADRI THERMAL POWER STATION.**

2.0 DESIGN CONDITIONS FOR CONDENSATE POLISHING UNIT

There shall be three service vessels (3X50%) for each 800 MW unit each polishing 50% of the condensate flow corresponding to VWO (valve wide open) condition at 1% make up (Flow through each service vessel indicated in the data sheet).

There shall be two common external regeneration facility shall be provided for station. For regeneration, resin from the exhausted Condensate Polisher Mixed Beds will be transferred hydraulically/hydro pneumatically to any one of the available common external regeneration facility.

All CPU service vessels of all 5 TG units shall be connected through pipe lines with both common external regeneration facilities so that any of the service vessel exhausted resins shall be transferred to any of the available regeneration system of CPU regeneration area.

There shall be two common external regeneration facility with interconnection shall be provided for station. For regeneration, resin from the exhausted Condensate Polisher Mixed Beds will be transferred hydraulically / hydro pneumatically to any one of the available common external regeneration facility. The DM water required for resin transfer, regeneration etc. shall be tapped off from DM water storage tank of DM Plant.

CPU regeneration facilities shall be located outside of TG hall near to DM plant (identified in plot plan BHEL Doc. No PE-DG-417-100-M001 R2 under sr. no. 10a). The approximate distance between CPU Regeneration facility and different Service vessel area of TG Units are as mentioned below.
Distance between CPU regeneration area and Service vessel area of TG unit -1 =1250 meter (Approx.)
Distance between CPU regeneration area and Service vessel area of TG unit -2 =1100 meter (Approx.)
Distance between CPU regeneration area and Service vessel area of TG unit -3 =1100 meter (Approx.)
Distance between CPU regeneration area and Service vessel area of TG unit -4 =1250 meter (Approx.)
Distance between CPU regeneration area and Service vessel area of TG unit -5 =1400 meter (Approx.)

Bidder to note that complete CPU package shall be supplied under two Stages (Stage –1 & Stage -2). Stage-1 CPU shall consist of TG hall area unit-1 & unit -2 and 1st set of regeneration system supplies and stage -2 CPU shall consist of TG hall area unit-3, unit-4 & unit -5 and 2nd set of regeneration system supplies along with interconnection of stage-2 CPU with stage-1 CPU.

GENERAL DESIGN DATA TABLE FOR SERVICE VESSEL AREA		
Sr.No.	**Description**	Parameter
1.	Total Number of Vessels	Three (3x50%)
2.	CEP Discharge Pressure (Operating).	31.27 kg/cm2(g)

3.	CEP Shut off head	38.8 kg/cm2(g)
4.	Design Pressure of CPU,	47kg/cm2(g)
5.	Condensate Flow (flow at VWO condition at 1% make up)	1648.061 t/hr
6.	Condensate Flow (800 MW , 1% MU)	1542.07 t/hr
7.	Flow through each polisher vessel.(Design)	825 t/hr.
8.	Condensate Temperature (Operating)	42.4 Deg. C
9.	Condensate Temperature Maximum (Process Design)	51.8 Deg. C
10.	Condensate Temperature (Mechanical Design)	60 Deg. C
11.	Service Run Cycle-Normal Run (Hrs)	240 hrs
12.	Service Run Cycle-Start up condition (Hrs)	48 hrs
13.	Service Run Cycle-Condenser Tube Leakage condition (Hrs)	48 hrs
14.	Average velocity of condensate through service vessels	≤ 120 m/ hour

3.0 BRIEF DESCRIPTION OF THE SYSTEM

The proposed condensate plant shall treat the entire condensate of the turbine generator of each unit of power station. The proposed schematic arrangement of the condensate polishing plant and its regeneration facility shall be as per the enclosed P&I Diagram. Arrangement of piping, valves and instruments shown in the P&ID are bare minimum. The bidder shall include the complete system including regeneration facility as elaborated in this specification meeting the contractual requirements.

The condensate polisher service vessels shall be located in the TG hall of each corresponding units. The resins shall be transferred to and from the common regeneration facility by sluicing through a pipeline hydraulically / hydro pneumatically.

The regeneration process offered by the bidder shall be of proven design and shall essentially be the same process by virtue of which the bidder is qualified and shall give resin-separation compatible with the desired effluent quality.

4.0 SCOPE OF SUPPLY (MECHANICAL)

Following are in bidder's scope of supply:

Bidder to note that complete CPU package shall be supplied under two Stages (Stage –1 & Stage -2). Stage-1 CPU shall consist of TG hall area unit-1 & unit -2 and 1st set of regeneration system supplies and stage -2 CPU shall consist of TG hall area unit-3, unit-4 & unit -5 and 2nd set of regeneration system supplies along with interconnection of stage-2 CPU with stage-1 CPU.

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

A. SERVICE VESSEL FACILITY

1) There shall be three service vessels (3X50%) for each 800 MW unit, each polishing 50 % of the condensate flow. Total CPU service vessels for all 5 TG units shall be 15 numbers each polishing 50 % of the condensate flow of one TG unit.

2) Each Condensate polisher vessels shall be complete with condensate inlet and outlet connections, connections for resin transfer to and from the vessels, bed support-cum-under drain system, inlet water distributors, air distribution arrangement for resin mixing, all fittings and appurtenances etc. as specified and as required.

3) One no. External resin traps at the condensate & rinse outlet of each of the condensate polisher

mixed bed each designed for in-place manual back flushing facility. Total 15 nos. of external resin traps for all 5 TG units.

4) Condensate inlet and outlet headers for each installation with pipe connections to the condensate polisher vessels for each 800 MW TG unit.

5) Resin transfer headers and pipe lines of stainless steel construction connecting the both common external regeneration facilities to all the condensate polisher vessels of each installation (TG units) along with all necessary supports, anchors etc.

6) Rinse water outlet headers from condensate polisher vessels of each installation up to the condenser hot well of respective TG unit. Rinse water outlet headers from condensate-polisher vessels shall be provided with a pressure reducing valve and orifice plate, suitably designed to enable the water entry to the condenser hot well under all operating condition of condenser. The pressure reducing station shall consist of either a pressure reducing valve (reducing the pressure from design pressure of service vessel to condenser vacuum) or a combination of orifice plates to reduce pressure from design pressure of service vessel to 2 kg/cm2 and a pressure reducing valve from 2 kg/cm2 to condenser vacuum for each 800 MW TG unit.

7) All necessary valves, and fittings for the installations with actuators necessary for their remote operation from CP System Control Panel of each 800 MW Unit. These shall include suitable fool proof arrangement to prevent accidental over pressurization of the resin transfer pipeline and each regeneration facilities (1st set & 2nd set of regeneration facilities) connected to it, which are designed for pressure much lower than that of the Condensate Polisher Mixed Beds / Condensate Polisher Service vessels. It shall be PCV (Pressure Control Valve) with pressure controller and operable from DC and also provided with safety relief mechanism and the same shall be in bidder's scope.

8) A common drain header for the condensate polisher service vessel of unit up to the condenser hot well for each 800 MW TG unit. All necessary drains, vents and sampling points, with valves as specified and as required. The same shall be considered for all 5 TG units.

9) Gland sealing water piping for the Gland sealing valves in the rinse water line & other lines for each 800 MW TG unit. The same shall be considered for all 5 TG units.

10) Sample cooling line piping for sample cooling for all analysers for all 5 TG units.

11) Two nos. (1W + 1S) per unit oil free type air blowers with electric motor drives for each TG unit for supplying air required for mixing the resins in the service vessels. Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter, silencer, flexible couplings and discharge snubber, acoustic hood, relief valve etc. all mounted on a single base. Total service vessel area blowers to be supplied for all 5 TG units shall be 10 nos. each of 100% capacity along with the accessories as detailed above shall be supplied by bidder.

12) Two (2) nos. (2x100%), Rinse Recirculation pumps, each complete with electrical drive motor and all other accessories as required for each TG unit. Hence total 10 nos. of Rinse Recirculation pumps, each complete with electrical drive motor and all other accessories shall be supplied for all 5 TG units. Each pump shall be of 100% capacity.

13) Complete Instrumentation and Control for automatic operation.

14) Instruments racks & analyser racks for mounting pressure & flow transmitters, pressure switches, conductivity analysers & all other analysers etc. for each of condensate polisher mixed beds. The same is applicable of all 5 TG Units.

15) Emergency bypass between the condensate influent and effluent headers. Each Condensate polisher service unit shall be provided with an automatic bypass for the condensate polisher on the condensate inlet and outlet headers of the unit with a modulating butterfly type (flanged) control valve, along with lugged wafer type motorised butterfly isolation valves (resilient material seated, to ensure bubble tight shut off) on the upstream and downstream side of the control valve. The control valve shall be of 1x100% configuration to achieve proper control under all operating conditions. Isolation

valve shall be provided with geared operators for manual operation. The same is applicable and provided for all 5 TG units.

In addition to control valve, one no. flanged motorized On/off type butterfly valve of similar capacity (i.e. 100%) shall be provided in the bypass line of control valve as per P&ID of the Condensate Polishing Unit. Further on the upstream and downstream side of this motorized On/off valve lugged wafer type butterfly isolation valves (resilient material seated, to ensure bubble tight shut off) shall be provided. Isolation valve shall be provided with geared operators for manual operation. The same is applicable and provided for all 5 TG units.

Complete instrumentation and controls for this emergency by-pass system for each TG unit. Further all tubing, wiring air sets and other fittings required to complete the system shall be provided for each TG unit. The same is applicable and provided for all 5 TG units.

16) The plant shall include resins for first fill of resins for all condensate polisher mixed beds, Mixed resin storage vessel of all 5 TG units i.e. Twenty (20) complete charges of resin. Further to this Resin for resin injection hoppers charge (150 liters for each resin injection hopper) shall also be provided separately. In addition, the above charges bidder to also provide make-up resin for first three years of operation and the same shall be in bidder's scope (Quantity of make-up resins shall be calculated on the basis of 3% and 5% attrition loss per annum for cation and anion resin respectively). Therefore, total resin quantity to be supplied for the project shall include total resin charges for all TG units (20 nos. resin charge) + Two (2) nos. resin injection hopper charge + Make up resin quantity (Make up resin quantity shall be calculated based on the basis of 3% and 5% attrition loss per annum for 3 years for total resin quantity (i.e. 20 charge resins+ 2 resin injection hopper charge) that will be supplied for the plant.

Deration factor of 10% for all resins shall be considered while calculating the quantity of resin to be supplied.

One resin charge shall be considered as resin required for one service vessel i.e. cation resin, anion resin and inert resin (if any) used for the project.

17) One no. specific Conductivity analyser at condensate common inlet header, one no. specific Conductivity Analyser at condensate common outlet header of each TG unit & One no. specific Conductivity Analyzer at individual outlet of each Condensate polishing Mixed Beds / Condensate Polisher Service vessels of all TG units. Hence total number of specific conductivity analysers to be supplied for all 5 TG units shall be 25 numbers for service vessel area.

18) One no. cation Conductivity Analyser at condensate common outlet header of each TG unit & Three (3) nos. cation Conductivity Analyser at outlet of each Condensate polishing Mixed Beds / Condensate Polisher Service vessels of all TG units. Hence total number of cation conductivity analysers to be supplied for all 5 TG units shall be 50 numbers for service vessel area

19) One no. pH analyser at condensate inlet header, one no. pH analyser at condensate outlet header of each TG unit & one no. pH analyser at outlet of each Condensate polishing Mixed Beds / Condensate Polisher Service vessels of all TG units. Hence total number of pH analyser to be supplied for all 5 TG units shall be 25 numbers for service vessel area.

20) One no. multichannel (Four channel) sodium analyser to measure process value of each service vessel outlet & common condensate outlet header for each TG unit. Hence total number of multichannel (Four Channel) sodium analysers shall be five (5) nos. for all 5 TG units (service vessel area).

21) One no. multichannel (Four channel) Silica analyser to measure process value of each service vessel outlet & common condensate outlet header for each TG unit. Hence total number of multichannel (Four Channel) silica analysers shall be five (5) nos. for all 5 TG units (service vessel area).

22) Complete instrumentation and controls for this system, including the differential pressure transmitters, panel mounted indicating type controller with provision for remote manual operation, actuator for the

control valve with positioner etc. All tubing, wiring, airsets, and other fittings, required to complete the system for each TG unit. The same is applicable for all 5 TG units and shall be provided by bidder.

23) All the piping, valves, fitting, accessories etc. used in service vessel area shall be 300# class minimum and this area shall be considered as high pressure side to complete the system for each TG unit shall be in bidder's scope. The same is applicable for all 5 TG units and shall be provided by bidder. Further rest shall be considered as low pressure side (regeneration area) and all piping, valves, fitting, accessories etc. used in regeneration area shall be of 150# class minimum.

24) Minimum instrumentation required shall be as per P & ID included in this tender specification. Further to meet the redundancy criterion as specified in section IC, if any instrument, transmitter & analyzer required shall be included by bidder service vessel area and shall be in bidder's scope and shall be provided by bidder without any price and delivery implication to BHEL & customer.

25) All butterfly valves MOC used in service vessel area in condensate inline line shall be (body: WCB Disc:CF8M/SS316) and condensate outlet line will be (Body & Disc both: CF8M/SS316). Further to this valves used in rinse to condenser hot well line and suction and discharge of rinse recirculation pumps shall be (Body & Disc both: CF8M/SS316).

26) Condensate Inlet piping & condensate outlet piping (as marked in P&ID of CPU) to each condensate polisher mixed bed & up to the common outlet line shall be CSRL (SA 106 Gr-C with 3.0 mm thick rubber lining) for all TG units.

27) All instrument air distribution for SOV shall be through SS-316 manifold with SS-316 isolation and auto drain traps.

28) Solenoid valve shall be kept in pneumatic junction boxes only. Air distribution for SOV's shall be through -316 manifold and SS-316 isolation valves only and SS tubing from SOV to valve shall not be more than 6 meters.

29) Instrument and transmitter provided in Resin line, Resin slurry line (Resin with DM water) and DM waterline shall be of capillary diaphragm type only.

30) All non-stainless steel pipe colour coding shall be provided by bidder during detail engineering.

31) All nuts, bolts etc. in submerged and corrosive application shall be of SS-316.

B. REGENERATION SYSTEM

The regeneration system (2 sets) with interconnection (one interconnection of resin transfer line and one interconnection of DM water line in regeneration area & one interconnection of resin transfer line and one interconnection of DM water line nearby service vessel area as indicated in P&ID of CPU) shall be common to polisher of all five (5) TG units and shall be external. The interconnection shall be done in such a manner that anyone of CPU regeneration cum resin transfer pumps shall be utilised to supply DM water for resin transfer to any of the service vessel of any TG unit and similarly any of the resin transfer line shall be utilised for transferring the resin from anyone of the service vessel of any TG unit to any one of available two regeneration system of regeneration area. For this purpose, minimum number of valves as shown in CPU P&ID shall be provided by bidder. Any additional number of valves required to achieve the same, shall be included by bidder in bidder's scope and shall be provided by bidder during detail engineering without any price and delivery implication to BHEL & customer.

The CPU regeneration system will be located near DM plant area. Regeneration area shall be considered as low pressure area.

The Acid and alkali unloading equipment for regeneration of condensate polishing resins shall preferably be mounted on skid. In order to facilitate erection at site chemical dosing preparation equipment shall be mounted on structural steel skids and assembled (including piping) at the manufacturer's shop, to the maximum extent possible, prior to shipping. The number of mechanical

connections shall be minimized by the use of pipe headers wherever possible. The bidder may also supply and install this equipment's independently instead of assembling the skids. Complete facility for preparing alkali solution from alkali lye & flakes shall be included in Bidder's scope.

The Acid and alkali dosing equipment for regeneration of condensate polishing resins shall preferably be mounted on skid and shall be in bidder's scope. All the equipment, piping etc. shall be assembled on two structural steel skids one for acid and one alkali dosing equipment.

Complete regeneration facility (2 sets) with interconnection as mentioned below and as indicated in P & ID of CPU shall be in Bidder's scope:

I. The 1st set of Regeneration System Shall consist of following below mentioned items and shall be provided by the bidder:

1) One (1) no. Resin Separation Vessel complete with all accessories

2) One (1) no. Anion Resin Regeneration Vessel complete with all accessories

3) One (1) no. Cation Resin Regeneration Vessel / Mixed Resin Storage Vessel complete with all accessories.

4) All vessels must be complete with vents, drains, piping & valves for air scrubbing, back-washing & regeneration process.

5) All internals, fittings and appurtenances for these vessels as indicated under sr. no. 1,2 & 3 above.

6) One (1) no. common waste effluent header with resin trap in each waste effluent header designed for in place manual backwashing.

7) The equipment and accessories for external regeneration as indicated above (s.no 1, 2 and 3) of ion exchange resins are tentative. However, any other proven alternative scheme of external regeneration as per the standard practice of Supplier of CPU System may also be adopted subject to suitability of the same in all respects for satisfactory operation and performance of Condensate Polisher Mixed Beds. However, design requirement shall be as per tender specification.

8) Resin Make up/injection hopper complete with water ejector system for resin make up. Resin make Up /injection hopper shall be sized to handle up to minimum 150 liters of as received new resins per Single injection or maximum attrition loss whichever is higher.

9) Two (2) nos. (1W+1S) oil free type air blowers with electric motor drives, for supplying all the process air required for cleaning of the resins and their regeneration processes. Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter, silencer, flexible couplings and discharge snubber, acoustic hood, relief valve, anti-vibration pads etc.as required and shall be mounted on a single base.

10) Two (2) nos. CPU Regeneration cum Resin Transfer Pumps (located in DM transfer pump house) each with electric drive motor drives, one normally operating and the other standby, for water supply for chemical preparation / dosing, dilution and transfer of resin from service vessel to regeneration vessels & vice-versa, backwash & rinse activities shall be provided. These CPU Regeneration cum Resin Transfer Pumps will take suction from DM water storage tanks (DM water storage tanks not in bidder's scope).

11) One (1) no. resin trap at common discharge line of CPU regeneration vessels.

12) Two (2) numbers (2X100%) simplex hydraulically operated diaphragm type, positive displacement acid dosing pumps for regeneration, each complete with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump along with all other required accessories for acid dosing.

13) One (1) no. (1X100%) acid measuring tank for regeneration complete with fume absorbers, overflow

seal pot, integral pipe works, valves, instrumentation and all other accessories required. Tank capacity shall be equal to 120% of regeneration requirement of one regeneration.

14) Two (2) nos. (2X100%) Alkali transfer cum recirculation pumps each complete with electrical drive motor and all other accessories as required. These pumps shall take suction from bulk alkali storage tank. These pumps shall be provided with a pulsation dampener at the outlet header of each pump along with necessary valves & instrumentation & accessories as required.

15) One (1) no. Activated carbon filter for alkali complete with internals, integral pipe works, valves, instrumentation, manhole, hand hole etc. and all other accessories as required. One (1) no. Activated Carbon Filter for alkali rated flow of each filter shall not be less than the design capacity of the alkali unloading pump/alkali transfer cum recirculation pump (as applicable), and the maximum velocity through each activate carbon filter for this flow shall not exceed 15 meters/hour. Depth of the filter materials shall not be less than 1.2 meter in activated carbon filter.

16) One number carbon trap shall be provided at the outlet line of Activated carbon filter (ACF). This carbon trap shall have screen opening of 60 mesh.

17) Two (02) numbers (2X100%) simplex hydraulically operated diaphragm type, positive displacement alkali dosing pumps for regeneration, each complete with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump along with all other required accessories for alkali dosing.

18) One (1) no. (1X100%) alkali measuring cum preparation tank for regeneration complete with slow speed agitator driven by motor complete with carbon dioxide absorber, overflow seal pot, dissolving basket, integral pipe works, valves, instrumentation and all other accessories required. The tank capacity shall be equal to 120% of regeneration requirement of one regeneration.

19) One (1) no. (1X100%) hot water tank for heating of alkali diluent water for anion resins with (2X60%) electric heating coil, adequately insulated of carbon steel rubber lined construction shall be provided complete with integral pipe works, valves, instrumentation and all other accessories required shall be provided. The effective capacity of the hot water tank is suitable to meet the requirements for alkali injection and alkali displacement in course of single regeneration of a Condensate Polisher Mixed Bed, plus 20% margin. This tank shall be provided with burn out protection, pressure relief valve, level transmitter, temperature indicator etc. The heaters shall be sized for heating the water from a temperature of 15 to 50 deg. C in 5 hours at the outlet of ejector.

20) Diluent water supply separately, for acid and alkali, each provided with an automatic on-off valve, a throttling valve for setting of flow, a local flow indicator with flow transmitter and a mixing tee where the chemicals get injected into the water stream.

21) 2 nos. concentration analyser for measuring density of diluted acid & alkali shall be provided, one (1) in acid dilution line and one (1) in alkali dilution line. This concentration analyser shall be provided in addition to mechanical density indicator in each line.

22) All the equipment, piping etc. shall be assembled on two structural steel skids one for acid and one for alkali dosing equipment. The bidder shall supply all anchor bolts, foundation plates, sleeves, nuts, inserts etc. to be embedded in concrete for these equipment skids. The length of the foundation bolts shall be liberally sized to reach below the reinforcement level. Each equipment skid shall be provided with suitable lighting lugs, eye bolts etc. to facilitate erection and maintenance.

23) One (1) no. hose Station for Transfer of Hydrochloric Acid (30-33% HCl). The hose station shall consist of two (2) sets of rubber hoses each of size 80 mm /NB @ 20 m, provided along with coupling & Diaphragm type isolation valves.

24) Two (2) nos. (2X100%) Hydrochloric acid unloading / transfer pumps each complete with electrical drive motor, necessary valves & instrumentation and all other accessories as required. These pumps shall take suction from the unloading tankers.

25) Two (2) nos. Bulk Acid storage tank complete with integral pipe works, valves, radar type level

transmitters, level gauges, fume absorber cum overflow seal pot, instrumentation, manhole, ladder and platform and all other accessories required. Capacity of both tanks together shall adequate to hold the quantity of commercial Acid (30-33% HCl) required for thirty (30) days of operation of 2 TG Units cation resin regeneration requirement & acid required to neutralise the excess alkali present in effluent generated from the one regeneration waste.

26) One (1) no. hose Station for Transfer of Alkali (48% NaOH). The hose station shall consist of two (2) sets of rubber hoses each of size 80 mm /NB @ 20 m, provided along with coupling & Diaphragm type isolation valves.

27) Two (2) nos. Alkali unloading/transfer pumps, each complete with electrical drive motor, necessary valves & instrumentation and all other accessories as required. These pumps shall take suction from the unloading tankers.

28) Two (2) nos. Bulk Alkali storage tank complete with integral pipe works, valves, ultrasonic type level transmitters, level gauges, CO2 absorber, over flow seal pot, instrumentation, manhole, ladder and platform and all other accessories required. Capacity of both tanks together shall adequate to hold the quantity of commercial Alkali (48%NaOH) required for thirty (30) days of operation of 2 TG Units anion resin regeneration requirement & alkali required to neutralise the excess acid present in effluent generated from the one regeneration waste.

29) All integral pipe works, valves, internals, fittings, hangers, supports and appurtenances etc. for these vessels, atmospheric tanks & dosing pumps as well as unloading and transfer pumps. All necessary suction and discharge piping for these pumps including all strainers, valves and fittings as required, up to the mixing tee with the diluent water. Further flushing connections to all dosing, unloading and transfer pumps shall be provided with service water along with an isolation valves for individual pumps and for drain arrangement shall be provided with an isolation valves for individual pumps as shown in P&ID of CPU.

30) All interconnecting piping, valves and fittings & instrumentation as required to complete the 1st set of CPU regeneration system and interconnection piping, valves and fittings & instrumentation required for its interconnection with 2nd set of regeneration system shall be in bidder's scope.

31) One (1) no. Neutralization Pit of RCC construction (civil work not in bidder's scope) with two (2) compartments with PVC lining along with 2nos. isolation gates for each compartment shall be provided in the CPU regeneration area. Each section/compartment shall have capacity to hold 120% of waste water generated from CPU in one regeneration. Dosing of acid and alkali shall also be provided to neutralize effluents of CPU regeneration waste before disposal.

32) One (1) no. (1X100%) Acid Measuring Tank for Neutralization- pit complete with fume absorbers, over flow seal pot, flanges, integral pipe works, pneumatic valves & instruments all other fitting and accessories as required shall be supplied by bidder. Capacity of the AMT for N-pit is Adequate to hold the quantity of acid required for neutralization of excess alkali in waste effluent due to one regeneration of a Condensate Polisher Mixed Bed with 20% overall margin.

33) One (1) no. (1X100%) Alkali Measuring Tank for neutralization-pit along with slow speed agitator driven by motor and complete with CO2 absorbers, over flow seal pot, dissolving basket, flanges, integral pipe works, pneumatic valves & instruments all other fitting and accessories as required shall be supplied by bidder. Capacity of the ALMT for N-pit Adequate to hold the quantity of alkali required for neutralization of excess acid in waste effluent due to one regeneration of a Condensate Polisher Mixed Bed with 20% overall margin.

34) Two (2) nos. (2 x 100%) capacity Neutralized Waste Transfer cum Recirculation Pumps of vertical centrifugal type, each complete with electrical drive motor along with necessary valves, instrumentation, piping, flanges, fittings and accessories as required. These pumps shall be supplied for waste recirculation and disposal to CMB of ETP.The pump shall be designed to pump the total volume of one section/ compartment of the neutralization pit in 4 hours or 100 m3/ hr (whichever is higher). Proven agitation system like air agitation, venture mixing etc. shall be provided in addition to recirculation from pumps.

35) Three nos. pH analyser at effluent discharge header, shall be in the scope of bidder.

36) All interconnecting piping, valves, instrumentation and fittings as required for the N-pit and N-pit disposal system.

37) Further all interconnecting piping, valves, instrumentation and fittings as required for the complete CPU regeneration system shall be in bidder's scope.

38) Two (2x100%) nos. (1W+1S) oil free type N –Pit air blowers with electric motor drives, for supplying air required for air agitation of neutralisation pit (both compartments) of 1st set of Regeneration System. Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter, silencer, flexible couplings and discharge snubber, acoustic hood, relief valve, anti-vibration pads etc.as required and shall be mounted on a single base.

II. The 2nd set of Regeneration System Shall consist of following below mentioned items and shall be provided by the bidder:

1) One (1) no. Resin Separation Vessel complete with all accessories.

2) One (1) no. Anion Resin Regeneration Vessel complete with all accessories.

3) One (1) no. Cation Resin Regeneration Vessel / Mixed Resin Storage Vessel complete with all accessories.

4) All vessels must be complete with vents, drains, piping & valves for air scrubbing, back-washing & regeneration process.

5) All internals, fittings and appurtenances for these vessels as indicated under sr. no. 1,2 & 3 above.

6) One (1) no. common waste effluent header with resin trap in each waste effluent header designed for in place manual backwashing.

7) The equipment and accessories for external regeneration as indicated above (s.no 1, 2 and 3) of ion exchange resins are tentative. However, any other proven alternative scheme of external regeneration as per the standard practice of Supplier of CPU System may also be adopted subject to suitability of the same in all respects for satisfactory operation and performance of Condensate Polisher Mixed Beds. However, design requirement shall be as per tender specification.

8) Resin Make up/injection hopper complete with water ejector system for resin make up. Resin make Up /injection hopper shall be sized to handle up to minimum 150 liters of as received new resins per Single injection or maximum attrition loss whichever is higher.

9) Two (2) nos. (1W+1S) oil free type air blowers with electric motor drives, for supplying all the process air required for cleaning of the resins and their regeneration processes. Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter, silencer, flexible couplings and discharge snubber, acoustic hood, relief valve, anti-vibration pads etc.as required and shall be mounted on a single base.

10) Two (2) nos. CPU Regeneration cum Resin Transfer Pumps (located in DM transfer pump house) each with electric drive motor drives, one normally operating and the other standby, for water supply for chemical preparation / dosing, dilution and transfer of resin from service vessel to regeneration vessels & vice-versa, backwash & rinse activities shall be provided. These CPU Regeneration cum Resin Transfer Pumps will take suction from DM water storage tanks (DM water storage tanks not in bidder's scope).

11) One (1) no. resin trap at common discharge line of CPU regeneration vessels.

12) Two (2) numbers (2X100%) simplex hydraulically operated diaphragm type, positive displacement acid dosing pumps for regeneration, each complete with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump along with all other required accessories for acid

dosing.

13) One (1) no. (1X100%) acid measuring tank for regeneration complete with fume absorbers, overflow seal pot, integral pipe works, valves, instrumentation and all other accessories required. Tank capacity shall be equal to 120% of regeneration requirement of one regeneration.

14) Two (2) nos. (2X100%) Alkali transfer cum recirculation pumps each complete with electrical drive motor and all other accessories as required. These pumps shall take suction from bulk alkali storage tank. These pumps shall be provided with a pulsation dampener at the outlet header of each pump along with necessary valves & instrumentation & accessories as required.

15) One (1) no. Activated carbon filter for alkali complete with internals, integral pipe works, valves, instrumentation, manhole, hand hole etc. and all other accessories as required. One (1) no. Activated Carbon Filter for alkali rated flow of each filter shall not be less than the design capacity of the alkali unloading pump/alkali transfer cum recirculation pump (as applicable), and the maximum velocity through each activate carbon filter for this flow shall not exceed 15 meters/hour. Depth of the filter materials shall not be less than 1.2 meter in activated carbon filter.

16) One number carbon trap shall be provided at the outlet line of Activated carbon filter (ACF). This carbon trap shall have screen opening of 60 mesh.

17) Two (02) numbers (2X100%) simplex hydraulically operated diaphragm type, positive displacement alkali dosing pumps for regeneration, each complete with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump along with all other required accessories for alkali dosing.

18) One (1) no. (1X100%) alkali measuring cum preparation tank for regeneration complete with slow speed agitator driven by motor complete with carbon dioxide absorber, overflow seal pot, dissolving basket, integral pipe works, valves, instrumentation and all other accessories required. The tank capacity shall be equal to 120% of regeneration requirement of one regeneration.

19) One (1) no. (1X100%) hot water tank for heating of alkali diluent water for anion resins with (2X60%) electric heating coil, adequately insulated of carbon steel rubber lined construction shall be provided complete with integral pipe works, valves, instrumentation and all other accessories required shall be provided. The effective capacity of the hot water tank is suitable to meet the requirements for alkali injection and alkali displacement in course of single regeneration of a Condensate Polisher Mixed Bed, plus 20% margin. This tank shall be provided with burn out protection, pressure relief valve, level transmitter, temperature indicator etc. The heaters shall be sized for heating the water from a temperature of 15 to 50 deg. C in 5 hours at the outlet of ejector.

20) Diluent water supply separately, for acid and alkali, each provided with an automatic on-off valve, a throttling valve for setting of flow, a local flow indicator with flow transmitter and a mixing tee where the chemicals get injected into the water stream.

21) 2 nos. concentration analyser for measuring density of diluted acid & alkali shall be provided, one (1) in acid dilution line and one (1) in alkali dilution line. This concentration analyser shall be provided in addition to mechanical density indicator in each line.

22) All the equipment, piping etc. shall be assembled on two structural steel skids one for acid and one for alkali dosing equipment. The bidder shall supply all anchor bolts, foundation plates, sleeves, nuts, inserts etc. to be embedded in concrete for these equipment skids. The length of the foundation bolts shall be liberally sized to reach below the reinforcement level. Each equipment skid shall be provided with suitable lighting lugs, eye bolts etc. to facilitate erection and maintenance.

23) One (1) no. hose Station for Transfer of Hydrochloric Acid (30-33% HCl). The hose station shall consist of two (2) sets of rubber hoses each of size 80 mm /NB @ 20 m, provided along with coupling & Diaphragm type isolation valves.

24) Two (2) nos. (2X100%) Hydrochloric acid unloading / transfer pumps each complete with electrical drive motor, necessary valves & instrumentation and all other accessories as required. These pumps

shall take suction from the unloading tankers.

25) Two (2) nos. Bulk Acid storage tank complete with integral pipe works, valves, radar type level transmitters, level gauges, fume absorber cum overflow seal pot, instrumentation, manhole, ladder and platform and all other accessories required. Capacity of both tanks together shall adequate to hold the quantity of commercial Acid (30-33%HCl) required for thirty (30) days of operation of 3 TG Units cation resin regeneration requirement & acid required to neutralise the excess alkali present in effluent generated from the one regeneration waste.

26) One (1) no. hose Station for Transfer of Alkali (48% NaOH). The hose station shall consist of two (2) sets of rubber hoses each of size 80 mm /NB @ 20 m, provided along with coupling & Diaphragm type isolation valves.

27) Two (2) nos. Alkali unloading/transfer pumps, each complete with electrical drive motor, necessary valves & instrumentation and all other accessories as required. These pumps shall take suction from the unloading tankers.

28) Two (2) nos. Bulk Alkali storage tank complete with integral pipe works, valves, ultrasonic type level transmitters, level gauges, CO2 absorber, over flow seal pot, instrumentation, manhole, ladder and platform and all other accessories required. Capacity of this tank shall adequate to hold the quantity of commercial Alkali (48%NaOH) required for thirty (30) days of operation of 3 TG Units anion resin regeneration requirement & alkali required to neutralise the excess acid present in effluent generated from the one regeneration waste.

29) All integral pipe works, valves, internals, fittings, hangers, supports and appurtenances etc. for these vessels, atmospheric tanks & dosing pumps as well as unloading and transfer pumps. All necessary suction and discharge piping for these pumps including all strainers, valves and fittings as required, up to the mixing tee with the diluent water. Further flushing connections to all dosing, unloading and transfer pumps shall be provided with service water along with an isolation valves for individual pumps and for drain arrangement shall be provided with an isolation valves for individual pumps as shown in P&ID of CPU.

30) All interconnecting piping, valves and fittings & instrumentation as required to complete the 2nd set of CPU regeneration system and interconnection piping, valves and fittings & instrumentation required for its interconnection with 1st set of regeneration system shall be in bidder's scope.

31) One (1) no. Neutralization Pit of RCC construction (civil work not in bidder's scope) with two (2) compartments with PVC lining along with 2 nos. isolation gates for each compartment shall be provided in the CPU regeneration area. Each section/compartment shall have capacity to hold 120% of waste water generated from CPU in one regeneration. Dosing of acid and alkali shall also be provided to neutralize effluents of CPU regeneration waste before disposal.

32) One (1) no. (1X100%) Acid Measuring Tank for Neutralization- pit complete with fume absorbers, over flow seal pot, flanges, integral pipe works, pneumatic valves & instruments all other fitting and accessories as required shall be supplied by bidder. Capacity of the AMT for N-pit is Adequate to hold the quantity of acid required for neutralization of excess alkali in waste effluent due to one regeneration of a Condensate Polisher Mixed Bed with 20% overall margin.

33) One (1) no. (1X100%) Alkali Measuring Tank for neutralization-pit along with slow speed agitator driven by motor and complete with CO2 absorbers, over flow seal pot, dissolving basket, flanges, integral pipe works, pneumatic valves & instruments all other fitting and accessories as required shall be supplied by bidder. Capacity of the ALMT for N-pit Adequate to hold the quantity of alkali required for neutralization of excess acid in waste effluent due to one regeneration of a Condensate Polisher Mixed Bed with 20% overall margin.

34) Two (2) nos. (2 x 100%) capacity Neutralized Waste Transfer cum Recirculation Pumps of vertical centrifugal type, each complete with electrical drive motor along with necessary valves, instrumentation, piping, flanges, fittings and accessories as required. These pumps shall be supplied for waste recirculation and disposal to CMB of ETP.The pump shall be designed to pump the total

volume of one section/ compartment of the neutralization pit in 4 hours or 100 m3/ hr (whichever is higher). Proven agitation system like air agitation, venture mixing etc. shall be provided in addition to recirculation from pumps.

35) Three nos. pH analyser at effluent discharge header, shall be in the scope of bidder.

36) All interconnecting piping, valves, instrumentation and fittings as required for the N-pit and N-pit disposal system.

37) Further all interconnecting piping, valves, instrumentation and fittings as required for the complete CPU regeneration system shall be in bidder's scope.

38) Two (2x100%) nos. (1W+1S) oil free type N –Pit air blowers with electric motor drives, for supplying air required for air agitation of neutralisation pit (both compartments) of 2nd set of Regeneration System. Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter, silencer, flexible couplings and discharge snubber, acoustic hood, relief valve, anti-vibration pads etc.as required and shall be mounted on a single base.

III. Common Requirement of both the regeneration system shall consist of following:

1) Three (3) no. personnel water drench shower/safety shower and eye bath with necessary accessories in regeneration area shall be provided by the bidder.

2) All the pressure vessels (except service vessels) shall be designed for a pressure that is maximum expected pressure to which the vessel may be subjected plus 5% extra margin, Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pump suction or 10 kg/cm2(g) whichever is higher.

3) Further all measuring tanks and storage tanks shall be designed for atmospheric pressure.

4) Four (4) sets of safety equipment comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall also be provided by bidder.

5) Bidder to include one no toilet block having facilities for Ladies & Gents as per attached Space available for CPU Regeneration area (Vide BHEL Ref. Dwg. No. PE-DG-417-155A-A003).

6) All instrument air distribution for SOV shall be through SS-316 manifold with SS-316 isolation and auto drain traps.

7) Solenoid valve shall be kept in pneumatic junction boxes only. Air distribution for SOV's shall be through -316 manifold and SS-316 isolation valves only and SS tubing from SOV to valve shall not be more than 6 meters.

8) Instrument and transmitter provided in Resin line, Resin slurry line (Resin with DM water) and DM waterline shall be of capillary diaphragm type only.

9) All non-stainless steel pipe colour coding shall be provided by bidder during detail engineering.

10) Motor operated valve instead of pneumatic isolation valve shall be provided for each CPU to DM water line as indicated in P&ID. Further if any valve which is not indicated or indicated as pneumatic in tender P&ID the same shall be considered by bidder as Motorized isolation valve.

11) All nuts, bolts etc. in submerged and corrosive application shall be of SS-316.

IV. Effluent Neutralization System:

Neutralization pit of RCC construction with inside lined with PVC sheet (3 mm thick) shall be provided for 1st set regeneration facilities & 2nd set regeneration facilities separately. 1st set regeneration facilities neutralization pit shall be provided in two compartments and each compartment shall have a holding capacity to hold the quantity of waste effluent generated due to one regeneration of

Condensate Polisher Mixed Beds of plus 20% overall margin. Similarly, 2nd set regeneration facilities neutralization pit shall be provided in two compartments and each compartment shall have a holding capacity to hold the quantity of waste effluent generated due to one regeneration of Condensate Polisher Mixed Beds of plus 20% overall margin. The regeneration waste shall be led to the N- pit through drain. For further disposal of effluents from CPU Regeneration area N-pit two nos. (2X100%) Effluent disposal pumps shall be provided for N-pit of 1st set regeneration facilities. Similarly, for further disposal of effluents from CPU Regeneration Area N-pit two nos. (2X100%) Effluent disposal pumps shall be provided for N-pit of 2nd set regeneration facilities.

2 nos. isolation gates for each compartment/section of each N-pit shall be provided by bidder. Hence total 8 number gates shall be provided for effluent neutralization system of 2 sets of CPU regeneration system of common external regeneration area.

Dosing of acid and alkali shall also be provided to neutralize effluents of CPU regeneration waste before disposal to Central Monitoring basin(CMB) of ETP.

C. PIPING

All the piping as listed below shall be in bidder's scope. The below indicated pipes shall be designed, supplied, erected, laid and tested by the bidder. Elbows, tees, flanges, counter flanges, Hangers and supports, embedment plates with lugs etc. required for the below given piping shall also be provided by the bidder.

1) Service vessel inlet header shall be SA 106 Gr-C (OD 457.2 X 12.7 mm thick) with Rubber lining as indicated in CPU P&ID for each TG unit. Complete piping of all 5 TG units shall be in bidder's scope.

2) Service vessel outlet header shall be SA 106 Gr C (OD 457.2 X 12.7 mm thick) with Rubber lining as indicated in CPU P&ID for each TG unit. Complete piping of all 5 TG units shall be in bidder's scope.

3) Service vessel by pass line piping shall be SA 106 Gr-C (OD 457.2 X 12.7 mm thick) for each TG unit. Complete piping of all 5 TG units shall be in bidder's scope.

4) Rinse water outlet piping shall be SA 106 Gr-B (OD 168.3 x 7.11 mm). The distance between CPU service vessel to condenser hot well shall be considered as 100 meter for each TG unit (Total 500 m for all 5 TG units) and this piping shall be in bidder's scope. Complete piping of all 5 TG units shall be in bidder's scope.

5) Rinse recirculation piping confirming to CS to SA 106 Gr-B, complete rinse recirculation piping of each TG unit shall be in bidder's scope. Complete piping of all 5 TG units shall be in bidder's scope.

6) Resin transfer piping shall be minimum 80 NB and of ASTM A 312 Gr. TP 304 (SS 304) Sch 10S (minimum). One-way distance for resin Transfer Piping between farthest service vessel of TG unit -1and 1st set of regeneration system located in regeneration area shall be minimum 1250 m. In addition to that complete resin transfer piping shall be in bidder's scope which shall include resin transfer piping of TG unit -1,2 from 1st set of regeneration system, piping inside 1st set of regeneration area & Service vessel areas unit -1 & 2 equipment's also, the minimum length of this piping shall be 150 meter.

7) Resin transfer piping shall be minimum 80 NB and of ASTM A 312 Gr. TP 304 (SS 304) Sch 10S (minimum). One-way distance for resin Transfer Piping between farthest service vessel of TG unit -5 and 2nd set of regeneration system located in regeneration area shall be minimum 1400 m. In addition to that complete resin transfer piping shall be in bidder's scope which shall include resin transfer piping of TG unit -3,4 & 5 from 2nd set of regeneration system, piping inside 2nd set of regeneration area & Service vessel areas unit -3,4 & 5 equipment's also, the minimum length of this piping shall be 250 meter.

8) Piping handling DM water shall be ASTM A 312 Gr. TP 304 (SS 304) Sch 10S (minimum). One-way distance for DM water piping between farthest service vessel of TG unit -1 and CPU regeneration cum resin transfer pumps located in DM transfer pump house of 1st set of regeneration system shall be 1250 m. Further complete DM water piping shall be in bidder's scope which shall include DM water piping of TG unit -1, 2 from 1st set of regeneration system, piping inside 1st set of regeneration area & Service vessel areas unit -1 & 2 equipment's also, the minimum length of this piping shall be 400 meter.

9) Piping handling DM water shall be ASTM A 312 Gr. TP 304 (SS 304) Sch 10S (minimum). One-way distance for DM water piping between farthest service vessel of TG unit -5 and CPU regeneration cum resin transfer pumps located in DM transfer pump house of 2nd set of regeneration system shall be 1400 m. Further complete DM water piping shall be in bidder's scope which shall include DM water piping of TG unit -3 4, & 5 from 2nd set of regeneration area & Service vessel areas unit -3,4 & 5 equipment's also, the minimum length of this piping shall be 500 meter.

10) Distance Between CPU regeneration area stage 1& 2 and DM water transfer pumps shall be approx. 200 meters. Similarly distance between CPU regeneration area stage 1& 2 and DM water storage tanks shall be approximately 250 m.

11) Interconnection piping along with isolation valves, tee, bends and flanges along with instruments between Resin transfer lines & DM water lines of CPU regeneration area stage-1 and stage -2 in service vessel area as well as regeneration area shall be in bidder's scope and the same shall be provided by bidder.

12) N-Pit effluent common discharge piping from N-Pit effluent transfer pumps of 1st set of regeneration system to ETP of CMB shall be minimum 150 NB size or as per velocity criterion for sizing given in technical specification whichever is higher of MOC CSRL shall be in bidder's scope. The distance between N-Pit of 1st set of regeneration system and CMB (common monitoring basin) of ETP shall be 1500 m and this piping shall be in bidder's scope. Complete N-pit effluent discharge piping of CPU regeneration system shall be in bidder's scope.

13) N-Pit effluent common discharge piping from N-Pit effluent transfer pumps of 2nd set of regeneration system to ETP of CMB shall be minimum 150 NB size or as per velocity criterion for sizing given in technical specification whichever is higher of MOC CSRL shall be in bidder's scope. The distance between N-Pit of 2nd set of regeneration system and CMB (common monitoring basin) of ETP shall be 1500 m and this piping shall be in bidder's scope. Complete N-pit effluent discharge piping of CPU regeneration system shall be in bidder's scope.

14) Piping used for handling alkali (concentrated) and alkali solution shall be CPVC Sch. 80 minimum for complete CPU regeneration area. The distribution of the same inside the CPU regeneration (1st stage & 2nd stage) shall be in bidder's scope.

15) Piping handling acid service shall be CPVC Sch. 80 minimum for complete CPU regeneration area. The distribution of the same inside the CPU regeneration (1st stage & 2nd stage) shall be in bidder's scope.

16) Piping for the instrument & service air confirming to SS 304 Sch 40S for size equal to & less than 50 NB and SS 304 Sch 10S for size equal to & more than 65 NB. The distribution of the same inside the CPU regeneration area and CPU service vessel area shall be in bidder's scope

17) All piping within each of the above skids/equipment for both the regeneration system (1st stage & 2nd stage) shall be in bidder's scope.

18) Similarly, DM water piping from DM water storage tanks common outline header line to each CPU REGENERATION CUM RESIN TRANSFER PUMPS (located in DM water transfer pump house) suction lines along with their isolation valves, tee, bends, piping and flanges shall be in bidder's scope.

19) Similarly, DM water piping from each CPU REGENERATION CUM RESIN TRANSFER PUMPS (located in DM water transfer pump house) discharge recirculation line to common recirculation header along with their isolation valves, tee, bends, piping and flanges shall be in bidder's scope.

20) Further DM water piping from each CPU REGENERATION CUM RESIN TRANSFER PUMPS to service vessel area of all 5 TG units and 1st stage & 2nd stage regeneration area all equipments shall be in bidder's scope.

21) Service water piping (used for cooling of condensate sample & other activities in regeneration area), piping for gland sealed valve cooling, instrument air piping and service air piping, potable water piping for eye wash & other applications etc. shall be in bidder's scope.

22) Similarly, all piping between the external regeneration facility (1st stage & 2nd stage) and the skids for chemical dosing and acid/alkali preparation, and acid & alkali storage shall also be designed, supplied, erected and tested by the bidder. These shall include demineralized water piping to the chemical dosing,

acid /alkali piping from external bulk storage tanks to respective preparation skids, the alkali preparation skids from the external regeneration facility, alkali solution from its preparation facility to the alkali dosing skid, dilute chemical solution piping for acid and alkali from the dosing skids to the external regeneration facility, piping to the preparation/dosing facilities, instrument air piping and power supply for immersion heaters of the diluent water tank from the regeneration facility, and all instrumentation and control wiring between these skids, etc.

23) In addition, any additional piping and associated accessories required to complete the system shall be in bidder's scope.

NOTE: There will be no price implication to BHEL/Customer from bidder's side due to addition / deletion in piping, when the piping quantity increases ± 10% from the specified quantity in the technical specification. Layout and routing shall be finalized during detailed engineering. However, system shall be designed to take care of any increase or decrease in length of piping.

D. ADDITIONAL REQUIREMENT

1) Operating platforms, ladders, supports and other structural works for each vessel to facilitate accessibility for operation and maintenance for all the condensate polisher mixed beds, regeneration vessels, storage tanks, alkali and acid measuring tanks & preparation tanks and other equipment's etc. is also in bidder's scope.

2) Initial charge of all lubricants & grease.

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

4) Start-up and commissioning spares are bidder's scope of supply.

Start-up and Commissioning spares are those which would be required during equipment or system testing, start-up and commissioning. All spares used until the plant is finally handed over by the bidder to the customer come under this category. All start-up and commissioning spares as required shall be provided by the bidder without any additional cost to the BHEL and customer. Bidder to provide spares as per their system requirement without any commercial and delivery implication to BHEL/Customer during detailed engineering. List of spares shall be furnished by BIDDER along with the offer.

Bidder shall be responsible for the ready and timely availability for all the startup and commissioning spares as required during various stages of testing, cleaning and commissioning up to handing over of each unit of the total plant.

An adequate stock of start-up spares shall be available at the site such that the start-up and commissioning of the equipment/systems, Performance guarantee test and handing over the equipment/ systems to the customer will be carried out without hindrance and delay. All start-up spares which remain unused after the taking over of the plant shall remain the property of the customer.

5) All required elbow, tee, pipe fittings etc. required for erection of the complete system including piping shall be in bidder's scope. Bidder to provide the detailed BOQ shall be derived during detail engineering. Bidder to consider 10% margin over and above the BOQ requirement of all the fittings.

6) Wherever pipe racks are not available, pipes shall run on pedestals or below ground. All fixing items such as U clamps, nuts, bolts etc. required to lay the pipes on pedestals shall be in bidder's scope of work. Coating, wrapping and protection required for buries pipes shall be in bidder's scope of work.

7) Bidder shall consider 12 m static head + 10% margin in addition to the losses in straight pipes and bend in pipes, tees, reducer, expander and valves etc. (in yard piping) while selection of pump head during detailed engineering.

8) The Bidder's scope includes all the first fill and one year's topping, requirements of consumables such as greases, oils, lubricants, servo fluids/control fluids, gases, reagents, standard reference chemical solutions etc. which will be required to put the equipment covered under the scope of specifications. Consumption of all these consumables during the initial operation or PG test of bidder's supplied equipment (whichever is later) and final filling after the initial operation OR PG test of bidder's supplied equipment (whichever is later) shall also be included in the scope of the Bidder. Bidder shall also supply a quantity not less than 10% of the full charge of each variety of lubricants, servo fluids, gases, chemicals etc. used which is expected to be utilised during the first year of operation. This additional quantity shall be supplied in separate Containers. Suitable standard lubricants as available in India are desired. The variety of lubricants shall be kept to a minimum possible.

9) On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Owner along with lubrication requirements.

10) MCC, DDCMIS based control room & battery room shall be located in CPU regeneration area building. All regeneration vessels and chemical dosing facilities shall be located in CPU regeneration building. Bulk chemical storage tanks, unloading and transfer pumps shall be located open to sky. Further N-pit shall be located in open area near CPU regeneration area. CPU regeneration cum resin transfer pumps shall be located near DM water Storage tanks (inside DM Transfer Pump house) and shall have been provided with localised KNOPY arrangement on pump & motor and the same shall be in bidder's scope. Further Bidder to also provide the localized KNOPY arrangement on all pumps & motors which are open to sky.

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

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

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

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

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

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

17) Ladder & platforms shall be provided for each tank for easy accessibility & maintenance purpose by

bidder.

18) Necessary approach (platform) shall be provided for all the Pneumatic Valves & Flow Orifice Plates. Necessary drawing/documents, indicating the same, shall be provided by successful bidder during contract stage.

19) AII the transmitters (Pressure, Temperature, Flow, Level, Differential Pressure etc.) & analysers which are used in system for interlock & protection shall be redundant. For redundancy please refer the C&I portion of this specification section I-C. The same shall be indicated in P&ID by successful bidder after award of contract.

20) Instruments, analyzers etc. used in system should sustain operating & design parameters of system. In case operating & design parameters of instruments, analysers are less than system's parameters, then necessary arrangement/accessories shall be provided by bidder for safe operation.

21) Embedment plates with lugs shall also be provided by bidder as per system requirement.

22) All channels & brackets, mounting plates as required for mounting of motors, pumps, stirrers, tank etc. shall be in bidder's scope.

23) Mandatory spares as per attached Annexure-VI of Sub-Section IA to this technical specification.

24) All necessary structural steel for pipe supporting structure, platforms, walkways / pathways and access stairs, mechanical plant and equipment, mechanical services and pipe work associated with CPU Plant.

25) All Motorized valves with integral starter as per requirement and as indicated in the P&ID.

26) All handrails shall be of 32 mm nominal bore MS pipes (medium class) as per IS: 1161 galvanized using 750 gm/sq. m of zinc. Hand railing shall be a two-rail system with the top rail 1000 mm above the walkway surface and the intermediate rail 450 mm below the top rail. Handrail post spacing shall be limited to 1500 mm as far as possible but can be proportioned to the length of the opening. In such a case spacing shall not exceed 1850 mm centre to centre of posts. Hand railing shall be shop fabricated for specific locations and field welded or bolted to the erected structural steel. Railings shall be provided with 100 mm wide and 8 mm thick MS strip at bottom as toe guard all along the length of railing in horizontal plane. For RCC stairs, hand railing with 20 mm square MS bar balustrade with suitable MS flat and Aluminium / Teakwood handrail shall be provided, unless specifically mentioned otherwise.

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

28) Permanent ladder (not rungs) for approaching the top of tanks, valves for All steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc. as required to grout in civil works and to support/hold the equipment's being supplied under this specification for opening/maintenance purpose.

29) Wrapping, coating and protection of the entire buried pipe shall be as per IS 10221 or AWWA C 203-93.

30) Any item/work either supply of equipment or erection material which have not been specifically mentioned in but are necessary to complete the woks for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification and shall be in bidder's scope without any commercial, technical and delivery implication to BHEL.

31) If service air required by the bidder in the service vessel area (for hydro-pneumatic resin transfer operation etc.) then bidder to provide necessary compressors, valves, piping, fittings, flanges, instruments etc. to meet the system requirement.

32) If service air required by the bidder in the CPU regeneration area (for hydro-pneumatic resin transfer operation etc.) then bidder to provide necessary compressors, valves, piping, fittings, flanges,

instruments etc. to meet the system requirement.

33) All other items are also included in scope of supply as specified in other part of the specification.

34) Space available for CPU Regeneration area (Vide ref. Dwg. No. PE-DG-417-155A-A003) are attached in Section-C1 of this specification. Bidder to accommodate their equipment within the space provided.

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

36) Bidder to take care for cooling/ lubrication of the pumps being supplied by the bidder under this technical specification. If service water pressure requirement is more than available pressure, bidder to consider suitable number of pumps for cooling for each location of 2X100% configuration for CPU package.

37) Any statutory requirement / clearance required for the packages from government / local body shall be in bidder's scope.

38) KKS codes for all drives and instruments for the project have to be followed.

39) KKS numbering shall be followed for all instruments/equipment's/tanks/valves/pipe etc. For maintaining plant quality standard.

40) The suction & discharge valves of pumps shall be provided with open & close limit switches for auto operation. All discharge valves placed at the outlet of the pumps shall be auto valves for auto operation of the plant.

41) Bidder to use analysis given in Sub-Section –IA ANNEXURE –VIII of this technical specification under SALIENT DESIGN INPUTS/ CRITERIA for NORMAL RUN & START-UP OR CONDENSER LEAK CONDITION for design of condensate polishing plant.

42) Bidder shall perform the guarantee parameters as per specification requirement to the satisfaction of owner. The exact modalities of verifying guarantee for the parameters indicated in the specification shall be finally as agreed with the owner during detailed engineering & mutually agreed.

5.0 ELECTRIC HOIST AND MANUAL HOIST (CHAIN PULLEY BLOCK) FOR CPU PACKAGE

Required number of electric hoist / manual hoist of adequate capacity, to meet the erection and maintenance requirements are to be provided for the various areas.

DESIGN CRITERIA

Selection of Electric Hoist and Manually operated Chain Pulley Blocks shall be as per following criteria -

(a) Electric hoist shall be provided for capacity >2T.
(b) Chain pulley block (Manual hoist) - 500kg to <2T, wherever feasible, considering layout constraints.

Capacity of electric and manual (Chain pulley block) hoists shall be decided keeping 20% margin over equipment to be handled.

For hand operated hoists, the hoists shall be suitable for operation from floor level. Hand chain shall be provided for long travel of trolley and the Hoisting mechanism. The operator shall be able to control the movement of the electrical hoist with the help of floor operated pendant
Note:

1. Area, type, capacity mentioned are minimum requirement and shall be finalised during detail engineering without any commercial implication
2. Travel and Lift are layout dependent and shall be finalised during detail engineering without any commercial implication
3. Additional electric/manual hoist required during detail engineering shall be provided as per design criteria given above without any commercial implication.

SCOPE OF SUPPLIES

2.1.0 Equipment and services to be furnished by the bidder for the ELECTRIC HOIST/ MANUAL HOIST with accessories as per the details given in the technical specification and data sheet A. Any equipment / accessories not specified in the specification but required to make the ELECTRIC HOIST/ MANUAL HOIST complete and efficient operation shall also be under the bidder's scope of work.

Compliance with this specification shall not relieve the bidder of the responsibility of furnishing material and workmanship to meet the specified working/duty conditions.

A. Electric hoist shall include but not be limited to the following: -

a. Hoisting and CT drive arrangement
b. All electrical equipment including cables (as per electrical scope matrix) and panels.
c. PVC insulated shrouded bus bar DSL
d. Earthing arrangement.
e. Initial fill of lubricant.
f. Painting of electric hoist and accessories.
g. Maintenance tools & Tackle
h. Erection & Commissioning spares
i. Power cable from isolator switch to DSL
j. Isolating switch in enclosure at operating floor for disconnecting supply to DSL while maintaining the electric hoist.
k. Mandatory spares

B. Manual hoist shall include but not be limited to the following:

a. Chain pulley blocks with/without traveling trolleys
b. Maintenance Tools and Tackles
c. Painting

2.2.0 **Erection and Commissioning spares (ELECTRIC HOIST)**

The Bidder shall also supply erection & commissioning spares along with his main equipment as per his experience, for replacement of damaged or unserviceable parts during the execution of the project at site, to avoid delay in the project schedule. This shall form part of the main equipment supply. The Purchaser shall retain the unutilized commissioning spares. The initial fill of lubricants, oil etc. shall also be supplied by the bidder.

2.3.0 Services to be provided by the bidder Packing, forwarding and transportation to site, storage and handling at site.

2.4.0 Erection and Commissioning

2.5.0 Functional test (Overload testing, load testing at rated speed, travel and hoisting motion checks as per relevant design standards)

2.6.0 Obtaining clearance and acceptance certificate from the concerned competent authority after site test as applicable. Necessary fees/expenditure as required shall be borne by the supplier.

3.0 **Inspection and Testing**

As per quality plan approved during detail engineering. Prime inspection agency shall be BHEL. Equipment supplied shall be strictly in accordance with nomenclature & technical specification.

4.0 **Runway beam**

Shall be supplied by civil contractor.

5.0 **PAINTING SPECIFICATION**

Painting of the equipment shall be carried out to protect the same from rusting / corrosion during shipping, long storage at site, erection, and during its normal operation / usage.

Whilst the essential requirements of surface preparation and painting are specified here, these in no way relieve the contractor of his responsibility to carry out his work in accordance with good practices. However, any deviation/modification from the specification shall be referred to the purchaser for approval.

Surface preparation: De greasing and Mechanical cleaning with wire brush or hand tool. (SA 1/ ST 2 / ST 3 as applicable)

Primer : Red oxide Zinc chromate as per IS: 2074 (Alkyd medium) - 1 coat, DFT 35µ per coat.

Intermediate: Red oxide Zinc chromate as per IS: 2074 (Alkyd medium) - 1 coat, DFT 35µ per coat.

Finish Coat : Synthetic enamel (Alkyd medium) as per IS: 2932- 2 coats, DFT 25 µ per coat.

Total DFT : 120µ

Electrical /Control Panel:

Surface preparation: Seven tank process

Primer : Zinc phosphate (Alkyd medium) - 2 coat, Minimum DFT 25- 35 µ per coat.

Finish Coat : Synthetic enamel (Alkyd medium) as per IS: 2932- 3 coats, Minimum DFT 20-25 µ per coat.

Total DFT : 110 - 145µ

Color Shade:

SL. No	Item Description	Color Shade	Remarks
1	Crane Structure	Smoke Gray shade 692 as per IS-5	
2	Bottom block assembly	Smoke Gray shade 692 as per IS-5	
3	Hooks	Lemon yellow, shade 356 as per IS-5	With 100 mm wide black zebra strip
4	End carriage sweep	Smoke Gray shade 692 as per IS-5	
5	Motors	Smoke Gray shade 692 as per IS-5	
6	Control Panels	Smoke Gray shade 692 as per IS-5	

6.0 **PACKING**

As per packing details specified elsewhere in specification.

7.0 DEMONSTRATION TEST

Hoist along with its drives, controls and other accessories shall be demonstrated for the rated capacity against the rated speed of motions and for the service conditions specified as specified in QAP and as per IS 3938 for electric hoist and IS 3832 for manual hoist.

The bidder shall have the full responsibility for the safe and efficient operation of the hoist with associated accessories as a single unit.

If the shop performance tests indicate the failure of any of the components to achieve the guaranteed performance, the deficiency shall be made good at bidder's cost.

Demonstration tests shall be carried out each time after the rectification /modification is carried out.

8.0 MAKE OF SUB - VENDOR ITEMS

Makes of bought out items will be as per list specified in the specification. No other make will be acceptable, until and unless specifically got it approved by the purchaser/ end client.

9.0 TESTING AT SITE

A) ELECTRIC HOIST:
As required for statutory clearance for operating at site i.e., overload test, load test and other tests as per IS 3938.

Test for Operation -After the supply has been connected, tests shall be carried out to prove the following:
a) The satisfactory operation of each controller, switch, contactor, relay and other control devices and in particular the correct operation of all limit switches under the most unfavourable conditions;
b) The correctness of all circuits and interlocks and sequence of operation; and
c) The satisfactory operation of all protective devices.

Overload Test -After test but before the hoist is put into service, it shall be tested with overload relays appropriately set, to lift and sustain a test load of 125 percent of the working load. During the overload test, the hoist shall sustain the load under full control. The specified speeds need not be attained but the hoist shall show itself capable of dealing with the overload without difficulty.

B) MANUAL HOIST:
As required for statutory clearance for operating at site with following minimum test i.e., overload and load test.

10.0 TECHNICAL DATA SHEET:

A) ELECTRIC HOIST:

S.No.	DESCRIPTION	TECHNICAL PARTICULARS
1.0	**Type**	Electric wire rope hoist with electrically operated trolley
2.0	**Overload test**	125% of SWL
3.0	**Design Ambient temperature**	50 deg C
4.0	**General Design**	As per IS: 3938, class-II
5.0	**Operating speed**	Full speed (m/min)

5.1	Hoisting speed	3.0 M / min.
5.2	Trolley speed	15.0 M / min.
6.0	**Type of transmission**	Through Electric motor and gearbox
7.0	**Wire Rope**	RHO lay construction
7.1	Construction / core	6 x 36/ 6 x 37 Steel/Fiber core
7.2	Strength	1770 or 1960 N/m2 as per IS:2266
7.3	Code	IS:2266
7.4	Material	Plough steel
7.5	Factor of safety	5 as per IS:3938
8.0	**Load Hook and block**	
8.1	Type of load hook	Forged steel to IS 15560- C shank, swiveling type with safety latch and pin
8.2	Load hook Code	IS:15560
8.3	Load hook Material	As per IS: 15560
8.4	Hook suspension	Thrust bearing
9.0	**Gear (Hoisting)**	
9.1	Type	Spur / Helical
9.2	Material	As per IS 3938
9.3	Bearing type	Antifriction Ball / Roller
10.0	Trolley drive	
10.1	**Wheel**	Single flange taper thread
10.2	Wheel conform to (Std. / code)	IS: 3938
10.3	Wheel material	Cast steel/ forged steel as per IS 3938
10.4	Bearing type	Antifriction Ball / Roller
11.0	**SHEAVE**	
11.1	Material	Fabricated from steel plate. IS: 2062 Gr. A or B as per IS: 3938
11.2	Bearing type	Antifriction Ball / Roller
12.0	**BRAKE (Hoist)**	
12.1	Type	DCEM brakes
12.2	Capacity	150 % of FLT

	TITLE: 5X800 MW YADADRI THERMAL POWER STATION	SPECIFICATION NO. PE-TS-417-155A-A001	
		SECTION : I	
	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	**SUB-SECTION:** IA	
		REV. NO. 00	DATE :

12.3	Number	One number for each motor	
13.0	**BRAKE (Trolley)**		
13.1	Type	DCEM brakes	
13.2	Capacity	125 % of FLT	
13.3	Number	One number for each motor	
14.0	**ROPE DRUM**		
14.1	Material	Rolled steel, welded construction / seamless pipe as per ASTM A106 / 53 GR A/B	
14.2	Type of groove	Right hand groove or Right hand and left hand groove	
15.0	**TYPE OF DSL**		
15.1	Travel	PVC shrouded bus bar	
16.0	**MOTORS** (for hoisting and trolley)		
16.1	Type	Sq. Cage induction, TEFC, S4 duty, 40% CDF	
16.2	Number of start	150 starts / hr	
16.3	Voltage, Phase and Frequency	415V $\pm$ 10%, 3 phase, 4 wire, 50 Hz, ± 5 %	
16.4	Class of insulation	Class “F” and temperature rise limited to class “B”.	
16.5	Type of enclosure	TEFC	
16.6	Degree of protection provided for enclosure	IP-55	
16.7	Margin	Motor rating shall be calculated keeping margin of at least 15% over the maximum power requirement in the duty condition specified.	
17.0	**LIMIT SWITCHES**	Hoisting	Trolley
17.1	Type	Snap action	two way lever
18.0	**Pendent Push Buttons**	Up/ down/ forward/ reverse push button with indicating lamps	
18.1	**Emergency stop push button**	Provided. (Mushroom head)	
19.0	**Power cable & Control Cable**	All cabling shall be XLPE insulated fire resistant (FRLS) cables.	
20.0	**Control Voltage**	110 V (shall be provided through suitable rated 415/110V control transformer).	
21.0	**Painting**	Shall be submitted as separate document in line with KTPS (Stage - VII) during detail engineering. Color Shade from the same is being reproduced below:	

	TITLE: 5X800 MW YADADRI THERMAL POWER STATION	SPECIFICATION NO. PE-TS-417-155A-A001	
		SECTION : I	
	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	**SUB-SECTION:** IA	
		REV. NO. 00	DATE :

SL. No	Item Description	Color Shade	Remarks
1	Crane Structure	Smoke Gray shade 692 as per IS-5	
2	Bottom block assembly	Smoke Gray shade 692 as per IS-5	
3	Hooks	Lemon yellow, shade 356 as per IS-5	With 100 mm wide black zebra strip
4	End carriage sweep	Smoke Gray shade 692 as per IS-5	
5	Motors	Smoke Gray shade 692 as per IS-5	
6	Control Panels	Smoke Gray shade 692 as per IS-5	

B) MANUAL HOIST (CHAIN PULLEY BLOCK):

1.0	**Type**	Chain pulley block with/without trolley
2.0	**General Design**	IS: 3832
3.0	**Duty Class as per IS:3832**	Class –II
4.0	**Hoisting Mechanism**	
a)	Type	Hand operated gear transmission
b)	Type of gear	Spur / Helical
c)	Load Chain	
i)	Type	Link type
ii)	Material	T (8) as per IS: 6216
iii)	Conforms to (Std./Code)	IS: 6216
d)	Hand Chain	
i)	Type	Link type
ii)	Material	Mild steel Grade 30
iii)	Conform to Std.	IS:2429 (Part I)
e)	Load Hook & Hook Block	
i)	Type of load hook	Plain shank- Trapezoidal section
ii)	Load hooks conforms to	IS: 15560
iii)	Type of hook suspension	Swivelling type with lock
iv)	Type of make of bearing	Thrust ball bearing of hook suspension
v)	Type & Material of hook	As per IS 15560
f)	Gears/ Pinion	
i)	Type	Spur
ii)	Material	Alloy steel / carbon steel as per IS 3938
	Type of Bearing	Antifriction ball bearing / Roller
g)	Sprockets : Type of bearings used	Antifriction ball bearing / Roller
h)	Method of lubrication	
	Bearings	Grease
	Gearing & Pinions	Grease
	Sprocket	Grease

i)	Brakes Type	 Screw and friction disc type
5.0	**Trolley and Bridge drive**	
a) i) ii)	Trolley Type Material of frame	 Geared (Manually operated) Mild steel (IS:2062 Grade A or B)
b) i) ii)	Drive Chain Type Material	 Link type Steel Gr.30
c) i) ii) iii) iv)	Wheel Number of pairs of wheel Flange Type of bearings need Wheel material	 Two in each trolley/bridge Single flanged Antifriction Cast steel
d) i) ii) iii)	Gears Type Material Type of bearings used	 Spur / helical EN8 Antifriction
e) i) ii) iii)	Method of lubrication for Bearings General Sprockets	 Grease Grease Grease
6.0	**Painting**	As per manufacturer's standard

11.0 Maintenance Tools and Tackles

One (1) complete unused new set of special purpose tools, tackles and accessories along with detailed instructions and maintenance manual shall be supplied. Tools shall be of suitable sizes for maintenance of electric hoist of each type and capacity. Each tool and wrench shall be stamped so as to be identified easy for its use. The tools shall be supplied in steel toolbox and with a copy of instruction manual. The items supplied shall be of the best quality, specially protected against rusting. The following shall be provided as minimum requirement:

S. No.	Description	Qty
1	Complete set of ring spanners (Indicate the sizes offered)	1 Set
2	Complete set of screwdrivers (Min. 6 nos. Indicate the sizes)	1 Set
3	Adjustable Spanner	1 No.
4	Insulated pliers	1 No.
5	Wrench spanner	1 No.
6	Grease Gun	1 No.
7	Oil Gun	1 No.
8	Hand Lamp	1 No.
9	Line tester	1 No.

Note: -The tools shall be supplied in one tool box. Bidder shall ensure that the tools & tackles mentioned in above list are sufficient to handle all sizes/capacities of hoists & in case any other /additional tool is required for handling/maintenance any size/capacity of hoist the same shall be included in this list.

12.0 DRAWING/DOCUMENT SUBMISSION

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

A) ELECTRIC HOIST

Sl. No.	BHEL DRG.NO	DRAWING TITLE
1	PE-V1-417-155-A100	Manufacturing Quality Plan with Sub vendor list
2	PE-V1-417-155-A101	GA Drawing & Tech. Datasheet for Electric Hoist, DSL arrangement and painting details
3	PE-V1-417-155-A102	Schematic Circuit Diagram for electric hoist
4	PE-V1-417-155-A103	Mechanism Sizing Calculation
5	PE-V1-417-155-A105	O & M Manual including erection procedure

B) MANUAL HOIST (CHAIN PULLEY BLOCK):

Sl. No.	BHEL DRG.NO	DRAWING TITLE
1	PE-V1-417-155-A200	Manufacturing Quality Plan
2	PE-V1-417-155-A201	GA Drawing & Tech. Datasheet for CPB with detail BOM with painting details
3	PE-V1-417-155-A202	O & M Manual including erection procedure

Notes:

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
2. Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
3. Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
4. Detailed list/ break-up of mandatory spares shall be submitted along with BBU by supplier for approval during engineering.
5. Bidder to note that all values/dimensions/elevations etc. without supporting back up data adopted/assumed by the successful bidder (during contract stage) in the design calculation/drawings shall be taken by the customer/owner to be correct unless they are stipulated in the specification. Any problem arising later in this regard shall be made good by the successful bidder at his cost and no extension of time shall be granted for the same.
6. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:-
   a) All drawings and documents shall indicate the list of all reference drawings including general arrangement.
   b) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.
   c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.
   d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their

quantity, material of construction indicating its applicable code / standard, weight, make etc.

e) Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C… etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3 ….etc.

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

g) All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.

h) All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing No.

i) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

j) Bidder to follow the following the drawing submission schedule:
   i. 1st submission of drawings from date of LOI as per the submission schedule.
   ii. Every revised submission incorporating comments – within 7 days.

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

l) Manufacturing shall be started on receipt of cat II approved drawings.

8.0 SCOPE OF SUPPLY (ELECTRICAL)

Complete electrical as per specification / details indicated in Sub-Section IB (Specific Technical Requirement Electrical) and IIB (General Technical Requirement Electrical).

9.0 SCOPE OF SUPPLY (C&I)

Complete C&I as per specification / details indicated in Sub-Section IC (Specific Technical Requirement C&I) and IIC (General Technical Requirement C&I).

10.0 SCOPE OF SUPPLY (CIVIL)

Total Civil is in BHEL's Scope of work, however complete grouting for equipments, fixing and any concreting inside the vessels, puddle pipe inside civil structure, nozzles, supporting plate/ structures & lining shall be in bidder's scope.

Also detailed Civil Input drawing shall be provided by bidder. Successful bidder shall furnish civil assignment drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder and shall be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by vendor, BHEL reserves the right to debit cost of such rework to vendor".

11.0 SCOPE OF SERVICES

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

(i) Erection and commissioning, unloading, storage and handling at site.

(ii) Minor civil work like chipping of foundation, grouting below base plate for all structures, equipment, grouting of anchor bolts wherever these are not placed in the foundation during casting of foundation

itself, excavation & filling of earth for buried pipes if and as required. To the extent possible, vendor shall ensure to supply all foundation bolts timely so as to facilitate placement of these bolts while casting the foundation. Wrapping, coating and protection of all the buried pipe shall be as per IS 10221.

(iii) Pre-commissioning work such as flushing, hydraulic testing etc. Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities shall be arranged by the successful bidder at their own cost.

(iv) Arrangement of all instruments, equipments, lab facilities, reagents, monitoring gadgets for monitoring, pre-commissioning, carrying out trial run, commissioning, PG test & till plant hand over.

(v) Monitoring gadgets, instruments and equipments required for maintenance.

(vi) During Logic preparation, FAT & commissioning of DDCMIS, bidder shall arrange his concerned personnel at PEM office, BHEL –EDN office & for commissioning of DDCMIS at site, as and when required by customer / BHEL without any delay as per clause specified under Sub -section-IC (C&I).

(vii) Complete grouting for equipment, fixing and any concreting inside the vessels and lining.

(viii) All personnel required during maintenance, Commissioning, trial run and PG test.

(ix) Trial run for requisite period.

(x) Performance Guarantee testing.

(xi) Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.

(xii) All other facilities/ services as described in section on site services in specification and related to CPU Plant scope of work.

(xiii) Relevant requirements as per GTR, GCC, ECC & SCC.

(xiv) All the Piping, Valves and Equipment's of this system shall be protected against external corrosion by providing suitable painting. The surfaces of stainless steel, Gunmetal, brass, bronze and non-metallic components shall not be applied with any painting. The condensate pipelines and valves near the condensate polisher vessels shall be painted as per Sub-Section IA ANNEXURE V of this Technical Specification.

(xv) Painting shall be as specified Sub-Section IA ANNEXURE V of this technical specification. However, any variation in the painting schedule as finally approved by BHEL / Customer shall be taken care by the bidder without any commercial and delivery implication to BHEL / Customer. Colour coding scheme shall be intimated to vendor during detail engineering.

(xvi) Final touch up paint at site.

12.0 TERMINAL POINTS

12.1 CONDENSATE POLISHING PLANT - SERVICE VESSEL AREA

(i) Service vessel inlet – (OD 457.2 X 12.7 mm thick, SA 106 Gr-C) - Single piping connection near service vessel area in BC bay for unit 1, unit -2, unit -3, unit -4 & unit -5 as per attached Composite Piping Layout Plan Below Mezzanine Floor Dwg. No. PE-DG-417-100-M032.

(ii) Service vessel outlet – (OD 457.2 X 12.7 mm thick, SA 106 Gr-C) - Single piping connection near service vessel area in BC bay for unit 1, unit -2, unit -3, unit -4 & unit -5 as per attached Composite Piping Layout Plan Below Mezzanine Floor Dwg. No. PE-DG-417-100-M032.

(iii) Rinse water outlet- Rinse water outlet piping (OD 168.3 x 7.11 mm, SA 106 Gr-B) from the service vessel outlet till condenser hot well for each TG unit is in the scope of bidder.

(iv) The DM water used for resin transfer operations from the Regeneration building to the Condensate Polisher vessels shall be terminated by the bidder to the nearest drain trench through drain channel.

(v) 25 NB connection of Instrument air supply at 5 to 7 kg/cm2 (g) – At 5-meter distance from service vessel area for each TG unit. However, distribution and piping inside each TG hall service vessel area shall be in bidder's scope.

(vi) Gland sealing valves cooling water supply & analysers rack cooling water supply piping – Service water connection (25 NB) at 5-meter distance from service vessel area for each TG unit. Piping inside service vessel area for each TG unit for mentioned services will be in bidder's scope.

12.2 EXTERNAL REGENERATION AREA

(i) DM Water Supply –The DM water piping terminal point shall be common outlet line from all 5 DM water storage tanks (DM water storage tanks not in bidder's scope) & for recirculation line terminal point shall be up to common DM water recirculation line to all 5 DM water storage tanks at a distance of 10 m from the DM water transfer pump house. Piping from these terminal points to the pump suctions of 1st & 2nd stage of CPU regeneration cum resin transfer pumps shall be in the scope of bidder. Approximate piping distance for the same shall be considered as 25 m for each stage pump suction line.

(ii) CPU regeneration cum resin transfer pumps Recirculation Lines – Piping from 1st stage & 2nd stage CPU regeneration cum resin transfer pumps outlet lines to all 5 DM water storage tanks common recirculation line up to terminal point shall also be in the scope of bidder. Approximate piping distance for the same shall be considered as 25 m for each stage pump recirculation line.

(iii) 50 NB Instrument air supply at 5 to 7 kg/cm2 (g) – At 5-meter distance from the CPU regeneration building.

(iv) Service water (50 NB) - At 5-meter distance from the CPU regeneration building. However, distribution and piping inside CPU regeneration area will be in bidder's scope.

(v) Drinking/Potable water (50NB) - At 5-meter distance from the CPU regeneration building. However, distribution and piping inside CPU regeneration area will be in bidder's scope.

(vi) N-Pit effluent piping (150 NB) from N Pit up to CMB OF ETP shall be in bidder's scope. The piping distance to be considered from 1st set of regeneration system N-pit to CMB of ETP shall be 1500 m. Similarly, the piping distance to be considered from 2nd of regeneration system N-pit to CMB of ETP shall be 1500 m.

(vii) In addition to that detailed terminal points shall be as per the P&ID for CPU plant (BHEL Drg. No.: PE-DG-412-155A-A001) enclosed with the technical specification.

13.0 EXCLUSIONS

13.1 All civil works including foundation of equipment. However complete grouting for equipment, fixing and any concreting inside vessels and lining shall be in the scope of the bidder. But civil works including operating / maintenance platforms and interconnection platforms (if any) with ladders / stairs & handrails, structural supports and hangers for pipes / cables / ducts, crane rails, all embedments and inserts with lugs including anchor fasteners, bolts etc., dressing of foundations, grouting of pockets and underpinning of base plates for equipment / structures and fixing supports, filling and finishing of openings in walls, floors, cladding, roof and trenches shall be in Bidder's scope.

13.2 Main pipe trestles interconnecting CPU regeneration building and Service vessel Pipe trestle. However, auxiliary structure, hanger/support components for all the piping (CPU regeneration area, in acid/alkali handling area, interconnecting acid/alkali storage area, CPU service vessels, DM water piping, resin transfer piping, instrument air piping, service water piping, potable water piping and effluent disposal piping etc.) are in bidder's scope.

13.3 Instrument air up to terminal points.

13.4 All chemicals except reagents, monitoring gadgets required for pre- commissioning, commissioning, trial run and PG test.

13.5 Air conditioning, ventilation & firefighting facilities.

13.6 Supply of ISMB monorail.

13.7 Other exclusions are mentioned in the electrical & C&I parts of this specification.

13.8 Service water, Drinking/ potable water & DM water up to terminal points.

13.9 Plates as mentioned in the specification section IA, Clause no. 4.E

14.0 QP AND SUB VENDOR APPROVAL

14.1 Minimum QP requirements are specified as Sub-Section IA ANNEXURE I. BHEL & customer reserves the right for inspection of imported items by BHEL/customer officials (if felt necessary). The same shall be decided during detail engineering during approval of QP's.

14.2 However, any additional comments as given by BHEL/Customer on quality plan shall be adhered by the bidder without any commercial & delivery implication to BHEL.

14.3 Requirement of detailed QP, inspection checklist, certificate of conformance etc. for each equipment and sub-vendor shall be finalized during detailed engineering stage; decision of BHEL/customer shall be binding on vendor in this regard. Any changes/additional tests insisted upon by Owner during approval of QAP's shall be accepted by bidder without any commercial and delivery implication to BHEL/Customer. Bidder shall submit the quality plans in BHEL format during detailed engineering stage. Bidder to note further that during detailed engineering all the QAP's/check lists etc. shall be submitted to Customer/BHEL for approval. All inspection & testing etc. shall be carried out accordingly.

14.4 List of make sub vendor items is enclosed as Sub-Section IA ANNEXURE-II is indicative only and is subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.Any additional sub vendor shall be subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.

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

14.6 Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges; counter flanges etc. from approved sub vendor only.

15.0 FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES

Functional Guarantees and liquidated damages shall be as per enclosed Sub-Section IA ANNEXURE III**.**

16.0 DESIGN/ CONSTRUCTION

In addition to the requirements of Sub-Section IIB, IIC the following shall also be complied under scope of this specification.

The P&I diagram is enclosed herein in this section for bidder's compliance.

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

17.0 DRAWING/DOCUMENTS REQUIREMENT

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

The number of drawing/documents to be submitted by the bidder shall be as per enclosed Sub-Section IA ANNEXURE IV. The submission of soft copy or hard copy of the document whichever is later will be considered as final date of submission of the document. The bidder has to submit the revised drawing /document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. Bidder to comply with the observations of the BHEL and CUSTOMER without price & delivery implication.

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

After award of LOI/LOA, drawing/documents to be submitted by the bidder for BHEL/Customer approval has been indicated in Sub-Section IA Annexure VII. However, any additional drawing /document if found necessary for completion of the engineering, the same shall be submitted by bidder without any technical, commercial & delivery implication to BHEL. Bidder confirmed drawings submission schedule as follows:

a. Drawing/documents submission schedule: First submission of basic drawings/ documents – (Please refer MDL for list of basic drawing/documents & submission schedule).
b. Every revised document shall be submitted by bidder incorporating BHEL/customer comments – within 10 days.

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

(a) List and schedule of drawings/documents to be submitted after award of contract: -

MASTER DRAWING LIST(MDL)				
Sr.No.	**Drawing/Document No.**	**Drawing/Document Title**	**No. of weeks for drawing/document submission after placing LOI/PO**	**Paper Size of Dwg/Docs.**

	TITLE: **5X800 MW YADADRI THERMAL POWER STATION**	SPECIFICATION NO. PE-TS-417-155A-A001	
		SECTION : I	
	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	**SUB-SECTION:** IA	
		REV. NO. 00	DATE :

1.0	PE-V0-417-155-A001	QAP FOR PRESSURE VESSELS FOR CONDENSATE POLISHING UNIT	10	A4
2.0	PE-V0-417-155-A002	QAP FOR SERVICE VESSEL FOR CONDENSATE POLISHING UNIT	10	A4
3.0	PE-V0-417-155-A003	QAP FOR ATMOSPHERIC TANKS FOR CONDENSATE POLISHING UNIT	10	A4
4.0	PE-V0-417-155-A004	QAP FOR BLOWERS WITH MOTOR FOR CONDENSATE POLISHING UNIT	10	A4
5.0	PE-V0-417-155-A005	QAP FOR METERING PUMPS WITH MOTOR FOR CONDENSATE POLISHING UNIT	10	A4
6.0	PE-V0-417-155-A006	QAP FOR HORIZONTAL / VERTICAL CENTRIFUGALPUMPS WITH MOTOR FOR CONDENSATE POLISHING UNIT	10	A4
7.0	PE-V0-417-155-A008	QAP FOR VALVES FOR CONDENSATE POLISHING UNIT	10	A4
8.0	PE-V0-417-155-A009 *	OPERATION & CONTROL PHILOSOPHY FOR CPU ALONG WITH CONTROL SYSTEM CONFIGURATION DIAGRAM	6	A4
9.0	PE-V0-417-155-A010 *	PROCESS DESIGN & SIZING CALCULATIONS, DS OF RESIN, VESSEL THICKNESS & PR. DROP CALCULATIONS FOR CPU	4	A4
10.0	PE-V0-417-155-A011	TECHNICAL DATA SHEET FOR HEATER FOR CONDENSATE POLISHING UNIT	10	A4
11.0	PE-V0-417-155-A012	TECHNICAL DATA SHEET OF BLOWERS FOR CONDENSATE POLISHING UNIT	10	A4
12.0	PE-V0-417-155-A013	TECHNICAL DATA SHEET FOR MOTOR FOR CONDENSATE POLISHING UNIT	10	A4
13.0	PE-V0-417-155-A014	TECHNICAL DATA SHEET FOR ANALYSERS FOR CONDENSATE POLISHING UNIT	10	A4
14.0	PE-V0-417-155-A015	TECHNICAL DATA SHEET FOR HIGH PRESSURE VALVES FOR CONDENSATE POLISHING UNIT	10	A4
15.0	PE-V0-417-155-A017	PAINTING SCHEDULE FOR CPU	10	A4
16.0	PE-V0-417-155-A018	TECHNICAL DATA SHEET FOR METERING PUMPS FOR CONDENSATE POLISHING UNIT	10	A4
17.0	PE-V0-417-155-A019	DATASHEET OF RESIN TRAP, CARBON TRAP, ACF, AGITATOR FOR CONDENSATE POLISHING UNIT	12	A4
18.0	PE-V0-417-155-A020	TECHNICAL DATA SHEET FOR INSTRUMENTS FOR CONDENSATE POLISHING UNIT	10	A4
19.0	PE-V0-417-155-A021	TECHNICAL DATA SHEET OF HORIZONTAL / VERTICAL CENTRIFUGALPUMPS FOR CONDENSATE POLISHING UNIT	10	A4
20.0	PE-V0-417-155-A022	TECHNICAL DATA SHEET FOR LOW PRESSURE VALVES FOR CONDENSATE POLISHING UNIT	10	A4
21.0	PE-V0-417-155-A023	QAP / ICL FOR CPU (FOR BALANCE OF ITEMS)	12	A4
22.0	PE-V0-417-155-A024	ELECTRICAL LOAD DATA FOR CONDENSATE POLISHING UNIT	10	A4
23.0	PE-V0-417-155-A025	GA DRAWING OF SERVICE VESSELS FOR CPU	10	A1

TITLE: 5X800 MW YADADRI THERMAL POWER STATION	SPECIFICATION NO. PE-TS-417-155A-A001	
	SECTION : I	
TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	**SUB-SECTION:** IA	
	REV. NO. 00	DATE :

24.0	PE-V0-417-155-A026	GA DRAWING OF PRESSURE VESSELS FOR CPU	10	A1
25.0	PE-V0-417-155-A027	GA DRAWING OF ATMOSPHERIC TANKS FOR CPU	10	A1
26.0	PE-V0-417-155-A028	CONTROL SCHEME FOR CONDENSATE POLISHING UNIT	14	A4
27.0	PE-V0-417-155-A029	CIVIL ASSIGNMENT DRAWING OF CONDENSATE POLISHING UNIT (SERVICE VESSEL AREA)	8	A1
28.0	PE-V0-417-155-A030	CIVIL ASSIGNMENT DRAWING OF CONDENSATE POLISHING UNITREGENERATION AREA)	8	A1
29.0	PE-V0-417-155-A031 *	P&I DIAGRAM FOR CONDENSATE POLISHING UNIT	4	A1
30.0	PE-V0-417-155-A032 *	EQUIPMENT LAYOUT OF CONDENSATE POLISHING UNIT (SERVICE VESSEL AREA)	4	A1
31.0	PE-V0-417-155-A033 *	EQUIPMENT LAYOUT OF CONDENSATE POLISHING UNIT (REGENERATION AREA)	4	A1
32.0	PE-V0-417-155-A034	PIPING LAYOUT (REGENERATION AREA) FOR CONDENSATE POLISHING UNIT	10	A1
33.0	PE-V0-417-155-A035	YARD PIPING LAYOUT FOR CONDENSATE POLISHING UNIT	16	A1
36.0	PE-V0-417-155-A036	PG test procedure for condensate polishing unit	20	A4
37.0	PE-V0-417-155-A037	PIPING LAYOUT (SERVICE VESSEL AREA) FOR CONDENSATE POLISHING UNIT	10	A1
38.0	PE-V0-417-155-A038	VALVE SCHEDULE FOR CONDENSATE POLISHING UNIT	12	A3
39.0	PE-V0-417-155-A039	INSTRUMENT SCHEDULE FOR CONDENSATE POLISHING UNIT	12	A3
40.0	PE-V0-417-155-A040	VALVE SEQUENCE CHART FOR CONDENSATE POLISHING UNIT	10	A3
41.0	PE-V0-417-155-A041 *	SUB-VENDOR LIST AND INSPECTION CRITERIA	4	A4
42.0	PE-V0-417-155-A042	I/O LIST FOR CONDENSATE POLISHING UNIT	10	A4
43.0	PE-V0-417-155-A043	DRIVE LIST FOR CONDENSATE POLISHING UNIT	12	A4
44.0	PE-V0-417-155-A044	CABLE TRAY/TRENCH & CONDUIT ROUTING AND EARTHING LAYOUT DIAGRAM FOR CPU(REGENERATION AREA)	12	A1
45.0	PE-V0-417-155-A045	CABLE TRAY/TRENCH & CONDUIT ROUTING AND EARTHING LAYOUT DIAGRAM FOR CPU(SERVICE VESSEL AREA)	12	A1
46.0	PE-V0-417-155-A046	CABLE SCHEDULE FOR CONDENSATE POLISHING UNIT	16	A3
47.0	PE-V0-417-155-A047	O&M MANUAL FOR CONDENSATE POLISHING UNIT	24	A4

Note- The drawing/document marked as (*) shall be considered as basic drawings/documents. In addition to above bidder to refer Sub Section-, IA, IB, IC, IIB & IIC for documents related to Electrical & Control & instrumentation respectively.

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

- Internet explorer version – Minimum Internet Explorer 7
- Internet speed – 2 mbps (Minimum preferred)

1. Pop ups from our external DMS IP (124.124.36.198) should not be blocked

- Vendor's Internal proxy setting should not block DMS application's link (http://124.124.36.198/wrenchwebaccess/login.aspx)"
- DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.
- For quick access bidder may refer the link http://bhelpem.com/DMSManuals/DMSManuals.html

18.0 SPARES

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

16.1 RECOMMENDED SPARES:

The bidder shall also furnish list of recommended spares parts for three (3) years normal operation with unit prices. These recommended spares shall be those considered necessary by the bidder on a stand-alone basis. The BHEL reserves the right to buy any of the recommended spare parts as considered necessary by him.

The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment. The price of these spars will remain valid upto 6 months after placement of Notification of Award for the main equipment. However, the Bidder shall be liable to provide necessary justification for the quoted prices for these spares as desired by the BHEL/Customer.

16.2 MANDATORY SPARES:

All Mandatory spares listed in Sub-Section IA Annexure VI of this specification are in bidder's scope of supply.

All the Mandatory spares for the equipment under the contract provided by the vendor will strictly conform to the specifications and documents and will be identical to the corresponding main Equipment/components supplied under the contract.

Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.

All mandatory spares shall be delivered at site at least two months before scheduled date of initial Operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments.

Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.

Inspection of mandatory spares shall be in line with the approved quality plans for the respective Items/equipments. The inspection categorisation of mandatory spares shall also be in line with the approved categorisation plan for the respective items/equipment.

16.3 START-UP & COMMISSIONING SPARES

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

Notes:

1) The Bidder shall indicate the service expectancy period for the spares parts (mandatory) under normal operating conditions before replacement is necessary.

2)That all spares supplied will be new and in accordance with the contract document and will be free from defects in design, material and workmanship and shall further guarantee as under.

3) In case of any failure in the original component/equipment's due to faulty designs, materials and workmanship, the corresponding spare parts if any, supplied will be replaced without any extra cost to the BHEL and customer unless a joint examination and analysis by BHEL and/or customer of such spare parts prove that the defect found in the original part that failed can safely be assured not to be present in spare parts.

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

5) All the spares (mandatory) shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.

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

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

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

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

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

11) The bidder shall guarantee the long term availability of spares to the BHEL/Customer for the full life of the equipment covered under the contract. The Bidder shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, He shall give the BHEL/Customer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-vendors. Further, in case of discontinuance of manufacture of any spares by the Bidder and/or his sub-vendors, bidder will provide the BHEL/Customer, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by BHEL /Customer for the purpose of procurement of such items.

12) Further in case of discontinuance of supply of spares by the vendors or his sub-vendors, the vendor will provide the BHEL and the customer with full information for replacement of such spares with other equivalent makes, if so required by the BHEL and the customer.

13) Notwithstanding the above, the vendor shall be responsible for supply of spares for the lifetime of the package at reasonable prices. The prices of all future requirements of spares shall be derived from the corresponding ex-works price at which the orders for such spares have been placed by the BHEL and the customer as a part of the mandatory or long term or any other kind of spares. The base indices for calculating ex-works price shall be commissioning of last equipment under main contract

14) Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the item as defined elsewhere in this specification, unless specified otherwise and the fraction will be rounded off to the next higher whole number.

15) Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed and the break up for these shall be furnished.

16) In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities.

17) The Bidder will indicate the delivery period of the spares, which the BHEL and the customer may procure in accordance with this clause.

18) In case of emergency requirements of spares, the vendor would make every effort to expedite the manufacture and delivery of such spares on the basis of mutually agreed time schedule.

19) In case the vendor fails to supply the mandatory or long term or any other kind of spares on the terms stipulated above, the BHEL and the customer shall be entitled to purchase the same from the alternate sources at the risk and the cost of the vendor and recover from the vendor, the excess amount paid by the BHEL and the customer over the rates as per the contract. In the event of such risk purchase by the BHEL or the customer, the purchases will be as per the works and procurement policy of the BHEL and the customer prevalent at the time of such purchases and BHEL & the customer at his option may include a representative from the vendor in finalizing the purchases.

20) It is expressly understood that the final settlement between the parties in terms of relevant clauses of the tender document shall not relieve the vendor of any of his obligations under the provision of long term availability of spares and such provisions shall continue to be enforced till the expiry of 30 (thirty) years period reckoned from the scheduled date of completion of trial operation of the last equipment unless otherwise discharged expressly in writing by the BHEL or the customer.

19.0 MISCELLENEOUS REQUIREMENT

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

II. The complete system shall be proven and necessary design documentation in support of proveness shall be submitted by the successful bidder in support of the systems, if asked by the customer without any price and delivery implication to BHEL and customer.

III. System to be designed to meet all the statutory requirements. Preparation of all necessary drawings/data/ documents for obtaining necessary Approval of statutory authorities like CCOE, IBR, Weight & Measures Department and any other agency/ competent authority, on behalf of the customer, related to installation of CPU plant (if required) is included in bidder's scope. All expenses required to obtain the approval shall also be borne by the successful bidder. Successful bidder shall inform customer well in advance requirement of authority letter along with format for the same. After issuance of authority letter by customer, it will be vendor's responsibility to regularly follow up with the concerned authorities to obtain timely approval from these authorities. Any delay on account of the same, unless any specific information related to above approval to be furnished by customer is delayed by customer, shall be to vendor's account and shall not be used as a reason for extension in contract completion.

IV. Vendor to attend regular engineering meeting with BHEL and customer fortnightly in BHEL or customer office as decided during detail engineering. Vendor will depute all his concerned engineering representative along with the project manager for discussion and approval. Meeting can be held at site also.

V. The requirements mentioned in section –I shall prevail and govern in case of conflict between requirements mentioned in section I & section –II for any item or equipment or system.

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

VII. Latest version of all codes and standards to be followed.

VIII. CPU regeneration facilities (except bulk acid & alkali storage and Neutralisation pit which area kept in open) shall be housed in RCC Building. Control room, battery room & MCC room for CPU plant shall be shall be housed shall be located in RCC building. RCC building shall have toilet blocks for ladies and gents.

IX. Any statutory requirement / clearance required for the package from government / local body shall be in bidder's scope.

X. All interconnecting piping, valves, fittings including dosing piping, drain piping from tanks to nearby drain, flushing lines from nearest available water source, valves, fittings and accessories is also in bidder's scope.

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

XII. Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval shall be taken from BHEL. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while

submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

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

XIV. Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.

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

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

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

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

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

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

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

XXII. While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections & sub - sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under SECTION -III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser / Customer shall prevail and shall be

complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication to BHEL / Customer.

XXIII. The bidder shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the vendor from the responsibility of providing such facilities to complete the supply and erection & commissioning of condensate polishing unit.

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

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

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

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

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

XXIX. Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder / vendor and Customer / Purchaser / Employer will mean BHEL and /or TELANGANA STATE POWER GENERATION CORPORATION LIMITED (TSGENCO), HYDERABAD and /or TCE (customer's assigned consultant).

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

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

20.0 BIDDER TO FURNISH 4 SETS OF TECHNO-COMMERCIAL BID INCLUDING FOLLOWING DOCUMENTS/INFORMATION (FOR ELECTRICAL AND C&I PLEASE REFER THE RESPECTIVE SECTION OF THE SPECIFICATION).

- Deviation if any in the enclosed Schedule of deviation with cost of withdrawal only with mention of specification clause for which deviation is being asked. (Stamped & Signed)
- Compliance certificate. (Stamped & Signed)
- Schedule of Declaration. (Stamped & Signed)
- Singed and stamped copy of equipment layout of CPU regeneration area.
- Unpriced Price Schedule duly filled as “Quoted”. (Stamped & Signed).

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

21.0 SITE VISIT BEFORE SUBMISSION OF OFFER.

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

	TITLE: 5X800 MW YADADRI THERMAL POWER STATION	SPECIFICATION NO. PE-TS-417-155A-A001	
		SECTION : I	
	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	**SUB-SECTION:** IA	
		REV. NO. 00	DATE :

TECHNICAL DETAILS OF CONDENSATE POLISHING PLANT

1.00.00 INTRODUCTION

For maintaining the feed water purity condensate polishing plant will be provided in the feed water cycle at the downstream of condensate extraction pumps. The function of the CPU will be to purity the condensate effluent from the condenser by removing solids and dissolved salts with the intent of reducing corrosion and depositions in the steam-water cycle. The proposed Condensate Polishing Unit (CPU) shall treat the condensate of the Turbine-Generator (TG) Units of the power station, using deep Mixed Bed Ion Exchange Polisher vessels and an external regeneration system. One (1) number of Condensate Polishing Plants (CPP), for each TG (Turbine-Generator) unit, along with Two sets of common external regeneration system shall be provided alongwith instrumentations, valves and pipings, controls etc. for all 5 sets of TG units.

2.00.00 SYSTEM DESCRIPTION (GENERAL)

2.01.00 The proposed Condensate Polishing Plant (CPP) shall treat the condensate of the respective Turbine-Generator (TG) Units of the power station. The system shall be as per tender drawing titled P&ID of Condensate polishing Plant.

2.02.00 The proposed schematic arrangement of the Condensate Polishing Plant has been shown in the relevant Tender Drawing (P&ID). Arrangement of piping and valves shown in them are bare minimum only. The Contractor shall propose the complete system including regeneration facilities as per their standard design and as elaborated in this specifications meeting the basic functional requirements.

2.03.00 The system should be capable of producing the output characteristics which will be better than or equal to the specified conditions as prescribed by the Boiler Manufacturer or as specified elsewhere in this document whichever is more stringent. The system should be also capable of monitoring and maintaining the characteristics during unit start up, load variations and condenser tube leakage.

2.04.00 The regeneration process offered by the bidder, shall be of proven design and shall essentially be the same process by virtue of which the bidder is qualified and shall give resin-separation compatible with the desired effluent quality. Documentary evidence shall be submitted by the bidder to the Customer/BHEL to establish this requirement during detailed engineering stage if required.

2.05.00 The bidder shall include inert resin in the system if they feel that it helps in better resin separation.

2.06.00 In case, after separation of resins, there are undesired contaminant resins, the bidder shall provide a system either to eliminate this cross contamination of resins or to nullify the detrimental effect of entrapped resins to the effluent quality.

2.07.00 The guaranteed chemical consumption figures must be supported by relevant published data such as performance of the resin system, statistical data on resin losses and actual field performances of Systems using a similar technique, indicating the quantity of chemicals required for regeneration, in particular, besides other parameters. The data on the chemical consumption figures and the calculations furnished by the Bidder shall be the primary basis of checking the guaranteed parameters. The operating exchange capacity and regeneration levels shall be vetted by resin manufacturer and the Bidder must furnish the resin performance curves specially applicable for this project.

2.08.00 The Condensate polishing Plant shall consist of one set of Condensate polishing Units (CPU) for each TG unit inside TG Building and a common external regeneration system (consist of 2 sets of external regeneration facilities) for all 5 TG units. There shall be three service vessels (3X50%) for each 800 MW unit each polishing 50% of the condensate flow corresponding to VWO (valve wide open) condition at 1% make up (Flow through each service vessel indicated in the data sheet) condition.

2.09.00 The regeneration system (consist of 2 sets of external regeneration facilities) shall be external and common to the CPU of all the TG units. For regeneration, resin from the exhausted exchanger vessel will be transferred hydraulically/ Hydro-pneumatically to this facility. The exhausted resin charge will be cleaned, separated, regenerated, mixed and rinsed before being stored for the next use.

2.10.00 The common influent and effluent headers of each CPU, will be connected to an automatic bypass line (s) to be provided by Bidder. On high pressure signal across the service vessel, the automatic control valve(s) in the bypass line(s) shall open, bypassing the service vessel(s).

2.11.00 In the event of a tube failure in the condenser, circulating water will enter the condensate system and will contaminate it. Typical composition for the "START-UP OR CONDENSER LEAK CONDITION" is exhibited elsewhere in the technical specification and the condensate polishing plant shall be designed for such tube leakage condition as mentioned.

2.12.00 For arriving water analysis under condenser tube leakage condition. The analysis of the clarified water is exhibited in the Sub-Section IA Annexure VIII of tender specification shall be multiplied with 6.5 COC to derive the circulating water analysis.

2.13.00 Polisher mixed bed / service vessels of each 800 MW Unit shall be located in respective TG hall unit. However, the regeneration system shall be common to polisher of all 5 TG units and shall be external consisting of 2sets of external regeneration facility and in building (except bulk acid & alkali storage facility & N-pit which is in open area). The CPU regeneration system will be located near DM plant area (kindly refer plot plan for the same).

2.14.00 The equipments kept in open area (Pumps, blowers, motors, tanks, instruments, analysers etc.) have localized shade provisions which is in bidder's scope. All the instruments associated with condensate polishing plant shall be provided with proper enclosures by Bidder. All vessels, pumps & blowers and their drives and other electrical and C&I equipments/accessories of regeneration system shall be suitable for outdoor duty and enclosures class of all the equipments shall be suitably selected by the bidder as per contract specification requirement.

3.00.00 SALIENT DESIGN DATA

3.01.00 There shall be three service vessels (3X50%) for each 800 MW unit each polishing 50% of the condensate flow corresponding to VWO (valve wide open) condition at 1% make up condition (Flow through each service vessel indicated in the data sheet)

3.02.00 The following dissolved solids concentration and conditions shall be used as a basis of design for the condensate polishing system.

(a) NORMAL RUN:
The ionic concentrations indicated below are as such.

CONTAMINANT	UNIT	INFLUENT	EFFLUENT
Ammonia	ppb	250	Below detectable limit.
Total dissolved solids (TDS, ammonia excluded)	ppb	*110*	< 25

Conductivity (at 25^{O}C) (After removal of all amines)	Micro S/cm	*As actual*	< 0.1 (after hydrogen column at 25 ^{O} C)
Silica (as SiO_2)	ppb	30	< 5 (Refer note # 1)
Total Ferric Iron	ppb	50	< 2
Sodium(as Na)	ppb	10	< 2
Chloride (as Cl)	ppb	20	< 2
pH (polisher runs at 25^{O}C with H/OH mode)		8.5-9.0	6.5-7.5
Crud (mostly black oxide of iron)	ppb	50	< 5

Note-1: For temperature 50˚C and above the silica value in the effluent shall be based on the resin supplier's recommendations.

Under the Normal Condition, each Condensate Polisher Mixed Bed shall be designed to operate in hydrogen cycle for not less than 240 hours of continuous operation, while maintaining the above treated condensate quality.
In addition to the dissolved solids, the influent condensate shall also contain some quantities of suspended solids (crud) derived from the corrosion of water and steam carrying pipelines, turbine condenser, and steam side of the feed water heater. Normally this concentration will not exceed about 50 ppb and the polisher beds shall provide sufficient filtering action to restrict the effluent crud content to less than 5 ppb & same shall be guaranteed.

(b) START-UP:

During start up conditions, quality of the influent may deteriorate to:

CONTAMINANT	**UNIT**	**INFLUENT**	**EFFLUENT**
Ammonia	ppb	1500	Below detectable limit.
Total dissolved solids (TDS, ammonia excluded)	ppb	*As actual*	< 50
Conductivity(at 25^{O}C)	Micro S/cm	*As actual*	< 0.2 (after hydrogen column at 25 ^{O} C)
Silica (as SiO_2)	ppb	500	< 20 (Refer note # 1)
Crud (mostly black oxide of iron)	ppb	1000	< 100
pH(polisher runs at 25^{O}C with H/OH mode)		9.0-9.6	6.5-7.5
Total Ferric Iron	ppb	1000	< 10
Sodium(as Na)	ppb	20	< 5
Chloride (as Cl)	ppb	100	< 10

Note-1: For temperature 50°C and above the silica value in the effluent shall be based on the resin supplier's recommendations.

Useful service run under this condition shall be 48 hours before regeneration.

(c) CONDENSER TUBE LEAKAGE CONDITION:

During condenser tube conditions, quality of the influent may deteriorate to:

CONTAMINANT	**UNIT**	**INFLUENT**	**EFFLUENT**
Total dissolved solids (TDS, ammonia excluded) (In addition to normal influent contaminants stated in clause 3.02.00 (a) above	ppb	2000	---

Silica (as SiO_2)	ppb	*As actual*	< 20 (Refer note # 1)
Sodium(as Na)	ppb	*As actual*	< 20

Note-1: For temperature 50˚C and above the silica value in the effluent shall be based on the resin supplier's recommendations.

Useful service run between regeneration under the Startup conditions and under condenser tube leakage condition shall not be less than 48 hours each.

3.03.00 Influent water quality as indicated in the above clauses is minimum only. Bidder to check the same and higher values, if felt by them, shall be considered in the design so as to meet the specified effluent quality.

3.04.00 The bed cross section in the service vessels shall be such that the average velocity of condensate through it shall not exceed 1.75 meters/min (105 M3/hr/M2) at the design flow rate for spherical vessel. Internal diameter of the service vessels (excluding the rubber lining) of spherical type shall be selected meeting the above mentioned velocity criteria. The effective depth of mixed bed in condensate polisher service vessel shall be not less than 1100 mm.

3.05.00 At the design flow rate, the pressure drop between inlet and outlet flanges of the polisher Condensate Polisher Mixed Beds with clean resin bed shall not exceed 2.0 bar (g). This pressure drop shall include losses due to entrance and exit nozzles, distributors, under drains, resins and the effluent resin traps. Maximum pressure drop under dirty conditions shall be restricted to about 3.5 bar (g) including the pressure drop across effluent resin traps.

3.06.00 Cation resins shall be regenerated by technical grade hydrochloric acid to IS: 265 (concentration 30-33% by volume) and anion resins by sodium hydroxide, rayon grade to IS: 252 available as 48% lye. For calculations regeneration temperature should be taken as 25°C. In no case, the regeneration levels cannot be lower than the valves indicated below:

a) Cation resin: 125 kg of 100% HCl per cubic meter of resin
b) Anion resin: 160 kg of 100% NaOH per cubic meter of resin.

3.07.00 Rinse water outlet headers from condensate-polisher vessels shall be provided with a pressure reducing valve and orifice plate, suitably designed to enable the water entry to the condenser hot well under all operating condition of condenser. The pressure reducing station shall consist of both a pressure reducing valve from design pressure of service vessel to condenser vacuum or a combination of orifice plates to reduce pressure from design pressure of service vessel to 2 kg/cm2 and a pressure reducing valve from 2 kg/cm2 to condenser vacuum.

3.08.00 Two (2) nos. Rinse Recirculation Pumps, each complete with electrical drive motor and all other accessories as required for each TG unit.

3.08.00 While calculating pump head, 10% margin (minimum) shall be considered of the value of friction losses. Pipe friction loss shall be calculated as per Willam-Hazen formula and "C" value to be adopted shall be as below: -

1. Carbon Steel pipe : 100
2. CI pipe/ductile Iron : 100
3. Rubber lines steel pipe : 120
4. Stainless steel pipe : 100
5. PVC/HDPE pipe : 140

For pumps whose discharge pipes shall be running on pipe trestle/ pipe rack and traveling from one area to another area bidder to select 12 m static head while selecting the pump head.

Pump recirculation with a regulating valve shall be provided for all the pumping system.

4.00.00 GUARANTEES

All the design parameters at clause no 3.02.00 of this chapter, i.e. the effluent quality, the design flow, design service length and Pressure drop across the resin bed in clean and dirty condition at rated design flow shall be guaranteed by the Bidder. In addition to that Bidder to refer detail chapter of guarantees as specified in Sub-Section-IA, Annexure -III of this specification for the same.

5.00.00 SYSTEM REQUIREMENT

5.01.00 The regeneration process offered by the bidder, shall be of proven design and shall essentially be the same process by virtue of which the bidder is qualified and shall give resin-separation compatible with the desired effluent quality. Documentary evidence shall be submitted by the bidder to the Customer/BHEL to establish this requirement during detailed engineering stage if required.

5.02.00 The bidder shall include inert resin in the system if they feel that it helps in better resin separation.

5.03.00 In case, after separation of resins, there are undesired contaminant resins, the bidder shall provide a system either to eliminate this cross contamination of resins or to nullify the detrimental effect of entrapped resins to the effluent quality.

5.04.00 **EXCHANGE RESINS**

5.04.01 Plant shall include resins for first fill of resins for all condensate polisher mixed beds, Mixed resin storage vessel of all 5 TG units i.e. Twenty (20) complete charges of resin and the same shall be provided by bidder. Further to this Resin for resin injection hoppers charge (150 liters for each resin injection hopper) shall also be provided separately by the bidder. In addition, the above charges bidder to also provide make-up resin for first three years of operation and the same shall be in bidder's scope (Quantity of make-up resins shall be calculated on the basis of 3% and 5% attrition loss per annum for cation and anion resin respectively). Therefore, total resin quantity to be supplied for the project shall include total resin charges for all TG units (20 nos. resin charge) + Two (2) nos. resin injection hopper charge + Make up resin quantity (Make up resin quantity shall be calculated based on the basis of 3% and 5% attrition loss per annum for 3 years for total resin quantity (i.e. 20 charge resins+ 2 resin injection hopper charge) that will be supplied for the plant.

5.04.02 Cation-anion resin ratio shall be 2.0 parts Cation to 1.0 part anion by volume. In case the process requires any non-ionic resin the same shall represent at least 10% of the bed volume, but not less than 15 cm of the bed depth in the resin separation / cation regeneration tank of the external regeneration facility.

5.04.03 After Separation anion resin in the cation resin shall be less than 0.1 % and cation resin in the anion resin shall be less than 0.1%.

5.04.04 Deration factor of 10% for all resins shall be considered while calculating the quantity of resin to be supplied.

5.04.05 The resins used for the Condensate Polishing Unit shall be in the form of spherical beads. Base of the ion-exchange resins shall be a copolymer of styrene and divinyl benzene forming a macro porous or macrorecticular structure. Other details are as follows:

Cation : Strong acid, with sulfonic acid functional group.

Anion : Strong base, with quaternary ammonium (type-I) functional group.
Inert (if required) : Non-ionic, compatible with the above resin types.

Cation resins shall be supplied in hydrogen form and Anion resins shall be supplied in hydroxide form.

5.04.06 **PHYSICAL PROPERTIES:**

The resin strength and other physical properties shall be suitable to withstand the design pressures in the system.

5.04.07 CHEMICAL PROPERTIES:

Total wet volume ion-exchange capacities in equivalents/liter shall be based on resin supplier recommendation and shall be preferably the following:

Cation in hydrogen form: 1.7
Anion in hydroxide form: 0.8

The resins shall contain a minimum of metallic and organic impurities consistent with good processing. The processing procedure will include rinsing the resins with demineralized water before packing, so that further rinsing will not be required before use. Foreign objects in the resins shall constitute a basis for its rejection.

Cation-Anion resin ratio shall be 2.0 parts cation to 1.0 part anion by volume. In case the bidder's process requires any non-ionic resin the same shall represent at least 10 percent of the bed volume, but not less than 15 cm of the bed depth in the resin separation / cation regeneration vessel of the external regeneration facility. The CPU Grade resin shall be of uniform particle size quality.

The resin charge shall consist of material properly selected, washed, processed and graded to provide the guaranteed capacity and life. The resin shall have adequate abrasion resistance during its guaranteed life.

Manufacturer: The resins selected must have been in use in Condensate Polishing Systems capable of producing water as specified or better, for a period of not less than three (3) years.

The resin shall be suitable for the condensate temperature that may be achieved in all operating regimes of TG cycle. However, the anion resin shall be suitable for a minimum temperature of 60 deg.C.

5.05.00 CONDENSATE POLISHING UNITS

5.05.01 Operating pressure for service vessels shall be normal operating pressure of condensate extraction pump. Service vessel design pressure shall be equal to shut off pressure of condensate extractions pump plus 5% margin or as specified in data sheet (A) of this technical specification, whichever is higher.

5.05.02 Design temperature of the service vessel shall take care of all operating regimes including HP-LP bypass operation of TG cycle. Maximum temp. expected during all loads at CEP discharge is 60 Deg C.

5.05.03 EMERGENCY BYPASS SYSTEM:

1) Each Condensate polisher service unit shall be provided with an automatic bypass system for the condensate polisher on the condensate inlet and outlet headers of the unit with a set of

control valve (1X100%) and with its motorized isolation valves (resilient material seated, to ensure bubble-tight shut off) on the upstream and downstream sides of the control valve. The same is applicable and provided for all 5 TG units.

2) In addition to this emergency by pass control valve, one no. flanged motorized On/off type butterfly valve of similar capacity (1X100%) shall be provided in the bypass line of control valve as per P&ID of the Condensate Polishing Unit. Further on the upstream and downstream side of this motorized On/off valve lugged wafer type butterfly isolation valves (resilient material seated, to ensure bubble tight shut off) shall be provided. Isolation valve shall be provided with geared operators for manual operation. The same is applicable and provided for all 5 TG units.

3) In the event of excessive pressure differential (0.35 MPa) between the condensate inlet and outlet headers, this control valve will open automatically to bypass requisite quantity of condensate to prevent this pressure differential from exceeding a preset limit when two vessel/one vessel /no vessel is in operation.

4) When condensate temperature exceeds 50 Deg C the bypass valve shall be 100% opened automatically and the inlet / outlet of the condensate polisher mixed bed shall be closed to protect elements and resins inside the polisher.

5) Bidder to provide 1x100% control valve to achieve proper control under all operating conditions as per Customer/BHEL's approval of Engineering Documents.

6) The control system shall be so designed that the control valve is able to bypass 50 % of rated flow when any of the service vessel is out of service & 100% when both the service vessels are out of service.

7) The isolation valves shall be provided with geared operators for manual operation. The entire system shall be designed for an internal pressure of at least the design pressure of service vessels and for a maximum condensate flow of not less than total design flow of all the working service vessels.

8) Complete instrumentation and controls for this system, including the differential pressure transmitters, panel mounted indicating type controller with provision for remote manual operation, actuator for the control valve with position indicator shall be furnished by the bidder as part of this package. All tubing, wiring, air sets, and other fittings, required to complete the system, shall also be installed by bidder for all 5 TG units.

5.05.04 EXTERNAL REGENERATION FACILITY (REGENERATION PLANT)

The pressure vessels in the common external regeneration facility shall be provided with adequate freeboards over the top of the settled resins, to minimize resin loss during their use. Minimum freeboards to be are as follows:

(i)	Mixed resin Storage vessel	: 100%
(ii)	Resin separation vessel	: 100%
(iii)	Anion and cation regeneration vessels	: 100%
(iv)	Activated carbon filter	: 75%
(v)	Resin Injection hopper	: 80%

However, if a vessel is used for more than one service, then the vessel design shall be based on the service which gives maximum freeboard.

5.05.05 Design pressure of the condensate Polisher Service Vessels is indicated elsewhere. For all other Pressure vessels, the design pressure shall be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin, Maximum expected pressure for vessels

placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pump suction or 10 kg/cm2 (g) whichever is maximum.

5.05.06 All equipment for dosing of acid and alkali solutions shall be rated to provide a maximum dosing rate at least 20% in excess of that required from process calculation.

5.05.07 Mill tolerances 0.3 mm shall be considered for determining the thickness of the shells and dished ends of pressure vessels. A minimum thinning allowance of 2 mm shall be considered for the dished ends of pressure vessels. Corrosion allowance for non-rubber lined vessels shall be minimum 2mm.

5.05.08 HOT WATER TANK (FOR ALKALI)

Total 2 nos. of hot water tank shall be provided for 2 sets of regeneration system. Each hot water tank for heating of alkali diluent water with (2X60%) electric heating coil, adequately insulated of Mild steel rubber lined construction shall be provided complete with integral pipe works, valves, instrumentation and all other accessories required shall be provided. The capacity of each Hot water tank shall be minimum 20% higher than the maximum water demand. This tank shall be provided with burn out protection, pressure relief valve, level transmitter, temperature indicator etc. The heaters shall be sized for heating the water from a temperature of 15 to 50 deg. C in 5 hours at the outlet of ejector.

5.05.09 ACTIVATED CARBON FILTER (FOR ALKALI):

Rated flow of the filter shall not be less than the design capacity of the alkali transfer-cum recirculation pump, and the maximum velocity through the filter for this flow shall not exceed 15 meters/hour. Depth of the filter material shall be as specified in DATASHEET –A of this specification.

The filtering medium shall be granulated activated carbon, meeting following minimum requirements.

Total Surface area	:	Not less than 850 sq.m/gm.
Bulk density	:	Not less than 400 kg/cu.m.
Iodine number	:	850 minimum
Carbon content	:	Not less than 90%
Moisture content	:	5% (max)
Uniformity coefficient	:	1.5-1.6
Effective Size mm	:	0.8-0.9 mm
Particle density wetted in water	:	1.3-1.4 gm/cc
Abrasion number	:	70 minimum
Ash Content	:	8% maximum

Mean particle diameter shall be about 1.2-1.4 mm with following size distribution:

On 20 mesh	:	Less than 3%
Through 40 mesh	:	Less than 10%
Through 50 mesh	:	Less than 1%

The filter shall be provided with all necessary valves and connections for manual backwashing and rinsing with demineralized water. Rate set valves shall be provided with adjustable limit stops for setting backwash and rinse rates.

5.05.10 DM WATER STORAGE TANKS (NOT IN BIDDER' SCOPE) FOR CONDENSATE POLISHING PLANT

DM water required for CPU regeneration as well as resin transfer operations shall be drawn from DM Water Storage Tanks (not in bidder's scope). Bidder to consider the piping from common suction line terminal point to CPU regeneration cum resin transfer pumps and recirculation line piping from the

outlet discharge line of these pumps to common recirculation line along with pneumatic/electric actuated on –off valves, required flanges, counter flanges, fittings to each set of regeneration cum resin transfer pumps (2 sets) and the same shall be in bidder's scope. Further Bidder to consider interlock (trip) of these pumps from the Pressure transmitters provided by bidder in the common suction line of CPU regeneration cum resin transfer pumps. These signals shall be also brought by Bidder to CPU DDCMIS (not in bidder's scope) for tripping and auto operation of the CPU regeneration cum resin transfer pumps for both stage regeneration systems. The arrangement shall be as per Tender P&ID of CPU and same shall be in scope of bidder.

5.05.11 RESIN INJECTION HOPPER

Two nos. resin injection hopper shall be provided by bidder. The bidder shall provide a hopper type tank for resin make-up, using water slurry, to the condensate polishing systems. This make-up system will constitute a portion of the condensate polishing external regeneration system. The resin hopper shall have a conical bottom and a flat top. The top shall have a piano type hinged port, having a lifting handle, of sufficient size for easy resin loading. The resin shall discharge through a bottom connection to a water ejector for transport. Water shall be added to the hopper to assist in the resin transfer. The ejector discharge shall be to the resin separation-cation regeneration vessel. Demineralized water shall be used throughout for the resin transfer. Piping of the resin make-up system shall be the responsibility of the Bidder as a part of the external resin regeneration system.

a) **Capacity**: The resin make-up hopper tank shall be sized to handle up to 150 liters of as received new resin per single injection.

b) Material: The resin make-up hopper tank shall be fabricated of mild carbon steel having a minimum thickness of 6 mm and lined.

5.05.12 PIPING

1) Bidder shall design, supply and erect the piping between the service units and the common external regeneration facility, for transferring the exhausted and regenerated resins as required.

2) All piping shall be laid above ground and generally laid in pipe trestles including crossing of road/pipe/cable trenches if any. Piping of between chemical tanks area and regeneration area etc. may be laid on pedestals if layout permits.

3) Complete supporting system for the pipeline shall be designed, fabricated and supplied by the Bidder. Inside the building, the overhead portion of the pipeline may be supported from the building structures. In outdoors, the pipeline may run on steel posts. Crossing of the roads shall be on a pipe bridge with a clear height of at least 6.1 meters over the road surface. All the steel structures of the pipe bridge and the supporting posts along with all necessary hanger, clamps, connecting steel, fixing bolts, nuts, etc. shall be supplied and erected by the bidder.

4) Routing of this pipe line shall be developed by the bidder and shall be finalized in coordination with the BHEL/Customer, based on the space available and the final layout.

5) The resin transfer pipeline arrangement shall avoid any sharp bends which cause segregation of the mixed resins, and pockets where the resins can get trapped. Suitable observation ports shall be provided in all critical areas to enable the operator to monitor completeness of the resin transfer operations. All necessary arrangements for venting and draining of the pipeline shall be provided.

6) The resin transfer pipeline shall be sized for a flow velocity of between 2.3 and 3.0 meters/sec.

7) The condensate pipeline shall be sized for a flow velocity between 3 and 5 m/sec.

8) Remotely operated valves suitably interlocked with the plant operation, shall ensure that the resins get transferred to and from only the particular service vessel which has been selected by the operator.

9) All lined vessel connections and connections in unlined vessels (25 Nb and larger) shall be flanged to ANSI 150 lb class except the polisher service vessels which shall be ANSI 300 lb class (minimum): Flat face flanges shall be used throughout. Nozzle material shall be ASTM-106 Gr.B. Sch.80 pipe for all vessels. All flanged connections shall be supplied complete with matching counter flanges, nuts, bolts and full face gaskets. All the pipeline in service vessels area where pressure may attain same as service vessel shall be designed for 300 lb class (minimum).

10) Bidder to also the refer the detailed specification for low pressure piping for piping inside regeneration area & power cycle piping for piping inside service vessel area which is enclosed elsewhere in this specification.

5.05.13 VALVES

1) All valves shall be designed as per applicable AWWA/IS/BS or equivalent international standard / codes.

2) The isolation valves on the resin transfer line shall be of eccentric plug type/ball valve (full bore type) of stainless steel construction.

3) Emergency bypass control valve shall be of double flanged butterfly type for Each TG units. Lugged wafer type Butterfly motorized Isolation valves (resilient material seated, to ensure bubble-tight shut off) shall be provided on the upstream and downstream sides of the control valve for Each TG units. Isolation valve shall be provided with geared operators for manual operation. The same is applicable and provided for all 5 TG units.

4) In addition to this emergency by pass control valve, one no. flanged motorized On/off type butterfly valve of similar capacity (1X100%) shall be provided in the bypass line of control valve as per P&ID of the Condensate Polishing Unit. Further on the upstream and downstream side of this motorized On/off valve lugged wafer type butterfly isolation valves (resilient material seated, to ensure bubble tight shut off) shall be provided. Isolation valve shall be provided with geared operators for manual operation. The same is applicable and provided for all 5 TG units.

5) Isolation Valves handling Acid, Alkali, Ammonia etc. shall be diaphragm type and MOC and pressure rating shall be as per DATASHEET –A of condensate polishing unit.

6) Isolation Valves handling DM water shall be Butterfly or gate or globe type and shall be SS construction. Isolation valves handling DM water can also be of diaphragm type MOC and pressure rating shall be as per DATASHEET –A of condensate polishing unit.

6) Non-return valves for DM Water & alkali shall be SS construction and for acid non-return valve shall be lined type or as per manufacturer's standard practice.

7) All valves in service vessels area where pressure may attain same as service vessel shall be designed for 300 lb class (minimum).

8) MOC of butterfly valve at inlet of service vessel Body- CS, Disc- SS-316 and outlet of service vessel Body – SS-316, disc- SS-316. Rinse recirculation and Rinse line valve will be of MOC:

Body – SS-316, disc- SS-316.

5.05.14 PRESSURE VESSELS, ATMOSPHERIC TANKS & MISCELLANEOUS ITEMS

1) Design pressure of the condensate Polisher Service Vessels shall be as indicated in the data sheet. For all other pressure vessels, unless otherwise mentioned design pressure shall be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin, Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pump suction or 10 kg/cm2 (g) whichever is maximum).

2) All pressure vessels shall be designed and constructed in strictly in accordance with the ASME code Section VIII Div.-I /IS-2825 or acceptable equivalent international standard.

3) All pressure vessels shall be fabricated from carbon steel plates as per SA-515 Gr. 60/ 70 or SA-516 Gr. 60/ 70 and lined internally.

4) Lining used shall be natural rubber having a shore durometer reading of 65 ± 5 Shore 'A' as per IS 4682 Part I.

5) The lining shall be applied in three layers, resulting in a total thickness of not less than 4.5 mm anywhere on the internal surfaces of the vessels. The lining shall extend over the full face of all flanged connections and shall have a minimum thickness of 3 mm in all such external areas.

6) Design of all vertical cylindrical atmospheric storage tanks containing water, acid, alkali and other chemicals shall conform to IS: 803.

7) Design of all horizontal cylindrical storage tanks containing water, acid, alkali and other chemicals shall conform to BS EN12285-2:2005.

8) Unless otherwise mentioned design temperature of all pressure vessels and storage tanks shall be 10 deg.C higher than the maximum temperature that any part of the vessel/tank is likely to attain during operation.

9) In case, tank is subjected to vacuum, the same shall be taken care in designing the tank.

10) The design of Demineralized water storage tanks (Vertical type) shall conform to IS: 803. Supporting frame where required shall be in accordance with IS: 800. The tank shall be ''Non-pressure'' fixed roof type with atmospheric vents.

11) CPU service vessels of spherical shape is acceptable only.

12) All vessels/tanks without inside rubber lining shall have a corrosion allowance of minimum 2 mm and mill allowance (minimum 0.3 mm) for shell and dished ends. Thinning allowance of 2 mm (minimum) shall be considered for dished end of all type.

13) All the atmospheric tanks shall have sufficient free board above the ''Level High /Normal Level'' as the case may be. The overflow level shall be kept at least 30 cm or 10% of vessel height above the ''Level High /Normal Level'' for all the tank. Further, a minimum 100 mm free board shall be provided above the top of overflow level to the top of tank.

5.05.15 MATERIAL

1) All pressure vessels shall be designed and constructed in strict accordance with the ASME code Section VIII or acceptable equivalent international standard. Suitable mill tolerances shall be considered for determining the thickness of the shells and dished ends. A minimum thinning

allowance of 2 mm shall be considered for the dished ends of torishpherical type.

2) Pressure vessel ends shall be of dished design and constructed by forging, pressing or spinning process. Spherical vessels for CPU service vessels are acceptable. Conical or flat ends shall not be accepted. All the atmospheric vessels shall be at least 6 mm thickness.

3) All pressure vessels shall be fabricated from carbon steel plates as specified in DATASHEET-A and lined internally. The lining shall be of rubber having a hardness of 65 plus/minus 5 shore -A meeting the requirements of IS: 4682, Part-I. The lining shall be applied in three layers, resulting in a total thickness of not less than 4.5 mm anywhere on the internal surfaces of the vessels. The lining shall extend over the full face of all flanged connections and shall have a minimum thickness of 3 mm in all such external areas.

5.05.16 VESSEL INTERNALS REQUIREMENTS:

Vessel internal shall meet the following requirements:

1) Inlet water and regenerant distributor: - Hub and internals diffuser splash plate or header and perforated laterals. Material of construction shall be SS-316 except for acid service which will be of suitable material as per process requirement and proven practice.

2) Under drains: The under drain system shall be provided with screened laterals with internal perforated pipes and rubber lined flat bottom. For resin separation/regeneration/mixed resin vessels, it may have fully screened bottom (NEVA - clog type with pora-septanurese screen, fully supported by subway grid or equal) /Fasteners.

3) All internal fasteners shall be of SS-316 and heavy duty locknuts shall be used throughout.

5.05.17 RESIN TRAP & CARBON TRAP:

1) Resin Traps: Outlet of each condensate polisher vessel, activated carbon filter and waste effluent header of the common regeneration shall be provided with a resin trap. Pressure drop at design flow through a clean resin trap shall not exceed 0.35 kg/sq.cm. Resin trap housing shall be of rubber lined steel construction for regeneration area & Housing MOC shall be SS316 provided at the outlet of each condensate polisher vessel and for internals (cord & screen) shall be of JOHNSON SCREENS IRELAND or equivalent (SS-316) construction. Resin traps of process effluent line shall have screen opening not exceeding 120 percent of associated process vessel under drain screen opening. Other resin traps shall have screen opening of 60 mesh. In place manual back flushing shall be provided for all resin traps.

2) Carbon Trap (for ACF): Outlet of each Activated Carbon filler on Carbon trap (media trap) shall be provided. MOC of carbon trap Housing shall be SS316 and for internals (cord & screen) MOC shall be SS-316.

6.00.00 OPERATION & CONTROL PHILOSOPHY OF CPU PLANT

The regeneration system (consist of 2 sets of external regeneration facility) with interconnection shall be external and common to the polisher of all 5 TG units. Under normal conditions, it will hold a complete charge of freshly regenerated and mixed resin, ready for use, in its storage tank. For regeneration, resin from the exhausted exchanger vessel shall be transferred hydraulically / hydro pneumatically to any one of the available common external regeneration facility.

The empty exchanger vessel will then be filled up with the already regenerated resin which was stored in the any one of the regeneration facility. This exchange vessel shall come into service soon after perquisite condition is satisfied or as and when desired by the operator. In the

meantime, the exhausted resin shall be cleaned, separated, regenerated, mixed and rinsed before being stored for next use.

The control & operation of regeneration area shall be from DDCMIS based control system located in regeneration area. There shall be provision for remote manual operation also.

Each CP System, shall be operated for service and resin transfer from concerned Service Area - Equipment Control center (ECC) to be located indoor in the vicinity of Condensate Polisher Vessels of each TG unit.

Operation from this ECC can only be undertaken under authorization from Regeneration Area – ECC addressed hereinafter.

6.01.00 GENERAL

6.01.01 It is not the intent to specify here the complete details of the control system. Basic type of controls required has been specified below. The bidder shall submit with the proposal the complete detail of the system offered by him like the extent of automation offered, operation of the complete system, logic/flow diagrams, type and details of the presentation of information, the type of mimic, hardware details etc. along with detailed circuit descriptions.

6.01.02 It shall be possible to operate the regeneration plant in Auto/Semi-Auto /Manual mode. In ‘Auto’ mode, once the sequence has been initiated, it shall proceed from step to step automatically. In ‘Semi-Auto’ mode each step shall be performed only after initiation by the operator. In ‘Manual’ mode complete operation shall be by the operator by operation of the Control switches on the panel. Control for chemical dosing system and alkali preparation facilities shall be provided in it.

6.01.03 ‘Close-Auto-Open’ control facility shall be provided from OWS/control panel for solenoid valves. In ‘Auto’ position, the valves shall receive close / open command from the Control system.

6.01.04 ‘Stop-Auto-Start’ Control facility shall be provided from OWS / control panel for the various drives. In ‘Auto’ position, the drives shall receive stop/start command from the Control system.

6.01.05 On control system failure, it shall be possible to operate the valves by means of manual operation of solenoid valves too.

6.01.06 The control system shall link the various steps such as closing/opening of different valves, starting/stopping of various pumps etc. which form a sequence. The logic system shall adhere to the correct sequence of operation and predetermined time intervals. The system shall have interlocks so that, criteria necessary for each step are complete prior to proceeding to the next step.

6.01.07 It shall be possible to switch mode of operation from one to the other at any moment and the operation shall proceed on the newly selected mode from that time.

6.01.08 For steps, which require frequent time adjustment, it shall be possible to change the time setting from the OWS/EWS. For all other steps it shall be possible to adjust the time setting from inside the OWS/EWS.

6.01.09 For all sequences, the current step number, set time of the step, elapsed time of the step and the total elapsed time of the sequence shall be indicated in the OWS/OWES.

6.01.10 A mimic shall be provided for the CPP scheme and Regeneration system scheme shall be provided. Status of various vessels, drives, valves etc. shall be indicated by on the mimic.

6.01.11 The system shall incorporate the necessary safety features. During automatic sequential operation, if any pre-requisite criterion is not fulfilled or missing for a pre-determined time interval, the steps should not proceed further, and Alarm shall be provided. Missing criteria, sequence, which is under hold up etc., shall be displayed.

6.01.12 The safety system for any sequence/step shall check the opening of the required valves and closure of the remaining valves of the plant to avoid mal-operation.

6.01.13 Wherever standby equipments are provided, it shall be possible to select each of the drive on 'standby' duty.

6.01.14 The detailed logic for the sequence and for each of the drive shall be subject to the BHEL/Customer's approval.

6.01.15 Start, progress and stop of each of the sequence shall be annunciated.

6.01.16 The status of vessels of Condensate Polishing Plants shall be available in all the CPP panels of all TG units and as well as in the regeneration plant control panel. Similarly, the status of regeneration plant status shall be available in the panels of Condensate Polishing Plants of all TG units.

6.02.00 CONTROL & OPERATION OF THE CONDENSATE POLISHING UNIT

6.02.01 The regeneration system control system shall be linked with TG control system for data transfer through a two-way link for both information and control.

6.02.02 It shall be possible to select each of the CPU vessel for any of the following operations or mode:

- Standby (Applicable for where spare service vessel (s) are provided.
- Service.
- Isolation from service.
- Exhausted Resin Transfer from CPU vessel to Regeneration plant.
- Regenerated Resin Transfer from Regeneration Plant to CPU vessel.
- Rinse recycle mode.

Each mode or operation is described as below:

6.02.03 STANDBY MODE:

(1) Among the vessels, any one of the vessels may be selected in this mode.

(2) Under this mode, the vessel, which was regenerated in previous cycle and filled with regenerated resin, shall be kept ready for next Service cycle.

(3) The selection of any vessel for Standby mode shall be initiated by operator and there shall be indication about the details such as "Condition of the resin; Whether it is filled with regenerated resin or exhausted resin, whether the standby vessel has undergone rinse cycle or not, date and time of receipt of regenerated resin and completion of rinse cycle etc.

6.02.04 SERVICE MODE:

(1) Service flow rate for each polishing vessel shall be monitored by panel mounted flow indicators. During periods of low condensate flow the operator may select to remove one of the

vessels from service by a manually initiated automatic sequence.

(2) A differential pressure transmitter installed between the influent and effluent headers will on a high signal cause an annunciator alarm and bypass system shall be initiated as described elsewhere in this section.

(3) By observing the individual vessel flow indicators, or conductivity at vessel outlet the operator can determine which vessel is contributing most to the pressure drop and is in need of resin cleaning.

(4) Panel mounted Cation conductivity indicators shall monitor the polishing system influent and effluent streams as well as the discharge of each service vessel. A high influent conductivity annunciator alarm will alert the plant operator that a problem condition such as air or condenser cooling water leakage has occurred. This conductivity analyzer shall also provide contacts for an alarm at the power station main control room. A high effluent header or service vessel conductivity annunciator alarm will alert the operator to the need for regeneration of a polishing vessel.

(5) When the vessel under Service mode is ready for regeneration, the operator shall change the same into “Isolation mode” in the panel. Subsequently the “Standby vessel” shall be selected for “Service mode” from the OWS/control panel. The selection shall follow, required sequences such as pressurization of the vessel, checking of the effluent quality and putting the vessel in service on satisfactory effluent quality.

6.02.05 ISOLATION FROM SERVICE:

(1) Normally “Service Vessel” once exhausted shall be isolated from service till the “Resin Transfer” operation is complete. In addition, provision to be kept for isolation of one or all the vessels from service if required by operator from the panel.

(2) The sequence ‘Resin Transfer from CPU Vessel to Regeneration plant’ and Resin Transfer from Regeneration plant to CPU Vessel’ shall be initiated from the condensate polishing unit control panel but shall be controlled by the CPU DDCMIS in the Regeneration Control Panel.

6.02.06 EXHAUSTED RESIN TRANSFER FROM CPU VESSEL TO REGENERATION PLANT:

(1) When a vessel in a service mode needs regeneration as stated above, the resin transfer from the particular vessel to the regeneration plant shall be initiated from the panel of the condensate polishing plant.

(2) Manually initiated automatic sequences shall be provided for transferring resin from a Service vessel to the remote common regeneration facility for all 5 TG units for physical cleaning and chemical regeneration.

(3) The transfer of resin from the service vessel shall include operations such as isolation of the service vessel, hydraulic/hydro-pneumatic transfer of the resin to the external regeneration system (resin separation vessel) and the complete drain down of the service vessel to the hotwell.

(4) The sequence of “Resin Transfer” operation from CPU service vessel to regeneration plant and from regeneration plant to CPU vessel shall be initiated from service vessel area as well as regeneration area panel and shall be controlled from Regeneration area panel.

(5) The completion of the operation shall be exhibited in the control panels.

6.02.07 RESIN TRANSFER FROM REGENERATION PLANT TO CPU VESSEL:

(1) When the regeneration is completed in the regeneration plant, the resin shall be transferred to the empty service vessel of Condensate Polishing plant.

(2) This shall be initiated by the operator from the control panel of condensate polishing plant of the unit from which resin was transferred to the regeneration plant in previous service. Provision shall also be kept to transfer the regenerated resin to any of the empty vessel of the CPP of any of the TG unit if required.

(3) The transfer of resin from the regeneration plant shall include operations such as hydraulic/Hydro-pneumatic transfer of the resin and the complete drain down of the water.

(4) The sequence shall be initiated from the panel of CPP and shall be controlled in the regeneration Control Panel.

(5) The completion of resin transfer operation shall be exhibited in both the Control panels.

6.02.08 RINSE RECYCLE MODE:

(1) After transfer of regenerated resin from the regeneration plant to the empty condensate polisher vessel, this rinse cycle shall be initiated from the Control system of the respective unit so that the vessel may be rinsed and kept ready for next service cycle.

(2) The rinse recycle shall be manually initiated in full automatic sequence. This sequence shall include the rinse down step using condensate at the desired flow rate until the unit effluent quality is acceptable for boiler feed water. Prior to rinsing, the resin shall be given air scrub by means of air blowers provided near the CPP.

(3) The effluent quality shall be determined by conductivity monitoring of the rinse water outlet, which is returned to the condenser hotwell for recycle.

(4) Panel mounted cation conductivity indicator shall be interlocked to prevent advancing of the automatic sequence until the rinse down is complete.

(5) Cation conductivity values shall be monitored and interlocked to prevent advancing of the automatic sequence until the rinse down is complete.

(6) The completion of rinse operation shall be annunciated in the panel so that the rinsed vessel may be selected for “Standby mode” or “Service mode” as per requirement.

6.03.00 EXTERNAL REGENERATION CONTROL SYSTEM

The control for the external regeneration system shall be from the Operation workstation with DDCMIS RTU located in a separate Control Room at Regeneration Area. This shall clearly show the status of each concerned Condensate Polisher Mixed Bed. This Console will provide a manually initiated automatic sequence for physical cleaning and chemical regeneration of the resins and show the status of the cycle at all times. This shall also provide all controls and operation facilities for the acid and alkali solution preparation and dosing system. The Regeneration Area Operation Console shall also control the sequences of Resin Transfer – i.e. to transfer resin from the Condensate Polisher Mixed Bed to the external regeneration facility and to receive freshly regenerated resin from the regeneration facility– this involves depressurization of the Condensate Polisher Mixed Bed, water sluicing of exhausted resins to the regeneration system, draining the Condensate Polisher Mixed Bed to the condenser hot well, receiving a water slurry of fresh resin from the regeneration system and finally completely

filling the vessel with condensate.

There shall be 2 common external CPU regeneration system with interconnection shall be provided in CPU regeneration area and nearby service vessel area for all 5 CPU service vessels area (TG units). The system shall be designed so that any of the polisher vessel of anyone of the service vessel area shall be capable of transferring the exhausted resin to any one of the regeneration system which is available for service and shall be capable to transfer the regenerated resin vice –versa in the polisher vessel. The necessary control, logic and interlocks shall be incorporated in control system for CPU. The arrangement of the same shall be shown in P&ID of CPU as well as single line diagram of CPU service vessel and regeneration area.

6.03.01 One external regeneration system (consist of 2 sets of external regeneration facility) with interconnection shall be provided to serve the condensate polishing for all 5 TG units. This system shall be designed for physical cleaning and chemical regeneration of the resin system will consist of required number of resin separation and regeneration vessels, a mixed resin storage vessel, the tank for introducing the required regeneration solutions and means for adding make-up resin. It will have acid, alkali, and ammonia (if required) dosing system and alkali preparation facilities.

6.03.02 Manually initiated automatic sequences shall be provided for transferring resin from a vessel to the remote common facility for physical cleaning, separation and chemical regeneration and for returning fresh resin to the service vessel(s). Control for chemical dosing system and alkali preparation facility shall also be provided in it.

6.03.03 Physical cleaning of the resin shall consist of three steps, drain to level, air scrub and rinse. The air scrub and rinse steps are of short duration, approximately 1 and 2 to 3 minutes respective time. However, the program will allow the operator to increase or decrease the number of times the sequence is repeated to meet the requirements existing at that time.

6.03.04 The chemical regeneration is a many step sequence. Regeneration shall include hydraulic reclassification of the resins and the transfer of the resins to the respective regeneration vessels shall be hydraulically/ hydro-pneumatically. The Bidder may include a layer of inert, intermediate density resin to achieve a better separation of the cation and anion resins, improve resin regeneration, and reduce leakage. The separated resins are then back washed, cation & anion resin shall be regenerated with hydrochloric acid and sodium hydroxide solutions respectively and then rinsed. Following the rinse step the resins shall be given an air scrub followed by a good backwash. The resin is then transferred back to the resin separation vessel and the resins are air mixed. The mixed resins after regeneration are given a final rinse with the discharge conductivity being monitored. The quality of this discharge will determine if the regeneration has been effective. If the quality is not satisfactory the regeneration sequence must be repeated. If satisfactory, the mixed resin is transferred to the resin storage vessel.

6.03.05 A resin mixing and final rinse may occur in the resin storage vessel provided that the system design will permit direct return of the resins to the resin separation vessel in the event of an unsatisfactory regeneration.

6.03.06 Upon satisfactory completion of regeneration, the status shall be annunciated audio-visually in the regeneration system OWS/control panel and as well as in the Main Plant Control System. This repeat annunciation in the CPP OWS/panel shall facilitate the operator to initiate resin transfer operation from the regeneration plant to the desired vessel of the Unit in which the service vessel is empty.

6.03.07 Upon resin transfer operation from regeneration plant as described by the operator from the I Control System, the regeneration plant shall be ready to receive next batch of exhausted resin from any of the CPP. The status of regeneration plant (Whether ready to receive resin for

regeneration or under regeneration etc.) shall be available in the Control System of CPP.

6.03.08 Demineralized water shall be used throughout the regeneration process for backwashing, diluting the regenerant, rinsing and resin transfer.

6.03.09 A conical bottom hopper having a water ejector will be used for resin make-up.

6.03.10 The complete detail of the regeneration system shall be supplier specific and the extent of automation offered, operation of the complete system, logic/flow diagrams, type and details of the presentation of information, the type of mimic, hardware details etc. along with detailed circuit descriptions shall be provided during detail engineering.

6.03.11 It shall be possible to operate the Regeneration Plant in Auto/Semi-Auto/Manual mode.

6.03.12 In ‘Auto’ mode, once the sequence has been initiated, it shall proceed from step to step automatically.

6.03.13 In 'Semi-auto' mode each step shall be performed only after initiation by the operator.

6.03.14 In ‘Manual’ mode complete operation shall be by the operator.

6.03.15 ‘Close-Auto-Open’ control switches shall be provided on the panel for the various drives. In ‘Auto’ position, the drives shall receive stop/start command from the DDCMIS.

6.03.16 ‘Start-Auto-Start’ Control switches shall be provided on the panel from the various drives. In ‘Auto’ position, the valves shall receive close/open command from the DDCMIS.

6.03.17 On CPU DDCMIS failure, it shall be possible to operate the valves by means of manual operation of solenoid valves also.

6.03.18 It shall be possible to switch mode of operation from one to the other at any moment and the operation shall proceed on the newly selected mode from that time.

6.03.19 For steps which require frequent time adjustment, it shall be possible to change the time setting from the front of the panel. For all other steps it shall be possible to adjust the time.

6.03.20 For all sequences, the current step number, set time of the step, elapsed time of the step and the total elapsed time of the sequence shall be indicated on control system.

6.03.21 The system shall incorporate the necessary safety features. During automatic sequential operation, if any pre-requisite criteria is not fulfilled or missing for a pre-determined time interval, the steps should not proceed further, the Alarm shall be provided. Missing criteria, sequence which is under hold up etc. shall be displayed.

6.03.22 The safety system for any sequence/step shall check the opening of the required valves and closure of the remaining valves of the plant to avoid mal-operation.

6.03.23 wherever standby equipments are provided, it shall be possible to select each of the drive on ‘standby’ duty.

6.03.24 Start, progress and stop of each of the sequence shall be annunciated in all the control system.

6.03.25 At any time only one of the sequence shall be in progress.

6.04.00 INTERLOCKS

All interlocks for safe operation of the plant shall be provided. The following interlocks as a bare

minimum requirement of the system shall be provided:

6.04.01 Service vessels shall be taken back in service, only after they have been pressurized.

6.04.02 Service vessels can be taken up for resin transfer only after they have been completely isolated from the condensate system and depressurized.

6.04.03 Resin can be transferred to and from only one service vessel at a time from one set of regeneration system. In view of this control system shall be designed so that simultaneous 2 resin charges shall be transferred to any two service vessels of all 5 TG units and vice-versa to the regeneration system through dedicated resin transfer lines provided for 2 sets of external regeneration system.

6.04.04 Resin transfer between the service and the regeneration skids shall be permitted only when the receiving vessel is initially empty.

6.04.05 Regeneration sequence can commence, only when the level in the waste neutralization pit is low enough to receive the entire waste quantity of waste water from the regeneration operation.

6.04.06 Wherever possible, completion of all timed steps in the regeneration and resin transfer process shall be physically verified by effluent conductivity etc, as applicable. The automatic sequence shall be prevented from advancing to next step, till these required physical conditions are achieved, and at the same time this delay shall be annunciated in the control panel, to draw the attention of the operator. The automatic sequence of operations shall be interruptive at any time by the operator and he shall be able to take over the control to manual from that step onwards. Further operator should be able to override sequence, if required.

6.04.07 It shall be possible for the operator to extend the timing of a particular step by isolating the timer for the duration. The timer will restart once the operator puts back the system on ‘auto’ and the other steps will then follow as programmed.

6.04.08 The regeneration sequence shall be prevented from advancing further in the event of tripping of a running motor or other fault condition, which do not permit the various desired parameter of this step to be achieved. A manual override for this shall also be provided.

6.04.09 Annunciation logic shall be carefully designed so that the alarms are activated only under abnormal conditions. As for example, low flow of diluent water is only relevant when the chemical dosing is in progress. All other times, when no diluent water flow is required, this annunciation should be blocked. In general, Normal and trouble free operation of the plant shall not activate any of these alarms.

6.04.10 adequate diluent water flow shall be established before starting of the ejectors/ dosing pumps for acid and alkali.

6.04.11 The immersion heater in the hot water tank can be put on only when there is adequate water level in the tank.

6.04.12 CPU service vessel inlet & isolation valves will close automatically in the event of tripping of condensate extraction pump.

Note: Bidder to note that for complete control & operation of the CPU plant bidder to also refer the respective Control & Instrumentation (Sub -Section IC& IIC) & Electrical (Sub-Section IB& IIB).

ANNEXURE-I

QUALITY PLAN

CONENSATE POLISHING PLANT

Tests/Check / Items / Components	Material Test	WPS/PQR/Welder Qualification	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic / Water Fill	Pneumatic Test	Functional/operational Test	Bleeding resistance tests	Adhesion/ Spark Test	Performance Test	Other Test	All Test as per relevant Std/ Appd Data Sheets	Dynamic Balancing	Remarks
CPU Service Vessel	Y[a]	Y	Y	Y	Y	Y	Y[3]						Y[1]			
Acid Alkali/Chemical Storage Tanks/ Vessels (LP)	Y[a]	Y	Y	Y	Y	Y[4]	Y									
Resins/Activated Carbon & Internals of CPU	Y[a]				Y									Y		
Rubber Lining of Vessels/ Tanks/ Pipes etc	Y[a]				Y					Y[2]	Y			Y		
Dosing Pumps/Metering Pumps	Y[a]						Y					Y[5]		Y		
Diaphragm Valves	Y[a]				Y		Y[6]	Y[6]						Y[7]		
Butterfly Valves (Low Pressure)					Y		Y[6]		Y				Y[8]			
1. Body (Cast)	Y[a]		Y[b]													
2. Disc (Cast)	Y[a]		Y[b]													
3. Shaft	Y[a]		Y										Y[c]			
High Pressure Ball Valves & Butterfly Valves	Y[a]						Y							Y		
Horizontal Centrifugal Pumps				Y	Y							Y[5]		Y		
1. Casing	Y[a]		Y[b]				Y									
2. Impeller	Y[a]		Y[b]												Y	
3. Shaft	Y[a]		Y										Y[c]		Y	
Rotary Blowers				Y	Y							Y		Y		
1. Casing	Y[a]		Y[b]				Y									
2. Rotor	Y[a]		Y										Y		Y	

Notes:

1. Heat Treatment shall be done as per ASME code.
2. Bleeding Resistance tests shall be done by keeping the sample in 33% HCl, 48% NaOH and DM Water for 72 Hrs.
3. Hydro Test shall be conducted, before Rubber lining.
4. As per code requirements.
5. As per HIS, USA.
6. Hydro test of body before Rubber lining. Seat Leakage test for Actuator operated valves shall be done by closing the Valves with Job Actuator.
7. Tests on Rubber parts such as Diaphragms shall be done per batch of Rubber mix, such as Tensile, Hardness, Adhesion, Spark Test, Bleed Resistance test and Flex test. Life Cycle test for Diaphragms for 50000 cycles etc shall also be done.
8. Hydro Test of Body, Seat & Disc Strength shall be carried out in accordance with latest edition of AWWA C-504 Standard. Proof of Design Test in accordance with latest edition of AWWA C-504 Standard shall also be carried out, if not carried out earlier. Seat Leakage test for Actuator operated valves shall be done by closing the Valves with Job Actuator. Seat leakage test shall be carried out in both directions.
   a) One per Heat/Heat Treatment batch/Lot
   b) On machined surfaces only.
   c) UT shall be done for shafts with Dia 50 mm or above.
9. For all other Misc. items, refer Table on LP piping.

10. Bidder will perform hydro test at 1.5 times of design pressure of entire Condensate Polishing Plant at site after commissioning of all the equipments in pressence of Customer/BHEL. Format of record will be through protocol, subject to BHEL/Customer acceptance.
11. Hydro test will be conducted before rubber lining.
12. Proof of Design (P.O.D.)

12.1 P.O.D. test certificates shall be furnished by the bidder for all applicable size-ranges and classes of Butterfly valves supplied by him in the presence of Customer's representative.

12.2 All valves that are designed and manufactured as per AWWA-C-504 shall be governed byt he relevant clauses of P.O.D test in AWWA-C-504. For Butterfly valves designed and manufactured to EN-593 or equivalent, the P.O.D. test methods and procedures shall generally follow the guidelines of AWWA-C-504 in all respect except that Body & seat hydro test and disc-strength test shall be conducted at the pressures specified in EN-593 or the applicable code. Actuators shall also meet requirements of P.O.D. test of AWWA-C-504.

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13.0 Inspection / test / check requirements for pressure vessels other than service vessel are same as for inspection / test / check requirements for service vessel as indicate in table given above.

14.0 For piping, vales, fillings in service vessel area quality requirements please also refer power cycle piping quality plan.

15.0 Quality requirements specified here if contradicting as specified elsewhere in this chapter, then stringent quality requirements shall be followed by the bidder for all items without any price and delivery implications to BHEL/customer.

16.0 The Quality requirements mentioned here in this annexure for different mechanical, electrical & C&I items are bare minimum, if any other quality requirements required for these items as per BHEL & customer during detail engineering the same shall be accepted and provided by bidder without any price and delivery implication to BHEL & customer.

CONTENT

VOLUME : IIA

SECTION-VII

QUALITY ASSURANCE REQUIREMENTS

1.00.00 **QUALITY ASSURANCE PROGRAMME**

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

a) His organisation structure for the management and implementation of the proposed quality assurance programme.

b) Documentation control system.

c) Qualification data for Bidder's key personnel.

d) The procedure for purchase of materials, parts, components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.

e) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

f) Control of non-conforming items and system for corrective actions.

g) Inspection and test procedure both for manufacture and all site related works.

h) Control of calibration and testing of measuring and testing equipments.

i) System for quality audit.

j) System for indication and appraisal of inspection status.

k) System for authorising release of manufactured product to the Owner.

l) System for handling storage and delivery.

m) System for maintenance of records.

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

o) Internal standards, if referred in the quality plans shall generally be compatible with National / International standards and shall be mentioned in the quality plans. Alternatively bidder shall furnish extracts of the internal standards detailing out acceptance norm for the product / material.

2.00.00 **GENERAL REQUIREMENTS - QUALITY ASSURANCE**

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

Contractor shall furnish list of Manufacturing Quality Plans of major equipments indicating proposed inspection catagorisation indicating items that will be offered for Owner’s inspection etc and the Field Quality Plans

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

Manufacturing Quality Plan for all major equipments/ items will be approved by owner. In these approved quality plans, Owner / Authorised representative shall identify customer hold points (CHP), test / checks which shall be carried out in presence of the Owners Engineer or his authorised representative and beyond which the work shall not proceed without consent of Owner / Authorised representative in writing. Inspection/ Test reports are to be submitted to owner as specified in final approved Manufacturing Quality Plans.

2.03.00 Field Quality Plans / Procedures for all field activities shall be submitted to

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

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

2.05.00 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/ Authorised representative for “CHP” and “W” points marked in quality plans , and duly authorised for despatch by issuance of Material Despatch Clearance Certificate (MDCC). For items which is not under owner’s inspection the contractor shall apply for despatch clearance (MDCC) from owner by submitting their internal inspection reports and quality records

2.06.00 All materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report. These certificates and reports shall indicate the sheet serial numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.

2.07.00 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record, mechanical property test results shall be furnished.

2.08.00 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section - IX (latest edition) or other International equivalent standard acceptable to the Owner.

All brazers, welders etc. employed on any part of the contract at Contractor's/ Sub-Contractor's works or at site shall be qualified as per ASME Section-IX (latest edition) or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner / his authorised representative or owner approved Third Party Inspection Agency(TPIA). Previously qualified WPS & PQR shall be acceptable if witnessed by owner’s approved TPIA.

For welding of pressure parts and high pressure piping coming under IBR purview, the requirements of IBR shall also be complied with.

2.09.00 All non-destructive examination (NDT) shall be carried out in accordance with LIST OF STANDARDS FOR REFERENCE as given below in this section.

The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non- destructive examination). Results of NDT for the list major equipments / items identified for owner's inspection shall be properly recorded and submitted for review and approval. Other items not covered under owner's inspection, contractor shall review and approve the NDT results and such reports shall be submitted to owner in the final documentation of the items / equipments

2.10.00 All the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment list of which shall be drawn up by the Contractor and finalised with the Owner shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalised and approved by the Owner/Authorised representative and form part of the Purchase Order between the Contractor and the Vendor.

2.11.00 All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalised with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed.

Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.

Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.

2.12.00 Quality requirements for main equipment shall equally apply for spares and replacement items.

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

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

3.00.00 **QUALITY ASSURANCE DOCUMENTS**

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

a) Material mill test reports on components as specified by the specification.

b) The inspection plan with verification, inspection plan check points, verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.

c) Non-destructive examination results /reports including radiography interpretation reports.

d) Factory tests results for testing required as per applicable codes and standards referred in the specification.

e) Welder identification list listing welder's and welding operator's qualification procedure and welding identification symbols.

f) Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

g) Stress relief time temperature charts.

h) Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following will also be recorded :

   i) When some important repair work is involved to make the job acceptable.

   ii) The repair work remains part of the accepted product quality.

i) Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.

4.00.00 **INSPECTION, TESTING AND INSPECTION CERTIFICATES**

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

4.02.00 The Contractor shall give the Owner’s Engineer/ Authorized Inspector twenty one (21) days written notice for “CHP” / “W” points of any material being ready for testing by owner’ engineer / Authorized inspector. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Engineer/ Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is notified as being ready for test/inspection. If owner’s Engineer / Authorised Inspector fail to attend the inspection, next mutually convenient date for test shall be agreed with Contractor. Contractor shall, in

no case proceed with the test without owner or his authorized inspectors, unless the witnessing is officially waived and advised Contactor to proceed with the test. Contractor shall forthwith forward duly certified completed test report and a product quality certificate in six (6) copies to owner upon completion of such test.

4.03.00 The Engineer or Inspector shall within fifteen (15) days from the date of Inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract / QAP or other approved quality documents. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract / QAP or other approved quality documents.

4.04.00 When the factory tests have been completed at the Contractor's or sub-contractor's works, the Engineer/Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests excluding the test completion date subject to submission of all certified documents related to the test, If the tests are not witnessed by the Engineer/Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Engineer/Inspector. Failure of the owner’s Engineer/Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests, or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract / QAP or other approved quality documents.

4.05.00 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the owner’s Engineer/Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contract / QAP or other approved quality documents. Contractor and shall give facilities to the owner’s Engineer/ Inspector or to his authorised representative to accomplish testing.

4.06.00 To facilitate advance planning of inspection in addition to giving inspection notice as per Clause 4.02.00, the Contractor shall furnish quarterly inspection programme indicating proposed schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

LIST OF STANDARDS FOR REFERENCE

a) International Standards Organisation (ISO).

b) International Electro-technical Commission (IEC).

c) American Society of Mechanical Engineers(ASME)

d) American National Standards Institute (ANSI).

e) American Society for Testing and Materials (ASTM).

f) American Institute of Steel Construction (AISC).

g) American Welding Society (AWS).

h) Architecture Institute of Japan (AIJ).

i) National Fire Protection Association (NFPA).

j) National Electrical Manufacturer's Association (NEMA).

k) Japanese Electro-technical Committee (JEC).

l) Institute of Electrical and Electronics Engineers (IEEE).

m) Federal Occupational Safety and Health Regulations (OSHA).

n) Instrument Society of America (ISA).

o) National Electric Code (NEC).

p) Heat Exchanger Institute (HEI).

q) Tubular Exchanger Manufacturer's Association (TEMA).

r) Hydraulic Institute (HIS).

s) International Electro-Technical Commission Publications.

t) Power Test Code for Steam Turbines (PTC).

u) Applicable German Standards (DIN).

v) Applicable British Standards (BS).

w) Applicable Japanese Standards (JIS).

x) Electric Power Research Institute (EPRI).

y) Standards of Manufacturer's Standardization Society (MSS)

z) Bureau of Indian Standards Institution (BIS).

aa) Indian Electricity Rules.

bb) Indian Boiler Regulations (IBR).

cc) Indian Explosives Act.

dd) Indian Factories Act.

ee) Tariff Advisory Committee (TAC) rules.

ff) Emission regulation of Central Pollution Control Board (CPCB).

gg) Pollution Control regulations of Dept. of Environment, Govt. of India

hh) Central Board of Irrigation and Power (CBIP) Publications

ANNEXURE-I
FORMAT OF QUALITY ASSURANCE PROGRAMME

VENDOR'S LOGO , NAME & ADDRESS	MANUFACTURING QUALITY ASSURANCE PLAN	DOC NO:	XXXXX-CAL-QAP-M-0001				
	-	REV NO :	0	1	2	3	4
	ITEM :	DATE :					

CLIENT :		LOCATION :	
PROJECT :		REFERENCE PURCHASE ORDER NO. & DT :	
VENDOR :		REFERENCE APPROVED DATA SHEET :	
SUB VENDOR :		REFERENCE APPROVED DRAWING. NO. :	

ABBREVIATIONS :

QAP - QUALITY ASSURANCE PLAN,	MATL - MATERIAL,	
CR - CRITICAL,	APP - APPROVED,	
MA - MAJOR,	DWG - DRAWING,	
MI - MINOR	SUPL - SUPPLIER,	
SPEC - SPECIFICATION,	PROC - PROCEDURE	
TC - TEST CERTIFICATES		
P - PERFORM		
w - WITNESS		
V - VERIFY		
CHP - CUSTOMER HOLD POINT		

AGENCY :

1 - DCPL/PROJECT AUTHORITY
2 - SUPPLIER
3 - SUB-SUPPLIER
4 - MANUFACTURER
5 - THIRD PARTY INSPECTION AGENCY

GENERAL REMARKS

1 THE ITEMS WHICH ARE FALLING UNDER ANY STATUTORY AUTHORITY'S (LIKE I.B.R. ETC.) SCOPE SHALL BE SUBJECTED TO THAT STATUTORY AUTHORITY'S INSPECTION CLEARENCE.

NOTES:

1. EXACT MATERIAL / PROCESS / INSPECTION / TESTS FOLLOWED BY THE MANUFACTURER SHALL BE SPECIFIED
2. EXACT REFERENCE DOCUMENT/ACCEPTANCE STANDARD SHALL BE SPECIFIED
3. IN CASE SPECIFIED ACCEPTANCE STANDARD / NORMS IS OTHER THAN NATIONAL / INTERNATIONAL STANDARDS

. STANDARD / COPY OF THE ACCEPTANCE NORMS FOLLOWED BY THE MANUFACTURER SHALL BE SUBMITTED FOR REVIEW RECORD

4 FINAL INSPECTION DOSSIER SHALL BE PREPARED BY MANUFACTURER & SHALL BE ENDORSED BY INSPECTIONTION AGENCY

	Prepared by			Checked by			Approved By		
Revision	R0	R1	R2	R0	R1	R2	R0	R1	R2
DATE									

VENDOR'S LOGO, NAME & ADDRESS	ITEM :	DOC NO:			
		REV NO :	R0	R1	R2
		DATE :			

SL NO.	DESCRIPTION	CHECKS			CATEGORY	REF DOCS	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
		TYPE	METHOD	QUANTUM					P	W	V	
1	2	3	4	5	6	7	8	9	12	13	14	15
1.00												

Notes:

Prepared by				Checked by			Approved By		
Revision	R0	R1	R2	R0	R1	R2	R0	R1	R2
DATE									

ANNEXURE-II

FIELD WELDING SCHEDULE

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

Sl No.	Drawing No. for Weld Locations & Identi-fication mark	Descrip-tion of parts to be welded	Material specifica -tion	Dimen-sions	Pro-cess of Weld-ing	Type of Weld	Electrode Filler Specifica -tion	WPS No.	Minimum Pre-heat Tempera-ture	Heat Treat-ment Tempe-rature [Holding Time in secs]	NDT Method Quantu m	NDT Speci-fication Number	Accep-tance Norm Ref.	Re-marks

The Field Welding Schedule should be submitted for :

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

16.0. LOW PRESSURE PIPING

Sl.No.	Tests/Check Items / Components	Material Test	DPT/MPI	Ultrasonic Test	WPS/ WQS/PQR	Balancing	Hydraulic / Water Fill Test	Pneumatic Test	Assembly Fit up	Dimensions	Functional/operational Test	Performance Test	Other tests	All Tests as per Relevant Std	Adhesion / Spark	Remarks
1)	Pipes & Fittings and Metered Bends	Y[a]	Y[b]		Y		Y									
2)	Diaphragm Valves	Y[a]					Y[5]			Y				Y[6]		
3)	Butterfly Valves (Low Pressure)															
a)	Casted Butterfly Valves															
(i)	Body (Cast)	Y[a]	Y[b]				Y		Y	Y	Y		Y[7]			
(ii)	Disc (Cast)	Y[a]	Y[b]													
(iii)	Shaft	Y[a]	Y	Y[c]												
b)	Fabricated Butterfly Valves															Ref. Note14
4)	Gate / Globe / Swing Check Valves	Y[a]	Y[b]	Y[c]			Y[5]	Y	Y				Y[8]			
5)	Dual Plate Check Valves	Y[a]	Y[b]	Y[c]			Y	Y	Y				Y[4]			
6)	Rolled & Welded Pipes	Y[a]	Y[3]		Y		Y[1]			Y						
7)	Coating & Wrapping of Pipes	Y[2]											Y[2]			
8)	Tanks & Vessels	Y[a]	Y[b]		Y		Y									
9)	Strainers	Y[a]	Y[b]				Y						Y[11]			

Sl.No.	Tests/Check Items / Components	Material Test	DPT/MPI	Ultrasonic Test	WPS/ WQS/PQR	Balancing	Hydraulic / Water Fill Test	Pneumatic Test	Assembly Fit up	Dimensions	Functional/operation al Test	Performance Test	Other tests	All Tests as per Relevant Std	Adhesion / Spark	Remarks
10)	Rubber Expansion Joints	Y[a]					Y[12]		Y				Y[13]			
11)	Rubber Lining of Pipes	Y[a]	Y[b]		Y		Y			Y				Y[9]	Y	
12)	Hangers & Supports	Y[a]						Y								
13)	Fastners	Y[a]		Y[b]				Y								
14)	Site Welding		Y[1]		Y		Y									

Notes:

1. Weld Joints not subjected to hydraulic test shall be subjected to 100% RT.

2. Spark Test, Adhesion Test and Material Test for primer and enameled & Coal Tar Tapes as per AWWA-C-203-91

3. DPT on route run and after back gouging and on finish welds.

4. Dry Cycle Test (Spring Cycle Test) for one lakh Cycles shall be carried out as a type test..

5. Seat Leakage Test for Actuator Operated Valves, shall be done with by closing the valves with actuator.

6. Tests on rubber parts per batch of rubber mix such as hardness, adhesion, spark test, bleed test and flex test on diaphragm, type test for diaphragm for 50,000 cycles.

7. Hydraulic Test of Body, Seat and disc-strength shall be carried out in accordance with latest edition of AWWA-C-504 in presence of Employer's representatives. Actuator operated valves shall be checked for Seat Leakage by closing the valves with actuator. Seat Leakage Test shall be carried out in both directions.

8. Blue matching, wear travel for gates, valves, pneumatic seat leakage, reduced pressure test for check valves shall be done as per relevant standard. Maximum allowable vacuum loss is 0.5 mm of Hg abs. for valves to be tested for vacuum operation for internal pressure 25 mm of Hg abs. for a period of 15 minutes 9.

9. Hardness, Bleeding Test and Ozone resistance test shall be done on rubber material

10. 2% of welds shall be subjected to DPT.

11. Pressure drop across the strainer for each type and size as a special test shall be carried out

12. During hydraulic and vacuum tests at 25mm Hg abs in 3 positions, the change in the circumference of arch should not be more than 1.5%. 24 hrs after the test permanent set in dimension should not exceed 0.5%.

13. Tests on rubber for tensile, elongation, hardness, hydraulic stability check as per ASTM D 471, ozone resistance test as per ASTM D 1149 aging test and adhesion strength of rubber to fabric, rubber to metal adhesion shall be carried out.

14. For fabricated butterfly valves: UT as per ASTM A-435 on plates material for body and disc. 100% RT as per ASTM, Section-VIII, Division-I, on butt joins of body and disc and post weld heat treatment as per ASME, Section-VIII, Division- I on butt joints of body and disc of thickness above 30mm shall be carried out in addition to other tests indicated for cast butter fly valves.

a) One per heat/heat treatment batch/lot.

b) On machined surfaces only for castings and on finished butt welds.

For shaft/spindles > or = 50 m

flange. The material of construction of spool pipe shall be the same as that of pumps suctions piping. The strainer element shall be of perforated sheet with aperture size of 6 mm and wrapped with AISI-316 stainless steel wire mesh of 500 micron nominal aperture. The clear opening area of the strainer shall be at least 5 times the pipe area.

j) Non-return Valves

i) All non-return valves shall be of approved type and make and the pressure drop shall be subject to approval. Non-return valves for steam services and on pump discharge sides shall be provided with approved dash pots, where required, and with prior approval.

ii) The body seat for swing check valves shall be inclined at such an angle as to minimise chatter.

iii) To enable the internal parts to be examined or removed without removing the valves from the pipeline, the flanged cover should be used. The bodies shall be stamped with an arrow to indicate the correct flow direction.

iv) Provision shall be made to drain both sides of a horizontal non-return valve where such a valve adjoins an isolating valve for non-return valves mounted on vertical pipe integral by-pass shall be used to facilitate draining as stated earlier.

k) De-super heaters

De-super heaters along with spray water supply and control system shall be provided on the auxiliary steam lines, etc. as required. A de-superheater shall be designed for the design conditions of the piping on its upstream side and shall also take care of its severe condition of working. As far as possible, the de-super heaters shall be mounted on a vertical line to avoid the problem of water accumulation in it. However, if installed horizontally, the inside diameter of the de-superheated shall be the same as that of the pipe on which it is mounted and the pipe shall be provided with drain pocket and trap station.

7.00.00 INSPECTION, TESTING AND INSTALLATION

7.01.00 Testing of Piping at Works

7.01.01 Material Test and Analysis

All materials shall be furnished in strict accordance with the codes specified and in accordance with the detailed specification. All sources of material shall be disclosed and relevant test certificates for the physical and chemical properties of the material shall be made available to the Owner/Engineer before the final shop inspection.

7.01.02 Hydrostatic Test

All piping shall be subjected to the hydrostatic test pressure at shop as required by the IBR or any other applicable standards. Test pressure shall however be not less than the following :

$$\text{Test Pressure} = 1.5 \times \frac{\text{Allowable Stress at Room Temp.}}{\text{Allowable Stress at Design Temp.}} \times \text{Design Pressure}$$

The Contractor shall guarantee his work as capable of withstanding such hydrostatic tests and consent to repair or replace at his expense any item, which fails to pass such tests at site. Hydrostatic test of all pipes coming under IBR shall be offered for witnessing by the representative of the Inspecting Authority recognised by IBR.

7.01.03 Wall Thickness Tests

Wall thickness tests shall be made on a length of pipe of each type to determine the actual wall thickness at outer wall of bend on such piping.

The tests shall be done before fabrication on the piping system and results submitted to Owner/Engineer for approval.

7.02.00 **Capacity Tests for Pipe Supports**

Each constant load and spring support shall be tested before delivery to ensure that the variation in support capacity provided through the specified ranges (i.e. the difference in load between hot conditions and cold condition) does not exceed 6 percent for constant load supports and 20 percent for variable spring supports.

All materials shall be of tested quality. Hanger springs shall be properly calibrated.

7.03.00 **Testing of Valves & Specialties at Works**

7.03.01 All materials shall be of tested quality and the contractor shall submit the relevant material test certificate for the approval of Owner/Consultant.

7.03.02 All Valves and Specialties as well as counter flanges to be used in steam service shall have IBR certification marked on them and IBR certificates in appropriate proforma, shall be submitted.

7.03.03 Gate valves shall be subjected to shop tests in accordance with API-598 including the high-pressure closure test. Globe valves shall be tested in accordance with BS-1873 and check valves in accordance with BS-1868.

7.03.04 All gaskets used for test shall be of the same material and design as specified for the finished product.

7.03.05 Each relief valve shall be subjected to hydrostatic test, seat pressure test, seat leakage test and test for relieving capacity.

The valve body test pressure shall be at least twice the set pressure.

The seat test pressure should be at least equal to the set pressure. During this test, the valve seat shall be demonstrated to be watertight for a period of at least two (2) minutes.

7.03.06 Functional tests : The fully assembled or completed valves including the operators and accessories shall be functionally tested to demonstrate the operability of the valve and the operator. This may be done by cycling typical valves 3 or 4 times from open to close position. The manual operation of the motor operated valves using the manual override to demonstrate freedom from friction shall also be conducted.

7.04.00 **Tests on Strainers and Traps at Works**

7.04.01 All strainers shall be subjected to hydrostatic test. The test pressure shall be twice the design pressure.

7.04.02 All steam traps shall be subjected to hydrostatic test at twice the design pressure. IBR certification shall be furnished for all steam traps.

7.05.00 Test reports and certificates of the mentioned tests and other tests as required to ensure satisfactory operation shall be submitted to Owner/ Consultant before despatch of equipment IBR certification as required shall be furnished.

7.06.00 All rubber lining should be subjected to tests as per IS:4682 (Part-I).

7.07.00 **Tests at Site**

Contractor shall carry out tests at site to prove to the Owner that the equipment of the plant complies with requirements stipulated and is erected in accordance with requirements. Before the plant is put on trial run the Contractor will be required to conduct tests to demonstrate to the Owner that each item of the plant is capable of correctly performing the functions for which it was specified. These test may be conducted concurrently with those required under commissioning sequence. Tests required shall in general be as follows :

a) All piping, valves and specialties after installation, will be tested hydraulically at a pressure, one half times that of the maximum attainable pressure in the system or 2 times the design pressure whichever is higher, to check against leak tightness.

b) All manually operated valves/gates shall be operated throughout 100% of the travel and these should function without any trouble whatsoever.

c) Visual check on all structural components, welding, painting etc. and if doubt arises these will be tested again.

d) All test instruments and equipment shall be furnished by the Bidder to the satisfaction of the Owner.

e) Checks on electrical items as mentioned in relevant electrical specification.

7.08.00 **Pre-Commissioning Testing**

7.08.01 Alignment Test

After completion of erection and before start-up, alignment test shall be carried out by the Contractor to check levelling, clearance, eccentricity etc. Measurement will be witnessed and acceptance will be certified by the Engineer.

7.08.02 Heat Treatment

All necessary preheating, post heating and stress relieving operation of welds/fabricated, items are part of the erection work and shall be supervised by the Contractor in accordance with relevant regulations and standard.

The Bidder shall arrange all required supervising staff for heat treatment and stress relieving works.

Heat treatment may be required to be carried out at any time during day and night to ensure the continuity of the progress. The Contractor shall provide supervising staff accordingly.

All data such as heating temperature, heating rate, sparking time, maximum temperature during heat treatment shall be properly recorded. All the data recorded during heat treatment shall be the property of the Owner.

7.08.03 Radiography Test

The Contractor shall carryout radiography tests of all field-welded joints coming under IBR the acceptability standard of which shall be as per IBR (latest revision). For other field welded joints radiography or other ND testing methods shall be employed as per ASME or equivalent. All radiography shall be carried out in presence of a competent supervisor of the contractor and his certificate of identification of the films of the radiographs shall be given invariably in all cases.

The repair work shall be suggested by the Contractor immediately after detection of the defective zone to the complete satisfaction of the Engineer. Regarding acceptance of the joints, decision of the Engineer shall be final.

All X-ray films of joints radiographed at site shall become the property of the Owner.

Contractor shall carryout the following optional non-destructive tests after completion of erection of all piping and equipment.

Ultrasonic test per weld joint.

Hardness test for 10% weld joints for each system of piping and/or as specified in the approved Field Quality Plan (FQP).

7.08.04 Hydrotest

Hydrotesting shall be conducted for all pressure parts after installation at required pressure irrespective of carrying out 100% radiography of field welded joints. All necessary blanking arrangement required for such hydrotesting shall be furnished by the Contractor. The hydro testing of piping coming under the I.B.R. shall meet the requirements of I.B.R. and all necessary test pump, temporary piping etc. shall be supplied by the Erection Contractor, irrespective of carrying out radiography on 100% basis of the field welded joints.

After the hydrostatic test, the Erection Contractor shall carry out thorough flushing of all lines with water to ensure removal of foreign materials like welding rods, metal chips etc. to the satisfaction of Engineer. After the flushing of the lines, all the water shall be drained and the piping shall be blown with air for drying the cleaned surface and the lines shall be air blasted to ensure proper cleaning of line to the satisfaction of engineer.

As a rule, hydro test shall be performed after all eventual pipe branching have been completed and valves installed. Should it be required to hasten erection work, hydrotest may be performed in sections.

All safety valves coming under purview of Indian Boiler Regulation shall be set and other tests shall be conducted to the satisfaction of concerned Boiler Inspector. All other safety valves shall also be set and sealed to the satisfaction of the Engineer.

All instruments necessary for the tests shall be supplied by the Contractor and calibrated before test as per relevant code.

The Contractor shall make necessary changes and corrections without any extra cost as may be felt by the Owner/Engineer to meet the guarantee and other technical particulars.

7.09.00 **Installation**

7.09.01 For all steam blown lines temporary strainers shall be installed at the equipment terminals so as to prevent any inflow of particles where that may cause any damage or harmful effect. For example, such strainers shall be placed on main steam and hot reheat line terminals at turbine end unless the turbine stop valves/interceptor valves have integral strainers suitable for the purpose. The temporary strainers shall be kept on line for sometime after the plant starts normal operation, as per the discretion of the Engineer. So, the design of strainers shall be based on the design conditions of the pipes on which they are installed. Where flow meters are to be installed in pipes requiring steam blowing, initially the pipes shall be erected with the flow meter branch pipes replaced by temporary spool pieces. After the end of steam blowing operation the temporary spool pieces shall be removed and the flow

meter branch pieces shall be erected in position. In case such a pipe has also to be subject to cold pull-up, temporary anchoring of the main pipe on either ends of the temporary spool piece shall be done before replacing it by the flow-meter branch pipe.

All piping shall be installed in a manner such that expansion will take place in the direction desired and so that vibrations will be minimised. The contractor shall be responsible for the expansion provisions and flexibility of all field run piping. No piping shall be cold-sprung or cold-pulled unless there remains absolutely no other means to bring down the hot stress or terminal forces/moments within acceptable limit. All such cold pull up shall be shown in the piping drawings, along with a write-up describing clearly the method adopted for cold-pulling. All necessary attachments for cold-pulling, along with temporary anchors, as and wherever required, shall be provided.

The forces and moments on the temporary anchors and attachments shall be submitted. The cold pull-ups and all the above-mentioned documents shall be subject to the approval of the Owner.

7.09.02 All expansion bellows shall be installed with a minimum of two tie rods or bolts across each bellows to prevent the bellows from opening under pressure. The connection of the tie rods or bolts to the pipe shall make adequate provision for angular movement of the pipe and bellows.

Pump suction pipes shall be installed in such a manner that no air can be trapped in the suction piping. Suction pipes shall be supported in such a manner that there will be no high spots where air can be trapped. The in trades of suction branch lines shall be in no place lower than the in trades of the manifold at the point where the branch line connects to the manifold.

Standard "Factory Made" fittings shall be used in all piping. Shop or site fabricated mitred fittings shall not be used unless accepted by the Owner.

7.09.03 During erection no weights must be lifted by means of tackle fastened to the beams or slabs of the floor or roof except where provision has been specifically made for this purpose.

Supporting straps around flanges of pipes or valves or around welded joints will not be accepted. Anchors shall be attached to pipe by approved means. All supports should be shop fabricated and should be positioned before erection of the piping takes place and near to joints & valves wherever possible.

7.09.04 The Contractor shall provide all the necessary wall boxes and collars where pipes pass through walls, floors and roofs, also the necessary supports for any trenched pipes. Roof collars shall be fitted with a high sealing to prevent water falling through the holes.

The wall boxes and floor collars shall be constructed so that they can if necessary be erected after the pipes are in position. Pipes passing through roof collars shall be provided with an approved pipe sleeves, weather hood and cowl which shall be fixed by the Bidder. Floor collars shall extend to an approved height above the floor level and the pipes shall be fitted with hoods where required.

7.09.05 Drainpipe work shall be designed as per ANSI B31.1.

High pressure drains (above 40 kg/sq.cm) shall have two valves in series and that near the condenser or flash box shall be motor operated arranged to open and close to ensure minimum wear on one valve.

High-pressure drains shall have a screw-down non-return valve at the point of discharge near the manifold of the Flash tank to prevent backflow of flashed steam.

Low-pressure drains shall have steam traps of an approved design complete with strainers, isolating valves and by-pass valves.

Low-pressure drains shall have an isolating valve at the point of take-off from the pipe or vessel to be drained or as near as possible for convenient operation.

Pipe wall thickness shall be as per international standard approved by Owner/Engineer during detailed engineering.

Drain pockets of an approved size and construction shall be provided for all steam lines.

Arrangement of valves in the drain line shall be as shown in the Bidder's P & I Diagram.

7.09.06 All electrical actuators and pneumatic/hydraulic actuator shall be erected, aligned, adjusted and finally set to the satisfaction of the Owner. This includes adjustment and setting of torque and limit switches.

8.00.00 **DRAWINGS, DATA, INFORMATION & MANUALS**

8.01.00 **Drawings, data, Information to be furnished by the Bidder along with the Bid**

8.01.01 A complete list of all piping systems and corresponding materials included in the scope of work.

8.01.02 A complete list of all valves with their quantities and ratings.

8.01.03 Manufacturer's catalogue indicating design and construction of spring hangers, valves, specialties offered.

8.01.04 Manufacturer’s catalogue indicating complete range of available size and rating of pipes and fittings.

8.02.00 **After Award of Contract**

8.02.01 Layout drawings as well as Isometric drawings (for line sizes NB 50 mm and larger) showing the routing of various piping and location of hangers, restraints, anchors, valves etc.

		MANUFACTURERS NAME & ADDRESS		STANDARD QUALITY PLAN				PROJECT					
		AS PER APPROVED VENDOR LIST		ITEM:	ELECTRIC WIRE ROPE	QP NO		PACKAGE					WIRE ROPE ELECTRIC HOIST
						REV	0	CONTRACT No					
						DATE		CONTRACTOR					BHEL
						PAGE	1 of 4						

Sl.No	COMPONENT & OPERATIONS	CHARACTERISTICS	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
									D*	M	C	N	
1	2	3	4	5	6	7	8	9		**	10		11
1.0	**RAW-MATERIALS**												
1.1	a) STRUCTURAL MATERIAL b) RAW MATERIAL FOR HOIST AND GEAR BOX HOUSEING, TROLLEY PLATE (AS APPLICABLE)	MECH. , CHEM. PROPS	MA	CHEMICAL COMPOSITION AND TENSILE STRENGTH	1 / lot	APPD. DRG./ DATA SHEET	APPD. DRG./ DATA SHEET	Mill.s TC	√	V	V	V	Test shall be carried out in absence of mill TC
1.2	GEARS, SHAFT/AXLES, WHEELS	MECH , CHEM. PROPS	MA	CHEMICAL COMPOSITION, HARDNESS (DURING IN-PROCESS)	I / LOT	APPD. DRG./ DATA SHEET	APPD. DRG./ DATA SHEET / IS:3938	LAB. REPORT / MANUFACTURER'S TEST CERTIFICATE	√	P	V	V	In case the items are not manufactured in-house, the manufacturer's test certificate shall be submitted for chemical
		U.T FOR DIA/THK > 50mm	CR	NDT	100%	ASTM A 388	NOTE 4	INSPN. REPORT	√	P	**V**	V	
1.3	WIRE ROPE	Dimensional CHECK	MI	Dia.	100%	APPD. DRG./ DATA SHEET	APPD. DRG./ DATA SHEET	MFRS' TEST CERT.	√	P	V	V	
		BREAKING LOAD CAPACITY	CR	BREAKING LOAD	100%	APPROVED DRG/DATA SHEET / IS:3938 / IS: 2266	APPROVED DRG/DATA SHEET AND / IS:3938 / IS:2266	MFRS' TEST CERT.	√	P	V	V	
1.4	HOOKS	PHYS./ MECH. , CHEM. PROPS.	MA	CHEMICAL COMPOSITION, HARDNESS	I / LOT	APPROVED DRG/DATA SHEET / IS:3938 / IS:15560	APPROVED DRG/DATA SHEET / IS:3938 / IS:15560	MFRS' TEST CERT.	√	P	V	V	
		U.T IF SHANK DIA > 50mm	CR	NDT	100%	ASTM A 388	NOTE 1	INSPN. REPORT	√	P	W	V	**SHANK PORTION ONLY**
		PROOF LOAD CAPACITY	CR	PROOF LOAD TEST	100%	APPROVED DRG/DATA SHEET / IS:3938 / IS:15560	APPROVED DRG/DATA SHEET ≠ IS:3938 / IS:15560	INSPN. REPORT	√	P	W	V	
		DP AFTER PROOF LOAD	CR	NDT	100%	ASTM E-165	NO CRACKS	INSPN. REPORT	√	P	V/W	V	
2.0	**IN-PROCESS**												
2.1*	WELDING PROCEDURE SPECIFICATION	CORRECTNESS	MA	SCRUTINY	100%	IS:7307 / ASME SEC IX	IS:7307 / ASME SEC IX	FORMAT OF IS / ASME SEC IX		P	V	V	
2.2*	PROCEDURE & WELDER QUALIFICATION	WEDLING PARAMETRES	MA	PHYS. TESTS/RT	100%	IS:7310 / ASME SEC IX	IS:7310 / ASME SEC IX	AS PER ASME SEC IX	√	P	W	W	IN CASE OF LLOYDS / EIL / TPL QUALIFIED WELDERS AVAILABLE, REQUALIFICATION OF WELDER IS NOT REQUIRED

LEGNDS

* RECORDS INDENTIFIED WITH 'TICK'(√) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION

** M: MANUFACTURER/SUBCONTRACTOR

C: CONTRACTOR NOMINATED INSPECTION AGENCY(BHEL) N: CUSTOMER

INDICATE 'P' PERFORM"W" WITNESS AND "V" VERIFICATION AS APPROPRIATE " CHP" CUSTOMER SHALL IDENTIFY IN COLUMN"N"

MANUFACTURER/ SUB CONTRACTOR	CONTRACTOR	REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY &SEAL
SIGNATURE			

2.3*	WELD SET UPS	DIMENSIONS	MA	MEAS. , VISUAL	100%	WPS, APPD. DRG.	WPS, APPD. DRG.	INSPN. REPORT		P	V		
2.4*	WELDMENTS –FINAL RUN	SURFACE DEFECTS	MA	PT	100%	IS:3658 / ASTME:165	ASME SEC. VIII DIV. I	INSPN. REPORT	√	P	**V**	V	

		MANUFACTURERS NAME & ADDRESS		STANDARD QUALITY PLAN				PROJECT					5X800 MW YADRADRI TPS
		AS PER APPROVED VENDOR LIST		ITEM:	ELECTRIC WIRE ROPE	QP NO		PACKAGE					WIRE ROPE ELECTRIC HOIST
						REV	0	CONTRACT No					
						DATE		CONTRACTOR					BHEL
						PAGE	1 of 4						
Sl.No	COMPONENT & OPERATIONS	CHARACTERISTICS	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
									D*	M	C	N	
1	2	3	4	5	6	7	8	9		**	10		11
2.5	**TRUNION / TROLLEY WHEELS**, GEARS PINION	SURFACE & INTERNAL FLAWS (**FOR DIA. / THICKNESS >50MM)**	MA	PT / **UT**	100%	ASTME:165	NO LINEAR DEFECTS / **NOTE-4**	INSPN. REPORT	√	P	W	V	
2.6	NDT OF LOAD BEARING BUTT WELDS (**IF ANY)**	WELD QUALITY OF a)Butt weld on tension 100% RT and 100% DPT b)Butt weld oncompression 10% RT and 100% DPT c)Butt weld on rope drum 100% RT and 100% DPT d) Fillet weld - Random 10%	CR	PT & RT	100%	ASME SEC. VIII DIV. I	ASME SEC. VIII DIV. 4 . CLUW-51 FOR RT APPENDIX -8 FOR PT	INSPN. REPORT ND FILM	√	P	V	V	FILMS TO BE REVIEWED BY BHEL & Customer. DPT SHALL BE CHP FOR Customer & BHEL
2.7	**GEAR BOXES**												
	COMPLETE ASSEMBLY	OVERALL DIMENSIONS	MA	MEAS.	100%	MFG. DRG.	MFG. DRG.	INSPN. REPORT	√	P	V		
	Gear shall be checked for reduction ratio, backlash & contact pattern.	CHECK FOR OIL LEAKAGE, VIBRATION, NOISE TEMP. RISE	MA	NO LOAD RUNNING FOR TWO HOURS	100%	MFG. DRG.	MFG. STD.	- DO -	√	P	V	V	
2.8	**ELECTRICALS**												
1	MOTORS	TYPE TESTS (INCLUDING DEGREE OF PROTECTION)	MA	TYPE TESTS	1 / TYPE, 100%	IS:3938	IS:3938	MFRS' TEST CERT., INSPN REPORT	√	P	V	V	
		ROUTINE TESTS		ROUTINE TESTS	100%	IS 325	IS 325	DO	√	P	V	V	
2	RESISTANCES (IF APPLICABLE)	TEMPERATURE RISE	MA	VERTIFICATION OF MNFRS' TEST CERT.	100%	IS:3938, RELV. ISS	IS:3938, RELV. ISS	MFRS' TEST CERT.	√	P	V	V	
3	CONTROLLER, LIMIT SWITCHES (IF APPLICABLE)	ROUTINE TESTS	MA	ROUTINE TEST	100%	IS:6975/TECH. SPEC.,	IS:6875/TECH. SPEC.,	MFRS' TEST CERT.	√	P	V	V	Rating and make to be verified.
4	BRAKES	ROUTINE TESTS	MA	ROUTINE TEST	100%	TECH. SPEC. / IS:15560	IS:3938/TECH. SPEC.	MFRS' TEST CERT.	√	P	V	V	
5	BRAKE DRUM (IF APPLICABLE)	VERIFICATION OF HT CHARTS, HARDNESS (IF APPLICABLE)	MA	VISUAL, HARDNESS TEST	100%	APPD. DRGS./TECH. SPC.	APPD. DRGS./TECH. SPEC.	HT. CHART /INSPN. REPORT	√	P	V	V	
6	CONTACTOR	ROUTINE TESTS	MA	ROUTINE TEST	100%	IS:2959 AND TECH. SPEC., IS:6547 / IS:3938	IS:2959 AND TECH. SPEC., IS:6547 / IS:3933	INSPN. REPORT	√	P	V	V	Rating and make to be verified.
7	CONTROL PANEL, PENDANT SWITCH	* FIXING OF COMPONENTS WIRING MARKING CONTINUITY * FUNCTIONAL TEST * IR & H.V. TEST * IP - PROTECTION TEST * PAINT SHADE, THICKNESS, SHEET	MA	VISUAL	100%	APPD.DRG. WIRING DIAGRAM,	APPD. DRG. WIRING DIAGRAM,	INSPN. REPORT	√	P	V	V	BOUGHT OUT ITEMS AS PER BHEL / CUSTOMER APPROVAL LIST
			LEGNDS										
			* RECORDS INDENTIFIED WITH 'TICK'(√) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION										
			** M: MANUFACTURER/SUBCONTRACTOR										
MANUFACTURER/ SUB CONTRACTOR		CONTRACTOR	C: CONTRACTOR NOMINATED INSPECTION AGENCY(BHEL) N: CUSTOMER										
			INDICATE 'P' PERFORM"W" WITNESS AND "V" VERIFICATION AS APPROPRIATE " CHP" CUSTOMER SHALL IDENTIFY IN COLUMN"N"										
SIGNATURE							REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY &SEAL					
8	CABLES	TYPE AND ROUTINE TESTS	MA	TYPE & ROUTINE TESTS	100%	AS PER TECH. SPEC. IS:1554/IS:9968- PART - I / IS:694 / RELEVANT IS FOR FRLS CABLES	AS PER TECH. SPEC. IS:1554/IS:9968-PART - I / IS:694	MNFRS' TEST CERT.	Ö	P	V	V	

	MANUFACTURERS NAME & ADDRESS		STANDARD QUALITY PLAN				PROJECT		5X800 MW YADRADRI TPS	
	AS PER APPROVED VENDOR LIST		ITEM:	ELECTRIC WIRE ROPE	QP NO		PACKAGE		WIRE ROPE ELECTRIC HOIST	
					REV	0	CONTRACT No			
					DATE		CONTRACTOR		BHEL	
					PAGE	1 of 4				

Sl.No	COMPONENT & OPERATIONS	CHARACTERISTICS	CATEGORY	TYPE OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*	AGENCY M	C	N	REMARKS
1	2	3	4	5	6	7	8	9		**	10		11
3.0	FINAL INSPECTION												
3.1	COMPLETELY ASSEMBLED HOIST	1. COMPLETENESS, CORRECTNESS, OVERALL DIMENSIONS	MA	VISUAL, MEAS	100%	APPD. DRG.	APPD. DRG.	MNFRS' TEST CERT.	√	P	W	V	
3.2	ASSEMBLED HOIST PERFORMANCE	1. LOAD TEST	CR	LOAD TEST at SWL	100%	IS:6547 / IS:3938	IS:6547 / IS:3938	MNFRS' TEST CERT.	√	P	W	V	
		2. HOISTING & LOWERING SPEED, PERFORMANCE OF CONTROLLERS SWITCHES CONTRACTORS, RELAYS AND OTHER CONTROL DEVICES CORRELATIONS OF CIRCUITS AND INTERLOCKS AND SEQUENCES OF OPERATION	CR	MEAS & VISUAL	100%	IS:6547 / IS:3938, TECH SPEC.	TECH SPEC.	MNFRS' TEST CERT.	√	P	W	V	
		3. OPERATION OF ALL PROTECTIVE DEVICES	CR	VISUAL	100%	TECH SPEC	TECH SPEC.	MNFRS' TEST CERT.	√	P	W	V	
3.3	OVER LOAD TEST	1. OVER LOAD	CR	TEST AT 125 % OF-SWL	100%	IS:6547/IS:3938	IS:6547/IS:3938	INSPN. REPORT	√	P	W	V	
4	PAINTING												
1	PRIMER & FINISHING AND SHADE	1. TO RELEVANT IS	MI	CORRECTNESS OF MFG. TEST CERT.	EACH CONSIGNMENT	DRG. & DATA SHEET & RELV. IS SPEC.	DRG. & DATA SHEET & RELV. IS SPEC.	MNFRS' TEST CERT.		P	V		
	NOTE:												
	*** 1.0 Clause from 2.1 to 2.4 shall be applicable for load bearing welded joints.**												
	2.0 Back Wall Echo shall be adjusted to 100% of Full Screen Height in sound (Defect Free) Area. Defect Echo Height more than 20% of Screen Height shall be treated as unacceptable. Back Wall Echo shall not be less than 80% of Screen Height in any case.												

		LEGNDS	
		* RECORDS INDENTIFIED WITH 'TICK'(√) SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION	
		** M: MANUFACTURER/SUBCONTRACTOR	
MANUFACTURER/ SUB CONTRACTOR	CONTRACTOR	C: CONTRACTOR NOMINATED INSPECTION AGENCY(BHEL) N: CUSTOMER	
		INDICATE 'P' PERFORM"W" WITNESS AND "V" VERIFICATION AS APPROPRIATE " CHP" CUSTOMER SHALL IDENTIFY IN COLUMN"N"	
SIGNATURE			REVIEWED BY
			NAME & SIGN OF APPROVING AUTHORITY &SEAL

	MANUFACTURER'S NAME & ADDRESS :	**MANUFACTURING QUALITY PLAN** **ITEM :** Chain Pulley Block **QP No.:** PE-TS-417-155-A001 **REV**.:0, **Date.:, PAGE**: 1 OF 4	**PROJECT : 5X800 MW YADRADRI TPS** **PACKAGE : CHAIN PULLEY BLOCKS** **VOL IIB, SEC C**

Sr. No.	COMPONENT / OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									M	C	N	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.			11.
1	**RAW MATERIAL & B/OUT ITEMS:**											
1.1	HOOKS	DIMENSIONS,	MA		One sample	IS: 15560	IS: 15560	MTC	✓	P	V	V	UT FOR SHANK DIA 50MM AND ABOVE
		CHEMICAL COMPOSITION, MECHANICAL, PHYSICAL PROPERTIES	MA	LAB ANALYSIS	PER LOT	Material specification as per approved drawings		T.C.	✓	P	V	V	
		IDENTIFICATION & COMPLIANCE WITH TC.	MA	VISUAL	100%	HOOK TC FROM COMPETENT AUTHORITY		IR	✓	P	V	V	
		INTERNAL DEFECTS	MA	UT	100%	ASTM A-388 (REFER NOTE 1)		TC	✓	P	V	V	
		PROOF LOAD TEST	MA	REVIEW	100%	IS 15560		TC	✓	P	V	V	
		NDT AFTER PROOF LOAD	MA	DPT	100%	ASTM E-165	NO RELEVANT IDENTIFICATION	TC	✓	P	V	V	
1.2	LOAD CHAIN	- DIMENSIONS	MA	MEASUREMENT	100 %	IS: 6216 &	IS: 6216 &	IR	✓	P	V	V	
		- BREAKING STRENGTH	MA	-TENSILE TEST	1/LOT	APPD. DRGS.	APPD. DRGS.	MTC	✓	P	V	V	
		- PROOF LOAD	MA	-TENSILE TEST	100%			MTC HT	✓	P	V	V	
		-HEAT TREATMENT	MA	REVIEW	100%			CHA	✓	P	V	V	
		-GRADE	MA	REVIEW	1/BATCH			RT MTC	✓	P	V	V	
1.3	RAW MATL. FOR GEAR/ RATCHET PAWL / RATCHET WHEEL	CHEMICAL COMPOSITION, MECHANICAL PROPERTIES	MA	LAB ANALYSIS	ONE SAMPLE PER LOT	MATERIAL SPECIFICATION AS PER	MATERIAL SPECIFICATION AS PER	MTC	✓	P	V	V	TC or inspection report for components

	LEGEND:	FOR CUSTOMER USE	
MANUFACTURER / CONTRACTOR SUB-CONTRACTOR	** M : MANUFACTURER / SUB-CONTRACTOR C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION		
SIGNATURE		REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL

	MANUFACTURER'S NAME & ADDRESS :	**MANUFACTURING QUALITY PLAN** **ITEM :** Chain Pulley Block **QP No.:** PE-TS-417-155-A001 **REV**.:0, **Date.:, PAGE**: 2 OF 4	**PROJECT : 5X800 MW YADRADRI TPS** **PACKAGE : CHAIN PULLEY BLOCKS** **VOL IIB, SEC C**

Sr. No.	COMPONENT / OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									M	C	N	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.			11.
						APPROVED DRAWING	APPROVED DRAWING					shall be given.
		INTERNAL DEFECTS	MA	UT	10%	ASTM A-388 (REFER NOTE 1)		IR	✓	P	V	V	
1.4.	LOAD CHAIN WHEELS	- CHEMICAL COMPOSITION MECHANICAL PROPERTIES	MA MA	CHEMICAL MECHANICAL PROPERTIES	ONE SAMPLE PER LOT	APPD. DRG.	APPD. DRG.	MTC	✓	P	V	V	
1.5	BEARINGS	MAKE, TYPE, CATALOGUE NO.	MA	VISUAL	RANDOM	APP DRG / MFR"S CATALOGUE	APP DRG / MFR"S CATALOGUE	IR	✓	P	V	V	
1.6	HAND CHAIN WHEEL	CHEMICAL MECHANICAL PROPERTIES	MA	CHEMICAL MECHANICAL PROPERTIES	ONE SAMPLE PER LOT	AS PER DRAWING	AS PER DRAWING	MTC	✓	P	V	V	
1.7	HAND CHAIN	GRADE/ DIMENSION	MA	GRADE DIMENSION	100 %	AS PER DRAWING	AS PER DRAWING	MTC	✓	P	V	V	
1.8	TROLLEY GEARS, PINION,WHEELS, AXLE	CHEMICAL & MECHANICAL	MA	LAB ANALYSIS,	100%	APPVD DRGS	APPVD DRGS	IR/TC	✓	P	V	V	
2	**IN PROCESS**											
2.1	RATCHET PAWL / RATCHET WHEEL	-HARDNESS	MA	HARDNESS	100%	IS:3832 / APPD DRG.	IS:3832/ APPD. DRG.	IR	✓	P	V	V	

	LEGEND:	FOR CUSTOMER USE	
MANUFACTURER / CONTRACTOR SUB-CONTRACTOR	** M : MANUFACTURER / SUB-CONTRACTOR C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION		
SIGNATURE		REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL

	MANUFACTURER'S NAME & ADDRESS :	**MANUFACTURING QUALITY PLAN** **ITEM :** Chain Pulley Block **QP No.:** PE-TS-417-155-A001 **REV**.:0, **Date.:, PAGE**: 3 OF 4	**PROJECT : 5X800 MW YADRADRI TPS** **PACKAGE : CHAIN PULLEY BLOCKS** **VOL IIB, SEC C**

Sr. No.	COMPONENT / OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									M	C	N	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.			11.
		-SURFACE CRACK	MA	DPT	100 %	ASTM E165	NO DEFECT	IR	✓	P	V	V	
2.2	GEARS AND PINIONS AFTER MACHINING	SURFACE HARDNESS HEAT TREATMENT, SURFACE CRACK, CASE DEPTH	MA	HARDNESS HT CHART, DPT FOR SURFACE CRACK	RANDOM ASTM E 165 FOR DPT	MFG STANDARD NO DEFECT	MFG STANDARD	IR IR	✓ ✓	P P	V V	V V	
3.0	**FINAL INSPECTION**												
3.1	COMPLETE ASSEMBLY	OVERALL DIMENSION	MA	MEASUREMENT	100 %	IS:3832 /APPD DRG	IS:3832 /APPD DRG	IR	✓	P	W	V	
		PROOF LOAD TEST	CR	LOAD TEST	100%	-DO-	No cracks, flaws & other defects	IR	✓	P	W	V	
		LIGHT LOAD TEST	MA	LOAD TEST	100%	IS 3832	IS 3832	IR	✓	P	W	V	
		HEIGHT OF LIFT	MA	MEASUREME NT	100%	-DO-	-DO –	IR	✓	P	W	V	
		SWIVELING OF HOOK	MA	VISUAL	100 %	-DO-	-DO-	IR	✓	P	W	V	
		EFFORT	MA	PULL ON CHAIN	100%	-DO-	-DO-	IR	✓	P	W	V	
3.2	PAINTING	-CLEANING	MA	VISUAL	AT RANDOM	APPROVED	APPROVED	IR		P	--	--	
		- SHADE & DFT OF PAINT (Blue / Black)	MI	VISUAL	AT RANDOM	DRAWING/ SPECIFICATION	DRAWING/ SPECIFICATION	IR		P	W	-	

	LEGEND:	FOR CUSTOMER USE	
MANUFACTURER / CONTRACTOR SUB-CONTRACTOR	** M : MANUFACTURER / SUB-CONTRACTOR C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION		
SIGNATURE		REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL

	MANUFACTURER'S NAME & ADDRESS :	**MANUFACTURING QUALITY PLAN** **ITEM :** Chain Pulley Block **QP No.:** PE-TS-417-155-A001 **REV**.:0, **Date.:, PAGE**: 4 OF 4	**PROJECT : 5X800 MW YADRADRI TPS** **PACKAGE : CHAIN PULLEY BLOCKS** **VOL IIB, SEC C**

Sr. No.	COMPONENT / OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									M	C	N	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.			11.
3.3	NAME PLATE	VERIFICATION	MA	VISUAL	100%			IR		P	V	--	
3.4	PACKING	-VERIFICATION	MI	VISUAL	100%	SPECS.	SPECS.	IR		P	--	-	
3.5	REVIEW OF QA DOCUMENTATION	VERIFICATION	MA	VISUAL	100%	APPD. QP	APPD. QP		✓	V	V	V	

CR – CRITICAL, MA – MAJOR , MI – MINOR

NOTE 1: BACK WALL ECHO SHALL BE ADJUSTED TO 100% OF FULL SCREEN HEIGHT IN SOUND (DEFECT FREE) AREA. DEFECT ECHO HEIGHT MORE THAN 20% OF SCREEN HEIGHT SHALL BE TREATED AS UNACCEPTABLE. BACK WALL ECHO SHALL NOT BE LESS THAN 80% OF SCREEN HEIGHT IN ANY CASE.

NOTE 2: RECORDS IDENTIFIED WITH TICK SHALL BE ESSENTIALLY INLCUDED IN QA DOCUMENTATION.

	LEGEND:	FOR CUSTOMER USE	
MANUFACTURER / CONTRACTOR SUB-CONTRACTOR	** M : MANUFACTURER / SUB-CONTRACTOR C : BHEL / NOMINATED INSPECTION AGENCY. N : CUSTOMER INDICATE "P" PERFORM "W" WITNESS AND "V" VERIFICATION		
SIGNATURE		REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY & SEAL

QUALITY PLAN FOR MOTORS BELOW 55 KW (LV)

		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 P	AGENCY W	AGENCY V	REMARKS
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 FOR MOTORS BELOW 55 KW (LV)

	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	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10	10	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

QUALITY PLAN FOR MOTORS 55 KW & ABOVE

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
		SHEET 1 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVENT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	

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

QUALITY PLAN FOR MOTORS 55 KW & ABOVE

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 2 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC 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
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	

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

QUALITY PLAN FOR MOTORS 55 KW & ABOVE

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 3 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2	
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG. .	MANUFR'S DRG.	-DO-	3	-	2	FOR MV MOTOR INSULA-TION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
		2.ELECT. PROP, & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	RELEVANT IS/ BS OR OTHER STANDARDS	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2	

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

QUALITY PLAN FOR MOTORS 55 KW & ABOVE

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 4 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
1.10	BEARINGS	1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	

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

QUALITY PLAN FOR MOTORS 55 KW & ABOVE

	QUALITY PLAN	CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE
	SHEET 5 OF 9	SYSTEM	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVENT SPEC./ ASTM-E165	MANUFR'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	

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

QUALITY PLAN FOR MOTORS 55 KW & ABOVE

	QUALITY PLAN	CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
		BIDDER/ : VENDOR	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE
	SHEET 6 OF 9	SYSTEM	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10	10	10	11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	FOR MV MOTOR
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	THREE DIPS TO BE GIVEN

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

QUALITY PLAN FOR MOTORS 55 KW & ABOVE

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 7 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC 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
		4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.7	COMPLETE STATOR ASSEMBLY	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	VERIFICATION FOR MV MOTOR ONLY
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1	

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

QUALITY PLAN FOR MOTORS 55 KW & ABOVE

	QUALITY PLAN	CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE
	SHEET 8 OF 9	SYSTEM	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10	10	10	11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1$	1	$ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1$	1	$ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1$	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY $ NOTE - 2

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

QUALITY PLAN FOR MOTORS 55 KW & ABOVE

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 9 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11

NOTES:

1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.

2 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.

3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.

4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

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

PEM :: C&I

STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)

QUALITY PLAN NO.:	**PE-QP-999-145-I 006**
VOLUME	IIB
SECTION	D
REV. NO.	06 DATE: 05.09.2013
SHEET	1 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
1.0	**MATERIAL**											
1.1	Body & Bonnet casting / forgings, plug, valve stem, seat ring/cage.	1. Physical, Chemical properties	MA	Physical, Chemical tests	One/ Heat(HT Batch)	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Test Certificate	3	---	2,1	
		2. Heat Treatment	MA	Review of H.T. Chart	Each H.T.	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Test Certificate	3/2	2	1	IBR Certification (if applicable) to be verified by BHEL
		3. Internal quality of castings	MA	RT for Body & UT for Bonnet(NDT)	100%	ASME B 16.34	ASME B 16.34	Test Report / FILM	3/2	2	1	Only for rating ANSI 900 and above. Applicable for Body and Bonnet only. For Lower rating only if called for in specification.
		4. Surface Quality	MA	1. Visual	100%	MSS-SP-55	MSS-SP-55	Test Certificate	3/2	---	2,1	
				2. MT/PT	100%	ASME B 16.34	ASME B 16.34	Test Certificate	3	2	1	After Machining on machined surface only

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics
RT- Radiographic Test; UT – Ultrasonic Test; PT – Dye penetrant Test; MT- Magnetic Test
$ P - Agency Performing the Test.; W - Agency Witnessing the Test.; V - Agency Verifying the Test.
1 - BHEL; 2 - Vendor; 3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)

QUALITY PLAN NO.:	**PE-QP-999-145-I 006**
VOLUME	IIB
SECTION	D
REV. NO.	06 DATE: 05.09.2013
SHEET	2 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
		5. Pressure test for shell	MA	Hyd. Test	100%	ISA-S-75.19/ ASME B 16.34	ISA-S-75.19/ ASME B 16.34	Test Certificate	2	2	1	For Body & Bonnet after machining
1.2	Diaphragm	1. Surface Quality	MA	Visual	100%	Mfr. standard	Mfr. standard	Test Certificate	3/2	---	2,1	
		2. Hardness	MA	Measurement	100%	Mfr. standard	Mfr. standard	Test Certificate	3/2	---	2,1	
		3. Endurance / Life cycle	MA	Cyclic test 10,000 cycles	One / Type	10,000 cycles/ Mfr. standard.	No damage	Test Certificate	3/2		2,1	
1.3	Spring	1. Composition	MA	Chemical-Analysis	One sample/ Heat	Material spec. / Mfr. standard	Material spec. / Mfr. standard	Test Certificate	3	---	2,1	
		2. Mech. Properties	MA	Mech. Test	One sample/ Heat	Material spec. / Mfr. standard	Material spec. / Mfr. standard	Test Certificate	3	---	2,1	
		3. Performance	MA	1. Stiffness ratio	100%	Material spec. / Mfr. standard	Material spec. / Mfr. standard	Test Certificate	3	---	2,1	
				2. Scragging	100%	Material spec. / Mfr. standard	Material spec. / Mfr. standard	Test Certificate	3	---	2,1	
				3. Cyclic test (Endurance)	One / type	10,000 cycles	Material spec. / Mfr. standard	Test Certificate	3	---	2,1	
				4. Dimension (Measurement)	One sample/ Lot	Mfr. standard	Appd Drg	Record	3	---	2,1	

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics
RT- Radiographic Test; UT – Ultrasonic Test; PT – Dye penetrant Test; MT- Magnetic Test
$ P - Agency Performing the Test.; W - Agency Witnessing the Test.; V - Agency Verifying the Test.
1 - BHEL; 2 - Vendor; 3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)

QUALITY PLAN NO.:	**PE-QP-999-145-I 006**
VOLUME	IIB
SECTION	D
REV. NO.	06 DATE: 05.09.2013
SHEET	3 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
1.4	Electrical items [Limit switches, Solenoids, Position Transmitter(if provided externally)]	1. Routine Test	MA	HV, IR, Continuity function	100%	Rele. Standards	Rele. Standards	Test Certificate	3	---	2,1	In case TC is not available, Actual test shall be conducted
		2. Degree of protection	MA	IP/NEMA Tests	One sample / type	Approved Data sheet	Approved Data sheet	Test Certificate	3	---	2,1	
1.5	Pressure Gauges	1. Performance	MA	Review of calibration certificates	100%	Mfr. Standard	Mfr. Standard	Test Certificate	3	---	2,1	
		2. Marking	MA	Visual	100%	Mfr. standard	Mfr. standard	Records	3	---	2,1	
2.0	**IN PROCESS INSPECTION**											
2.1	After machining, i, Body ii Bonnet iii Plug iv Valve Stem v seat ring/cage	1. Surface flaws	MA	Visual & MT/PT	100% (on accessible surfaces)	ASME B 16.34	ASME B 16.34	Test Records	2	---	1	Butt weld ends shall be included.
		2. Dimensional checks	MA	Measurement	100%	Mfr. Standard	Mfr. Standard	Records	2	---	1	
		3. Hard facing (wherever applicable)	MA	Hardness Measurement	One sample/Lot	Mfr. Standard	Mfr. Standard	Records	2	---	1	
2.2	Lapping	Machining surface contact	MA	Blue Matching	One sample/lot	------	Proper Physical Contact	---	2	---	---	
3.0	**TESTS ON COMPLETED VALVE**											

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics
RT- Radiographic Test; UT – Ultrasonic Test; PT – Dye penetrant Test; MT- Magnetic Test
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1 - BHEL; 2 - Vendor; 3 - Sub-vendor

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STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)

QUALITY PLAN NO.:	**PE-QP-999-145-I 006**
VOLUME	IIB
SECTION	D
REV. NO.	06 DATE: 05.09.2013
SHEET	4 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
3.1	Actuator Chamber	Leakage & Strength	MA	Pneumatic test	100%	Mfr. Standard	No Leakage	Test Certificate	2	1	1	Refer Note-4
3.2	Body	Leakage and Pressure test (Body Mount Leakage)	MA	Hydro test	100%	ISA - S-75.19	No Leakage	Test Certificate	2	1	1	Refer Note-4
3.3	Seat leakage test for completed valve	Seat Leakage	MA	Pneumatic Test	100%	FCI-70.2	FCI-70.2	Test Certificate	2	1	1	Refer Note-4
4.0	**OPERATION TEST ON COMPLETED VALVE (Final inspection)**	1. Valve Travel	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4
		2. Opening/Closing time	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4
		3. Linearity/cam characteristic	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4
		4. Repeatability	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4
		5. Hysteresis	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4
		6. Sensitivity	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4
		7. Accuracy (Overall)	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4
		8. Control Valve characteristics / CV Test	MA	♦Measurement (Press. vs. discharge and discharge vs. opening 0-100% in steps of 10%)	One per type	As per specs/ Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Test Certificate	2	--	1	♦Size = Body & port size Or Body size & CV for non std port. Refer Note 1.

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics
RT- Radiographic Test; UT – Ultrasonic Test; PT – Dye penetrant Test; MT- Magnetic Test
$ P - Agency Performing the Test.; W - Agency Witnessing the Test.; V - Agency Verifying the Test.
1 - BHEL; 2 - Vendor; 3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)

QUALITY PLAN NO.: **PE-QP-999-145-I 006**
VOLUME IIB
SECTION D
REV. NO. 06 DATE: 05.09.2013
SHEET 5 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
		9. Operation of limit switch & solenoids and other accessories	MA	Function	100%	Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Test Report	2	1	1	On assembled valve Refer Note-4
		10. Overall dimensions	MI	Visual and dimensional	100%	Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Records	2	1	1	Refer Note-4
		11. Pre defined valve position in case of air failure	MA	Visual	100%	As per spec & Appd drg	As per spec & Appd drg	Test Certificate	2	1	1	
		12. Cleanliness, painting, stamping (for direction of flow), Tag No.	MA	Visual and dimensional	100%	Approved drg. / data sheet	As per specs/ Approved drg. / data sheet	Test Certificate	2	1	1	
5.0	**AUXILIARY ITEMS (Performance test of auxiliary items shall be performed on the completely assembled valve)**											
5.1	Positioner	Overall leakage after assembly including Nozzles leakage	MA	Leak Test (in the steady state input signal)	100 %	Mfr. Standard	No leakage	Test Certificate	3/2	---	1	Overall leakage including tubing
5.2	Air filter regulator	1. Normal air consumption	MA	Measurement	Each type	Mfr. Standard	No leakage	Test Certificate	3/2	---	1	
		2. Overall leakage	MA	Visual (soap solution)	100 %	Mfr. Standard	No leakage	Test Certificate	3/2	---	1	
5.3	Air lock relay	Performance Test	MA	Leakage test	100%	Mfr. Standard	No leakage	Test Certificate	3/2	---	1	
5.4	Electronic position transmitter(not applicable if provided integral to smart positioner)	1. Accuracy	MA	Operation	100%	Approved data sheet /	Approved data sheet /	Test Certificate	2	1	1	

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RT- Radiographic Test; UT – Ultrasonic Test; PT – Dye penetrant Test; MT- Magnetic Test
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1 - BHEL; 2 - Vendor; 3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)

QUALITY PLAN NO.: **PE-QP-999-145-I 006**
VOLUME IIB
SECTION D
REV. NO. 06 DATE: 05.09.2013
SHEET 6 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
5.5	Current to Pneumatic converter(not applicable for smart positioner)	1. Physical Verification Make/Model	MA	Visual	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Certificate	2	---	2,1	
		2. Degree of Protection	MA	IP/NEMA test	Each type	Relevant Standard	Relevant Standard	Test Certificate	3	---	2,1	
		3. Linearity	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1	
		4. Hysterisis	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1	
5.6	Smart Positioner (As Applicable)	1. Physical Verification Make/Model	MA	Visual	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Certificate	2	---	2,1	
		2. Degree of Protection	MA	IP/NEMA test	Each type	Relevant Standard	Relevant Standard	Test Certificate	3	---	2,1	
		3. Linearity	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1	
		4. Hysterisis	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1	
		5. Calibration with Hand Held Communicator	MA	Measurement	Each type	Approved data sheet / Mfr. Standard	Approved data sheet / Mfr. Standard	Test Certificate	2	1	1	
6.0	**PAINTING**	Soundness of Painting	MA	Visual and Measurement	100%	BHEL specn. / Mfr. Standard	BHEL specn. / Mfr. Standard	Inspection Report	2	---	---	Refer Note-2
7.0	**PACKING**	Soundness of Packing against transit damage	MA	Visual	100%	Mfr. Standard	Mfr. Standard	Inspection Report	2	---	---	Refer Note-3

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics
RT- Radiographic Test; UT – Ultrasonic Test; PT – Dye penetrant Test; MT- Magnetic Test
$ P - Agency Performing the Test.; W - Agency Witnessing the Test.; V - Agency Verifying the Test.
1 - BHEL; 2 - Vendor; 3 - Sub-vendor

PEM :: C&I	STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)	QUALITY PLAN NO.: **PE-QP-999-145-I 006**			
		VOLUME	IIB		
		SECTION	D		
		REV. NO.	06	DATE:	05.09.2013
		SHEET	7	OF	7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	

NOTES:

1. In case valid CV test certificate for a similar control valve(Same type, Same size, Same CV) is not submitted to BHEL by the vendor, CV test shall be conducted at FCRI/Any govt. approved laboratory/ BHEL approved Laboratory.
2. In the absence of BHEL spec. for painting, vendor to obtain BHEL's approval on their painting specification / procedure.
3. Sea worthy packing shall be provided, if applicable.
4. The quantum of check shall be 100% for manufacturer and 10% for BHEL/BHEL nominated inspection agency.
5. IBR certificates in Form III-C shall be submitted if called for in the specification/datasheet.
6. Copies of all TC's(Test Certificates) for materials duly correlated with Heat Nos., TC's for electrical items and mechanical tests(Leak/Operation) shall be submitted to BHEL for verification and acceptance.

LEGEND:
* CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics
RT- Radiographic Test; UT – Ultrasonic Test
PT – Dye penetrant Test; MT- Magnetic Test
$ P - Agency Performing the Test.; W - Agency Witnessing the Test.; V - Agency Verifying the Test.
1 - BHEL; 2 - Vendor; 3 - Sub-vendor

Instrumentation Quality Plan

STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR PRESSURE SWITCH

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	V	V	
	1.1 MODEL NO/TAG NO						
	1.2 RANGE						
	1.3 END CONN						
	1.4 NO. OF CONTACT						
2	CALIBRATION			P	V	V	
	2.1 REPEATABILITY						
	2.2 SET POINT ADJUSTMENT						
	2.3 DIFFERENTIAL						
3	OVER PR & LEAK TEST			P	V	V	
4	ELECT. INSULATION/HV TEST	ONE		P	V	V	
5	REVIEW OF TC FOR MATERIALS OF	FOR LOT		V	V	V	
	5.1 SENSOR						
	5.2 MOVEMENT						
	5.3 PROCESS CONNECTION						
	5.4 HOUSING						
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST		V	V	V	
7	REVIEW OF TC OF MICROSWITCH	FOR LOT		V	V	V	

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to carry out ROUTINE TEST on 100 %.
3. Contractor to provide compliance certificate for tests/checks verifid by contractor and the same alongwith test certificates to be verified by BHEL

STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR TRANSMITTER

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECKS FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	VISUAL.						
	MODEL/TAG No						
2	PROCESS CONNECTION			P	W	V	
3	ACCURACY			P	W	V	
4	REPEATABILITY			P	W	V	
5	HYSTERESIS			P	W	V	
6	EFFECT OF TEMP VARIATION ON ACCURACY			P	W	V	
7	SPAN / ZERO ADJUSTMENT	ONE / TYPE		P	W	V	
8	EFFECT OF SUPPLY VOLTAGE VARIATION			P	W	V	
9	EFFECT OF LOADING (500 OHM METERS)			P	W	V	
10	HIGH PRESSURE TEST	SEE NOTE-1 BELOW		P	W	V	
11	BURN-IN TEST	ONE / TYPE		P	W	V	
12	DEGREE OF PROTECTION			P	W	V	
13	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. When material corelation are not available manufacturer's compliance to be provided.
4. Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.

STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR PRESSURE & DP GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	SENSOR TYPE						
	DIAL SIZE						
	MODEL NO/TAG NO						
	RANGE/SCALE						
	SWITCH CONTACT RATING & NOS.						
	END CONNECTION						
2	CALIBRATION			P	W	V	
	ACCURACY						
	REPEATABILITY						
	SET POINT ADJUSTMENT						
3	OVER PRESSURE & LEAK TEST			P	W	V	
4	OPERATION OF PRESSURE. RELIEF DEVICE	ONE		P	W	V	
5	REVIEW OF TC FOR	FOR LOT		V	V	V	
	MATERIALS OF SENSOR						
	MOVEMENT						
	PROCESS CONNECTION						
	HOUSING						
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST		V	V	V	
7	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. Manufacturer to carry out ROUTINE TEST on 100 %.
4. When material corelation is not available, MFR's compliance to be provided
5. Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.

STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR LEVEL GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS / DRWGS	P	W	V	
	TYPE						
	MODEL/ TAG NO.						
	DAIL SIZE						
	RANGE/SCALE						
	END CONNECTION						
2	DIMENSIONS, PROCESS CONNECTION			P	W	V	
3	ACCURACY			P	W	V	
4	MATERIAL TC FOR	ONE / LOT		P	V	V	
	BODY ISO.						
	VALVE						
	GAUGE GLASS						
5	HYD. TEST	SEE NOTE-1 BELOW		P	W	V	
6	ACCESSORIES AS APPLICABLE			P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. Manufacturer to carry out ROUTINE TEST on 100 %.
4. Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.

STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR ANNUNCIATORS

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	TYPE/ MODEL						
	DIMENSIONS OF HARDWARE						
	MODULARITY						
	SEQUENCE						
	FACIA DETAILS						
2	FUNCTIONAL TEST	100%		P	W	V	
3	IMMUNE TO STEP VARIATIONS IN THE POWER SUPPLY	SEE NOTE-1 BELOW		P	W	V	
4	DEGREE OF PROTECTION FOR ENCLOSURE	TYPE TEST		P	W	V	
5	I/R CHECK	SEE NOTE-1 BELOW		P	W	V	
6	RESPONSE			P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. Manufacturer to carry out ROUTINE TEST on 100 %.
4. Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.

	Technical specification for **CONTROL & INSTRUMENTATION** **5x800 MW YADADRI TPS, NALGONDA**	SPEC NO.: **PE-TS-417-145-I**	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE : 03.04.2018
		SHEET OF	

LCP Quality Plan

PEM :: C&I

STANDARD QUALITY PLAN
FOR
LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 22-02-2008
SHEET	1 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
	INCOMING											
1.0	Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	Relevant standard	Relevant standard	Test Certificate	3	---	2	
		2. Bend Test	CR	Mech. test	Sample	Relevant standard	Relevant standard	Log Book	2	---	---	
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---	
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---	
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	---	
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	1	
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	Relevant standard	Relevant standard	Log Book	2	---	---	
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---	
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	---	---	
		4. Mill marking	MA	Visual	100%	Relevant standard	Relevant standard	Log Book	2	---	1	
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---	
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---	

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics

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1 - BHEL; 2 - Vendor; 3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
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SHEET	2 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
		3. Conductor a) Resistance b) Size c) Sheet colour	 MA MA MA	 Electrical Measurement Visual	 100% 100% 100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---	
		4. Type / Routine Test Certificates	MA	Verification	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	3	---	2	
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc.	1. Verification at make and Type	CR	Visual	Sample	BHEL Spec. and BOM	BHEL Spec. and BOM	Log Book	2	---	---	
		2. Verification of Test Certificates	CR	Scrutiny of Type / Routine T.Cs.	100%	Relevant standard	Relevant standard	Log Book	2	---	---	
		3. Operation / Functional check	CR	Electrical	Sample+ 100%@	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	+ for relay & contactors only
		4. I.R.	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	@ for all components except relays & contactors.
		5. H.V.	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	
		6. Calibration	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	1	
		7. Pick up / Drop off Voltage	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	

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PEM :: C&I

STANDARD QUALITY PLAN
FOR
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VOLUME IIB
SECTION D
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
		2. Surface defects	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
		3. IR / HV on Terminal Blocks	MA	Electrical	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
	IN PROCESS											
6.0	Blanking / Bending / Forming	1. Dimensions	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
		2. Surface defects after bending	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	---	
7.0	Nibbling / Punching	1. Cutout Sizes	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
		2. Deburring	MA	Visual	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
	ASSEMBLY											
8.0	Frame Assembly & Sheet fixing	1. Dimensions	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		2. Alignment	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		3. Welding Quality	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		4. Surface defects	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
9.0	Pre-treatment and Painting	1. Pretreatment Process	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		2. Process parameters like bath temp. concentration etc.	MA	Measurement	Periodic	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		3. Dipping / Removal Time	MA	Measurement	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		4. Surface quality after every dip	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		5. Primer after phosphating	MA	Visual, Thickness	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		6. Putty Application & Rubbing after primer	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		7. Paint first coat	MA	Visual, Thickness	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
10.	Panel Wiring	1. Wiring Layout	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		2. Wiring Termination (Crimped Lugs)	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		3. Ferrule numbers	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		4. Colour of wiring	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
		5. Size of Conductor	MA	Measurement	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
11.	Component Mounting	1. Correct components	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
		2. Fixing	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
	FINAL											
12.	Final Inspection	1. Workmanship	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.
		2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		3. Components identification Marking / Name plates	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.
		11. Wire Termination	MA	Pulling manually	Sample	-----	Firm termination	Inspection Report	2	1	1	
		12. Continuity	MA	Electrical	100%	-----	Continuity OK	Inspection Report	2	1	1	

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IEC-60947, IEC-60079	BHEL approved spec., drg relevant IEC-60947, IEC-60079	Type Test Certificate	3	---	1	
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant standard	BHEL approved spec., drg., BOM & relevant standard	Test Report	2	1	1	
15	FUCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		2. Instrument Calibratio	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant standard	BHEL approved spec/drg & relevant standard	Inspection Report	2	1	1	

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ANNEXURE II

LIST OF MAKES OF SUB-VENDOR ITEMS

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	PRESSURE VESSELS	GLOBAL STRUCTURES & COMPOSITE LTD	-	
		JASMINO POLYMERTECH	TALOJA	
		SYSCON ENGINEERS	AMBERNATH	
		S.V. FABRICATORS	NAVI MUMBAI	
		SPARK FABRICATORS / STEELCON	-	
		ANUP ENGINEERING	AHMEDABAD	
		MURTHAL TANKS & VESSELS	SONEPAT	
		TITAN ENGG.	DURGAPUR	
		RISHI INDUSTRIES	BAHALGARH	
		UNIVERSAL HEAT EXCHANGERS	-	
		ATS CHEM	SALEM/HOSUR	
		CHEM PROCESS SYSTEM	SANAND	
		PROGEN	CHENNAI	
		CRYSTAL ENGINEERING	HOSUR	
		ISHAN EQUIPMENTS	VADODARA	
2.	ATMOSPHERIC/ STORAGE TANKS	GLOBAL STRUCTURES & COMPOSITE LTD	-	
		JASMINO POLYMERTECH	TALOJA	
		SYSCON ENGINEERS	AMBERNATH	
		S.V. FABRICATORS	NAVI MUMBAI	
		SPARK FABRICATORS / STEELCON	-	
		ANUP ENGINEERING	AHMEDABAD	
		MURTHAL TANKS & VESSELS	SONEPAT	
		TITAN ENGG.	DURGAPUR	
		RISHI INDUSTRIES	BAHALGARH	
		UNIVERSAL HEAT EXCHANGERS	-	
		ATS CHEM	SALEM/HOSUR	
		CHEM PROCESS SYSTEM	SANAND	
		PROGEN	CHENNAI	
		CRYSTAL ENGINEERING	HOSUR	
		ISHAN EQUIPMENTS	VADODARA	
3.	RUBBER LINING (AT SHOP)	TEMSEC	KOLKATA	
		RISHI INDUSTRIES	SONEPAT	
		CORI ENGINEERS	CHENNAI	
		POLY RUBBER	MUMBAI	
		INDUSTRIAL LINING	VADODARA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		ARUL RUBBERS	CHENNAI	
		JASMINO POLYMERTECH	TALOJA	
		WESTERN RUBBER	NAVI MUMBAI	
		ELASTOMER LINNING	AMBERNATH	
		EMKAY RUBBER	MUMBAI	
4.	AIR BLOWERS (TWIN LOBE TYPE)	SWAN PNEUMATIC	NOIDA	
		EVEREST TRANSMISSION	NEW DELHI	
		KAY INTERNATIONAL	NEW DELHI / SONEPAT	
		EVEREST BLOWER	BAHADURGARH	
		KULKARNI POWER TOOLS	KOLHAPUR/ PUNE	
5.	METERING PUMPS	VK PUMPS	NASIK	
		MILTON ROY INDIA	CHENNAI	
		SWELLORE	AHMEDABAD	
		POSITIVE METERING PUMPS	NASIK	
		METACHEM	MUMBAI	
6.	AGITATOR	REMI PEOCESS PLANT & M/C	MUMBAI	
		FIBRE & FIBRE	MUMBAI / SILVASA	
		CEECONS	CHENNAI	
		STANDARD ENGINEERS	MUMBAI	
7.	HORIZONTAL CENTRIFUGAL PUMPS	BEST AND CROMPTON ENGG LTD.	CHENNAI	
		BHARAT PUMPS & COMPRESSORS LTD	ALLAHABAD	
		FLOWMORE LTD.	GURGAON	
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATORE	
		JYOTI LTD.	VADODARA	
		KIRLOSKAR BROTHERS LTD	PUNE	
		WILO MATHER & PLATT PUMPS PVT. LTD.	PUNE	
		V-FLO PUMPS & SYSTEMS CO. LTD.,	BEIJING-CHINA	
		WPIL LIMITED	KOLKATA	
8.	VERTICAL CENTRIFUGAL PUMPS	BHARAT PUMPS & COMPRESSORS LTD	ALLAHABAD	
		FLOWMORE LTD.	GURGAON	
		FLOWSERVE INDIA CONTROLS PVT. LTD.	COIMBATORE	
		JYOTI LTD.	VADODARA	
		WILO MATHER & PLATT PUMPS PVT. LTD.	PUNE	
		SULZER PUMPS INDIA LTD.	THANE	
		WPIL LIMITED	KOLKATA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
9.	HORIZONTAL CENTRIFUGAL PUMPS (RUBBER LINED)	KISHORE PUMPS	PUNE	
		SU MOTORS	MUMBAI	
10.	NON METALLIC (PP/FRP) HORIZONTAL CENTRIFUGAL PUMPS	ENGINEERS COMBINE	THANE	
		ANTICORROSIVE	VALSAD	
		LEAK PROOF PUMPS PVT. LTD. (RAJEDIA)	-	
11.	MISC. PUMP VERTICAL TURBINE TYPE	KBL	PUNE	
		M&P	PUNE	
		WPIL	GHAZIABAD	
		KISHORE PUMPS	PUNE	
		FLOWMORE	SAHIBABAD	
12.	DC BATTERY CHARGER FOR PLC	AMARA RAJA POWER SYSTEMS LIMITED	TAMIL NADU	
		CHHABI ELECTRICALS PVT.LTD.	MAHARASHTRA	
		CHLORIDE POWER SYSTEMS & SOLUTIONS LIMITED	KOLKATA	
		DUBAS ENGG PVT LTD	BANGALORE	
		EMERSON NETWORK POWER (INDIA) PVT. LTD.	MAHARASHTRA	
		HBL POWER SYSTEMS LTD	HYDERABAD	
		JEMA ENERGY	SPAIN	FOR STATIC SCR TYPE FULL WAVE FULLY CONTROL TYPE
		MASS-TECH CONTROLS PVT.LTD.	MUMBAI	
		STATCON POWER CONTROLS LTD	NOIDA (U.P)	
13.	UNDER BED NOZZLE	JONSONS SCREEN	AUSTRALIA/ IRELAND	
14.	COATING & WRAPPING MATERIAL TAPE	IWL LTD.	CHENNAI	
		MP TAR PRODUCT	BHILAI	
		PORWAL INDUSTRIES	RAIPUR	
		RUSTECH	KOLKATA	
		STP	JAMSHEDPUR	
15.	HEATER	ESCORTS	FARIDABAD	
		RACOLDS	FARIDABAD	
16.	RESIN	ROHM & HASS	FRANCE / USA	
		LANXESS	GERMANY	
		PUROLITE	ROMANIA/CHINA	
17.	HIGH PRESSURE BUTTERFLY VALVE	DeZURICK (Upto 400 NB)	USA	
		TYCO VALVES (UPTO 450 NB)	USA	
		BRAY	-	
18.	BALL VALVE (HIGH	VELAN	CANADA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
	PRESSURE) SIZE 100 NB	BRAY	USA	
19.	CAST IRON GATE/GLV/NRV/SRV	A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		G.M. DALUI AND SONS PVT.LTD.	HOWRAH	
		H.SARKER AND COMPANY	HOWRAH	
		LEADER VALVES LTD.	JALANDHAR	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
20.	BALL VALVE (MANUAL /PNEUMATIC/ ELECTRIC) CLASS 150	A.V. VALVES LTD	AGRA	
		AKAY INDUSTRIES PVT.LTD.	DHARWAD	
		BELGAUM AQUA VALVES PVT. LTD.	BELGAUN	
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS.	CHENNAI	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		DEMBLA VALVES LTD.	THANE	
		M/S GM ENGINEERING	RAJKOT	
		HAWA VALVES (INDIA) PVT. LTD.	NAVI MUMBAI	
		INTERVALVE (INDIA) LTD.	PUNE	
		LEADER VALVES LTD.	JALANDHAR	
		MICROFINISH VALVES PVT LTD.	HUBLI	
		NILON VALVES PRIVATE LIMITED	AHMEDABAD	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		UNIFLOW	CHENNAI	
		VALTECH INDUSTRIES	MUMBAI	
		VAAS AUTOMATION PVT. LTD.	NEW DELHI	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
21.	ELECTRIC MOTOR	CROMPTON GREAVES	NEW DELHI	
		LAXMI HYDRAULICS PVT. LTD	MAHARASHTRA	
		RAJINDRA ELECT INDUSTRIES	MUMBAI	
		GE-POWER	CHENNAI	
		BHARAT BIJLEE LTD.	NEW DELHI	
		SIEMENS	GURGAON	
		NGEF	NEW DELHI	
		KIRLOSKAR ELECTRIC CO LTD.	BANGALORE	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		ASEA BROWN BOVERI (ABB)	HARYANA	
		MARATHON	FARIDABAD	
22.	BUTTER-FLY VALVE	ADVANCE VALVES PVT. LTD.	NOIDA	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		INSTRUMENTATION LTD.	PALAKKAD	
		INTERVALVE (INDIA) LTD.	PUNE	
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		PENTAIR VALVES AND CONTROLS INDIA PRIVATE LIMITED	NAVI MUMBAI	
		UPADHAYA VALVES MANUFACTURERS PRIVATE LIMITED,	KOLKATA	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
23.	DIAPHRAGM VALVE (MANUAL / PNEUMATIC) CLASS 150	WEIR BDK	HUBLI	
		CRANE FLOW PROCESS	SATARA	
		PROCON	MUMBAI	
		MAJESTIC VALVES (LABLINE)	-	
		HAWA ENGINEERS	AHMEDABAD	
24.	DUAL PLATE CHECK VALVES	ADVANCE VALVES PVT. LTD.	NOIDA	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	1. DUAL PLATE CHECK VALVE CI - CLASS 150 & UP TO 600NB, 2. DUAL PLATE CHECK VALVE CCS - CLASS 150 & UP TO 500NB
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CI, CCS & STAINLESS STEEL SPRING ASSISTED DUAL PLATE CHECK VALVES UPTO 700 NB AND 150 CLASS RATING.
25.	Y-TYPE STRAINER / STRAINER (WATER SERVICE)	OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		GRAND PRIX	NEW DELHI	

	TITLE : 5X800 MW YADADRI THERMAL POWER STATION	SPECIFICATION NO. PE-TS-417-155A-A001	
		SECTION : I	
	TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	SUB-SECTION: IA	
		REV. NO. 00	DATE :

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		JAYPEE	NEW DELHI	
		GREAVES COTTON	MUMBAI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI / NOIDA	
		FILTERATION ENGINEERS (I) PVT. LTD	MUMBAI	
		FLUIDNYE	-	
		SUNGOV ENGINEERING PVT. LTD.	DELHI	
		GRAND PRIX	FARIDABAD	
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
		BHATIA ENGINEERING CO.	DELHI	
26.	RUBBER FLAP TYPE CHECK VALVES	ASHVIK VALVES	-	
		FLOW WAY VALVES	-	
		BDK	-	
		MAJESTIC VALVES (LABLINE INST)	-	
		ADVANCE VALVES	-	
27.	MEMBRANES	DOW		
		TORAY		
		KOCH		
		HYDRONOTICS		
		NORIT		
28.	CHAIN PULLEY BLOCK	ARMSEL MHE PVT. LTD	BANGALORE	
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 10 TONNE.
		TRACTEL TIRFOR INDIA PVT. LTD.	FARIDABAD	
		TECHNO INDUSTRIES	AHMEDABAD	
		ARMSEL MHE PVT. LTD	BANGALORE	
		ALPHA SERVICES	BHIWADI	
		CONSOLIDATED HOISTS PVT LTD	PUNE	UPTO 20 TONNES
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		EDDY CRANES PVT. LTD.	MUMBAI	CAPACITY UPTO 10 TONS. BOIS BHEL APP.SUB-VENDORS.
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD,	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		GLOBAL TECHNOLOGIES	HYDERABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		MANGLA HOISTS PVT LTD	NEW DELHI	
		MEEKA MACHINERY PVT. LTD.	AHMEDABAD	
		REVA INDUSTRIES LTD.	FARIDABAD	UPTO 25.0 T CAPACITY.
		ROCKWELL HOISTO CRANES PVT. LTD.	BAHADURGARH	
		SAFEX ENERGY PVT. LTD.	AHMEDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 15 TONNES.
		TECHNO INDUSTRIES	AHMEDABAD	
29.	ELECTRIC HOIST	ARMSEL MHE PVT. LTD	BANGALORE	
		ALPHA SERVICES	BHIWADI	
		CONSOLIDATED HOISTS PVT LTD	PUNE	UPTO 20 TONNES
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		EDDY CRANES PVT. LTD.	MUMBAI	CAPACITY UPTO 10 TONS. BOIS BHEL APP.SUB-VENDORS.
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD,	
		GLOBAL TECHNOLOGIES	HYDERABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	DELHI	
		MANGLA HOISTS PVT LTD	NEW DELHI	
		MEEKA MACHINERY PVT. LTD.	AHMEDABAD	
		REVA INDUSTRIES LTD.	FARIDABAD	UPTO 25.0 T CAPACITY.
		ROCKWELL HOISTO CRANES PVT. LTD.	BAHADURGARH	
		SAFEX ENERGY PVT. LTD.	AHMEDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 15 TONNES.
		TECHNO INDUSTRIES	AHMEDABAD	
30.	CABLE GLAND	ALLIED TRADERS & EXPORTERS	NOIDA (U.P.)	
		ARUP ENGG & FOUNDARY WORKS	CALCUTTA	
		BALIGA LIGHTING EQPT.PVT.LTD.	CHENNAI	
		COMMET BRASS PRODUCTS	MUMBAI	
		DOWELLS	MUMBAI	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		ELECTROMAC INDUSTRIES	MUMBAI	
		INCAB	KOLKATA	
31.	CABLE LUGS	DOWELLS	MUMBAI	
		UNIVERSAL MACHINES LTD.	CALCUTTA	
32.	MS PLATES	SAIL		
		ESSAR STEEL		
		TISCO		
		RINL		
		JINDAL		
		LLOYD		
		ISPAT		
		INDIAN IRON & STEEL CO. LTD		
33.	CS PIPE (ASTM A 106 GR. B)	INDIAN SEAMLESS METAL TUBES	AHMEDABAD	UPTO 150 NB
		MAHARASHTRA SEAMLESS	RAIGAD	UPTO 350 NB
34.	MS PIPES (IS: 1239 & 3589)	SAIL	ROURKELA	
		JINDAL	GHAZIBAD/HISSAR	
		SURYA ROSHNI	BAHADUR GARH	
		TATA TUBE	JAMSHEDPUR	
		PSL	CHENNAI/VIZAG/KUTCH/DAMAN	
		LALIT PROFILE	THANE	
		SAMSHI PIPES INDUSTRIES	VADODARA	
		MUKUT PIPES	RAJPURA	
		INDUS TUBES	G B NAGAR	
		MANN IND	INDORE	
		SURENDRA ENGG	RAJPURA	
		PRATIBHA PIPES & STRUCTURE PVT LTD	THANE	
		JCO GAS PIPE	CHINDWARA	
		NUKAT TANKS AND VESSELS	TARAPUR	
		DADU PIPES	SIKRANDRABAD	
		GOOD LUCK TUBES	SIKANDRABAD	
		ADVANCE STEEL TUBES	SAHIBABAD	
		BIHAR TUBES	SIKANDRABAD	
		HI TECH PIPES	SIKANDRABAD	
		RATNAMANI	KUTCH/AHMEDABAD/CHHATRAL	
		MAHARASHTRA SEAMLESS	RAIGAD	
		WELSPUN	ANJAR/BHARUCH	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
35.	SS PIPES / TUBES	APEX TUBES	BEHROR (ALWAR)	
		RATNAMANI	CHATTRAL	
		REMI	TARAPUR	
		PRAKASH STEELAGE	-	
36.	SAFETY SHOWER	UNICARE	-	
		MOHAN INDUSTRIES	-	
		SUPER SAFETY SERVICES	-	
37.	FRP TANKS & FITTINGS	GLOBAL COMPOSITE	-	
		EPP	-	
		DEEPA COMPOSITE	-	
		COROSEAL INDUSTRIES	-	
		CHEMICAL PROCESS & EQUIPMENT PVT LTD	-	
		J.R FIBRE INDUSTRIES PVT LTD	-	
		POLYPLAST	-	
38.	EJECTOR	ESSEM TECHNOLOGIES	-	
		RATNA PRASAD	-	
39.	TANK (FRP)	INDUSTRIAL SERVICE	KOLKATA	
		SUNRISE	BARODA	
		GANDHI & ASSOCIATES	AHMEDABAD	
		MODERN EQUIPMENTS	CHENNAI	
		EAGLE PLAST	PUNE	
		OMEGA PLAST	MUMBAI	
40.	STROKE CONTROLLER	V K PUMPS	NASIK	
		METACHEM	MUMBAI	
		SWELORE	AHMEDABAD	
		MILTON ROY INDIA	CHENNAI	
41.	SAFETY VALVES/RELIEF VALVES	METACHEM	MUMBAI	
		KEYSTONE	BARODA	
		V K PUMPS	NASIK	
		MILTON ROY	CHENNAI	
42.	DUPLEX STRAINER	JAYPEE INDUSTRIES PVT. LTD.	NEW DELHI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI	
		OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		SUNGOV ENGINEERING PVT. LTD.	CHENNAI	
43.	STEEL GATE/GLOBE/NR VALVES	A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	JALANDHAR	(1) CARBON STEEL GATE VALVES &

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
				NON RETURN VALVES: 15 NB TO 50 NB (#800) & 65 NB TO 300 NB (#150) (2) CARBON STEEL GLOBE VALVES: 15 NB TO 50 NB (#800) & 65 NB TO 200 NB (#150)
		FLUIDLINE VALVES COMPANY PVT.LTD.	KAUSHAMBI	
		M/S GM ENGINEERING	RAJKOT	
		INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C)SUPPLIER NOT REGISTERED FOR NR VALVES
		LEADER VALVES LTD.	JALANDHAR	
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
		NSSL LIMITED.	NAGPUR	
		STEEL STRONG VALVES (I) PVT.LTD.,	NAVI MUMBAI	LIMITED TO RANGES & CLASSES AS AVAILABE IN VD FILE.
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CC/CSS-GATE-BBT-UPTO600NB CL UPTO300,GATE-PSBT UPTO250NB CL 1500,GLV-BBT-UPTO300NB CL UPTO600,SCNRV-BBT-UPTO600NB CL UPTO150,SCNRV-BBT-UPTO300NB CL 300,SCNRV-PSBT-UPTO150NB CL UPTO900
		VALTECH INDUSTRIES	MUMBAI	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZ

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
				E-GV/150/900,GV/300/400, GV/600/300 , GV/GLV/NRV/900/250 , GLV/300/300,GLV/150/350/ , SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.
		V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
44.	SLUICE GATE	H SARKAR	KOLKATA	
		JASH ENGINEERING	-	
		YASHWANT INDUSTRIES	-	
45.	3 WAY VALVE	HI TECH	AHMEDABAD	
		ADVANCE VALVES PVT.LTD	NOIDA	
		BDK	HUBLI	
		FOURESS ENGG.INDIA LTD.	MUMBAI	
		FLUIDLINEVALVES COMPANY PRIVATE LTD.,	MUMBAI	
		INSTRUMENTATION LTD.	PALAKAD	
		KIRLOSKAR BROTHERS LTD.	PUNE	
		VENUS PUMP & ENGG. WORKS	KOLKATA	
		SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY	CHENNAI	
		STAFFORD CONTROLS LIMITED	PUNE	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
46.	PLUG VALVE(MANUAL)	BDK	HUBLI	
		HAWA ENGINEERS / MARCK & CARE	-	
		MICON VALVES	-	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
47.	FITTINGS (CS/SS)	M.S. FITTINGS	KOLKATA	
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
		TUBE PRODUCTS	BARODA	
		NL HAZRA	KOLKATA	
		GUJRAT INFRA PIPES	BARODA	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		EDWARDS	USA	
		PIPEFIT ENGINEERS	BARODA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
48.	FLANGES (SS/CS)	PRADEEP METALS LTD	MUMBAI	
		TUBE PRODUCT INCOROPORATION	BARODA	
		MS FITTINGS	KOLKATA	
		HAWA ENGINEERING	-	
		ALIANCE PIPE & PLANGES	KOLKATA	
		JAI AMBE	MUMBAI	
49.	PIPE & FITTING (PP,HDPE,PVC & CPVC)	GEROGE FISHCHER	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
		JAIN IRRIGATION	-	
		ORIPLAST	-	
50.	VALVES (GATE/GLOBE/NRV/BALL)- (PP,HDPE,PVC & CPVC)	GEROGE FISHCHER IPING SYSTEMS PVT LTD	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
		JAIN IRRIGATION	-	
		ORIPLAST	-	
51.	FILTER MEDIA	GLOBAL ABSORBENT	KOLKATA	
		BHARAT MINERALS		
52.	DC LEAD ACID BATTERIES	EXIDE INDUSTRIES LTD	NEW DELHI	
		HBL POWER SYSTEMS LTD	HYDERABAD	TUBULAR TYPE
		HOPPECKE BATTERIEN GMBH & CO.KG,	GERMANY	
53.	DC NI CD BATTERIES	AMCO SAFT INDIA LTD	BANGALORE	
		HBL POWER SYSTEMS LTD	HYDERABAD	
54.	PAINT	ASIAN PAINTS (I) LTD.		
		BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		JOTUN PAINTS		
55.	PNEUMATIC ACTUATOR	PROCON ENGINEERS	-	
		TYCO	-	

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		CRANE PROCESS	-	
		BDK	-	
		INTERVALVE	-	
		BRAY CONTROL	-	
56.	FRP CABLE TRAYS & ACCESSORIES	EPP COMPOSITES PRIVATE LIMITED	Rajkot-Gujarat	
		SUMIP COMPOSITES PVT.LTD.	Ahmedabad-Gujarat	

NOTE:

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

   BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.

2. DEALERS ARE NOT ACCEPTABLE FOR ANY ITEM OF THE PACKAGE. BIDDER SHALL PROCURE ALL ITEMS INCLUDING PLATES, STRUCTURAL, FLANGES; COUNTER FLANGES ETC. FROM APPROVED SUB VENDOR ONLY.

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

LIST OF MAKES OF SUB-VENDOR C&I ITEMS

Sl No	Package Name	Supplier Name
1	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.
2	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	DRESSER INDUSTRIES INC.
3	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Barksdale GmbH, Germany
4	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	GENERAL INSTRUMENTS CONSORTIUM
5	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	PRECISION MASS PRODUCTS PVT. LTD.
6	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SOR INC.
7	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS (INDIA) LIMITED
8	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS INDUSTRIES LIMITED
9	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Kaustubha Udyog,
10	ANALYTICAL INSTS.SAMPLE COOLER	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.
11	ANALYTICAL INSTS.SAMPLE COOLER	FORBES MARSHAL PVT. LTD.
12	ANALYTICAL INSTS.SAMPLE COOLER	SIEMENS LIMITED
13	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.
14	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.
15	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES
16	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.
17	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD
18	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.
19	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.
20	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.
21	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited
22	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,
23	TEMPERATURE GAUGE	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,
24	TEMPERATURE GAUGE	FORBES MARSHALL (HYD) LTD.
25	TEMPERATURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD
26	TEMPERATURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.
27	TEMPERATURE GAUGE	H.GURU INDUSTRIES
28	TEMPERATURE GAUGE	GOA THERMOSTATIC INSTRUMENTS PVT.LTD.
29	TEMPERATURE GAUGE	A.N. INSTRUMENTS PVT. LTD.
30	TEMPERATURE GAUGE	Baumer Technologies India Pvt. Ltd.

31	TEMPERATURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.
32	LEVEL GAUGE	TOSHNIWAL BROTHERS PVT.LTD.
33	LEVEL GAUGE	SIGMA INSTRUMENTS CO.
34	LEVEL GAUGE	BLISS ANAND PVT. LTD.
35	TEMP. ELEMENT	PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD.
36	TEMP. ELEMENT	Baumer Technologies India Pvt. Ltd.
37	TEMP. ELEMENT	DETRIVE INSTRUMENTATION & ELECTRONICS LTD.
38	TEMP. ELEMENT	Nesstech Instruments Private Limited
39	TEMP. ELEMENT	Thermal Instrument India Pvt. Ltd.
40	TEMP. ELEMENT	GAUGE BOURDON INDIA PVT. LTD.
41	TEMP. ELEMENT	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,
42	TEMP. ELEMENT	TOSHNIWAL INDUSTRIES PVT. LTD.,
43	TEMP. ELEMENT	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,
44	TEMP. ELEMENT	Tempsens Instrument (I) Pvt Ltd
45	TRANSMITTERS	YOKOGAWA INDIA LIMITED,
46	TRANSMITTERS	ABB INDIA LIMITED
47	TRANSMITTERS	V. AUTOMAT & INTRUMENTS (P) LTD.
48	TRANSMITTERS	Pune Techtrol Pvt. Ltd.
49	TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,
50	TRANSMITTERS	SBEM PVT. LTD.
51	TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,
52	TRANSMITTERS	Moore Industries International Inc.
53	TRANSMITTERS	PANAM ENGINEERS
54	TRANSMITTERS	Honeywell Automation India Limited
55	TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.
56	TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL
57	TRANSMITTERS	SIEMENS LIMITED
58	TRANSMITTERS	NIVO CONTROLS PVT. LTD.
59	TEMPERATURE SWITCH	SOR INC.
60	TEMPERATURE SWITCH	TOSHNIWAL BROTHERS PVT.LTD.
61	TEMPERATURE SWITCH	DRESSER INDUSTRIES INC.
62	TEMPERATURE SWITCH	INDFOS (INDIA) LIMITED
63	TEMPERATURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.
64	SIGHT FLOW INDICATORS	V. AUTOMAT & INTRUMENTS (P) LTD.
65	SIGHT FLOW INDICATORS	BLISS ANAND PVT. LTD.
66	SIGHT FLOW INDICATORS	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,
67	SIGHT FLOW INDICATORS	B.K.EQUIPMENTS PVT.LTD.
68	SIGHT FLOW INDICATORS	SIGMA INSTRUMENTS CO.
69	SIGHT FLOW INDICATORS	INSTRUMENTATION ENGINEERS PVT LTD
70	DIFFERENTIAL PRESSURE SWITCH	SOR INC.
71	JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.
72	JUNCTION BOX	SUCHITRA INDUSTRIES
73	JUNCTION BOX	Shrenik & Company,
74	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.
75	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS
76	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS
77	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.
78	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES
79	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED

80	ROTAMETER	INSTRUMENTATION ENGINEERS PVT LTD
81	ROTAMETER	Flow Star Engineering Pvt. Ltd.,
82	ROTAMETER	TANSA EQUIPMENTS PVT. LTD.
83	ROTAMETER	EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.
84	ROTAMETER	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,
85	LEVEL SWITCH-CAPACITANCE TYPE	SIGMA INSTRUMENTS CO.
86	LEVEL SWITCH-CAPACITANCE TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,
87	LEVEL SWITCH-CAPACITANCE TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.
88	LEVEL SWITCH-CAPACITANCE TYPE	LEVCON INSTRUMENTS PVT. LTD.
89	LEVEL SWITCH-CAPACITANCE TYPE	Flow Star Engineering Pvt. Ltd.,
90	LEVEL SWITCH-CAPACITANCE TYPE	Pune Techtrol Pvt. Ltd.
91	LEVEL SWITCH-CAPACITANCE TYPE	Baumer Technologies India Pvt. Ltd.
92	LEVEL SWITCH-CONDUTIVITY TYPE	Sapcon Instrument Pvt Ltd.
93	LEVEL SWITCH-CONDUTIVITY TYPE	LEVCON INSTRUMENTS PVT. LTD.
94	LEVEL SWITCH-CONDUTIVITY TYPE	BLISS ANAND PVT. LTD.
95	LEVEL SWITCH-CONDUTIVITY TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.
96	LEVEL SWITCH-CONDUTIVITY TYPE	HI-TECH SYSTEMS & SERVICES LTD.
97	LEVEL SWITCH-CONDUTIVITY TYPE	RAMAN INSTRUMENTS PVT.LTD.
98	LEVEL SWITCH-CONDUTIVITY TYPE	SIGMA INSTRUMENTS CO.
99	LEVEL SWITCH-CONDUTIVITY TYPE	SOR INC.
100	LEVEL SWITCH-FLOAT TYPE	Pune Techtrol Pvt. Ltd.
101	LEVEL SWITCH-FLOAT TYPE	D.K. INSTRUMENTS PVT.LTD.
102	LEVEL SWITCH-FLOAT TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.
103	LEVEL SWITCH-FLOAT TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,
104	LEVEL SWITCH-FLOAT TYPE	LEVCON INSTRUMENTS PVT. LTD.
105	LEVEL SWITCH-FLOAT TYPE	GENERAL INSTRUMENTS CONSORTIUM
106	LEVEL SWITCH-FLOAT TYPE	SBEM PVT. LTD.
107	LEVEL SWITCH-FLOAT TYPE	Baumer Technologies India Pvt. Ltd.
108	LEVEL SWITCH-FLOAT TYPE	SIGMA INSTRUMENTS CO.
109	LEVEL SWITCH-FLOAT TYPE	SOR INC.
110	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS
111	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.
112	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED
113	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES
114	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.
115	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.
116	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.
117	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES
118	INSTRUMENT FITTINGS	AURA INCORPORATED
119	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.
120	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.
121	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS
122	INSTRUMENT FITTINGS	PANAM ENGINEERS
123	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.
124	ELECTROMAGNETIC FLOW METER	V.A Valves
125	ELECTROMAGNETIC FLOW METER	Adept Fluidyne Pvt. Ltd.
126	ELECTROMAGNETIC FLOW METER	Electronet Equipments Pvt Ltd.
127	ELECTROMAGNETIC FLOW METER	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,

ANNEXURE

Sl.No	Package Name	Vendor Sl. No	Vendor proposed for approval	TSGENCO Remarks for YTPS (5x800MW)
1.	FLOW ELEMENT-ORIFICE	1	ASIAN INDUSTRIAL VALVES & INSTRUMENTS, TAMILNADU	Approved.
		2	GENERAL INSTRUMENTS CONSORTIUM, TAMILNADU	Approved.
		3	INSTRUMENTATION LTD., KERALA	Approved.
		4	INSTRUMENTATION ENGINEERS PVT LTD., HYDERABAD	Approved.
		5	MICRO PRECISION PRODUCTS PVT. LTD., HARYANA	Approved.
		6	STAR-MECH CONTROLS (I) PVT.LTD., PUNE	Approved.
		7	CHEMTROLS INDUSTRIES PVT. LTD., MUMBAI	Not Approved.
		8	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD., KARNATAKA	Not Approved.
		9	TANSA EQUIPMENTS PVT. LTD., MUMBAI	Approved.

		10	HYDROPNEUMATICS PVT. LTD., GOA	Approved.
		~~11~~	~~MINCO (INDIA) PRIVATE LIMITED, GOA~~	~~Not Approved.~~
		~~12~~	~~MINCO (INDIA) FLOW ELEMENTS PVT. LTD., GOA~~	~~Not Approved.~~
		~~13~~	~~SCIENTIFIC DEVICES (BOMBAY) PVT LTD, MUMBAI~~	~~Not Approved.~~
		14	FLOW STAR ENGINEERING PVT. LTD., FARIDABAD	Approved.
2.	FLOW ELEMENT-NOZZLE	1	ASIAN INDUSTRIAL VALVES & INSTRUMENTS,TAMILNADU	Approved.
		2	BOPP & RUETHER HEINRICHS MESSTECHNI,GERMANY	Approved.
		3	GENERAL INSTRUMENTS CONSORTIUM,NEWDELHI	Approved.
		4	HYDROPNEUMATICS PVT. LTD., GOA	Approved.
		5	INSTRUMENTATION LTD., KERALA	Approved.
		6	MICRO PRECISION PRODUCTS PVT. LTD., HARYANA	Approved.
		7	STAR-MECH CONTROLS (I) PVT.LTD., PUNE	Approved.
		8	TECHNOMATIC ITALY	Approved.

		9	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD., KARNATAKA	Not Approved.
		10	MINCO (INDIA) FLOW ELEMENTS PVT. LTD., GOA	Approved.
		11	MINCO (INDIA) PRIVATE LIMITED, GOA	Not Approved.
3.	CONTROL VALVE	1	BTG KALLE INVENTING, SWEDEN	Approved.
		2	CONTROL COMPONENT INC.,NEW DELHI	Approved.
		3	DAUME REGELARMATUREN GMBH,	Approved.
		4	DRESSER VALVE INDIA PVT. LTD, TAMIL NADU	Approved.
		5	DRESSER PRODUITS INDUSTRIELS, FRANCE	Approved.
		6	EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	Approved.
		7	FORBES MARSHALL ARCA PVT.LTD., PUNE	Approved.
		8	FISHER SANMAR LTD., NEWDELHI	Approved.

9	FLOWSERVE INDIA CONTROLS PVT. LTD.,KOLKATA	Approved.
10	INSTRUMENTATION LTD., KERALA	Approved.
11	KSB MIL CONTROLS LTD., KERALA	Approved.
12	KOSOFLUID CONTROLS PALAKKAD, KERALA	Approved.
13	KOSO INDIA PRIVATE LIMITED, MAHARASHTRA	Approved.
14	LESLIE CONTROLS, INC, USA	Approved.
15	SEVERN GLOCON INDIA PVT. LTD., TAMIL NADU	Approved.
16	BOMAFA SPECIAL VALVE SOLUTIONS PVT LTD., GUJARAT	Approved.
17	MASCOT VALVES PVT. LTD., GUJARAT	Approved.
18	R.K.CONTROL INSTRUMENTS PVT. LTD., MAHARASHTRA	Approved.
19	SUZHOU DELAN ENERGY SCIENCE & TECHNOLOGY CO., LTD., CHINA	Not Approved.

		20	VALVITALIA S.P.A. , ITALY	Not Approved.
		21	WALDEMAR PRUSS ARMATURENFABRIK GMBH, GERMANY	Not Approved.
4.	ULTRASONIC FLOWMETER	1	CHEMTROLS INDUSTRIES LTD, MUMBAI	Approved.
		2	FLASH FORGE MUMBAI	Approved.
		3	ADEPT FLUIDYNE PVT. LTD., MAHARASHTRA	Approved.
		4	ELECTRONET EQUIPMENTS PVT LTD., PUNE	Approved.
		5	FLEXIM FLEXIBLE INDUSTRIEMESSTECHNIK GMBH, GERMANY	Not Approved.
		6	NIVUS GMBH, GERMANY	Not Approved.
		7	ROCKWIN FLOWMETER INDIA PVT. LTD., GHAZIABAD (UP)	Not Approved.

Sl No.	Package Name	Vendor Name	LOCATION
1	LOCAL CONTROL PANELS	C and S ELECTRIC LTD.	New Delhi
		PYROTECH ELECTRONICS PVT. LTD.	Udaipur
		PROCON INSTRUMENTATION PVT. LTD.	Chennai
		INDUSTRIAL CONTROLS & APPLIANCES PVT LTD	Mumbai
2	ANALYSERS (ALL TYPES)	ABB INDUSTRIES AG	SWITZERLAND.
		ROSEMOUNT ANALYTICAL INC	IRVINE
		ENDRESS + HAUSER INDIA PVT. LTD.	MUMBAI
		HACH LANGE S.A.R.L CH-1222,	VESENAZ
		SWAN Analytische Instrumente AG, CH-8340	Hinwii
		METTLER-TOLEDO INDIA PVT. LTD.,	MUMBAI
		THERMO ORION INC	BEVERLY
3	UPS	EMERSON NETWORK POWER,	AMBERNATH
		EMERSON NETWORK POWER	PUNE
		HITACHI-HIREL,	GANDHINAGAR
		KELTRON,	TRIVANDRUM
		CONSUL NEOWATT POWER SOLUTIONS,	PUNE
5	MOTORISED ACTUATOR	ROTARK	UK
		AUMA	Bengaluru
		WEIR BDK VALVES	Hubli
		LIMITORQUE	Faridabad
6	AIR FILTER REGULATOR	PLACKA	Chennai
		SHAVO-NORGREN	Mumbai
		SCHRADER SCHORILL DUNCAN LTD.	Mumbai
		FAIRCHILD	USA
		SMC PNEUMATICS	Noida
7	SOLENOID VALVE	ASCO	USA
		ROTEX	Vadodra
		SCHRADER	Pune
		AVCON	Mumbai
		HERION-NORGREN	Germany
		IMI-NORGREN	Germany
		JAFFERSON	Argentina

Notes :-

1) The above sub-vendor list is tentative & reference only. However sub-vendor list is subject to BHEL/end user approval without any commercial/ delivery implication.

2) New subvendor, if proposed by vendor during contract stage shall be subject to BHEL/end user approval without any commercial implication.

NOTE:

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

   BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.

2. DEALERS ARE NOT ACCEPTABLE FOR ANY ITEM OF THE PACKAGE. BIDDER SHALL PROCURE ALL ITEMS INCLUDING PLATES, STRUCTURAL, FLANGES; COUNTER FLANGES ETC. FROM APPROVED SUB VENDOR ONLY.

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

ANNEXURE-III

PERFORMANCE GUARANTEES

VOLUME : X

SECTION-I

PERFORMANCE GUARANTEES

1.00.00 **PERFORMANCE GUARANTEES, PERFORMANCE/ACCEPTANCE TESTS & LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE**

1.01.00 The Bidder shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment covered in this specification. The guarantees are categorised as:

a) Those which attract liquidated damages, as listed below (Category-"A"). The Bidder shall furnish signed declarations in the manner prescribed in the bid proposal schedules for these guarantees.

b) Those which do not attract liquidated damages, as listed below (Category-"B"). This guarantee list indicated in this section is not exhaustive and the Owner reserves the right to call upon the Bidder to demonstrate any parameter, operation, etc. of any equipment as specified and as required to meet the duty conditions.

1.02.00 The guaranteed parameters shall be without any tolerance values. The Bidder shall demonstrate all the guarantees covered in various volumes and sections of this specification during Performance/Acceptance test. In case during tests it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modification to make the equipment/system comply with guaranteed requirements. However, if the Contractor is not able to demonstrate the guarantees, even after the modifications within ninety (90) days of notification by the Owner, the Owner will at his discretion :

i. reject the equipment and recover the payment already made or accept the equipment only after levying liquidated damages as identified in this section for those guarantees which are covered under category "A".

OR

ii. reject the equipment and recover the payment already made or accept the equipment only after assessing and deducting from the contract price an amount equivalent to the deficiency of the equipment/system as assessed by the Owner, for those guarantees which are covered under Category-B.

1.03.00 All guaranteed parameters shall necessarily be quoted by the Bidder based on the established proven results obtained from similar units in successful operation. Evidence for this shall necessarily include the test codes used, acceptance test results, accuracies of various instruments used for the performance test, details of tolerances, if allowed, etc. While quoting the guaranteed parameters, the Bidder shall keep in view the requirements

specified in the specification especially regarding the reliability, operability and maintainability of the equipment proposed. The Owner reserves the right to evaluate the parameters quoted by the Bidder based on his experience and published material available.

1.04.00 The liquidated damages shall be calculated prorata for the fractional parts of the unit unless stated otherwise.

1.05.00 The turbine generator, boiler, auxiliaries, and all other plant equipment and system shall perform continuously without the noise level (individual or collectively) exceeding the values specified in respective equipment specification over the entire range of output and operating frequencies.

1.06.00 **Performance/Acceptance Tests**

1.06.01 The performance/acceptance tests for various equipment and systems shall be carried out as specified under the respective equipment specifications and those specified below shall be specifically applicable. All the guarantees shall be tested together as far as practicable.

1.06.02 In case of systems with stand-by equipment the liquidated damages for non-performance will be levied for normal operating number of equipment only. However, for this purpose all the equipment including standby equipment shall be tested and average values arrived at.

1.06.03 For instrument inaccuracies during PG Test, refer subsequent clauses of this section.

1.06.04 For Total Auxiliary Power Consumption, the transformers listed under the respective clauses, shall be taken together for purposes of guarantee and not individually.

2.00.00 **START-UP, INITIAL OPERATION, RELIABILITY RUN AND PERFORMANCE TESTS**

For the purpose of Taking over of the Plant, the following activities shall have to be completed successfully.

i) Mechanical Completion
ii) Preliminary Operation
iii) Initial Operation
iv) Reliability Operation
v) Trial Operation
vi) Performance Guarantee Tests

2.01.00 **Mechanical Completion**

(a) Mechanical completion is defined as the state of readiness of works and completeness of Field Quality checks under the scope of contract to undergo the pre-commissioning checks, followed immediately thereafter by commissioning including preliminary operation, initial operation, reliability operation, performance tests including unit characteristics tests for functional or operational occupation of the

works.

(b) Mechanical completion shall be deemed to occur when the contract erection/installation/construction and Field Quality check works are completed as per specifications for all equipment / systems including standby. It also include but not limited to the following:

(i) all installation/erection and Field Quality checks duly carried out and individual protocol viz. erection, FQA (Field Quality Assurance) and commissioning protocol to be signed.

(ii) all defects/deficiencies notified by the Purchaser during installation/erection rectified to the satisfaction of Purchaser which, in the opinion of the Purchaser, will not affect the safe operability and maintainability of the works, and

(iii) the contract works, in the opinion of Purchaser, subject to sub-clause (ii) above, being fit, sound, safe and operable for undertaking the pre-commissioning checks, preliminary operation, initial operation, reliability operation and performance tests including unit characteristics tests followed by subsequent commercial operation without interruption for reason of defect/deficiency or unfulfilled obligations of the Contractor in the erection/installation work.

2.02.00 **Specific Requirements of Mechanical Completion**

(a) Mechanical completion in different disciplines shall be determined based on the following characteristics, signifying the readiness of the works/plants and systems for undertaking the pre-commissioning checks and subsequent preliminary operation, initial operation, reliability operation and performance tests including unit characteristics tests as applicable to the contract works:

(i) All plant construction/installation in various disciplines, as detailed under (b) below and as applicable to the contract are completed including aesthetic and workmanship and safety aspects, with all installation/construction checks as per specification, relevant codes, standards and practices ensuring conformity to contract and meeting any applicable statutory requirements.

(ii) All contractual obligations up to the stage of completion of construction / installation are fulfilled to the satisfaction of the Purchaser.

(b) All contract works or otherwise ready to be taken into service, or for functional or operational occupation save pre-commissioning/ commissioning checks, preliminary operation, initial operation, reliability operation, performance tests, unit characteristics tests are to be carried out as per approved commissioning procedure submitted by the contractor including but not limited to the following:

(i) Areas inclusive of all roads, accesses, structures, housings, platforms, walkways, stairs, ladders, safe approach to equipments, safety/ protective guards, covers, hand rails and such items of work are constructed as per specification and approved for use.

(ii) Drains, sewers, waste disposal channels, vents, chutes, ducts and such works are constructed and connected to treatment and other disposal systems.

(iii) Equipment and piping in different systems/disciplines with all appurtenances, auxiliaries and accessories along with supporting structures, hangers, mounts, etc., are erected/ installed, supported, anchored, aligned, grouted and adjusted for operating conditions.

(iv) Electrical power supply, control, communication and lighting equipment along with control panels, control desks, switchgear, local starters and such accessories along with protective systems, interlocks and integral and auxiliary systems are permanently installed, aligned and adjusted, with megger, continuity and specified installation checks duly carried out.

(v) Cables are laid, routed, supported, dressed, clamped, tagged, ferruled and terminated with clamp terminals designated and all continuity and megger checks duly carried out.

(vi) Safety/relief valves are calibrated and set to operating conditions and tried out. All safety systems are installed, calibrated, checked and accepted.

(vii) Plant identification numbers, colour codes, tags, nameplates are duly mounted / painted/affixed.

(viii) All painting, lining and insulation works are completed with specified checks to the satisfaction of the Purchaser.

2.03.00 **Other Prerequisites for Mechanical Completion**

The Contractor shall also meet the following prerequisites for mechanical completion:

(a) Submit a compilation of all reports of shop tests, material tests and various stage inspection establishing total compliance to contract specification in manufacturing items of supply of contract.

(b) Submission of a certificate by the Contractor in a format agreed by the Purchaser that the contract works have been designed, selected, manufactured, furnished and installed under the full responsibility of the Contractor.

(c) All erected plants, structures, equipment and systems are maintained and preserved in sound condition and are fit and sound to undertake

pre-commissioning checks and 'tests before commercial operation' for operational and functional occupation immediately thereafter.

(d) All areas and constructed works are cleared daily upto the satisfaction of the Owner of all construction materials, temporary works, debris, rubbish water and all such impediments to render the contract works safe, sound and operable.

(e) All safety features and safety equipment are functional.

(f) Fire prevention and fire extinguishing system in all fire prone areas are to be made functional.

(g) Any specific statutory approvals pre-requisite to commissioning of the plant are duly obtained.

2.04.00 **Preliminary Operation**

Preliminary operation shall mean all activities undertaken as part of commissioning after mechanical completion upto commencement of initial operation and shall include mechanical and electrical checkouts, calibration of instruments and protection devices, commissioning of sub/supporting systems covered under the contract.

2.05.00 **Initial Operation**

Initial operation shall include all operations undertaken as part of commissioning after completion of preliminary operation upto commencement of reliability operation. It shall be the first integral operation of the complete BOP integrated with Boiler, Turbine Generator package covered under the contract and shall include first light up / initial equipment rolling, equipment stretch-out, dry-out no-load / partial load /full loads runs for mechanical / electrical tryout and gathering of operational data, calibration, setting and commissioning of controls systems; and shutdown inspection and adjustment after running trails of the plant under the contract.

During initial operation each and every activity wise commissioning protocols are to be jointly signed by the Purchaser and Contractor commissioning team.

The auto loop control tuning shall continue upto the commencement of 72 hour full load operation of trial run.

The initial operations shall include operation of unit as a whole under normal operating conditions for twenty four (24) consecutive hours at the 100% TGMCR load or twelve (12) consecutive hours for two (2) consecutive days at the 100% TGMCR load unless otherwise agreed to by the Purchaser or restricted by system load conditions. The completion of initial operation will be certified in writing by the Purchaser.

2.06.00 **Reliability Operation**

(a) After the initial operations, the plant shall be on reliability operation. During the reliability operation, the Contractor will be allowed to make

minor adjustments as may be necessary, provided that such adjustments do not interfere with or prevent the commercial use of the plant or result in significant reduction of output. The duration of the reliability operation of plant shall be spread over a period of thirty (30) days. The maximum number of interruption attributable to Contractor shall be of four (4) numbers each not exceeding four (4) hours duration. In case either the number of interruptions, attributable to the Contractor, exceeds four (4) or the duration of any of the four (4) interruptions exceeds four (4) hours the reliability test shall be repeated.

(b) For the period of reliability operation, the time of actual operation shall be counted. In case the duration of actual continuous operation of any of the above modes is discontinued for reasons, which are not due to Contractor's fault or negligence, that particular test would be deemed to have satisfied the reliability operation test. However, should the test be discontinued due to Contractor fault, the test shall be restarted for that particular case.

(c) Should any failure (other than of an entirely minor nature) due to or arising out of faulty design, materials, or workmanship (but not otherwise) occur in any item of the plant, sufficient to prevent commercial use of the plant, the reliability test period of thirty (30) days shall recommence for that item after the defect has been remedied by the manufacturer/Contractor. The onus of proving that any failure is not due to faulty design, materials and workmanship will lie with the Contractor.

(d) A 'reliability operation' report comprising observations and recordings of various parameters measured in respect of the 'reliability operation' shall be prepared and submitted to the Purchaser. This report, besides recording the details of various observations during 'reliability operation' shall also include the dates of start and finish of the reliability operation and shall be signed by the representatives of both the parties. The report shall have recordings of all details of interruptions that occurred, adjustments made and any repairs carried out during the 'reliability operation'.

Also a punch list is to be prepared during the reliability test and the defects are to be rectified by the contractor before commencement of 72 hour operation at full load during trial operation.

(e) Should any failure or interruption occur in any portion of the tests due to or arising from faulty design, materials, workmanship, omissions, incorrect erection, or inadequate instructions by the Contractor's supervisors, sufficient to prevent safe commercial use of the plant, the reliability operation test at the particular load shall be considered void and the reliability test shall recommence after the Contractor has remedied the cause of the defect.

(f) During the reliability operation all the equipments, Raw/ DM water system and sub-systems, control loops, interlocks and protection including switchyard installations will be in service and change over to standby equipments are to be done on running condition of the unit.

(g) The 'reliability operations' shall be considered successful, provided that each item of plant can meet the above requirements.

(h) Upon the completion of 'reliability operations', as soon as practicable, or at such time as may be otherwise agreed to by the parties concerned, the Contractor shall notify in writing to the Purchaser that the Plant is ready for performance tests.

2.07.00 **TRIAL OPERATION:**

1. On completion of erection of any major items along with its auxiliaries, the same shall be thoroughly inspected by the Contractor together with the TSGENCO's Engineers for correctness and completeness and acceptability for pre-commissioning tests. Though the TSGENCO's Engineers associate themselves with such inspection, the responsibility for declaration for correctness, completeness and acceptability shall rest with the Contractor and the pre-commissioning tests and inspections shall be carried out after such declaration. The pre-commissioning tests to be performed at site as well as necessary documentation and formats for the protocols to be signed during and after the tests shall be prepared by the Contractor taking into account relevant Indian/International/ Manufacturers standard as applicable and finalized by the TSGENCO sufficiently in advance through mutual discussions. On conclusion of satisfactory pre-commissioning tests of each individual equipment, the trial operation of the unit shall start consistent with parameters of the technical specifications.

2. The duration of trial operation shall be for 14 days during which period the unit shall be run from half to full load or any other load cycle mutually agreed to during which period the unit shall run at full load for 72 hours continuously. However, if required, the Purchaser and the Contractor may mutually agree for economical load operation for 48 hours continuously. Any interruption caused by the Contractor up to 24 hours will not effect the period of 14 days indicated above. In case of such interruption occurring for more than 24 hours, the above period shall be extended correspondingly. During the above trial operation the standby auxiliary equipment shall also be run for a minimum period of more than 72 hours during which period the equipment shall run at its rated capacity for a minimum period of 24 hours. Further the above trial operation shall be carried out in full fledged manner with the associated instruments and controls. The unit is deemed to be commissioned on successful completion of the above trial operation.

3. A document shall be prepared on the results of trial operation. This document besides recording of the details of the various observations during the trial run will also include the date of start and finish of the trial operation and will be signed by the representative of both the parties. The document of the trial operation shall have log sheets and all adjustments, repairs, interruptions etc., shall be recorded therein. If any major adjustment is carried out which has been changed from the initial operation value, then the reason for it is to be furnished in the

report in detail.

The Purchaser and the Contractor will observe the plant overall reliability and shall test the equipment runback, rundown, auto start of equipments, CMC function and its reliability, complete automation of the plant system etc.

4. The readiness of the unit for the trial operation shall be intimated by written notice to the TSGENCO after mutual discussions. After receipt of such notice if the trial operation could not be performed or could not be completed due to any reasons not attributable to the Contractor and if the situation continues, the Contractor shall be absolved of the responsibility for the delay and the plant shall be deemed to have been taken over by the TSGENCO at the end of 60 days after the Contractor's notifications of readiness of the same.

5. The trial operation shall be carried out in compliance with relevant manufacturer's standards and/or relevant Indian/International standards and manufacturer's operation directions before starting them.

6. Defects which are minor in nature and do not endanger the safe operation of the plant, shall not be considered as reasons for not taking over the plant by the TSGENCO. These defects shall be listed in the above mentioned documents and shall be rectified by the Contractor in accordance with the agreement made in this respect.

2.08.00 **Performance Tests**

(a) PG test notification to be given by the contractor to the purchaser after COD. The performance tests shall be conducted at site on all major systems by the Contractor. The Contractor's commissioning Engineers shall make the entire plant ready for such tests and assist the Purchaser in operation during the tests. The test shall be commenced after the 'Plant/Equipment' has attained stable operation at the end of 'reliability operation'. The date of commencement of the performance tests shall be as soon as practicable on completion of the 'reliability operation' or as may be mutually agreed upon between the Contractor and Purchaser.

Final trail operation shall be carried out for a period of seventy two (72) hours at 100% TGMCR before 'taking over'.

(b) **Independent Inspector**

The Purchaser reserves his right to appoint an independent inspector at his own cost as his representative to discuss the test programme, to approve the instrumentation, to witness the tests and to analyze the test results.

(c) The tests shall be binding on both the parties of the contract to determine compliance of the 'plant'/'equipment' with the performance

guarantees.

(d) The performance tests shall be carried out to prove the guarantees. The purpose of the performance tests is to check whether the plant meets the guaranteed performances.

(e) The performance test procedure, the instrumentation to be installed, the instrument accuracy classes, including the definition of the calculation method to be used, the areas of responsibility and the items which specifically require preparation and agreement shall be submitted by the Contractor for review and approval during detail engineering phase. The schematics identifying the guarantee test instrumentation shall be submitted along with procedure. It shall be ensured that necessary test points and spool pieces are installed during the detail-engineering phase and also identified in process and instrumentation drawings. Code of the PG test is to be fixed up during detail engineering stage. The Contractor shall furnish detail test programme during detail engineering stage.

(f) The performance test instruments shall be of precision type with instrument accuracy limits as required and defined in the applicable performance test codes such that measurement uncertainty does not exceed the values agreed to by the Contractor in the Schedule of Performance Guarantees.

(g) All test instrumentation for the performance tests as required shall be supplied by the Contractor on loan basis. All costs associated with the supply, calibration, installation and return of the test instrumentation are deemed to have been included in the contract price. The test shall be in accordance with those specified or as per agreed performance test codes. Batch calibration shall not be accepted.

(h) Any special equipment, tools and tackle required for successful completion of the performance tests shall be provided by the Contractor.

(i) It is Contractor’s responsibility to co-ordinate for carrying out the performance tests. The duration of the test shall be in accordance with the agreed test codes. All other tests to prove the guarantees as indicated in the Contractor’s offer shall also be conducted.

(j) The plant parameters during the performance test shall be adjusted as far as practicable to the guaranteed performance test conditions. The tests shall be conducted to provide guaranteed parameters as defined in the contract.

(k) Category-B tests are to be completed before Category-A PG test. Protocols are to be signed jointly by the Purchaser and Contractor for each Category-B test.

(l) **Reporting of Test Results**

(a) Within two weeks after the conclusion of the performance test,

the Contractor shall submit ten (10) copies of test reports to the Purchaser stating whether the plant passed or failed such test(s), accompanied by sufficient test data and calculations to demonstrate the level of performance attained with respect to each of the tested parameters.

(b) The report(s) shall include as a minimum, the following:-

(i) Scope

(ii) Various guaranteed parameters & tests as per the contract.

(iii) Codes/standards used

(iv) . Description of the test procedures

(v) Full schematic diagrams with indication of test instruments locations and identification tags of same.

(vi) Instrumentation details and calibration.

(vii) Duration of test, frequency of readings and number of test runs

(viii) Test logs and summary of test readings used for performance calculations.

(ix) Full set of correction curves.

(x) Computation of test results.

(xi) Sample calculation

(xii) Performance calculation

(xiii) Computations to prove measurement uncertainty is within acceptable limits.

(xiv) Acceptance criteria

(xv) Any other information required for conducting the test

(xvi) Conclusions of performance tests.

(m) Within fifteen (15) days of receipt of such test report(s), the Purchaser shall submit a notice to the Contractor stating either:-

(i) That Purchaser concurs with the information provided in the test report(s), or

(ii) That Purchaser disputes some or all of the information provided

in the Contractor's test report(s), the areas being disputed, and the levels of performance being disputed.

(n) If Purchaser concurs with the information in the Contractor's test report(s), the Purchaser shall, within fifteen (15) days of receipt of the test report, provide a written notice to the Contractor accepting the results of the tests.

(o) If Purchaser disputes any or all of the results contained in the Contractor's test report(s), the Contractor and Purchaser shall meet within fifteen (15) days of the receipt of the Purchaser notice at a mutually acceptable location to review and discuss the dispute.

All the category-B test results are to be computed and to be submitted along with the PG test report for detail study by the Purchaser.

2.08.00 **Notice of Tests**

The Contractor shall issue 21 days notice to the Purchaser of the date after which he will be ready to commence the tests and the Contractor shall commence the tests promptly thereafter.

2.09.00 **Delayed Tests**

(a) If the tests could be carried out but are being unduly delayed by the Contractor, the Purchaser may by notice inform the Contractor to conduct the tests within 14 days after the receipt of such notice. The Contractor shall conduct the tests on such days within that period as the Contractor may fix and of which he shall issue notice to the Purchaser.

(b) If the Contractor fails to conduct the tests within such notice period, the Purchaser may himself proceed with the tests. All tests so conducted by the Purchaser shall be at the risk and cost of the Contractor and the cost thereof shall be deducted from the contract price or charged to the Contractor. The tests shall then be deemed to have been conducted by the Contractor and the test results shall be binding on the Contractor.

(c) **Facilities for Tests on Completion**

Except where otherwise specified, the Contractor shall provide and bear costs for these items, as may be required to carry out the tests on completion.

(d) **Retesting**

If the plant fails to pass the test (which in the case of performance tests means not achieving the acceptable limits), the Purchaser may require such tests to be repeated on the same terms and conditions save that only reasonable notice of the date and time of such tests shall be required to be given by the Contractor to the Purchaser.

(e) **Disagreement as a Result of Tests**

If the Purchaser and the Contractor disagree on the interpretation of the test results, each shall give a statement of his views to other within 14 days after such disagreement arises. The statement shall be accompanied by all relevant evidence.

3.00.00 SCHEDULE OF GUARANTEES WHICH ATTRACT LIQUIDATED DAMAGES [CATEGORY-A]

Sl. No.	Plant/ System	Parameter for Performance Guarantee	Liquidated Damages
3.01.00	**Plant**		
3.01.01	Efficiency of steam generator	Efficiency of the steam generator at 100% & 80% TMCR while firing the Design coal at rated steam parameters, rated coal fineness and rated excess air. **(Refer Note-1 for estimation of weightage factor.)** Design coal shall be blended coal (50% imported coal + 50% indigenous coal).	As per Volume-I.
3.01.02	Steam generating capacity	Steam generating capacity in T/hr of steam at rated steam parameters at superheater outlet (with any combination of mills working) with the coal being fired from within the range specified.	As per Volume-I.
3.01.03	Turbine Cycle Heat rate	Turbine Cycle Heat rate in kcal/kWh under rated steam conditions, design condenser pressure with zero make up at 100% & 80% of rated load **(Refer Note-1 for estimation of weightage factor.)**	As per Volume-I.
3.01.04	Output	Continuous output (MW) of 100% TMCR at Generator terminals under rated steam conditions at Turbine Inlet (247 kg/cm^2(a), 565°C, 593°C) and CW temperature of 33°C with 0% make-up with excitation power deducted	As per Volume-I.
3.01.05	Condenser Pressure	Condenser pressure in mm Hg (abs) under VWO conditions, 3% make up, design CW temperature and CW flow.	As per Volume-I.

1.01.00 SCHEDULE OF GUARANTEES WHICH ATTRACT LIQUIDATED DAMAGES [CATEGORY-A]

NOT APPLICABLE

1.02.00 SCHEDULE OF GUARANTEES WHICH DO NOT ATTRACT LIQUIDATED DAMAGES FOR VARIOUS EQUIPMENT WHICH INCLUDE BUT ARE NOT LIMITED TO THE FOLLOWING [CATEGORY-B]:

1.02.00 CONDENSATE POLISHING UNIT (CATEGORY-B)

1.02.01 The design flow (through working vessels) for each condensate polishing plant shall be the corresponding condensate flow of TG unit at VWO (Valve wide open) condition at 1% cycle make-up (Flow through each service vessel indicated in the data sheet).

1.02.02 During Normal Operation, the following dissolved solids concentration and conditions shall be used as a basis of design for the condensate polishing system. The ionic concentrations indicated below are as such.

CONTAMINANT	UNIT	INFLUENT	EFFLUENT
Ammonia	ppb	250	Below detectable limit.
Total dissolved solids (TDS, ammonia excluded)	ppb	110	< 25
Conductivity (at 25^{O}C) (After removal of all amines)	Micro S/cm	As actual	< 0.1 (after hydrogen column at 25 ^{O} C)
Silica (as SiO_2)	ppb	30	< 5 (Refer note # 1)
Total Ferric Iron	ppb	50	< 2
Sodium(as Na)	ppb	10	< 2
Chloride (as Cl)	ppb	20	< 2
pH (polisher runs at 25^{O}C with H/OH mode)		8.5-9.0	6.5-7.5
Crud (mostly black oxide of iron)	ppb	50	< 5

Note: 1. For temperature 50˚C and above the silica value in the effluent shall be based on the resin supplier's recommendations.

Under the Normal Condition, each Condensate Polisher Mixed Bed shall be designed to operate in hydrogen cycle for not less than 240 hours of continuous operation, while maintaining the above treated condensate quality.

1.02.03 During start up conditions, quality of the influent may deteriorate to –

CONTAMINANT	UNIT	INFLUENT	EFFLUENT
Ammonia	ppb	1500	Below detectable limit.
Total dissolved solids (TDS, ammonia excluded)	ppb	*As actual*	< 50
Conductivity(at 25^{O}C)	Micro S/cm	*As actual*	< 0.2 (after hydrogen column at 25 ^{O} C)
Silica (as SiO_2)	ppb	500	< 20 (Refer note # 1)
Crud (mostly black oxide of iron)	ppb	1000	< 100
pH(polisher runs at 25^{O}C with H/OH mode)		9.0-9.6	6.5-7.5
Total Ferric Iron	ppb	1000	< 10
Sodium(as Na)	ppb	20	< 5
Chloride (as Cl)	ppb	100	< 10

Note-1: For temperature 50°C and above the silica value in the effluent shall be based on the resin supplier's recommendations.

Useful service run under this condition shall be 48 hours before regeneration.

1.02.04 CONDENSER TUBE LEAKAGE CONDITION:

During condenser tube conditions, quality of the influent may deteriorate to:

CONTAMINANT	UNIT	INFLUENT	EFFLUENT
Total dissolved solids (TDS, ammonia excluded) (In addition to normal influent contaminants stated in clause 1.02.02 above	ppb	2000	---
Silica (as SiO_2)	ppb	*As actual*	< 20 (Refer note # 1)
Sodium(as Na)	ppb	*As actual*	< 20

Note-1: For temperature 50˚C and above the silica value in the effluent shall be based on the resin supplier's recommendations.

Useful service run between regeneration under the Startup conditions and under condenser tube leakage condition shall not be less than 48 hours each.

1.02.05 Influent water quality as indicated in the above clauses is minimum only. Bidder to check the same and higher values, if felt by them, shall be considered in the design so as to meet the specified effluent quality.

1.02.06 The bed cross section in the service vessels shall be such that the average velocity of condensate through it shall not exceed 1.75 meters/min (105 M3/hr/M^2) at the design flow rate for spherical vessel. Internal diameter of the service vessels (excluding the rubber lining) of spherical type shall be selected meeting the above mentioned velocity criteria. The effective depth of mixed bed in condensate polisher service vessel shall be not less than 1100 mm.

1.02.07 At the design flow rate, the pressure drop across the polisher service vessels with clean resin bed shall not exceed 2.0 bar. This pressure drop shall include losses due to entrance and exit nozzles, distributors, under drains, resins and the effluent resin traps. Maximum pressure drop under dirty conditions will be restricted to 3.5 bar including the pressure drop across effluent resin traps.

1.02.08 Cation resins shall be regenerated by technical grade hydrochloric acid to IS:265 (concentration 30-33% by volume) and anion resins by sodium hydroxide, rayon grade to IS:252 available as 40-48% lye or as flakes. For calculations regeneration temperature should be taken as 25 Deg. C.

In no case, the regeneration levels cannot be lower than the values indicated below:

a) Cation resin: 125 kg of 100% HCl per cubic meter of resin

b) Anion resin: 160 kg of 100% NaOH per cubic meter of resin.

1.02.09 Each rinse water outlet header of condensate polishing unit shall be provided with a pressure reducing station with isolating valves, suitably designed to enable the water entry to the both condenser's hot well which is operating under vacuum. Each pressure reducing station shall consist of either a pressure reducing valve from design pressure of service vessel to condenser vacuum or a combination of orifice plates to reduce pressure from design pressure of service vessel to 2 kg/cm2 and a pressure reducing valve from 2 kg/cm2 to condenser vacuum.

1.02.10 While calculating pump head, 10% margin (minimum) shall be considered of the value of friction losses. Pipe friction loss shall be calculated as per Willam-Hazen formula and "C" value to be adopted shall be as below:-

1. Carbon Steel pipe : 100
2. CI pipe/ductile Iron : 100
3. Rubber lines steel pipe : 120
4. Stainless steel pipe : 100
5. PVC/HDPE pipe : 140

1.02.11 Each Pump shall be guaranteed for capacity, total dynamic head and power consumption for CPU package.

1.02.12 All blowers shall be guaranteed for head and power consumption for CPU package.

1.02.13 Each Condensate Polisher Mixed Bed will have a rated continuous treated water output capacity of not less than design value. Each Condensate Polisher Mixed Bed Unit shall be regenerated once after every 240 hours of continuous service run during normal operation.

1.02.14 Net output from each of Condensate Polisher Mixed Beds shall be not less than design volume of treated water for the design water analysis as exhibited in cl. no. 1.02.02, 1.02.03 & 1.02.04. In case water analysis is different from the design values, guaranteed quantity shall be calculated as indicated elsewhere in this Specification and guarantee shall be applicable on this calculated quantity.

1.02.15 Chemical consumption of the Condensate Polisher Mixed Bed as indicated by the Bidder shall be guaranteed against the regeneration level employed and resin volume provided without any tolerance.

1.02.16 Qualities of treated water from Condensate Polisher Mixed Bed shall be as per treated water analysis as exhibited in cl. no. 1.02.02, 1.02.03 & 1.02.04.

1.02.17 Noise level of all pumps and blowers at the rated duty point shall be demonstrated at site.

a) Maximum noise level shall not exceed 85 dB (A) when measured at 1.0M away from the noise emission source.

b) Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, `Ambient Air Quality Standards' in respect of noise.

c) Any statutory changes in stipulations regarding noise limitation that may occur in future according to State Pollution Control Board or Central Pollution Control Board or Ministry of Environment & Forest regulation during tenure of the contract, the Bidder shall comply with the requirement.

1.02.18 Liquidate Damages (LD) for Non Achievement of Specific Performance:

The performance Guarantee parameters for Condensate Polishing System have been indicated in above clauses.

No negative tolerance in respect flow, head and other performance guarantee parameters are acceptable to the Purchaser. In case, any equipment of Condensate Polishing System is not able to achieve the performance guarantee parameters during the Performance Guarantee Tests, Bidder shall make necessary modifications or replace the Equipment/ Plant or any part. If even after rectification, the Equipment/Plant is not able to achieve the guaranteed performance parameters, the Purchaser shall have right to reject the Equipment/Plant. In such case, the Bidder shall pay back the total amount paid to them with reference to the Equipment/Plant (with all taxes and duties as applicable) to the Purchaser.

PROCEDURE FOR CONDUCTING PG TESTS

design C W flow and CW i nlet temperature corresponding to guranteed vacuum. T he c leanliness f actor s hall be det ermined in ac cordance with t he latest edition of ASME PTC-12.2.

4.07.00 Feed Water Heaters and Drain Cooler

Performance test for feed water heaters shall be conducted in accordance with the latest edition of ASME PTC-12.1.

4.08.00 Deaerator

Performance test for deaerator shall be conducted in accordance with the latest edition of ASME PTC-12.3.

The di ssolved o xygen c ontent i n f eed water at outlet of deaer ator s hall be determined b y A SME-D 888. R eference Method A an d an y r ecognised modification thereof.

Free carbondioxide content of deaerator effluent shall be measured by APHA method.

1.00.00 STATUTORY REQUIREMENTS

All par ameters of pl ant, eq uipment & facilities which ar e under j urisdiction of Statutory A uthorities, l ike M OEF, TPCB etc., s hall be g uaranteed. Conformance to the performance parameters under statutory requirement is mandatory.

2.00.00 CONDENSATE POLISHING UNIT

For Condensate polishing plant, the performance test shall be carried out as per the respective equipment specification and the applicable codes.

ANNEXURE IV

DRAWING DOCUMENTS SUBMISSION/DISTRIBUTION PROCEDURE

DRAWING DOCUMNTS SUBMISSION/DISTRIBUTION PROCEDURE

- Bidder shall submit soft copy/hard copy/CD ROMs of all the finally approved drawings and O&M Manuals as required by Customer/Customer consultant/BHEL-site/BHEL-PEM. The exact number of hard copies/CD ROMs of these documents to be submitted shall be notified to the bidder at the time of detailed engineering and bidder shall submit the same without any commercial/delivery implications to BHEL/Customer.
- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.
- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.
- Editable copy of all the drawings and documents shall be provided.
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copes whichever is later.
- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.
- Vendor to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.
- Bidder to submit instrument schedule, cable schedule and valve schedule in MS- Excel format during detailed engineering.
- Bidder to also furnish the auto cad copy/MS-Excel/MS-word (as applicable) of the following documents after award of contract. However any other auto cad copy/MS-Excel/MS-word of any other document as per the insistence of BHEL and customer will also be submitted by the bidder without any delivery and commercial implication to BHEL and customer.
  - P&IDs.
  - Equipment lay out of the service vessel area and regeneration area.
  - Equipment Cable tray layout for service vessel area and regeneration area
  - Equipment earthing layout service vessel area and regeneration area
  - Civil scope drawings.
  - Piping lay out drawing for Service vessel area, regenerative area and yard piping layout.
  - Valve schedule
  - Instrument schedule
  - Cable Schedule

ii) Other requirements

- Successful bidder shall furnish detailed erection manual for each of the equipment as well as complete system supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.
- Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

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

DISTRIBUTION SCHEDULE

S. No	Description	TSGENCO								M/S DCPL, KOLKATA			Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/ KTPS	SE/ Civil KTPS	SE/E&M / KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS		
A	**Letter Of Intent or Contract Documents**	1	1	1	S	1	2	2	1	1	1	1	2	
B	**Vendor Drawings**													
1.	Preliminary	1	1	1	2	1	1	2	2	12	1	-	S	
2.	Return preliminary with comments	-	-	1	2	1	1	1	1	S	1	-	1	
3.	Final and any revision thereof													
	a. Civil	1	1	6+1T	1	1	6+1T	1	-	2+1T	1	1	S	
	b. E&M	1	1	1	6+1T	1	1	6+1T	1	2+1T	1	1	S	
C.	**Design Drawings**													
1.	Preliminary													
	a. Civil	1	1	2	1	1	2	1	1	4	1	1	S	
	b. E&M	1	1	1	2	1	1	2	1	4	1	1	S	
2.	Released for construction													
	a. Civil	1	1	2	1	1	6	1	1	1	1	2	S	
	b. E&M	1	1	1	1	2	1	6	1	1	1	2	S	
3.	Return marked 'As built'													
	a. Civil	-	-	1	-	-	1	-	-	1	1	S	1	
	b. E&M	-	-	-	1	-	-	1	1	1	1	S	1	
4.	As built drawings													
	a. Civil	-	-	1+1T	-	2+1T	5+1T	-	1	1+1T	-	1	S	
	b. E&M	-	-	1	2+1T	2+1T	-	5+1T	1+1T	1+1T	-	1	S	

S. No	Description	TSGENCO								M/S DCPL, KOLKATA			Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/ KTPS	SE/ Civil KTPS	SE/E&M / KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS		
D	Progress Report Monthly													
1.	Equipment vendor	1	1	1	2	1	1	2	1	1	1	1	S	
2.	M/s DCPL, Kolkata	1	1	2	2	1	1	2	1	S	1	1	Nil	
E	Test & Inspection Reports													
1.	Equipment manufacturer													
	a. Civil	1	1	1	2	1	1	1	-	11	1	1	S	
s	b. E&M	1	1	-	2	1	-	1	1	11	1	1	S	
2.	M/s DCPL, Kolkata	1	1	-	2	1	-	1	1	S	-	1	-	
F	Instruction Manuals/Data Books													
1.	Equipment manufacturer													
	a. Civil	1	1	1+1T	1	1	6+1T	1	1	2+1T	1	1	S	
	b. E&M	1	1	-	3+1T	1	-	6+1T	2	3+1T	1	1	S	
2.	M/s DCPL, Kolkata	1	1	-	10+1T	1	-	15+1T	-	S	1	1	Nil	
G	M/s DCPL, Kolkata Criteria	1	1	1	8+1T	1	1	2	1	1	1	1	S	
H	Design Calculations	1	1	1	8+1T	1	1	2	1	1	1	1	S	
I	Final consulting Engineering Report	1	1	1	10	1	1	2	1	S	1	1	Nil	

S – Source, T – Transparency & Soft Copy on CD,

TSGENCO : Telangana State Power Generation Corporation Limited

Director, Projects, Hyd : Director/ Projects, TSGENCO, Vidyut Soudha, Hyderabad – 500 082

NOTES:
The above schedule of submission does not include Docs/Drgs. of quality assurance/inspection and delivery/dispatches.
All documents & drawings shall be in English and in metric units.

ANNEXURE V

PAINTING SPECIFICATION

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

C O N T E N T S

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

1.00.00 INTENT OF SPECIFICATION

1.01.00 This specification addresses the requirements of all labour, material, and appliances necessary with reference to preparations for lining / painting, application as well as finishing of all lining / painting for all mechanical and electrical equipment, piping and valves, structures etc. included under the scope of this Package.

1.02.00 The Bidder shall furnish and apply all lining, primers including wash primers if required, under-coats, finish coats and colour bands as described hereinafter or necessary to complete the work in all respects.

2.00.00 CODES & STANDARDS

2.01.00 The Bidder shall follow relevant Indian and International Standards wherever applicable in cleaning of surface, selection of lining material / paints and their application. The entire work shall conform to the following standards / specifications (latest revision or as specified).

a) SSPC SP 10 / NACE 2 / Sa 2½	:	Near White Blast Cleaning
b) SSPC PA 2	:	Measurement of dry film Coating Thickness with magnetic gauges.
c) ASTM D 4541	:	Method for pull off strength using portable Adhesion Tester.
d) NACE RP 0274 – 2004	:	High-Voltage Electrical Inspection of Pipeline Coatings
e) NACE SP 0188 – 2006	:	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

f)	NACE RP 0169 – 2002	:	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
g)	AWWA C 210 – 2007	:	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
h)	IS 3589:2001 Annexure B	:	Steel Pipes for Water and Sewage Specification.
i)	AWWA C222-2000	:	Polyurethane Coating for the Interior and Exterior of Steel Water Pipe and Fittings.
j)	IS 13213 : 2000	:	Polyurethane Full Gloss Enamel (Two pack)

3.00.00 GENERAL REQUIREMENTS

3.01.00 The steel surface preparation prior to actual commencement of coating shall conform to SSPC SP 10 / NACE 2 / Sa2½ (near white metal) with sand blasting.

3.02.00 The contractor shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to Owner/Consultant for approval.

3.03.00 The contractor shall also provide copies of test reports from NABL approved laboratory (like National Test House, Kolkata) in support of the paint/primer materials to be used shall conform to the specification requirement.

3.04.00 The contractor shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) shall also be submitted prior to commencement of supply of material and field application.

3.05.00 Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.

3.06.00 Applied coating shall be tested for dry film thickness, holiday (electrical inspection for continuity) and adhesion as per relevant standard such as SSPC PA 2, NACE RP 0274 and ASTM D 4541.

3.07.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.

3.08.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.

3.09.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a Purchaser approved method shall be adopted.

3.10.00 The colour scheme of the entire Plant, covered under this specification shall be approved by the Purchaser in advance before application.

3.11.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by Purchaser.

3.12.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti corrosive painting.

3.13.00 For vessels / tanks requiring lining and epoxy painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.

3.14.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.

3.15.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).

3.16.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.

3.17.00 All lining projecting outside of the vessel shall be protected adequately from mechanical damages during shipment, handling storage etc.

3.18.00 Suitable warnings, indicating the special care that must be taken with respect to these lined vessels shall be stenciled on their outside surface with the letters at least 12 mm high.

3.19.00 All insulated piping shall have aluminium sheet jacketing.

4.00.00 EQUIPMENT, MAT ERIAL A ND SERVICES TO B E F URNISHED BY TH E BIDDER

4.01.00 After erection at site, the outside surfaces of all equipment having a shop coat shall be given further priming coat and finished coats of paint as detailed in following clauses. However, if the painting system is such that the shop coat and primer coat to be applied at site are not compatible, then shop coat has to be removed from the surface of equipment before application of primer coat with prior blasting.

All factory finished paints shall be touched up at site as required.

All uninsulated piping shall be finished with final paintings after use of proper wash primer and primer. Aluminium sheet jacketed piping need not be painted. Colour bands of Purchaser's approved shade shall however be applied on jacketed piping near walls or partitions, at all junctions, near valves and all other places as instructed by the Purchaser. All structures shall be painted with approved paint.

4.02.00 Surface Preparation

4.02.01 Unless mentioned otherwise, all rust and mill scale shall be removed by blasting to Sa 2-1/2 Swiss Standard before applying the primer.

4.02.02 Special care shall be taken to remove grease and oil by means of suitable solvents like Trichloroethylene or Carbon Tetrachloride.

4.02.03 The minimum degree of surface preparations for all equipment, piping, fittings, valves, structures etc. shall be "Near White" according to Steel Structure, Painting Council-SSPC-SP-10 before application of any primer/paint.

4.03.00 Painting

4.03.01 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc. to be installed indoor shall be as follows :

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

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

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

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

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

4.03.02 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc to be installed **outdoor** shall be as follows :

a) Surface preparation shall be done by means of sand blasting, which shall conform to Sa 2-1/2 Swiss Standard.

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

c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.

d) Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade and colour with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.

e) Total DFT of paint system shall not be less than 300 microns.

4.03.03 Specification for application of paints for external surfaces protection of steel pipes and fittings which are **buried underground / laid in side a hum e pipe & or submerged Under Water and laid under Pipe Trenches** (in road/rail/pipe or trench crossings) shall be as follows :

External surface of the pipe, fittings, specialties etc. handling raw water/clarified water/filter water shall be painted with one coat of two part chemically cured polyurethane primer of min 50 micron dry film thickness followed by three or maximum four coats of two part solvent less polyurethane to build up coating of dry film thickness of 2000 micron including primer coat.

4.03.04 Specification for application of paints for **internal surface protection of larg e diameter pipes** (sizes above 600 mm NB and above) if any, shall be as follows :

a) All Internal surfaces of steel pipes, fittings, specialties etc. buried underground or located within pipe trenches shall be given epoxy coating to protect them from (except for drinking water service, where the compatible painting shall be so selected to meet relevant quality standards) corrosion.

b) Internal surface of the pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT (dry film thickness) followed by two part polyamide cured solvent less epoxy.

c) The minimum dry film thickness (DFT) of internal lining shall be 600 micron.

4.03.05 Specification for application of paints for protection of **internal surfaces of DM Water Storage Tank(s)** shall be as follows :

a) Primer - One coat of epoxy primer containing high level of Zinc Phosphate anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.

b) Finish Paint - Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.

c) Total thickness of primer and paint should not be less than 500 microns.

4.03.06 All motors, local push button stations, cable racks, structures used for supports etc. are to be painted with acid proof paint.

4.03.07 The following surfaces shall not be painted - stainless steel, galvanized steel, aluminum, copper, brass, bronze and other nonferrous materials.

4.03.08 No painting or filler shall be applied until all repairs, hydrostatic tests and final shop inspection are completed.

4.03.09 All machined surfaces shall have two (2) coats of water repellant grease after thorough cleaning.

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface Preparation :

Pipe shall be blast cleaned by sand. The cleanliness achieved prior to application shall be in accordance with the requirement of SSPC SP 10 / NACE 2 / Sa2½ of ISO 8501 (near white metal)

a) The blast pattern or profile depth shall be 40 to 100 micron and shall be measured by dial micrometer.

b) Before sand blasting is started or during blasting or coating, temperature of the pipe surface should be more than 3°C above dew point temperature. Blast cleaned surface should be primed within 4 hours and shall be protected from rainfall or surface moisture and shall not be allowed to flash rust. If the rust occurs, the surface again to be prepared by sand blasting or wire brushing.

5.02.00 Application of Epoxy Coating

a) Coating shall be applied when

i) When the pipe surface temperature shall be atleast 3°C above dew point temperature.
ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater that 50°C.

b) Material preparation shall be in accordance with manufacturer's recommendations.

c) Application of epoxy coating system :

The epoxy coating system shall be applied as per recommendation of the manufacturer and shall be applied by airless spray / plural component spray machine. For more than one coat, the second shall be applied with the time limits as recommended by the manufacturer.

5.03.00 Application of PU Coating

a) PU coating shall be applied when the pipe surface temperature atleast 3°C above dew point temperature (when R.H is more than 85%).

b) Material preparation and application shall be done as per manufacturer recommendation.

6.00.00 TEST REQUIREMENTS :

6.01.00 Measurement of dry film thickness

Measurement of dry film thickness of coating : Coating thickness shall be in the range of ±20% and as per SSPC PA 2.

6.01.01 Apparatus / Instrument:-

The instrument used for dry film thickness may be Type 1 pull of gauges or Type 2 electronic gauges.

6.01.02 Procedures:-

a) Number of measurements:
For 100 square feet (9.29 square meters), five (5) spots per test area (each spot is 3.8 cm) in diameter. Three gauge readings per spot (average becomes the spot measurement).

b) If the structure is less than 300 square feet, each 100 square feet should be measured.

c) If the structure is between 300 and 1000 sq ft, select 3 random 100 square feet test areas and measure.

d) For structure exceeding 1000 square feet, select 3 random 100 square feet testing areas for the first 1000 sq ft and select 1 random 100 square feet testing area for each additional 1000 square feet

e) Coating thickness Tolerance: Individual reading taken to get a representative measurement for the spot are unrestricted (usually low or high readings are discarded). Spot measurements (the average of 3 gauge readings) must be within 80% of the minimum thickness and 120% of the maximum thickness. Area measurement must be within specified range.

6.02.00 Electrical Inspection (Holiday) Test